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VOLUME II

Topic II

POLICE ORGANIZATION – STRUCTURE AND FUNCTIONING

THE INFORMATION EVALUATION PROCESS AND THE POLICE

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Abstract: In the internet-dominated world the mass information available to the humanity doubles every five years. The societies of our age suffer from an abundance of information. The information travels unexplored paths and the world-wide pace of life has accelerated, so that in addition to the abundance of information, the flow of information has also been accelerated. It is essential for every organization to have an intelligent processing structure. The abundant information that is available to us requires from us to develop the ability to identify the information needed. Every organization needs to critically evaluate and select the information. It has to link it to the previous knowledge. As the information grows, the amount of irrelevant information inevitably increases, which additionally demands analytical and critical thinking from the user. The unnecessary information is distracting, confusing.

According to modern history and experience, an organization can compete with its rivals, which of them can more efficiently process the information within its scope. The information also transcends the police activity; therefore the effective application of management is an important organizational interest. The prepared information of the police organization can significantly reduce the distance between crime and law enforcement activities. The police organization can gain advantage against criminals. The availability of the necessary and sufficient information makes it possible to prepare for unexpected events and develop alternative responses.

The aim of this essay is to clarify these complicated questions and presents the up-to-date information processing and evaluation system of the Hungarian National Police. This method can be a good example for every police organization.

Key words: information, information evaluation process, selection of the information, leadership and the information, Hungarian National Police.

INTRODUCTION

Both history and modern experience show that an organization can compete with its rivals, which can use the information most efficiently, while processing and evaluating data. The information also transcends the police activity, therefore the effective application of the information process is of common managerial and organizational interest. The preparedness of the police organization can significantly reduce the distance between crime and law enforcement activities, and in special cases, it can gain advantage.[1] The availability of the necessary and sufficient information makes it possible to handle and prepare for the unexpected events and develop alternative responses.

1. The information in the present time

The societies of our age suffer from information abundance. The amount of the information available to the humanity in the world doubles every five years. In this abundance of information, the flow of information has also accelerated.

It is essential to have an intelligent processing of the abundant information available to us, which includes the ability to identify the information needed. It is very important to critically evaluate the selected information. We can connect it to previous knowledge, and formulate the new knowledge.

Currently, the phenomenon that is very prominent is that as the information grows, the amount of irrelevant information inevitably increases. Analytical and critical thinking is needed from the user. The unnecessary information is distracting and confusing the users.

Now it is clear, the result is an intensive knowledge that the world has entered to the information society.

2. The Police organization and the information

According to this introduction, it is perceptible that the information has a strong impact on the police authorities. Perhaps it is obvious that criminals are increasingly trying to use modern tools that offer great opportunities for them.

These are good opportunities for the creation of protective nets, the hiding and disintegration of information, the transmission of disinformation and communication with each other. This inevitably entails the creation of 'digital traces', so that searching, capturing and involvement in providing evidence are at the top of today's law enforcement challenges.

The lively, moving element of the police organization is the collected information. The police, as a reactive organization, make a strong effort in their activities to collect the information. The police are permanently engaged in collecting different information relating to the phenomena of crime and criminals, the events, announcements, reports, etc.

1 Czuprák Ottó – Kovács Gábor (2013), Vezetés- és szervezéselmélet. Budapest, NKE. 305., 311.

The organization performs a policing-adequate answer, organises different actions that are consistent with the content of the different information.[2]

A common feature of all is that the information that reaches the organization or its members implies action and task performance by the police organization. The present and future intellectual power of the police is reflected in the ability to receive, collect, process, and generate new information.

It can be measured how fast the police can react and make preventive, restrictive and reconnaissance-based activity on the different information. Every police organization has double tasks: one is the information gathering part, the other is the information processing part (a data controller, a data provider for the different user).

3. Identifying and obtaining the police-relevant information

It is not an easy task to evaluate the content of the necessary and sufficient information. Before the decision of the leader, it is necessary to carry out all intellectual, physical, evaluation, and other analytical activities. In this context we can see what is the needed and what is the sufficient information.

Another question before the police officer makes a decision is whether it is possible to obtain all the necessary information that meets the criteria of necessity and sufficiency. On the basis of processing it, it is necessary to evaluate the minimum quantity, quality and relevance of the information.

Some police decision-makers want to gather more and more information. The risk-taking leader will make his/her decisions based on less information, sometimes based on his/her intuitions and experiences. There are a number of decision-making situations in which, despite the efforts, we cannot obtain all the information that we are interested in or need. On the other hand, the scope of information cannot always be clearly marked, as there can always be a feeling of lack of information.

During the decision-making process we have to evaluate the information: the degree of its importance, as well as whether it is authentic, partially or fully verified. Therefore, it is important to analyze and verify their credibility, to compare them with other information. To use the experience of decisions made in a similar situation in earlier time, the ability to foresee the problem, the knowledge to indicate and the tolerable level of the risk. It is also essential to recognize disinformation, conspiracy, defense, and response of individuals.

It is more common that the offenders prepare for their failure. They also collect information, data, compromising documents which they can be of benefit for them. Police forces are increasingly gathering all the knowledge that highlights the perpetrators' behavior, defense tactics, countermeasures, and methods. Carrying out this task is a half success against the criminals.

2 Finszter, G (2013), A rendészet elmélete és a rendészeti eszközrendszere. NKE Kiadó Budapest, 2013. pp. 45.

The police not only wait for the arrival of the information, but also collect and react to it. The police need to have thematic requirements, tasks and activities, a pre-defined information gathering system. It is important to facilitate the investigation processes, to set up the tools and methods in order to collect information.

The evaluation of sources upon receiving information from citizens means that external and internal bodies have to be developed and operated. These sources are partly traditional, such as letter, fax, announcement, filing, anonymous notification in writing, by phone or otherwise. New features include the following: email, sms, Skype, photos, documentation/written documents, tape, video, electronic devices and the media.

Receiving of information should include on-call service, emergency services, the complainant, the victim, the post-dismantling and the media monitoring person, the police officer, website, fax, e-mails, and other electronic messages.

For the purpose of documenting the information, the date, the content, the location, the familiarization, and other related data should be recorded.

The person who transmits the information should be given protection. This depends on the nature of the information. An essential part of correctly handling the information is the protection of the "source". Discretion, the ethics of the authority and the acting person, and last but not least, the proper handling of classified information are of vital importance.

The incoming information has to be examined. If a notice is issued that another body is authorized, the notification has to be made in accordance with the relevant rules and regulations.

4. Information-related operations

Certain aspects of information processing include: collection, recording, highlighting, selecting, classifying, qualifying according to the content of the information processing and analysing system.

Every organization needs to evaluate and separate the essential and less relevant information. It is also necessary to evaluate the information, to be used as a source of fact, data and evidence. A qualitative and quantitative analysis of the written material must be carried out. In relation to this, the analysis of statistical data, time, and research is very important. The result of this evaluation is the preparation of the solutions of different alternatives, use of different techniques, methodologies, tactics, to give good methods for the analysis, evaluation, consideration and utilization of all kind of information.

In the processing of the information, evaluation requires special knowledge. The process needs a different methodology, which depends on the quantity, homogeneity, heterogeneity, appearance, reliability of the information, and the level of its verifiability.

In the process, we can use statistical, sociological methods, text analysis, forecasting, consulting, risk, threat and crime analysis, profiling, analysis of individual cases, serial crime analysis, etc.

5. Personal characteristics

The staff of evaluation experts' professional qualities are indispensable. Efficient evaluating of the information requires specific personal characteristics. One of these is the high degree of experience, attention and concentration ability, the tolerance of monotony, the good systematic ability, the transparency, the persistence of searching for relationships. It is necessary to have the ability to self-check, the objective approach, the ability to draw conclusions, the analysis-free evaluation of subjective elements, the meticulousness in the discovery of contradictions, and if justified, the acquisition of control information.

During the evaluation process the evaluation team can be a pre-selected, pre-assigned and well-prepared body or person, an ad hoc team, or a designated management team. It depends on the nature, quantity, quality, and qualification of the data, the tasks, methods, tools, order of the processing, the rules of information management, the way of communication, the deadline of the tasks, the responsible person, the rights and obligations of the team leader. The reporting procedure must be determined in advance.

6. Forms and characteristics of information

The police leaders on various levels have a well-organized internal information system, that provides information on the external and internal impacts (summaries, analyses, newsletters, websites, internal bulletins, statistics, press observers, etc.). Monitoring, analyzing, evaluating, and processing this information is essential, as it can all have an impact on our activities or the activities of our organization.

Nowadays, the information "floods" the leaders, so without the appropriate "filtering system", much unnecessary knowledge makes the life of the leader very difficult. Managers need to develop an evaluation system.

7. Sharing information

We use the term 'data' for all the news and announcements which have come to the organization, whether they affect the organization or not. By classifying, evaluating the data and news that arrives to the organization, we have to determine the information. Information is all data, news, knowledge that eliminates uncertainty, that helps make decisions and has some impact on the functioning of our organization.[3]

3 Kovács, G (2018), A rendészeti szervezetekben lejátszódó vezetési folyamatok. Dialog Campus Kiadó Budapest pp. 53.

8. The information can be obtained in the following ways

Directly obtained information, when the law enforcement organization receives information directly from the information source, which is generally accurate and reliable.

Indirectly obtained information arrives not directly from the source of resources. These include various management reports, evaluations, reports, statistics, etc. This information is generally quite accurate, but it may need to be checked occasionally when used.

Table 1: *Sharing information*[4]

classification criteria	features	content
According to the source	**external information**	knowledge about the external environment
	internal information	a set of knowledge about the organization
Measurable	**quantitative information**	can be expressed in numbers, percentages, ratios
	qualitative information	not measurable in numbers
By nature	**primary information**	when information comes directly to the organization
	secondary information	when information reaches the user through transmissions
It can be according to the flow	vertical	when information flows from top to bottom or vice versa
	horizontal	when the information flows between each of the associated organs
It can be based on time factor	past	events occurred
	present	ongoing events
	future	suspected events
Everything else can be	complete or incomplete, accurate or inaccurate, reliable or untrustworthy, true or false, verified or unverified, current or not current	

4 Horváth, J – Kovács, G (2016), Pálykezdő rendőrtisztek kézikönyve. Budapest, NKE Szolgltató Nonprofit kft. pp. 53-54.

9. The main possible forms and main features of the information sent to the police leader or organization

- Oral information - which comes directly to the manager, creating the opportunity for immediate and quick response and, if necessary, clarifying it. Disadvantage: it has no evidentiary force, it may be ambiguous. Occasionally, it may be important to have the exact time of receiving the information, the provider of the information, its availability and other features, answering the questions of what, when, where, why and how.
- Written information - one of the most important forms of data transfer, can be proven, normative, its form is precisely defined, so the preparation of written information sometimes takes more time.
- Illustrative information includes various sketches, maps, graphs and statements that provide concise, transparent information.
- Data format information are grouped according to specific criteria.

The way of information transmission can be extremely varied (live and spoken, telephone, e-mail, Skype on msn), but there is a requirement that you reach the target person or organization in time.

The information is useful if it is:
- in the right place
- timely
- in a proper form
- at the adequate level of processing
- of adequate content and quantity.

CONCLUSION

In the internet-dominated world the information is power, which grows extremely. This is a complex phenomenon which the European law enforcement organizations have to handle. The police organizations have to permanently collect and evaluate the information, which is not an easy task. The police organizations should not only wait for the arrival of the information, but rather need to systematically collect and gathering the information. The evaluation process is the most important work. The police officers need special knowledge in order to be effective during the evaluation work.

As a final thought, we can say that nowadays the information without the appropriate filtering system is confusing. We have to build an effective evaluation system which can provide effective support for the police work.

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PERFORMANCE AND EFFICIENCY MEASUREMENT IN THE HUNGARIAN POLICE

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Abstract In the new Hungarian police career model, individual performance evaluation has been given a prominent role, because it influences progress and also provides a separate allowance twice a year. Due to its importance, it is very important that the performance measurement system to be independent from the influence effects of subjective elements. Its objectivity must be precisely definable, transparent and uniform. In my study, I am looking for an answer which expectations have been met with the introduced system. For a more complete picture of possible anomalies, I also conducted a questionnaire survey and would like to present the most important results of this.

Keywords: performance measurement, indicator, police, efficiency, career model, indicator.

INTRODUCTION

The essence of police organizational benchmarking is that the organisation's strategic goals can be transformed into a harmonized performance indicator system. These can be used to examine the extent to which goals have been achieved. Therefore, long-term and comprehensive strategic objectives should be transformed into short-term and concrete goals (Sisa, 2010). In general, organizational performance evaluation means the transformation of organizational goals and the monitoring of the tasks required to achieve them. At the same time, organizational performance appraisal should also be suitable to serve as an indicator for the organizational leader, whether tasks have been defined in accordance with the objectives. The individual performance measurement system measures the extent to which the reformed goals are achieved and the extent to which these strategic goals are supported. The organizational performance evaluation of the police was defined as an evaluation system that promotes the professional, legal and targeted operation of the body performing law enforcement tasks, improves the efficiency of its activities, and supports management decision-making. (26/2013. (VI.26.) BM (Belügyminisztérium, BM for short in Hungarian, meaning Ministry of the Interior) Article 12 (1) of the Decree).

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The benchmarking of performance in the new type of public service model is essentially a development-oriented, competence-based, tailor-made, repetitive target-setting that provides feedback in a structured form. A process of sustained development supported and monitored by the leader, consisting of self-evaluation by civil servants, managerial ex-ante evaluation, and agreement between both of them (Guide to the new type of public service performance evaluation, 2008: 8). The basis of the evaluation is the communication between the two, where pre-defined clear and detailed goals can be set, which can be suitable for comparison, thus carrying objective elements (Amberg-Molnár, 2004) However, a significant part of the evaluation criteria are the range of human skills, which can be measured directly difficult or not at all. We think here about decision-making skills or the ability to connect to others. The consensual benchmarking model between leader and subordinate tries to resolve the subjective informal factor resulting from the hierarchy (Gyökér, 2007: 67). On the other hand, if the evaluation method becomes formal, or if the employee does not have a redress channel or advocacy forum against enforcing one-sided agreement, then this solution will only legalize the increase in subjectivity in performance evaluation. Of course, it would be naive to think that subjectivity can be completely eliminated from an individual performance assessment system, but that it must be enforced in accordance with the overall objective of the organization and expressed in leadership expectations. Nevertheless, all the objective elements of the evaluation system need to be formulated, so that we can get a tangible performance measurement formula.

In connection with the relationship between organizational culture and efficiency, it is worth mentioning a recent study by the police, which revealed clear and relatively strong cultural problems from the point of view of organizational culture, such as:

- human orientation - level of leadership empathy and social sensitivity;
- performance orientation - reward criterion;
- risk taking - the degree of willingness to innovate (Pirger, 2015).

In his opinion the appropriate level of leadership, command empathy and the social sensitivity of leaders are also of paramount importance in the development of vocation. Subjectivity cannot be eliminated, but it must be enforced in accordance with the general purpose and philosophy of the organization and must be expressed with sufficient empathy in managerial expectations.

THE CURRENT SYSTEM OF STANDARDS FOR ASSESSING THE ORGANIZATIONAL EFFICIENCY OF THE POLICE AND INDIVIDUAL PERFORMANCE IN HUNGARY

Act XLII of 2015 on the Service Relations of Professional Bodies of Law Enforcement Bodies Prior to the entry into force of the Act (Hszt.) on the re-regula-

tion of normative bases for police efficiency measurement, they have established and are required to:

- Recommended items of performance evaluation of professional members of certain armed forces under the authority of the Minister of the Interior, Procedural Rules related to the Application of Recommended Elements, Order of Qualification and Organizational Performance Assessment. (VI. 26.) BM Decree, hereinafter referred to as (Decree name in briefly: SZTÉR),

- Framework of the organizational performance evaluation of certain armed forces under the authority of the Minister of the Interior, on the criteria for the evaluation of performance indicators of organizational operation. (XII. 21.) BM instruction.

The organizational performance evaluation of the police has been defined as an evaluation system that promotes the professional, legal and the vocational operation of the body performing law enforcement tasks, improving the efficiency and effectiveness of its activities, and supports the decision-making and decision-making of management. Based on the two norms already mentioned, the practical operation of the individual performance evaluation system was the subject of the research, which would briefly describe the essential elements of the measurement (Vári, 2017b).

Beyond the definition of conceptual elements, the SZTÉR basically qualifies as a percentage of the mandatory and recommended elements. The elements are bound to work and competence as a job, and the weight of these two, depending on whether the head of the department, the subordinate or the local body, is 30-55%. An important element is the performance indicator of organizational operation, which may also vary between 15-35% depending on the previous ones. Among the recommended elements, development goals, strategic performance requirements and re-competencies may appear with a 30-35% weighting value. It should be added that as long as the latter does not appear for the officer and the officer, the two drivers are at the same level, but only a 5% difference with the weighting of the three elements. When evaluating individual performance, it can be stated that as long as there is a much higher weight of organizational performance in the case of managers, the leader's subject is more dominant than the subordinates'. Thus, if indicators of measuring organizational performance are not based on specific elements and metrics, measuring individual performance of managers becomes easily vulnerable and as a matter of course, turns towards a maximum value.

The three pillars of performance should be assessed on the basis of three aspects, such as the value of the driving activity (25%), the value of the functional activity (25%), the value of the professional activity (50%). These target areas will be assessed on the basis of the defined criteria and performance requirements for each year. The self-assessment of the evaluated organization plays an important role in the evaluation. The performance of the different bodies is to be assessed on the basis of a comparison of the performance of the current and/or the short-

term and medium-term time series. It can be said of the system that it is striving for a wide range of indicators that cover the entire police. In all organizational performance evaluations, it is a common feature that the degree of achievement of organizational goals is ultimately assessed by the leader defining goals. In the case of the police, this is linearly upward. By 15 February, the minister responsible for police monitoring will formulate the goal-setting as the basis for the evaluation. With this in mind, the National Commander will set organizational performance targets and professional performance requirements minimum for the regional offices by February 28th. By 15 March of the current year, the head of the regional body will determine the organizational performance goals and professional performance requirements of the local body based on the defined organizational performance targets and professional performance requirements (SZTÉR § 14 (1) - (3)).

RELATIONSHIP BETWEEN ORGANIZATIONAL EFFICIENCY AND INDIVIDUAL PERFORMANCE MEASUREMENT

We need to distinguish strongly between organizational efficiency measurement and individual performance measurement. One adapts the individual organizations to the overall strategic goals, while individual performance measurement is used to measure individual performance tailored to the purpose of the organization. It is only possible to compare bodies with the same tasks at the same level, but the organization may be able to create high individual performances within the given organization with low success. It is a fact that well-defined performance evaluation criteria cannot be complete and can be homogenized independently of the job. However, it can be argued that a performance evaluation system that is synchronized with organizational efficiency would fundamentally change the organization's operating system. It follows that without the organizational strategy goals that can be accepted at the individual level, the performance evaluation system will not be supported by the employees. In other words, converting the organization into "self-serving" or away from social purpose, rather than internal, bureaucratic operating principles, and noticeably only the hierarchy's efficiency indicators are converted into performance benchmarks, and employee performance is not a suitable tool. Efforts should be made to develop an embedded police force into society, for which individual benchmarking is only a tool (Vári, 2015a).

Measuring performance is important for the effectiveness of the police, because the development of the whole system is accomplished by increasing individual performance. To do this, the coherence between the organisation's perspective and direct goals and the goals of the individual members must be created. In order to develop this, the literature of management theory provides a scientific approach, defining the advantages of applying modern management

principles and methods, and the differentiated tooling of increasing motivation for performance. Successful performance at the police includes:

- the committed leadership,
- the active participation of the subordinates,
- consistent efforts,
- regular recognition
- consistency in the reward system
- appropriate and periodic training to develop the skills required (Vári, 2015b).

If the organization is to function successfully, it needs to develop a culture that evaluates efforts by focusing on results and achievements. All this helps to build a proper performance-oriented and effort-based culture (Morgan, 1995).

It is not fortunate in performance evaluation, or even in measuring organizational efficiency, that they are based primarily on output data, that is mainly extracted, in international scientific literature. Output data include: fines imposed, complaints, number of productions. Their uniform application to the strategic efficiency of the organization is a deliberate misrepresentation of society, the public and the individual, as well as self-deception (Finszter, 2006). Consequently, the overemphasis on such indicators is not justified in the performance evaluation criteria. After all, the doctor does not really make the number of patients treated effective. As the parliament is not the number of laws issued, it is the satisfaction and social peace surrounding their activities, their operations. Essentially, the state's law enforcement and law enforcement agency can be really successful if it produces as little quantitative data as possible, because it should guarantee social peace, i.e. public security. Ensuring an objective security situation, that is, negative law enforcement indicators, are markedly increasing in the subjective sense of security and in the reduction of latency (Sallai et al. 2018).

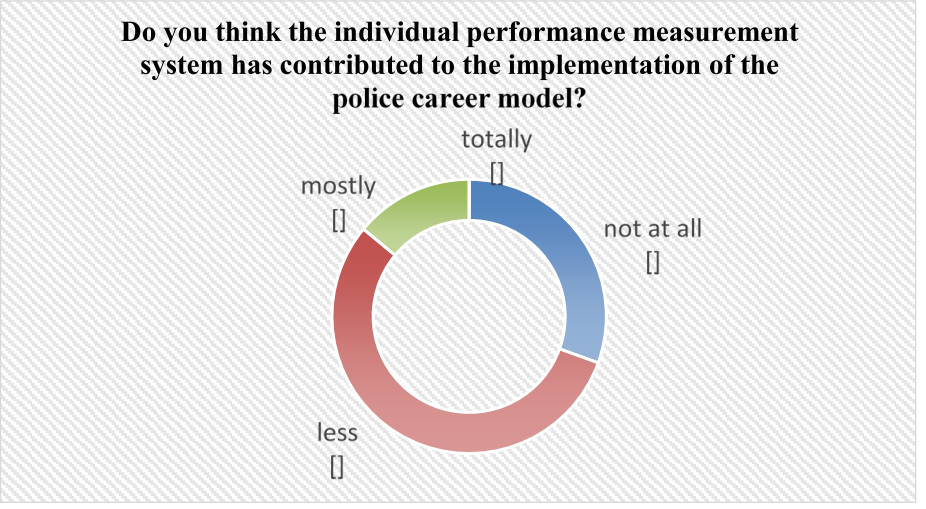
QUESTIONNAIRE RESEARCH ON POLICE PERFORMANCE MEASUREMENT SYSTEM

With my empirical research, I measured individual opinions about the measurement system. That is, how much the hopes have been added by the system, according to those involved in the evaluation. Is the individual performance assessment suitable to have a real incentive to increase quality and quantity of work? The questionnaire survey was voluntary and anonymous. The questionnaires contained a total of 15 closed questions, where question 14 consisted of two sub-questions, while question 15 consisted of eight sub-questions. A total of 118 persons, mainly senior officers completed the questionnaire (Vári, 2017a).

MAJOR FINDINGS

As explained above, the key to a performance measurement system is to fit into strategic goals, the latter being defined to meet both reality and workforce interests. The police performance measurement system was introduced in a way embedded in the lifestyle model, as a distinct, emblematic element. Consequently, if employees do not feel that the lifestyle model is a well-functioning system, it is unlikely that it will be accepted (Vári, 2018). The question in Figure 1 examines a complex dimension as it combines the performance evaluation system with the new life model of the new law. At the same time, the question is of course, a resolution against the quality of the operation of the system, but on the other hand, answering the question required more complex opinion formation, as the respondents had to know the pillars of the career model and the interfaces of the individual performance evaluation system. What is really striking on the basis of the results obtained is that the legislator and the policy play a major role in the individual modeling of performance in the design and development of the career model, and this was even worse than the general opinion in this constellation. The total number of non-responses was almost one-third of all categorical answers, mostly responses than more than half of them alone. It was less responsed - just 14%, and it wasn't at all that would have fully agreed that the benchmarking system and the career model are in sync. I think it might be best to review and map this area, i.e. what parameters you should have in your individual performance rating system to meet the expectations of the employee in the career model

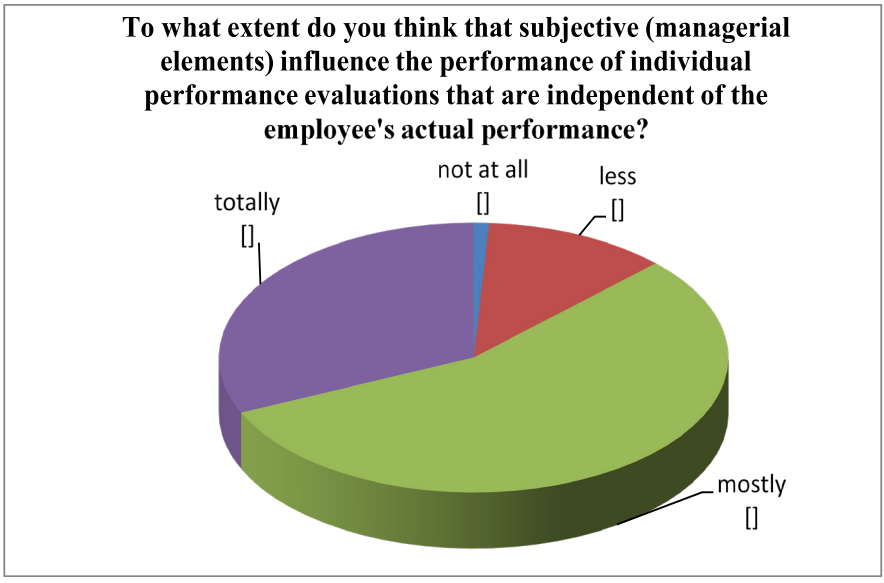
Figure 1. *(Source: the author)*



The question in Figure 2 was directed to the importance and weight of the subject of the leader in the development of the rating of individual performance

evaluation. Presumably, this is one of the dominant areas in which respondents have downgraded the new system and its link to the lifestyle model to the extent of the first question. The evaluation shows that more than half of the respondents (55%) who responded to the specific responses say that the management subject, i.e. the managerial element, while one third (32%), fully influences the qualification of the subordinates rather than the actual evaluation of the actual performance. All this leads to the conclusion that the system of individual performance evaluation is in vain regulated and weighted according to the statutory rules, but these factors do not influence the "impulsive" force to establish an objective, unbiased leadership position. There are two reasons why this can be explained: one is that the individual evaluation system is simply undeveloped, overly generic and offers a large margin of maneuver. Therefore, in order to develop objectivity, it is necessary to clarify and specify the actual performance products by appropriate, proportionate and comparable measurement, evaluation and qualification. The other explanation is that the norm leaves much room for maneuvering managerial certification, and allows the two qualified employees in the same area to qualify for discrimination in the same or reverse sign of actual performance. In turn, it triggers harmful processes that are contrary to the basic theses of leadership theory and human resources management, not to mention that this obviously has an adverse effect on organizational (external) efficiency.

Figure 2. *(Source: the author)*



The question of Figure 3, the elements related to the organizational interest, examined the appearance and significance of the role and significance of organizational evaluation in individual performance evaluations. Here, in fact, I was looking for the answer that individual performance evaluation in the case of

correct and rational operation is rather the result of the quality of the job tasks and competencies, or rather the organizational effects. The organisation's performance indicators are a realistic and reasonable summary of the tasks performed, accomplished goals or certified behaviors performed by the employees of the given organizational unit. Normally, therefore, individual performance evaluations should influence organizational indicators and not vice versa. The opposite of the answers is regrettable, namely, that the organizational performance indicators that have been created and adopted form the level of qualification of individual performance evaluations. So even a "worse" colleague can get a higher rating if the organizational unit performs "high", but in an organization that works well, but has a lower rating, the rating of the employee is underestimated by the organization. This malfunction is due to the top-down hierarchical-linear feature of the valuation system, which, in an irrational way, does not consider the amount of employee performance and develops the performance assessment of the individual and the organization in a bottom-up manner, but vice versa. Therefore, individual goals must also be met in accordance with the central goal setting. If this fails, or if it is not fully successful, the actual performance will be overwritten by the organization's performance indicator. This reasoning is supported by the successive dates of the prioritization of priority organizational goals in the subject of the research, from which it follows that the requirement flows from top to bottom, which in this line-up does not produce a rational result. This fact in itself makes the importance and the organizational purpose of individual performance assessment extremely frivolous and weightless.

Figure 3. *(Source: the author)*

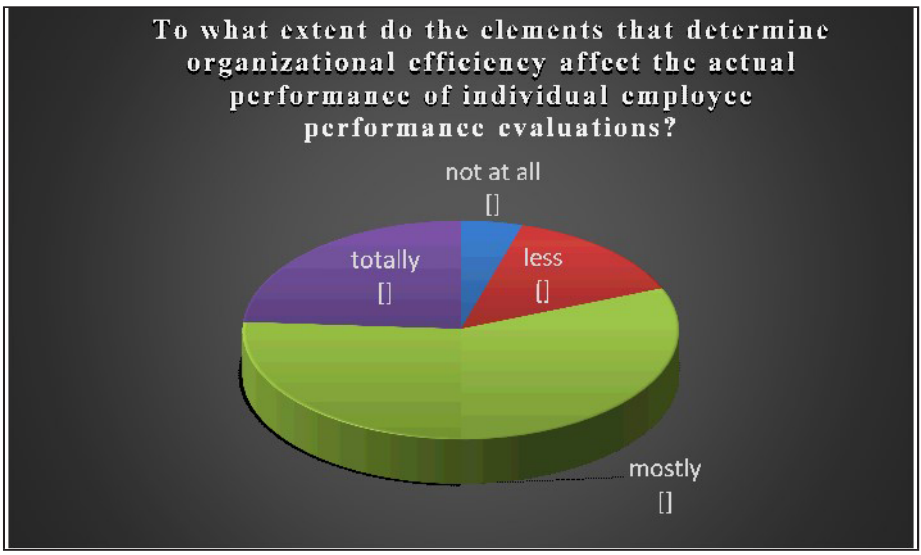
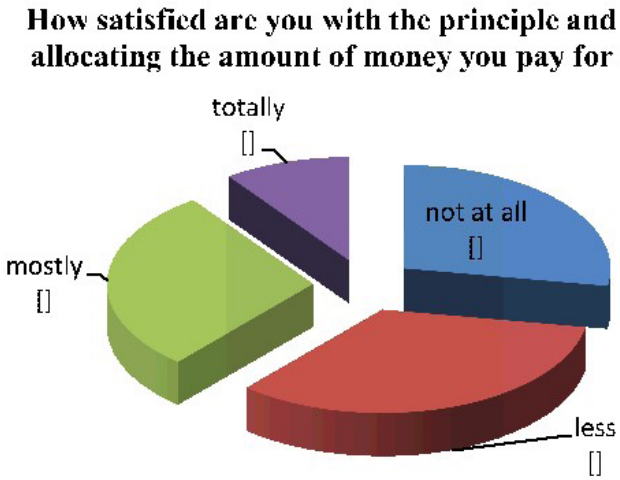


Figure 4. *(Source: the author)*



The figure above illustrated the impact factor on the organizational unit that was previously discussed and the distribution ratio of the given unit. Respondents strongly argued that the principles of organ allocation are not fair, that is, some organs are more, while other bodies deserve less money, depending on the function of the organization and the quality of its tasks. In individual performance evaluations, organizational performance indicators are considered to be stronger, so a decision made at a higher level than their own organization leads to the ineffectiveness of specific performance evaluations affecting their own organizational units. What is specifically related to the disproportionate and unreasonable distribution of the distribution, that is, the distribution of resources. What is shown by the fact that when a decision comes from above, the result of which is an organic work, not a bottom-up decision within the organization, the transparency of decision-making processes has been created, so its acceptance will be critical. Even if that decision is otherwise well-founded, its origin and therefore its meaning is not transparent and understandable.

SUMMARIZING

The research has highlighted that the new benchmarking system is not relieved of informal elements that impart to bias, that is the subjective judgment of the leaders also dominates the employee ratings. In addition, organizational interests have a decisive influence on individual performance appraisal, so individual performance evaluations within a given unit are closely related to the role of the rated person within the organization's hierarchy. In the validation system, belonging to the organizational unit and the position in the hierarchy already characterize the level of individual performance evaluation. And while it is true

that the effectiveness of an organization is essentially the result of employee performance, it cannot be a simple projection. Otherwise, it acts as a catalyst for high individual performance evaluations within a low-performing organization, a trend that is clearly counterproductive for both individual and organizational performance. Moreover, if the organizational performance indicator basically builds on self-evaluation, it is based on subjective or overly general evaluation principles, it will have an impact on individual performance evaluation, especially if the two are formally and informally coherent. In the case of current individual performance evaluations, the discretionary discretion of the qualifying leader is significantly limited by organizational interests, and within this narrow margin of maneuver, the methodology for calculating the rating is one that facilitates the preparation of subjective, biased evaluations and ratings other than objective performance.

On the basis of the theoretical analysis and the results of the research, it can be concluded that the individual performance and organizational efficiency measurement should be distinguished more sharply. While one is a function of an individual policeman's salary, recognition or promotion, the other is an indicator of achieving organizational strategic goals. In the case of individual performance evaluation, the autonomy of organizational units should be allowed a much larger space, making decision making transparent and accessible. The direction of the evaluation should be reversed so that the bottom-up and not the top-down "flow" is decisive. By doing so, performance is not reflected in predetermined plans, thus formalizing the rating, but is generated by the actual performance, in the worst case, by the innovation value, allowing greater autonomy and freedom of decision to the lower levels of management. To measure forces, tools, responses, and organizational features, principles, and overall performance, organizational efficiency measurement is the right method. It is necessary to examine to what extent the goals that have been set strategically (either centrally or locally) are achieved at different organizational levels. Where the organizational goals have been achieved, the resources used to achieve the goals should be evaluated and then decided whether they were excessive in relation to the objectives. An additional factor should also be taken into account, namely the "profitability" of the organization in terms of costs. This is a survey of how much loss has occurred, how much energy and time has been wasted. Here, attention should be paid to the relationship between results and methods. Consequently, while organizational efficiency is basically determined by strategic goals, individual performance evaluation is much less. On the other hand, it can be evaluated with specific, particular and exact elements, from which the unnecessary and distortive influence of organizational interests, especially the hierarchy, must be eliminated to a reasonable extent. The rating methodology should also be adapted to well-defined job criteria and competencies, thereby reducing the chance of managerial bias in individual employee ratings.

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NOTIFICATION AS A LEGAL INSTRUMENT UNDER THE NEW LAW ON GENERAL ADMINISTRATIVE PROCEDURE IN THE REPUBLIC OF SERBIA

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Abstract: The new Law on General Administrative Procedure envisages several forms and methods of communication between the parties and public law authorities. These include notification as a form of communication between an authority and a party or third parties in a proceeding. The said legal institute encompasses the following issues: the notion, manner and place of notification; notification in special cases; persons authorized to receive notifications; notification procedures; delivery. Notification is of great practical and legal significance for the parties and the achievement of their rights and duties and for the authority issuing the relevant document, i.e. for normal, efficient and cost-effective unfolding of an administrative procedure.Solutions envisaged in the new Law on General Administrative Procedure stipulating the issue of notification appear to be not only more broadly conceived than in the past, but also significantly improved.

Keywords: administrative procedure, authority, party, notification, delivery, authorized persons, delivery note.

INTRODUCTION

The new Law on General Administrative Procedure (LGAP)[2] of the Republic of Serbia has given due attention to the institute of notification as a form of communication between the authority in charge of proceedings on the one hand and a party and other participants in the proceedings on the other. As for third parties, the rules for notifying the parties apply to them as well, except in cases when the Law or some other special law stipulates exemption.

The solutions pertaining to the institute of notification allow for the continuity of the proceeding, protection of the public interest and exercise and protection of the rights of citizens and legal interests of the party and third parties to the proceedings.[3]

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2 Службени гласник РС, бр. 18/2016.
3 Д. Миловановић, Однос општ(ој)ег и посебн(ој)их управнопроцесних закона, Полис, Тема броја-Реформа административних процедура, август 2016, бр. 11.

Compared to the existing solutions relating to the delivery of notifications, new provisions have been not only broadened through the institute of notification, but also improved. It is the reason to devote this paper to the analysis of the provisions pertaining to this legal institute that are currently in place.

THE NOTION, MANNER AND PLACE OF RENDERING NOTIFICATION, NOTIFICATION IN SPECIAL CASES, AND PERSONS AUTHORIZED TO RECEIVE NOTIFICATIONS

Notification is an act by which the authority, in an appropriate way, informs a party and any other participants about actions in an administrative matter. The authority chooses the method of notification, unless otherwise stipulated. In doing so, the authority is obliged to take into consideration the legal protection of the party, publicity of information, economic expenditure of resources as well as the simplicity of the procedure.[4]

The authority may notify the party by electronic means, by mail, by delivery or in another appropriate manner. If the party is present in the official premises of the public law authority, the notification may be spoken.

Brief and urgent information may be given by telephone, electronically or in another appropriate way, of which a note is made and added to the file containing the personal name of the persons giving and receiving the notifications. The rule is that the public law authority notifies the party itself, unless the party is represented by a legal representative, proxy or authorized representative, who shall be notified instead.

It is possible for an error to occur during notification. Thus, when an obvious mistake is made in the notification, the notification shall be deemed to have been delivered on the day when it is actually delivered. Notification errors may vary (errors in entering the required data in the delivery note or a missing delivery note, sending the document to a wrong email address, etc.). Hence, all available evidential means are used to establish the exact date and time when the notification was actually delivered.[5]

Regarding the place where the notification is made, the Law envisages three rules: 1) the party is, as a rule, informed in the place of abode, business premises or at workplace; 2) an attorney is notified in his/her office, whereby the notification can also apply to a person employed in the office; 3) notification is also possible elsewhere if the recipient of the notification consents to it.

4 Д. Васиљевић, Јединствено управно место као правни институт у новом Закону о општем управном поступку Републике Србије, Криминалитет у Србији и инструменти државне реакције, I Тематски зборник радова, Криминалистичко-полицијска академија, Београд, 2016, pp. 225-235.
5 З. Р. Томић, Коментар Закона о општем управном поступку, Београд, 2017. pp. 334-363.

In the event of a change of the place of residence, place of abode or the seat of the party or the party's legal counsel, the public law authority must be informed about it immediately, without delay. If they fail to do so, and the official cannot contact them, the party shall be further informed by public delivery.

The competent authority must also be informed about the change of residence or place of abode of the attorney or representative authorized to receive notifications during the procedure. Otherwise, the notification shall proceed as if the representative has not been appointed.

The Law also envisaged the rules of notification in special cases. Notification in special cases includes three categories of persons: 1) natural and legal persons who are in a foreign country are informed directly or through diplomatic channels, unless otherwise provided for by a ratified international treaty; 2) persons who are in the army of Serbia are informed through the competent command, and members of special units of the Ministry of the interior through their command; 3) persons deprived of their liberty shall be informed through the management of the institution in which they are located.

In all of these three cases notification has been performed when the written document is delivered to the recipient.

We have already pointed out that the public law authority notifies the party itself. However, when a party has the representative authorized for receiving notifications, he/she will be notified instead. The person authorized to receive notifications is a special type of representative to whom all written documents addresses to the party are serviced. The party appoints his/her representative in such a way by informing the public law authority in charge of the proceedings about the representative either orally or in writing. The representative for receiving notifications has a narrowly specialized power. He/She is not authorized to take procedural actions on behalf of and for the account of the party, but only to receive the correspondence in the proceedings for the party.[6]

If the party or the legal representative of the party are in a foreign country, and do not have an attorney in the Republic of Serbia, the public law authority shall, when sending the first written document to them, set a deadline that cannot be longer than 30 days to appoint the representative for receiving notifications. The authority therein warns them that if they fail to do so, a representative for receiving notifications shall be appointed at their expense.

The receipt of a notice by a special representative in question is deemed to be a reception by the party, especially as regards the time of receipt.

For the purpose of efficiency and cost-effectiveness of the procedure, more than five parties in the same procedure that do not have opposing interests or a joint representative shall be obliged, at the request of the authority, to appoint a joint representative authorized to receive notifications within the deadline set by

6 З. Р. Томић, Опште управно право, Београд, 2017. pp. 362, 388.

the authority. If they fail to do so, the authority shall appoint a joint representative for receiving notifications at their expense.

The person authorized to receive notifications does not represent the party and is therefore obliged to forward every notification immediately upon the receipt, without any delay. However, if the written notification cannot be forwarded to a party, and the party may miss the deadline for a legal remedy, then the representative is authorized to declare a legal remedy on behalf of the party.[7]

Manners of informing/notifying

As regards the manner of notification, the Law envisages the following three ways of communicating: 1) notifying by electronic means; 2) notifying by mail; 3) delivery.

Notifying by electronic means can be formal or informal. Formal communication by electronic means is performed in accordance with the law and, unlike informal communication, involves a mandatory confirmation which proves the receipt of the document. Formal notification by electronic means is equalled with the delivery.

Notification by mail may be performed by regular or registered mail. A written document sent by regular mail is considered received by the recipient on the seventh day from the day it was handed over to the postal operator if it is sent to an address in the Republic of Serbia or on the fifteenth day after it has been handed over to the postal operator if it is sent to an address in a foreign country. However, the recipient can prove that he/she received the mail later or that they have not received the mail at all.

In case of a document sent by registered mail, it shall be deemed to have been received on the day stated in the note on the receipt of the consignment. The notification by registered mail equals delivery.

Delivery

As a form of notification, delivery can be personal, indirect and public.

Personal and indirect delivery are performed by the public law authority through an official, through the postal operator or by electronic means, in keeping with the law. Only exceptionally, the recipient of the written document may be summoned to take over the document if the nature or significance of the document should so require.

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7 З. Р. Томић, Д. Миловановић, В. Цуцић, Практикум за примену Закона о општем управном поступку, Београд, 2017. стр. 89-97; Д. Васиљевић, Концепт ванредних правних средстава по новом Закону о општем управном поступку Републике Србије, Правни живот, Београд, бр. 10/2016, том II, pp. 215-225.

Delivery is a type of formal notification of parties and other participants in the proceedings by the public law authority. This procedural action consists of sending and delivering different writings (summonses, decisions, etc.) by the authority to the persons they are intended for in order to create all necessary preconditions for the persons to become acquainted with the contents thereof.[8]

If the party to the proceedings is a legal person, then delivery to such a subject is done by delivering the document to its seat, to a person employed by the legal person, or to a special address for receiving mail which has been registered in accordance with the law or to the legal person's representative to his address from the public register or to the address of his residence.

The rule is that the action of delivery is performed on a working day from 8 to 20 o'clock. However, the authority may decide - for particularly important reasons - to perform the delivery also on the day when deliveries are not made or after 20 o'clock. This legal possibility should not lead to abuse in practice, i.e. to unnecessary disturbance of the citizens. That is why this legal possibility should be interpreted very strictly and every case of such 'extraordinary' delivery should be justified. This means that the forwarder is obliged to warn the addressee that such 'extraordinary' delivery is performed based on a decision of the competent authority and on the Law on Administrative Procedure.[9]

Speaking of delivery, the Law makes distinction between: personal delivery, indirect delivery and public delivery.

Personal delivery is mandatory in the following cases: 1) when the time starts expiring on the date of delivery and the deadline cannot be extended unless otherwise provided by law; 2) when required by law. Personal delivery involves servicing a written document to a person to whom it is addressed. The person receiving the document is called the recipient. The stipulation of mandatory personal delivery is in some cases motivated by the very significance of a certain document or legal effects related to its delivery.[10]

If the recipient of the written document refuses to receive it, the authority's representative or the postal operator (forwarder) makes a note on this and then leaves the notification in the place where the document was to be serviced. The notification specifies the personal name of the recipient, the data identifying the document, the office within the public law authority premises where the document can be taken over, the deadline within which it has to be taken over, and the date when the notification is left.

However, if a public law official or a postal operator (forwarder) does not find the recipient of the document at the address where the document is supposed to be delivered to them, the forwarder shall repeat the attempt of delivery within the

8 Д. Васиљевић, Управно право, Београд, 2015. pp. 294-297.
9 Д. Миловановић, В. Цуцић, Нова решења Нацрта закона о општем управном поступку у контексту реформе јавне управе у Србији, Правни живот, бр. 10, том II, Удружење правника Србије, Београд, 2015, pp. 95-110.
10 Р. Марковић, Управно право, Београд, 2002. pp. 347-354.

period of 24 hours. If the recipient is yet again not found at the address where the document is supposed to be delivered, the forwarded makes a note about it and leaves the notification in the same manner as explained in the paragraph above.

In any event, personal delivery is deemed to have been performed upon the expiry of 15 days from the date when the notification is left in the place where the document is supposed to be delivered.

The Law also provides for indirect delivery. Thus, if personal delivery is not mandatory, and the recipient is not found at the address where the document is supposed to be delivered to him/her, it can be delivered to another person who accepts to hand it over to the recipient and it should primarily, and if possible, be an adult member of the recipient's household or a person who works with the recipient – if the document is to be delivered to the recipient's work place. The only restriction here is that the document cannot be delivered to a person who is an opposing party in the same proceeding. Given the nature of the matter, it is likely that such a person would not take sufficient care about handing the document over to the addressee.

The other person to whom the document is delivered shall sign the delivery note. The forwarder shall enter the relationship of the other person with the recipient and the date when the notification was delivered to the other person in the delivery note.

If the other person does not accept the delivery of the document, it is left in the place where it is supposed to be served to the recipient, and the time and date of leaving the notification and the deadline after which the delivery shall be deemed to have been made are indicated on the envelope and the delivery note.

An indirect delivery is deemed to have been made upon the expiry of 15 days from the date of serving the document to another person or when it is left in a place where it is supposed to be handed to the recipient.

The delivery note is a confirmation and represents proof that the delivery has been made either personally or indirectly. It contains the personal name and address of a person, as well as the data identifying the delivered document. It is signed by the delivery officer and the recipient or another person to whom the document has been delivered. In addition, figures and letters are used to enter the date of delivery of the document on the delivery note. The delivery note may be in paper or electronic form.

If the recipient or another person to whom the document has been delivered refuses to sign the delivery note, the forwarder specifies this in the delivery note and uses figures and letters to write the date of the delivery of the document, whereby the delivery is deemed to have been duly performed. This situation should be distinguished from the situation in which the recipient of the document refuses to receive the document in case of personal delivery. Namely, in such a situation, the delivery has not been made, as the recipient has not come in possession of the document that is delivered. As we have already explained, the

forwarder produces a notification on the possibility to take over the document and possibly a note on the rejection of the reception. In the former situation, the delivery has been performed, as the document has been delivered - only the recipient or another person have refused to sign the delivery note. That is why there is no delivery deadline, as the delivery is considered to have been duly made as soon as the forwarder writes on the delivery note what happened and when.[11]

The Law also includes provisions on delivery by public announcement. Public delivery, as a rule, represents a subsidiary form of delivery and is used in the following situations/cases: 1) if no other form of delivery is possible; 2) if the decision is delivered concerning a larger number of persons who are not familiar to the authority, and the delivery in another way is not possible or appropriate; 3) in other cases stipulated by the law.

Obviously, this type of delivery is resorted to only when personal or indirect delivery regarding a specific matter is not possible.[12]

Delivery by public announcement consists of publishing the document on a web presentation and the notice board of the public law authority. The document may be published in an official gazette, daily paper or in another appropriate manner.

Delivery by public announcement is deemed to have been made within 15 days of the day when the document was published on the web presentation and the notice board of the authority. The authority can for justified reasons extend this deadline. If a decision is subject to public delivery, its justification may be omitted. The decision is accompanied by the data on the place, premises and manner of insight into the justification. The reason for this lies in the fact that persons other than the addressee could find out confidential or classified data or the data on the addressee's personality contained in the justification of the delivered decision.

CONCLUSION

Notification is an important legal institute of the general administrative procedure. It essentially encompasses a set of actions relating to the procedure for delivering official documents (summonses, decisions and other documents) to the persons they concern, or are communicated to them in another way. Notification is of great practical legal significance both for the parties and for exercising their rights and duties, and for the authority issuing the given document, i.e. for normal, efficient and cost-effective unfolding of the administrative procedure.[13]

11 Д. Миловановић, В. Цуцић, *Унапређење пословног окружења у Србији у светлу нових решења Нацрта закона о општем управном поступку*, Усклађивање пословног права Србије са правом ЕУ (ур. проф. др Вук Радовић), Правни факултет Универзитета у Београду, Београд, 2015, pp. 445-469.

12 Б. Мајсторовић, Коментар ЗУП-а, Београд, 1978.

13 В. Цуцић, Унапређење правне заштите грађана у управном поступку, Полис, Тема

In this sense, the delivery of a decision to a party is an integral part of passing the decision, and the decision can be deemed passed when the party has been duly notified about it. This is because the decision is passed when it can produce legal effect. The decision made in an administrative procedure cannot produce any effect until it has been communicated to the party. This is why the provisions of the Law pertaining to notification are very elaborate in respect of the delivery techniques.[14]

These rules have a twofold aim: 1) to protect the addressees against possible arbitrariness of the authority and from harmful consequences of improper notification; 2) to prevent all kinds of abuse by unconscientious individuals who would disregard the act of notification and thus avoid getting acquainted with the contents of the document in an attempt to avoid legal consequences deriving from the document.[15]

The provisions contained in the new Act pertaining to notification will hopefully lead towards achieving the said goals.

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14 Д. Васиљевић, Облици управног поступања по новом Закону о општем управном поступку Републике Србије, Правни живот, Београд, бр. 10/2017, том II, pp. 351.363; D. Vasiljević, Legal nature and significance of guarantee act as provided for in general administrative procedure bill, Međunarodni naučni skup Dani Arčibalda Rajsa, Tematski zbornik radova međunarodnog značaja, Kriminalističko-policijska akademija, Beograd, 2016, pp. 44-54, Vol. I.

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POLICE COOPERATION IN THE EUROPEAN UNION – ORIGINS, PRESENT STATUS AND CHALLENGES[1]

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Abstract: This article lays ground for a legal analysis of the EU police cooperation, i.e. its origins in the pillar structure established in the Maastricht Treaty and present-day features based on the Lisbon Treaty.

In the first part, the institutional setting is depicted, based on the intergovernmental decision-making process. Furthermore, the emphasis is put on the "remodelling" of the EU architecture with the aim of ensuring closer cooperation through supranational decision making. The third part deals with the institutional dialogue, set up with the Lisbon Treaty, and explore common goals of Member States. Finally, our article touches upon issues such as the importance of EUROPOL for the EU common goals which are, at the same time, the policies of utmost national interest. We argue that further improvement is needed, especially when it comes to better and close cooperation in practice, not only within EU Member States, but also with neighbourhood and accessing states.

Key Words: Police Cooperation, Justice and Home Affairs, Maastricht Treaty, Lisbon Treaty, Europol.

INTRODUCTION

EU police cooperation has been one of the very controversial areas of EU communitarisation process. The fear of "erosion of national sovereignty" (Tekin: 2015, 82) has been present since the beginning of the European project.

However, the creation of Common market's four freedoms, touched many issues deeply entrenched in legal systems and had strong affinities to question national sovereignty (Lavanex: 2010, 458). With the realisation of the free movement of persons and the establishment of the Schengen area,what was once perceived as the responsibility lying solely on states'governments, was later on stig-

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matised as egoism and inconsequent behaviour (Tekin:2015,86). Consequently, police cooperation was difficult to agree upon, due to different interests, legal and constitutional traditions. For those reasons authors tend to characterize the Area of Freedom, Security and Justice(AFSJ)[4] as slow in communitarisation but at the same time one of the fastest growing EU policy areas.

Our paper will depict police cooperation as a sensitive political issue through the legislative and institutional evolution in the changing Treaties. With the abolishment of internal borders, police forces were constantly confronted with legal, social, technological and trans-border challenges that they needed to respond to in a proper way (Gruschinske, Hirschmann, Füger, 2015).

The need for a common response led to the remodelling of the pillar structure and piercing of the Community method: The AFSJ was declared a fundamental objective[5], and in the Amsterdam and Nice era, it was the busiest one when it comes to the regulation and adoption of the EU policies.

Thus, in parallel with the analysis of institutional and legal setting, we will outline the stages in development dealing (more or less) effectively with common issues: through joint management and cooperation and through application of general institutional framework. Given the amount of opened issues surrounding its evolution, our work focuses on the EU integration path, as well as on the development of the police cooperation, in order to present its "thorny road" through the process of Europeanisation. Finally, we will also shed a light on issues of protecting core constitutional values occurring in the process.

INSTITUTIONAL SETTING OF THE FORMER TREATIES STRUCTURES

Pre-Maastricht cooperation and initiatives

It should be noted that prior to the Maastricht Treaty (Treaty on the European Union, Office for Official Publications of the European Communities, 1992) police cooperation remained on the intergovernmental level confronted with common cross-border issues, and the reason was difference in its nature and organization of European legal systems. Looser mechanisms of cooperation were envisaged in order to resolve, in the least „painful" way, the ongoing debate about preservation of national sovereignty depicted in police cooperation and freedom, security and justice.

Even though the idea of European police agency dates back in the early 1970s, the first proposals were discussed in the 1980s within ministerial and police groups in Germany. TREVI, an acronym for Terrorism, Radicalism, Extremism

4 Police cooperation is part of the JHA and later AFSJ policy of the EU

5 Article K.1, Treaty of Amsterdam Amending the Treaty On European Union, the Treaties Establishing the European Communities and certain related acts, Office for Official Publications of the European Communities, 1997

and Violence International, set in 1976, provided an important arena for 12 MS interior ministers to exchange information for encompassing European crimes. Its work was, however criticized from the beginning and characterized as controversial and secretive (Bunyan, 1993, 2). With the Single market creation, Ad Hoc Group on Europol was established and it recognized the importance of the information and practice sharing but also emphasized the work on education and training of police forces creating the European response (Bunyan, 1993).

Moreover, Schengen Agreement was the backbone of the Third pillar, as well as strong motivation for its institutional and legal foundation. Signed in 1985[6], it removed border controls and facilitated the complete freedom of movement including policing, immigration, asylum, trafficking and external border controls (Bunyan, 1993).

First cooperation mechanisms, therefore, had an important impact for the further development of the aforementioned area, but at the same time faced serious gaps in legitimacy, to name with exclusion of EU institutions in decision making, as well with secrecy that surrounded Schengen Convention[7] negotiations and implementation (Peers, 2011).

The emergence of the Third Pillar Structure "Europeanization of the fight against crime"

(Eckes, Konstadinides, 2011:4)

Maastricht Treaty was considered to be a „catalyst for the creation of Europol"(Monaco: 1995, 275), and, we add, first legal act that showed that European police cooperation efforts have achieved its legal results.

This phase could be described as „formal intergovernmentalism" (Peers, 2011: 271) and it was achieved through three-pillar structure. Treaty also established a mechanism for the cooperation of MS in the areas of Common Foreign and Security Policy and Justice and Home Affairs. The crucial difference laid precisely in the fact that First- Community Pillar was governed by the supranational method while the Third Pillar functioned on the intergovernmental level, which was the result of the sharply segmented national politics(Craig, De Burca, 2011: 926).

Rules that were laid in Title V gave MS the liberty to maintain maximum control over police cooperation, still considered undeniably a part of national sovereignty. Even though participation of EU institutions was envisaged, the decision making was on the Council, while the European Commission was even refused this joint right in the area such as policing and criminal law (Peers, 2011). This ultimately imposed significant limits on the EU effectiveness.

6 *https://www.schengenvisainfo.com/schengen-agreement/*, accessed on 22 May, 2019
7 The Schengen Agreement and the Convention (signed on 19 June 1990), *https://ec.europa.eu/home-affairs/content/schengen-agreement-convention_en*, accessed on 24 May, 2019

Article K.1[8]introduced police cooperation as an area of common interest with the aim of preventing terrorism, international crime and drug trafficking. The predominantly national decision making input is clearly stated in the article K.3, which explains that the Council could adopt Conventions or other acts, not clearly defined (Joint Actions, Joint Positions, and Common Positions)[9]. In addition, acts are brought by the Council, leaving the role of the EU Parliament as consultative, whose "views will be duly taken into consideration"[10].

Essentially, what Maastricht brought for the first time is a "new banner" that gives legitimacy to the EU which meant institutionalisation of Member states' forums without subjecting themselves to supranational control. However, in reality it was, as Jacques Delors described it, in November 1992: „Member states will inform and consult each other within the Council, the Commission has no power of initiative in this area" (Bunyan, 9).

Amsterdam Treaty and the "architecture" remodeling

The establishment the AFSJ in the Amsterdam treaty, on the 1st of May 1999[11], presented another step towards consistent and coherent policy (Eckes, Konstanides, 2011). It went on to adapt the decision making systems to new challenges that arose under free movement of persons incorporated under new Title IV. In reality, the driving force was European security (Lavenex: 2010). The era or the "modified intergovernmentalism (Peers, 2011: 272) consisted of three-pillars remodeling in order to adequately accept criticism that JHA policies were unsuited to the national governments' cooperation established (Craig, De Burca, 18). However, modifications it made were modest: the issues of immigration and asylum law were transferred to the First Pillar[12] while policing and criminal law remained outside of the Community legal order.

Article 30 of the Amsterdam Treaty was a formal attempt to strengthen and enhance community police cooperation (Heid: 2015), having in mind that the Third pillar dealt with police and judicial cooperation purely in criminal matters. It also emphasized operational cooperation, cooperation of police forces' task experience and training[13]. There was a dominance of non-binding documents through activities of the Council realised in Common Positions, Framework Decisions and Conventions[14]. In addition, the EU Court did not have a major role, leaving it to each MS to opt for full jurisdiction over references(by the end of the

8 Art. K1, Treaty on the European (TEU)
9 Article K.3 TEU
10 Article K.6 TEU
11*http://www.europarl.europa.eu/about-parliament/en/in-the-past/the-parliament-and-the-treaties/treaty-of-amsterdam* , accessed on the May 24, 2019
12 TITLE IV: Visas, Asylum, Immigration and other Policies related to Free Movement of Persons
13 Article 30 Amsterdam treaty
14 Article 34 Amsterdam treaty

Amsterdam period nineteen MS had given the Court jurisdiction (Peers, 2011: 275).

Even though co-decision process was expanded to the benefit of the European Parliament, its actual involvement was less than satisfactory (Lavenex, 2010: 466). The reason was the thin line between the legislation of the First and Third Pillar when it comes to AFSJ issues, and thus had the elements that could be encompassed by both decision making processes: community and intergovernmental. The European Commission, however, under the president Romano Prodi, gradually expanded, with the creation of the new Directorate-General on JHA (Lavenex, 2010: 463), and CATS (Committee for Police and Judicial Cooperation in Criminal Matters) that dealt solely with Third Pillar Issues.

In a broader perspective, one of the main achievements was the initiative that JHA Council is to replace the Europol Convention with the Europol Decision that would turn Europol to a regular EU agency (Lavenex, 2010: 474). In general, the weaknesses that led to reforms and reestablishment of the "common action" did not provide adequate institutional setting and the capacities for the pending enlargement. Instead it represented a delicate compromise with a limited impact of intergovernmental cooperation.

THE EVOLUTION OF EUROPOL

In 1989, former Metropolitan Police Commissioner Sir Peter Imbert: "The time is not right to consider a European Police Force, and those who are currently advocating it are perhaps expecting us to run before we have shown we can walk" (Woodward, 1993: 12). Conversely, in 1991 thanks to the initiative of the former German Chancellor, Helmut Kohl, internal security and task forces cooperation was recognized as "vital, overdue and essential accompaniment of the Single Market". Kohl argued for a European response and the establishment of Europol as a model of promoting police integration, which he envisaged to be a future "European FBI" (Mitsilegas, 2009:162).

Maastricht Treaty gradually developed Europol functions, with exchange of information, followed by the power to act within the MS accompanied by the right of the Commission and States individual initiative (Mitsilegas, 2009: 162). This raised numerous issues such as the transfer of powers, mandate and the accountability that would define the relationship of the newly founded European body and MS.

Europol Convention, signed in 1995[15] (Europol Convention, Official Journal of the European Communities, C 316/1, 1995) found it legal basis in the articles K.3.2 (c) and K.1 (9) of the Maastricht Treaty. Article 2 of the Convention provides the Europol objectives, emphasizing its intergovernmental nature: "within

15 Council Act of 26 July 1995 drawing up the Convention based on Article K.3 of the Treaty on European Union, on the establishment of a European Police Office

the framework of cooperation between the Member States" and underlying goals in prevention and fight against "terrorism, unlawful drug trafficking and other serious forms of international crime"[16]. It stressed collection and sharing of information as primary roles, but added: "aid in investigations, strategic intelligence, and development of the specialist knowledge as well as preparation of general situation reports"[17]. In addition, it set tasks for both Europol and MS, crucial for the EU police cooperation: training of authorities, organization of equipment, crime prevention methods, sharing of police methods advice in investigative procedures, which provided a solid basis for the CEPOL establishment[18]. Stemming from the Third pillar postulates, the Council had a major role in the functioning of the Europol while the Parliament was left with a consultative role. Europol gained legal capacity and established organs that were functioning also in accordance with the intergovernmental principle. However, one of the major "downsides" was the delay of the entry into force of the Europol Convention, because it required ratification by all (15) MS. Over and above that, the jurisdiction of the European Court of Justice was extremely limited: MS were asked to make a Declaration by which they opt for the Court to give preliminary rulings on the interpretation of the Europol Convention (Mitsilegas, 2009)

Lastly, two main issues were thoroughly discussed on the European Level: Europol legal framework that would not be regulated in the form of the Convention and the change of its mandate to become more operational (Mitsilegas, 2009).

TOWARDS A COMMUNITY METHOD

Lisbon Treaty setting

In 2009, Vice President of the European Commission and Commissioner in charge of Justice, Freedom and Security, Jacques Barrot stated: "Politics in the area of Freedom, Security and Justice are at the heart of the people's interest"[19]. Eurobarometer survey taken at the time of the Lisbon Treaty (Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community, Official Journal of the European Union C/306, 2007) entering into force, showed that "a majority of respondents feel concerned about all major policy areas in the AFSJ/JHA in particular the fights against organized crime, terrorism and drugs abuse (both 80%)"[20]. Opinion of citizens demonstrated that EU common response was indeed a priority. What is more, the dismantlement of the Pillars structure brought a greater participation of EU institutions which had effects on democratization of the entire process (Kietz: 2015). The Treaty formulates ambitious goals for the EU (J.P. Luchtman, 2013: 32) and among its core val-

16 Article 2.1 and 2.2 of the Europol Convention
17 Article 3 of the Europol Convention
18 The European Police College (CEPOL) was established by Council Decision 2005/681/JHA
19 *europa.eu/rapid/press-release_IP-09-70_en.pdf* , accessed on May 29, 2019
20 *Ibid.*

ues stated in the Article 3 lists AFSJ along with the crime prevention[21]. Article 67 TFEU characterizes the objectives set in Article 3.2 TEU by envisaging that: the EU "shall constitute an area of freedom, security and justice", but it still takes note of the national legal systems and the importance of safeguarding sovereignty[22].

Hereafter, policy making area was altered significantly by introducing new institutional setting[23] but also deeper police cooperation among MS in relation to prevention, detection and investigation of crime while legislative measures can now be enacted pursuant to the ordinary legislative procedure.

Central feature of the police cooperation was that it introduced new intergovernmental cooperation highlights, but in practice it also created room for inter-institutional conflict and depended on the will for cooperation between all actors involved (Kietz, 2015: 56). One of such was formal competence for the Council to set the strategic guidelines reinforcing "polycentric nature of EU policy making"[24]. Additionally, it gave EP power to exercise scrutiny over bodies operating in that field (Gruschinske, et al. 2015) and to finally be involved in the negotiations, and decision making procedure[25], which was a democratic step forward. Likewise, the Commission wanted to be an agenda-setter, and the Treaty boosted its powers along with ones of the national parliaments [26](Kietz, 2015: 56). Inevitably, there were some limitations imposed stating that the police cooperation will not affect in any way "maintenance of law and order and the safeguarding of internal security"[27] of each MS, therefore leaving the Third pillar method to still "throw a permanent shadow" over this area.

It is safe to say that new rules were more democratic and effective on the European level providing single legal order, but at the same time also complex as the Lisbon created basis for some conflict-prone intergovernmental issues.

EUROPOL and the Lisbon Treaty

The Council already brought a Decision establishing Europol and ended constant Convention amendments (Council Decision of 6 April 2009 establishing the European Police Office (Europol), Official Journal of the European Union L 121/37, 2009). It predicted partial communitarisation of the Europol legal and operational basis and enhanced the role of the European Parliament. Europol Decision reiterated the importance of being a fully operational EU agency: establishment and further functioning simplification "can be achieved through measures aimed at widening the possibilities for Europol's assisting and supporting the competent law enforcement authorities of the MS, without providing for ex-

21 Article 3 TEU
22 Article 67.1 TFEU
23 Chapter 5 - Police Cooperation - Article 87
24 Article 68 TFEU
25 Article 87.3 TFEU
26 Article 69 TFEU
27 Article 72 TFEU

ecutive powers for Europol staff"[28]. It envisaged joint investigation teams where Europol staff can directly access the Information System for all national units, which could profoundly facilitate the cross-border cooperation. Besides tasks stated in the Article 5[29], Europol shall also "assist MS through support, advice and research. Europol's main fields of action could be divided in two parts – an intelligence role and investigative and operational action with a mission to support and strengthen action by MS police authorities and their mutual cooperation in preventing and combating serious crime To summarize, Lisbon Treaty provided Europol a legal ground to function as an international agency, reconfirmed in the Council Decision. Even though Europol, in the same way as Interpol, does not function in its own operational capacities, it grew to be support to MS in a fight against serious transnational crimes, centralizing network based information. Additionally, it ensured transfer of police educational issues to mainstream policy-making (Aden, 2011: 101), which brought attention to the importance of police professionalism in the EU (Aden, 2011)

CONCLUSION

The evolution of EU police cooperation touched upon fields at the heart of states' sovereignty: on the one hand we had, what is traditionally the right to protect your citizens from crime which lies very close to the core of national state, and on the other, new security issues that stemmed from "borderless" crime. This provided a middle ground for the establishment of an 'Area' (not a 'Community') that stroke a balance between European integration and national sovereignty (Eckes, Konstadinides, 2011).

Externalisation of national affairs issues through Europol clearly showed that cross-border crime urges for cross-border response (Eckes, Konstadinides,2011: 2), as Lisbon treaty restored democratic legitimacy and aimed to bring efficiency. At the heart of all conflicts lies the never-ending struggle of national vs. supranational (Lukić Radović, 2016), especially when it comes to sensible security issues which demand police cooperation. The reforms were to facilitate political agreement by replacing unanimity rule with qualified majority voting in the Council for the majority of issues and to upgrade Commissions agenda-setting and enforcement powers. However, the role of the Commission is continuously in the conflict-zone as opposed to MS when it comes to legislative initiatives. European Parliament, although bringing a democratic "touch" to this field proved to depend on parliamentarians using their new abilities and building early public pressure on Commission and Member States (Peers, 2013: 671). Having in mind all the difficulties that burdened the process from "intergovernmentalism to communitarism" it was not clear whether the legal and institutional evolution within this field was a race to the top or bottom (Aden, 2015: 214).

28 Council Decision establishing Europol-Preamble
29 Article 5, Europol Decision

Although Lisbon Treaty created a solid legal base for the cooperation of the police forces in the EU, it should be noted that for example Article 87.2 TFEU expressly limits investigation solely to 'criminal offences' thus excluding other offences that ought to be handled on the European level.

Finally, leaving this article open for further discussions regarding the future development of the EU police cooperation legal basis, we would stress key points that we can draw from this brief analysis. Firstly, even though the Lisbon Treaty afforded police cooperation much greater degree of flexibility (Lukić Radović, 2016: 149) in relation to MS participation, European police leadership needs to be strengthened in order to have visible European response in and outside of the EU. Secondly, the experience gained in applying the mechanism of enhanced co-operation (Lukić, Radović, 2016) in conjunction with the need of deeper integration in order to have a European response leads us to the conclusion that sound police cooperation policy must concentrate on correcting existing deficiencies. The cooperation that has been achieved, even though improved in numerous aspects-from legitimacy of decision making to the involvement of the EU institutions in order to create a proper common response, lacks firm coherency and joint operability. Whether it is because of the slow evolution and the decades-long focus on economic integration or it is because of the "natural" opposing role of the EU Commission in contrast to national governments when it comes to sensible initiatives, we seem to miss the stable consistency in the joint institutional efforts. Europol still remains the brightest example, but we cannot say that MS completely accepted the role it strived to be from the beginning and is far from the "European FBI". However its role in supporting investigations and cooperation as well as in education and know-how sharing is important, if not crucial and it needs to be supported and developed from both sides. On the doorstep of the third decade of the XXI century, where rarely any crime or security issue is purely internal, Member States need to understand that common response to trans-border issues is the only adequate answer.

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THE POSSIBILITIES AND CHALLENGES OF UAV IMPLEMENTATION IN SERBIAN POLICE

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Abstract: Police officers are engaged daily on collection of the data necessary for carrying out tasks within their responsibilities. Sometimes this data has to be collected immediately (e.g., police intervention is in progress), while in other situations there will be more time available for data collection. In both cases an aerial perspective can be of great value in gathering critical information for law enforcement.

For a long time aerial support to police operations was provided by manned aircraft (usually helicopters). Because of technology development during the last decade, law enforcement organizations are turning more and more to cheaper, smaller and stealthier unmanned aerial vehicles popularly called drones. They proved themselves as beneficial to various police branches – from traffic and border police, to tactical units and forensic units. At the same time, their implementation into policing raises significant privacy concerns. Hence their implementation must be followed by strict legal provisions which will regulate the way they can be used. Having this in mind this paper explains the most common ways UAV can complement or substitute existing helicopter unit in Serbia and legal challenges their implementation poses.

Keywords: air support, drones, UAV, sUAS, helicopters, safety, privacy protection.

INTRODUCTION

It is expected that the police, by the way it is organised and performs its function in the society, increases the probability of providing immediate protection of life, integrity and property of citizens whenever the need arises. Preventing and resolving crimes, traffic control, search for a fugitive or missing persons, securing the large-scale public events are only some of the duties police perform daily. In

these and other situations, in order to facilitate rapid response and collect critical information from aerial perspective, air units can be asked to assist.

During the last decade in the field of the air support to policing, one "player" is taking prominent place – unmanned aerial vehicles (UAVs). Slowly but with a steady pace, they are becoming an integral part of everyday policing. They proved themselves as beneficial to various police branches – from traffic and border police, to tactical and forensic units (Milojkovic, 2015: 8). At the same time, equipped with powerful cameras, their implementation into policing raises significant privacy concerns (Bentley, 2018: 274-287). That is why their implementation must be followed by strict legal provisions. Having this in mind this paper explains advantages UAVs have over manned aircraft, the ways UAVs can complement or substitute existing helicopter unit in Serbia and legal challenges their implementation poses.

UAV TERMINOLOGY

The terminology used today for UAV is still not clear and/or universally defined (Vasiljević, Vasiljević, Đurić & Pavlović, 2017: 493). Over the years, the term "UAV" dominated by the expert literature. At the same time in the everyday life the term "drone" is more prevalent. In addition to these terms, other terms like the remotely piloted aircraft system (RPAS) or aircraft (RPA) also exist, making confusion for those who are outside of aviation field, especially because these terms are usually used interchangeably.

There are two main groups of drones: those that are remotely piloted and those that are autonomous. The term UAV is used to mean an unmanned, autonomously functioning aircraft, while the term RPA means an aircraft controlled remotely by a third party. If we take into account that in both cases there is no human pilot on-board and that UAVs may operate with various degrees of autonomy: either under remote control by a human operator or autonomously via preprogramed flight path, than "less autonomous" UAVs could be considered as RPAs (in this case RPA may be considered as UAV's subcategory). The term 'drone' is military in origin but now firmly established in public parlance for both UAV and RPA (Official Journal of the European Union [EUR-Lex], 2014).

Terms like unmanned aerial system (UAS) or remotely piloted aircraft system (RPAS) involves much more than just an aircraft (UAV/RPA) - they encompass everything that makes a UAV/RPA to operate: the ground control station, communications, support equipment etc. This terminology confusion deepens even more by the lack of terminology standardisation. For example, *European Union Aviation Safety Agency* considered several terms such as Unmanned Aircraft Systems (UAS), Remotely Piloted Aircraft Systems (RPAS) (a UAS subcategory), but finally followed the general usage of the term 'drone' with the following definition: "Drone shall mean an aircraft without a human pilot on board, whose flight is controlled either autonomously or under the remote control of a pilot on the

ground or in another vehicle" (European Aviation Safety Agency, 2015). At the same time, *International Civil Aviation Organisation* (ICAO) does not use the term *drone*, but the terms RPAS and UAV (EUR-Lex, 2014). Finally, the drone industry does not stand still, but is growing so rapidly that some new terms appear and some older ones have to be redefined.

UAS can be categorized in a variety of ways based on vehicle attributes including the type of aircraft (fixed wing or rotorcraft), flight altitude (high, medium, low), weight, speed, etc. In the police practice, UASs that weigh no more than 25 kg are the most common. According to aviation industry standards, these UASs are categorised as *small unmanned aircraft systems* (sUAS). The most popular sUAS are small vertical-lift aircraft that are lightweight and easily transported but have enough power to carry a high-quality camera, a sensor package and a technology package that can include a global positioning system (GPS), allowing the aircraft to be programmed to fly a route without remote pilot control (Valdovinos, Specht & Zeunik, 2016: 7). Typical flight time for these devices can range from 10 minutes to 45 minutes. When it comes to policing, these aircraft is commonly used, so in the rest of this paper, the term sUAS will be used.

sUAS AS A PART OF AIR SUPPORT TO POLICING

Air support units have existed in police practice over decades[1]. Usually these units are equipped with helicopters, but also there are examples of law enforcement agencies that are using other types of aircrafts (e.g. fixed-wings aircraft, police blimps). The use of police air units is associated with:

- substantial cost of buying, operating, and maintaining manned aircraft (usually helicopters) which presents a huge obstacle to their use on a widespread or regular basis[2]
- the arrival time - police officers cannot always rely on helicopters because it takes too long for them to arrive. For example, in the UK during the year 2016, the requests for helicopter support were cancelled during transit to an incident on over 40 percent of occasions with the main reason incidents are often over before air support can arrive (Her Majesty's Inspectorate of Constabulary and Fire & Rescue Services, 2017: 6).
- they are too noisy to be used in tactical situation where information needs to be collected covertly because the effect of surprise is needed.

1 The first use of the aircrafts in the policing field dates back to 1914 inside New York Police Department. See: http://nypdhistory.com/the-worlds-first-licensed-pilotpolice-officer-the-pdnycs-own-mile-a-minute-charles-m-murphy-track-bicycle-champ-thrill-seeker-police-aviation-pioneer-and-advocate/)

2 Approximately $25 per hour cost to operate a drone, while traditional manned aircraft cost between $256 and $600 per hour. Drones suited for use by law enforcement can be obtained for a cost between $1,000 and $50,000, depending on the features sought, while manned aircraft can cost between $600,000 and $1 million. Drones cost $0 to store while manned aircraft can cost $300-$500 per month to store (Mary, 2017: 7).

On the other hand, not only that sUAS are more affordable (both in terms of buying, maintaining and operating them) compared to manned aircraft, they offer greater operational flexibility:

- They are portable and can be assembled and launched in minutes which allows rapid deployment;
- They could be used in incidents that are too risky or are beyond the technical capabilities of manned aircraft (e.g. active-shooter incidents, response to and assessment of hazardous materials etc.);
- They can be valuable support to policing in the activities that traditionally didn't involve any form of air support (e.g. crime scene documenting etc.).

Prior to implementation of sUAS in policing, police officers could only get air support from helicopters. Nowadays each police patrol may have its own "air support" in the trunk of a patrol car and may use it when the need arises. Although the benefits of sUAS are obvious and confirmed by many successful cases of their use in police practice[3], they should not be considered as a replacement for traditional manned aviation, but rather as their supplement (Shinnamon & Cowell, 2019: 5).

Despite their everyday growing capabilities, sUAS cannot perform all the functions of manned aircraft, such as medical evacuations, rescue operations, and the deployment of high-powered search lights to illuminate large areas (Shinnamon & Cowell, 2019:5).

For larger agencies, a sUAS is essential addition to their air units that may expand their aerial support to situation which are not convenient for traditional aircraft or to perform other regular tasks but with considerably lower costs. For smaller agencies, sUAS may be the only option to have an airborne support to everyday policing.

PUBLIC SAFETY APPLICATIONS OF sUAS

With constantly decreasing cost of sUAS, they are becoming more common in police practice. Law enforcement agencies are using them in various situations: in hostage negotiation, crime scene investigation, search and rescue missions, active shooting scenarios, apprehension of dangerous criminals, border protection with drones searching for illegal crossings, traffic control by monitoring drivers breaking traffic laws etc. Apart from these situations, sUAS are especially useful when there is a need to send officers to locations which are difficult to approach or too risky. These examples are just an overview of the most frequent ways law enforcement currently uses sUAS in their work. As time passes and UAS technology advances, some new opportunity for sUAS implementation into policing practice will arise.

3 For example, Tukwila Police Department's police practice. See: https://www.policeone.com/police-products/accident-reconstruction/articles/471473006-How-a-Wash-PD-is-leveraging-drone-technology-to-serve-citizens/ available.

In Serbian police practice the advantages of sUAS are not yet recognised nor exploited. Aerial support to police officers is provided exclusively by helicopter unit. The engagement of helicopters is mainly focused on providing transportation services (not only to police officers, but other civilian subjects), providing support to special units (mostly for the purposes of air landing), border protection (detection of illegal border crossing) and traffic police activities (traffic condition monitoring), crowd monitoring, search and rescue missions and firefighting support. By the use of the sUAS air support policing activities in Serbia may be complemented in many ways, but the following areas could be the most beneficial: crime scene investigation and forensic photogrammetry, search and rescue missions, tactical operations and traffic enforcement. The way sUAS can be used in these situations is described below.

Crime scene investigation and forensic photogrammetry

One of the most common task police do is documenting crime scene. The use of sUAS in crime scene processing turned out to be beneficial especially in those situations where crime scene entails huge areas (e.g. airplane crash, natural disaster etc.). With the improvements of imaging systems, GNSS technology and advancement in photogrammetry, aerial pictures become "intelligent" and able to document the precise locations of objects (evidences) scattered on the scene. This is particularly useful in *forensic investigations of traffic accident***s** that involve many vehicles. In these cases collecting evidences can be time-consuming process. At the same time, there is a huge pressure to collect evidence as soon as it is possible in order reopen the road and to preserve safety of those officers who are processing the scene and/or traveling citizens. When sUAS is utilized to map the crash scene, research has shown that the time taken to clear a crash scene and reopen the road can be reduced by 56% to 73% when compared to other measurement tools. Furthermore, the time officers were at risk in the roadway was reduced by approximately 28 minutes (78%) (Gambold & Freeborn, 2015; cited according: The Johns Hopkins University Applied Physics Lab, 2017:19,20).

Once obtained, photogrammetric images makes the reconstruction process more effective as examiners are no longer constrained by decisions (measurement) made by investigators at the scene. Photogrammetric data make it possible to return to the scene repeatedly and to measure the distance between any two points at any stage of the reconstruction. According to Iain Lopata drones are particularly good at locating and capturing fluid trails from crashed vehicles, which can be difficult to spot via other methods of accident reconstruction. In the large scale crime scene a UAS could save investigators hours of time in photographing the scene while providing a detailed visual that can be later used during prosecution (Zercoe, 2018).

Although recent studies showed that images captured by sUAS can provide measurements with generally acceptable levels of errors using photogrammetric

techniques (Jurkofsky, 2015: 136-152), in order to get a better insight into accuracy of measurements using sUAS with photogrammetry, additional researches are needed. The future research effort should not be conducted in controlled environment using a mock crash scene, but in a real situation with the aim of determining equipment, software, environment, and weather factors that may impact measurement accuracy (The Johns Hopkins University Applied Physics Lab, 2017). Until solid research evidence is not obtained in regard to accuracy of measurement using sUAS, their use will be reduced to merely obtaining aerial photographs of the scene.

Search and rescue

Regardless of whether children are lost in inaccessible terrain, a fugitive is on the run, or building is collapsed because of earthquake, police may be called to intervene. In such situations every second counts. Children may be freezing, fugitive is about to reach his shelter, person inside collapsed building may be seriously injured and the search and/or rescue operation must begin as soon as possible. In this situation sUAS can be launched instantly from just about anywhere without being hampered or impeded by the terrain. By using thermal imaging sensors, the ability to identify and locate victims/target is enhanced.

By covering large areas in a short period, a UAS can help save a life by locating a person much more quickly than could be accomplished on foot and minimize the amount of force that would otherwise be required.

There are certain situations in which a stranded person might be at an unreachable position and can't be reached by helicopters. In such cases, because of its smaller size sUAS are more useful in comparison to helicopters. They can easily reach this area and, if there is a need, to deliver supplies like radios, first aid kit, medicine and similar.

The small size of sUAS allows them to get through narrow spaces for example, inside of a building that has collapsed. They can be sent inside the building to locate trapped persons, to better understand what obstacles exist and develop a strategy to avoid or overcome them.

Tactical operations support

Advantages of sUAS compared to traditional manned aircraft are particularly visible in situations where police officers are expected to serve a search warrant, conduct raids, arrest barricaded suspect and during the hostage situations. In these situations data from aerial perspective can be valuable for achieving situational awareness. sUAS can provide more data, faster than sending in a (reconnaissance) team of police officers with less risk for their safety. Helicopters due to the noise they produce are not convenient means of collecting information

(reconnaissance), particularly if there is a risk for the pilot and/or aircraft to be shot from the ground.

sUAS are capable of collecting information in different phases of police engagement. In the *planning* phase they can aid law enforcement in more accurately assessing the nature of the threat presented by the shooter. They can collect information (intelligence) about location, providing valuable information about access and escape points (doors and windows), animals that could alert the suspect of approaching officers, trip hazards, suspect(s)/others moving about inside the building, and lighting (interior and exterior) conditions (Shinnamon & Cowell, 2019: 17). Aided by powerful cameras officers could be informed about the number of suspects, types of weapons they use and to determine the position of the shooter(s). The unique capabilities of unmanned aircraft—particularly those equipped with multi-rotor systems, allow operators to approach elevated or difficult to reach positions with ease. Areas that would typically be impassable or inaccessible on the ground could be quickly accessed and evaluated from an unmanned aircraft (Wallace & Loffi, 2017: 6). During the entry phase, sUAS can provide real time video from aerial perspective or from inside the apartment, to officers and command post simultaneously, so they can react and make necessary and timely decision. In situations where decision should be made quickly, availability of real-time data is of the utmost importance. Should the suspect(s) attempt to escape, the sUAS can be used to detect such a movement and to alert officers in charge of perimeter security. In case suspect decides to surrender, sUAS can be sent to verify that he/she put his weapon down, so he/she could be approached more safely.

Traffic safety

By enforcing laws to curtail unsafe/illegal driving practices the main objective of traffic police is the reduction of traffic related injuries and fatalities. Recently, in order to increase the traffic police's omnipresence and reduce costs, police organisations worldwide started to implement drones into their traffic policing practice. The major advantage of sUAS compared to traditional traffic enforcement resources (e.g., police cars and speed cameras) is their ability to provide both a "bird's eye view" of drivers as well as their flexible mobility, which are not restricted to traveling on the road network and conditioned by traffic congestion (Rosenfeld, 2019:199-206). Using the police can enhance monitoring and reporting suspect traffic violations. For example, they can easily spot people driving in the emergency lane a driver who does not stop at stop signs, reckless overtaking and other illegal behaviors on the roads. The results show that drivers perceive traffic enforcement sUAS as significantly more efficient and deterring compared to current aerial traffic enforcement resources (i.e., police helicopters) and comparable in quality to speed cameras (Rosenfeld, 2019: 199-206).

In case a car is pulled over, a sUAS can be sent to check if the driver is injured, ill or just suffering car trouble. Based on info received from sUAS, tow trucks can be alerted and they can be given instructions about the best way to get to the scene. Similarly, drones can provide important information during major traffic accidents by visualizing the magnitude of the accident and its impact on traffic flow. This information can help redirect traffic, as well as to help incoming emergency units to respond more effectively (Werner, 2015).

LEGAL ASPECTS OF THE USE OF UNMANNED AERIAL VEHICLES IN POLICE WORK

Aided by surveillance technology, sUAS can collect various information about spaces, facilities and people, thereby violating their privacy. The use of sUAS without surveillance technology (e.g. cameras), just as the very use of a helicopter, basically does not constitute interference with fundamental human rights. The extent of the impact on privacy primarily depends on the equipment they have and the purposes for which such equipment is used (Brezpilotni letalniki, 2015: 5)[4]. For example, the use of a sUAS's camera for the photogrammetric recording of a scene does not carry the risk of human rights violation. At the same time, recording a person at a public gathering can have implications for human rights.

In our national frameworks, the right to privacy, other human rights and freedoms are guaranteed by the Constitution of the Republic of Serbia[5]. By guaranteeing the protection of personal data, the Constitution protects citizens from the unauthorized and unlawful collection of their data, prescribing thus for the collection, storing, processing and the use of personal data to be regulated by law (Article 42, paragraph 2).

Personal data protection is guaranteed to any person, regardless of nationality and residence, race, age, sex, language, religion, political and other belief, nationality, social origin and status, assets, birth, education, social position or other personal characteristics[6] (Article 1 paragraph 1 of the Serbian Law on Personal Data Protection[7]).

This right, like any other citizen's right, may be denied by a public authority only in cases grounded in law. So, public authorities may process data about a

4 UAVs may have installed devices for biometric face recognition, video recording, photographing, infrared, thermal and UV cameras, recording equipment, radars, automatic number plate recognition and vehicle speed measurement systems, arming and passivation systems (e.g. tear gas) and other means that could violate the constitutionally protected human rights.

5 "Official Gazette of the Republic of Serbia", no. 98/2006.

6 Personal data means any information relating to a natural person. See more in Article 3 par. 1 point 1 of the Law on Personal Data Protection.

7 "Official Gazette of the Republic of Serbia", No. 97/2008, 104/2009-as amended, 68/2012-decision of Const. Court, and 107/2012.

person[8] without his/her consent if processing is necessary in order to realise tasks from their competence determined by law or other regulation for the purpose of realising the interest of national or public security, state defence, prevention, detection, investigation and prosecution for criminal offences, economic or financial interests of the state, protection of public health and morals, protection of rights and freedoms and other public interest, and in other cases on the basis of data subject's written consent (Article 13 of the Law on Personal Data Protection). This means that any data processing must have legal grounds in the law that will be specified with a defined goal and purpose for which personal data is processed.

The police, as a public authority, can collect or process personal data in various ways including the sUAS only after legal prerequisites are met. For the accomplishment of this and other tasks, the police have authorities envisaged by the Law on Police[9]. Authorities from the Law on Police do not provide legal possibilities for the police to collect or process personal data with the help of sUAS. Thus, any use of the sUAS by the police for the processing of personal data would constitute a violation of the right to privacy,[10] the actions of which are incriminated by the provisions of the Criminal Code[11].

The positive practice of the world policing community on the use of sUAS in carrying out police tasks, as well as the efficiency and lower operational costs associated with their use, are factors that justify their introduction into Serbian police practice. In this view, the Law on Police should first create the legal grounds for their implementation. The legal regulation of the use of sUAS in the Law on Police for the processing of personal data can be established in two ways. The first would imply envisaging the possibility of collecting personal data using appropriate technical means within the scope of the already existing authority – the collection of information. Appropriate technical means would include not only sUAS but other means the police would use depending on the specific nature of an event. This solution can cause dilemmas and leaves space for possible abuse of certain technical means for different purposes.

8 Data processing is any action taken in relation to data such as collecting, noting, rewriting, reproducing, copying, transferring, searching, sorting, uploading, separating, crossing, merging, appropriating, modifying, securing, using, submitting for review, disclosing, publishing, disseminating, recording, organizing, storing, adjusting, disclosing by transmission or otherwise making available, concealing, removing and otherwise making unavailable, as well as carrying out other actions in relation to the above data, regardless of whether it is done automatically, semi-automatically or otherwise (Article 3, paragraph 1, point 3 of the Law on Personal Data Protection).

9 "Official Gazette of the Republic of Serbia", No. 6/2016, 24/2018 and 87/2018.

10 Violation of the right to privacy exists in cases where the restriction of the right to privacy is applied contrary to the provisions of the existing law. Also, the violation will exist even if there is no domestic regulation that regulates a certain type of right restriction. This rule was highlighted in the case of Taylor-Sabori v. the United Kingdom from 2002 when the applicant complained his pager was surveilled, although at the time there was no relevant regulation that allowed eavesdropping of this means of communication (Sinđelić, 2012: 30).

11 "Official Gazette of the Republic of Serbia", No. 85/2005, 88/2005-corr., 107/2005-corr., 7372009, 111/2009, 121/2012, 104/2013, 108/2014 and 94/2016. See Article 146 of the Criminal Code.

For the sake of avoiding any dilemma, the legal provison on the use of sUAS should be defined with a precise aim and purpose, and it can read: The police may use sUAS for collecting data about spaces, facilities, events and persons while performing anti-terrorist tasks, establishing a disrupted public order on a larger scale, arresting terrorist, criminal groups and individuals, securing public gatherings, certain persons and facilities of particular importance for the Republic of Serbia, searching and rescuing missions, and providing assistance in case of natural disasters and other emergency situation. Moreover, it should be envisaged that the police can use sUAS to perform other police tasks in case a task cannot be performed using other means and methods, or this would be difficult or associated with considerable difficulties and delays.

The data collected using sUAS could not be used as evidence, like the data collected through other informal measures in accordance with Criminal Procedure Code.

From the organizational aspect, it is possible to entrust the use of sUAS to individual members of organizational units who, by the nature of their jobs, can find themselves in a situation requiring the use of sUAS and who would undergo proper training and certification, in accordance with applicable regulations (for instance, uniformed police officers in a police directorate, Special Anti–Terrorist Unit specialists, gendarmes in the Gendarmerie, police officers in the Criminal Police, etc.) or to entrust these tasks to an existing organizational unit that carries out technical support activities[12]. In resolving this dilemma, one should consider the type, urgency, riskiness, and complexity of the tasks to be performed. Thus, the complexity and risk of tasks, the secrecy of operations and the urgency of action of the Special Anti–Terrorist Unit, the Gendarmerie and the Criminal Police[13] justify the equipping of these organizational units with sUAS, while other not so risky and complex tasks could be performed by organizational units for technical support in police directorates. Such a solution would be completely justified and acceptable, as the Special Anti–Terrorist Unit, Gendarmerie, and Criminal Police could use sUAS independently in case of a need for rapid and urgent action, while on the other hand, the technical support unit would use sUAS in carrying out regular tasks for the needs of the police directorate.

The beginning of the use of sUAS in Serbia for commercial and non-commercial purposes was followed by the adoption of regulations regulating the ways and conditions for their use. Thus, based on the Air Transport Law[14], the Rules on Unmanned Aircrafts[15] (hereinafter: the Rules) were adopted defining the conditions for the safe use of unmanned aircrafts, their classification, recording, maintenance, as well as the conditions that must be met by persons using unmanned

12 The work of organizational units for technical support in police directorates is organized by the 24/7 on-call system.
13 In the Criminal Police, it would be justified to equip specialized services with UAVs.
14 "Official Gazette of the Republic of Serbia", No. 108/15, 73/2010, 57/2011, 93/2012, 45/2015 and 66/2015.
15 "Official Gazette of the Republic of Serbia", No. 108/15

aircrafts. The Rules state that its provisions do not apply to aircraft used by the police, army, and customs (Article 1).

Along with establishing legal grounds in the law for the use of sUAS, bylaws should also regulate the issues related to the rules and procedures for using sUAS by police officers, issuing approvals for the use of sUAS, training police officers for handling and use of sUAS, issuing and extending licenses, conducting regular training, controlling the use, keeping records etc. in more detail.

The use of sUAS should be based on defined procedures, rules, and conditions and entrusted only to trained police officers. The normative framework, defined procedures, rules, and training system constitute the factors for the legal, proper, and safe use of UAVs.

CONCLUSION

During the last decade the use of sUAS attracted huge popularity worldwide. Not only are they used by hobbyists or commercial enterprises, but also from government agencies too. Numerous cases of successful use of UAS in police practice showed that they can increase operational efficiency and improve officer and community safety. They can, among other benefits, help find lost persons, protect police officers during searches for armed suspects, decrease time needed to process crime and accident scenes, and aid traffic safety efforts. While the sUAS has significant potential to improve public safety, there raise legitimate citizens' concerns about privacy risks. In order to overcome public-acceptance challenge, carefully devised legal frameworks must be implemented which will regulate who is allowed to deploy drones and where, under which circumstances and other issues related to how to collect, use, and disclose imagery obtained through the use of a UAS.

In Serbian police practice UAS can complement existing helicopter unit and make air support to policing more accessible. In order to do that, some legal steps need to be taken in order to change Law on Police in order to institute a legal base for sUAS use by police and define policies related to their practical use (how to incorporate them into existing organization, training, certification etc.). Finally, the benefits of sUAS are not only recognised by police, but from criminals too, so along with sUAS' implementation into police practice, there is a need for implementation of counter-drone systems.

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OBJECTIVE APPROACH TO POLICE OFFICERS SELECTION

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Abstract: Protection and enhancement of people and property security is the police aim. To achieve this aim police officers carry out numerous activities. Bearing in mind the previously mentioned, the goal accomplishment directly depends on an employee's quality. Thus, hiring the best candidates is one of the most important activities of human resource management in the police organization. In order to employ the best candidates, the police leadership strives to increase objectivity through the process of police officers' selection. In that process, based on job description, human resource specialists set the criteria of choice. Concerning different importance of the criteria, it is necessary to determine weight for each criterion and, based on the criteria and individual characteristics of candidates choose the candidate who best fulfils job requirements. The objective of this paper is to describe an objective approach to police officers selection through the application of Analytic Hierarchy Process (AHP) and Multi-Attributive Ideal-Real Comparative Analysis (MAIRCA). This approach is equally applicable within police organization as well as in other organizations.

Keywords: human resources, selection, AHP, MAIRCA, method.

INTRODUCTION

Police performs numerous activities to ensure equal protection, rights and freedoms for everyone. Bearing in mind that police officers carry out these activities, police efficiency depends on their quality. To increase the efficiency and accomplish police goals, it is necessary to hire employees with adequate knowledge,

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abilities and skills. Human resources selection is one of the basic processes that enable the choosing of the best candidate. One of the human resources selection characteristics is a certain level of subjectivity.

Concerning that, the responsible management strives to increase the objectivity as much as possible. In order to reduce bias, police management can apply predefined criteria. The criteria depend on job description and there are fundamental and additional criteria. Fundamental criteria are mandatory, i.e. all candidates have to fulfill these requirements. In contrast, auxiliary criteria are desirable, so candidates should meet demands as much as possible and the candidate choice hinges on the fulfillment level of the criteria.

Taking into account that additional criteria influence the selection differently, there are two main problems in the process of police officers selection: additional criteria significance and candidates ranking. There are various methods to determine the weights of criteria and rank candidates (ELECTRE, PROMETHEE, MENOR, VIKOR, AHP and cetera), but each of them has a certain level of subjectivity. It is necessary to combine several different methods to increase objectivity in the selection process. The goal of this paper is to check the applicability of amalgamating the AHP and MAIRCA methods in case of police officers selection. The AHP method enables determining criteria weights, and MAIRCA enables candidates ranking by their characteristic deviation from the ideal characteristic.

In addition to introduction and conclusion, the paper includes three chapters. The challenges of human resources selection is described in the first part of the paper. Besides the selection process description, AHP-MAIRCA hybrid method is explained in the second chapter. Finally, the model is applied on the case of police officers selection and its applicability is checked.

The challenges of human resources selection

Human resource management includes several activities. One of them is a selection that enables to hire the best candidates. There are a number of definitions of selection, but there are no essential differences among them. Human resources selection can be defined as a choice among eligible candidates by pre-set methods and hiring the best candidate or candidates (Dessler, 2014; Kulic, 2005; Lojić, 2011; Gusdorf, 2008; Mathis, et al., 2008). In effect, in the selection process, organizations compare job requirements and candidates' competences and hire a candidate who meets the demands most (Figure 1).

Based on job description, human resource specialists prepare job requirements (professional knowledge, experience and specific skills) which a management accepts or requests certain corrections. Practically, those requirements represent selection criteria. Essentially, there are two types of criteria: fundamental and additional (Kankaraš, et al., 2018). Fundamental criteria are compulsory and candidates have to meet all demands. However, those enable only the candidates' elimination. Objective ranking of eligible candidates based on the fundamental criteria is impossible. In contrast, additional criteria are desirable, so candidates

should meet demands as much as possible. Thus, candidates are different in the level of fulfillment of the additional criteria.

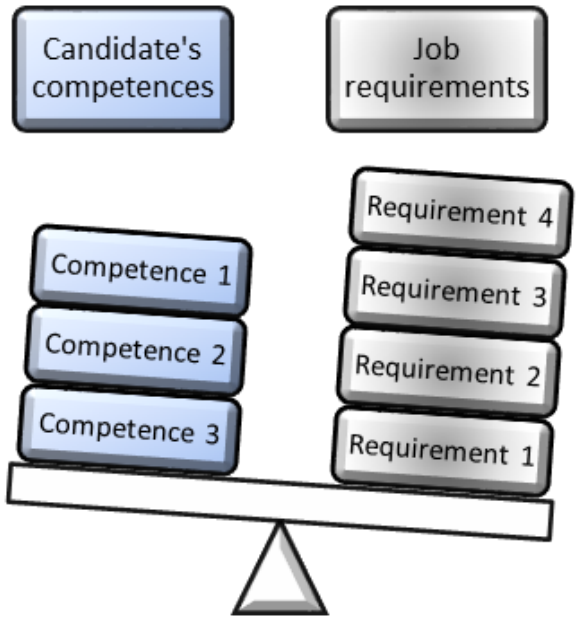


Figure 1: *Comparison between job requirements and candidate's competences*

Bearing in mind that an organization determines its fundamental criteria based on job description, there is no problem in defining them. Conversely, auxiliary demands are not directly related to job description but candidates with additional competencies would better do the job. Setting the additional criteria is one of challenges, which the management and human resource specialists should solve. Whereas additional criteria are desirable, their influence on the candidates' ranking is different. Due to these differences, organizations should determine the weights of criteria. Finally, based on the determined criteria, their weights and candidates' reference human resource specialists rank candidates and management can choose the best candidate.

In accordance whit the selection process analysis, there are three main issues: additional criteria determination, criteria weights setting, candidates ranking and the choice of the best candidate. Human resources selection is a serious process and its result has an effect on organizational success (poor employees, poor business). In order to increase the accomplishment, organizations should pay special attention to human resources selection process. To increase objectivity and quality of the selection process outcomes, organizations can use a wide range of scientific methods.

AHP-MAIRCA model

There are numerous methods to choose the best candidates, both in the theory and practice. The most applicable methods are AHP, ELECTRE, PROMETHEE, TOPSIS, MAIRCA, etc. Based on the approach, the methods are applied in two ways: individual or hybrid usage. Bearing in mind that each method has advantages and disadvantages, a hybrid approach is more suitable. It reduces the shortcomings of individual methods and its elements complement each other.

A choice of the hybrid model depends on the deficiencies that need to be vanquished. In the case of human resources selection process, it is necessary to determine the weights of additional criteria and to rank candidates by their competences. One of the suitable hybrid models is the AHP-MAIRCA model. This model enables weight setting using the AHP method, and candidates ranking according to the MAIRCA method (Figure 2).

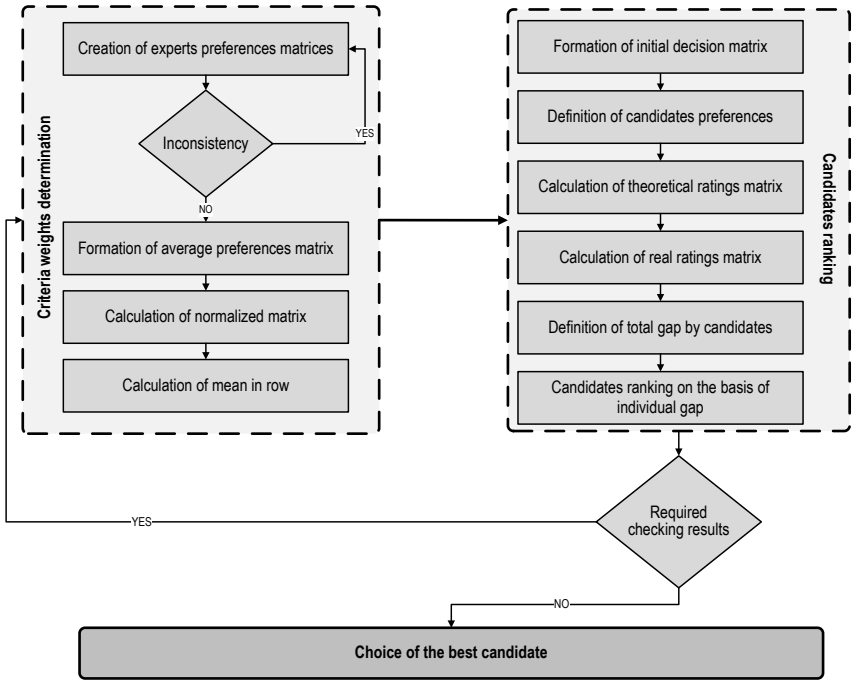


Figure 2: *AHP-MAIRCA model*

As shown in Figure 2, the model consists of two phases: criteria weights determination and candidates ranking. Bearing in mind that the list of candidates who fulfill both the fundamental and additional criteria are set, the first stage begins by determining expert preferences. Using Saaty rating scale, the experts compare the additional criteria, and, after consistency checking and based on individual experts matrices, average preferences matrix (X_p) is formed (equation 1).

$$X_p = \frac{1}{n}\sum_{i=1}^{n} x_{ij} \quad (1)$$

Where,

x_{ij} *– element of average preferences matrix;*

n *– number of experts.*

The next step includes a division of each column element whit the sum of column elements (Nikolić, et al., 1996). In this manner, normalized matrix (X_n) is calculated (equation 2).

$$X_n = \frac{x_{ij}}{\sum_1^n x_{ij}} \quad (2)$$

Criteria weights (w_i) are determined by a mean value of each normalized matrix row (equation 3).

$$w_i = \frac{1}{m}\sum_{i=1}^{m} x_{ni} \quad (3)$$

Where,

x_{ni} *– element of normalized matrix row;*

n *– number of elements in the row.*

The determination of criteria weights is one part of the model and it is performed by Analytic Hierarchy Process, as well as by software Expert Choice. Further, the first phase result is input to the second stage – candidates rating. A suitable method to rank candidates is Multi-Attributive Ideal-Real Comparative Analysis which is based on the comparison of theoretical and empirical solution (S) ratings by each criterion (C). The method determines a gap between ideal and observed ratings and, at the end of the process, ranks solutions by gap values (solution with the lowest gap value is the best ranked). In accordance with that, the second phase consists of six steps.

Based on MAIRCA procedure, the first step includes formulation of the initial decision-making matrix – *I* (Pamucar, et al., 2018; Tešić, et al., 2018). That matrix determines the candidates' characteristics – solutions values (S_i) by criteria – C_i (equation 4).

$$I = \begin{matrix} \\ S_1 \\ \vdots \\ S_m \end{matrix} \begin{matrix} \begin{matrix} C_1 & \cdots & C_n \end{matrix} \\ \begin{bmatrix} i_{11} & \cdots & i_{1n} \\ \vdots & \ddots & \vdots \\ i_{m1} & \cdots & i_{mn} \end{bmatrix} \end{matrix} \quad (4)$$

Depending on characteristics, solutions values can be quantitative and qualitative. To use descriptive (qualitative) values in the process directly is impossible. In that sense, it is necessary to transform these values applying an appropriate method (Nikolić, et al., 1996). The next step is preferences definition for the choice of solutions (P). Bearing in mind that employers should be neutral, in human resources selection process there are no the preferences of candidates. Thus, the preference of each candidate is the same, and depending on a number of candidates (equation 5).

$$P_{S_i} = \frac{1}{m};\ \sum_{i=1}^{m} P_{S_i} = 1, i = 1,2,\ldots,m \quad (5)$$

As shown, the solution preference is a ratio of one and total number of solutions – m. The next step includes the calculation of the theoretical (ideal) ratings matrix (T_p) as a product of solution preference and criterion weight – equation 6 (Pamucar, et al., 2018).

$$T_p = \begin{matrix} \\ P_{S_1} \\ \vdots \\ P_{S_m} \end{matrix} \begin{matrix} \begin{matrix} w_1 & \cdots & w_n \end{matrix} \\ \begin{bmatrix} t_{p_{11}} & \cdots & t_{p_{1n}} \\ \vdots & \ddots & \vdots \\ t_{p_{m1}} & \cdots & t_{p_{mn}} \end{bmatrix} \end{matrix} = \begin{matrix} \\ P_{S_1} \\ \vdots \\ P_{S_m} \end{matrix} \begin{matrix} \begin{matrix} w_1 & \cdots & w_n \end{matrix} \\ \begin{bmatrix} P_{S_1} * w_1 & \cdots & P_{S_1} * w_n \\ \vdots & \ddots & \vdots \\ P_{S_m} * w_1 & \cdots & P_{S_m} * w_n \end{bmatrix} \end{matrix} \quad (6)$$

Criteria weights are determined in the first stage. The fourth step enables the calculation of real ratings matrix (T_r). Based on MAIRCA procedure, the elements of real ratings matrix (t_r) represent a product of the theoretical ratings matrix elements (T_p) and the initial decision-making matrix elements (X) using the following formulas (Pamucar, et al., 2018):

higher is better (benefit type criteria):

$$t_{r_{ij}} = t_{p_{ij}} * \left(\frac{x_{ij} - x_j^-}{x_j^+ - x_j^-} \right) \quad (7)$$

lower is better (cost type criteria):

$$t_{r_{ij}} = t_{p_{ij}} * \left(\frac{x_{ij} - x_j^+}{x_j^- - x_j^+} \right) \quad (8)$$

Where:
x_j^+ – the maximum value of observed criterion by solutions;
x_j^- – the minimum value of observed criterion by solutions.

Based on a criteria type and its calculated elements, the real ratings matrix (T_r) is formed (equation 9).

$$T_r = \begin{matrix} \\ S_1 \\ \vdots \\ S_m \end{matrix} \begin{matrix} \begin{matrix} C_1 & \dots & C_n \end{matrix} \\ \begin{bmatrix} t_{r_{11}} & \cdots & t_{r_{1n}} \\ \vdots & \ddots & \vdots \\ t_{r_{m1}} & \cdots & t_{r_{mn}} \end{bmatrix} \end{matrix} \tag{9}$$

The next, fifth step, includes formatting a total gap matrix (G). The matrix elements (g_{ij}) are obtained as a difference between the theoretical and real rating matrix elements (Pamucar, et al., 2018). This difference represents the gap between ideal (theoretical) values and the observed (real) ratings (equation 10).

$$\mathrm{G} = \begin{bmatrix} g_{11} & \cdots & g_{1n} \\ \vdots & \ddots & \vdots \\ g_{m1} & \cdots & g_{mn} \end{bmatrix} = \begin{bmatrix} t_{p_{11}} - t_{r_{11}} & \cdots & t_{p_{1n}} - t_{r_{1n}} \\ \vdots & \ddots & \vdots \\ t_{p_{m1}} - t_{r_{m1}} & \cdots & t_{p_{mn}} - t_{r_{mn}} \end{bmatrix} \tag{10}$$

Based on the gap value, the best option is the smallest gap, i.e. the element of gap matrix should be zero or gravitate towards zero. A higher gap represents a worse solution (farther than ideal value). In accordance with that, the final step is solutions rating based on the declination of real solutions value from the ideal. The final values (Q_i) are obtained by summing gaps by solutions – equation 11 (Pamucar, et al., 2018).

$$Q_i = \sum_{i=1}^{m} g_{ij} \tag{11}$$

In this manner, the candidates can be ranked by their individual characteristics and objectivity is increased. Further, the described AHP-MAIRCA model is applied to solve the practical problem of police officer selection.

Police officer selection

This paper discusses the problem of ranking five candidates for the service as a police officer (S_i). Due to the limited scope, only four criteria are considered in the paper (C_i):

- C_1 – education (school grades);
- C_2 – physical ability (the test of physical fitness);
- C_3 – intellectual ability (the psychological test);
- C_4 – work experience (the years of experience).

In order to determine the weights of criteria, five experts have compared criteria by Saaty rating scale, and average preferences matrix have been formed by equation 1. Also, to perform the next step (the calculation of normalized matrix) the sum of column has been calculated (table 1).

Table 1: *Average preferences matrix*

Criterion	C_1	C_2	C_3	C_4
C_1	1.000	0.333	0.333	0.333
C_2	3.000	1.000	0.333	2.000
C_3	3.000	3.000	1.000	4.000
C_4	3.000	0.500	0.250	1.000
Σ	10.000	4.833	1.917	7.333

Bearing in mind that consistency ratio is 0.09, the pairwise comparison results are acceptable. Based on the experts' opinion and equation 2, the normalized matrix has been calculated (table 2).

Table 2: Normalized matrix

Criterion	C_1	C_2	C_3	C_4
C_1	0.100	0.069	0.174	0.045
C_2	0.300	0.207	0.174	0.273
C_3	0.300	0.621	0.522	0.545
C_4	0.300	0.103	0.130	0.136

Finally, the criteria weights have been determined by equation 3:

- w_1 (the weight of education) 0.097
- w_2 (the weight of physical ability) 0.238
- w_3 (the weight of intellectual ability) 0.497
- w_4 (the weight of work experience) 0.168

The determination criteria weights are the end of the first phase. The second stage starts by forming the initial decision-making matrix. That matrix has been formed based on the individual characteristics of candidates and by equation 4 (Table 3).

Table 3: *The initial decision-making matrix*

Candidate	C_1	C_2	C_3	C_4
S_1	4.20	70.00	110.00	2.00
S_2	3.60	65.00	125.00	3.00
S_3	3.70	70.00	120.00	1.00
S_4	2.50	75.00	114.00	4.00
S_5	4.00	90.00	110.00	3.00

Bearing in mind that there are no preferences of candidates, and using equation 5, the preference of each candidate is 0.2. Based on the criteria weights, the preference for the choice and using equation 6, the theoretical rating matrix is formed (table 4).

Table 4: *The theoretical rating matrix*

Candidate	C_1	C_2	C_3	C_4
S_1	0.019	0.048	0.099	0.034
S_2	0.019	0.048	0.099	0.034
S_3	0.019	0.048	0.099	0.034
S_4	0.019	0.048	0.099	0.034
S_5	0.019	0.048	0.099	0.034

In the case of police officer selection, the best candidate is the one who fulfils criteria to the greatest extent possible. Taking into account that the type of each criterion is benefit, equation 6 is applied to calculate the elements of the real rating matrix (table 5).

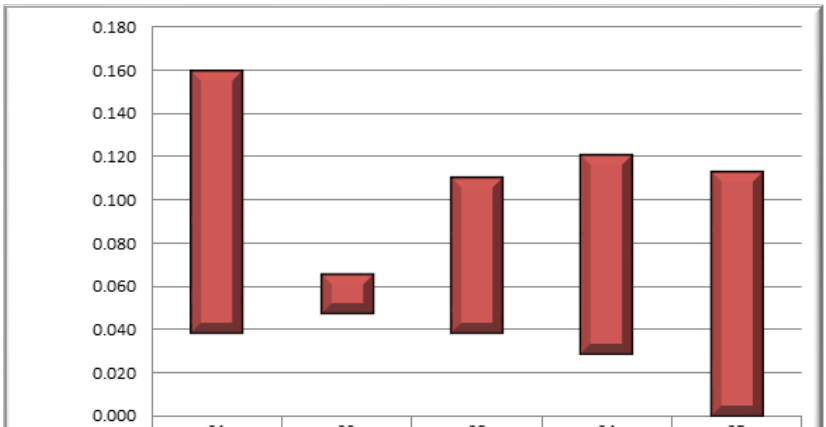
Table 5: *The real rating matrix*

Candidate	C_1	C_2	C_3	C_4
S_1	0.019	0.010	0.000	0.011
S_2	0.013	0.000	0.099	0.022
S_3	0.014	0.010	0.066	0.000
S_4	0.000	0.019	0.027	0.034
S_5	0.017	0.048	0.000	0.022

Finally, in accordance with the above and using equations 9 and 10, the total gap matrix is formed, the final values of each candidate, as well as candidates' rank (table 6).

Table 6: *The total gap matrix, the final values and candidates rank*

Candidate	C1	C2	C3	C4	Qi	Rank
S1	0.000	0.038	0.099	0.022	0.160	4
S2	0.007	0.048	0.000	0.011	0.066	1
S3	0.006	0.038	0.033	0.034	0.111	2
S4	0.019	0.029	0.073	0.000	0.121	4
S5	0.002	0.000	0.099	0.011	0.113	3



	S1	S2	S3	S4	S5
C1	0.000	0.007	0.006	0.019	0.002
C2	0.038	0.048	0.038	0.029	0.000
C3	0.099	0.000	0.033	0.073	0.099
C4	0.022	0.011	0.034	0.000	0.011
Final values	0.160	0.066	0.111	0.121	0.113

Figure 3: *Graphic presentation of the final values*

As shown in table 6, the smallest gap between ideal and observed ratings is 0.06, i.e. the characteristics of the second candidate (S2) are most in line with job requirements. Thus, the second candidate is the best choice for the organization in concrete circumstances. The final values can also be displayed graphically (Figure 3).

CONCLUSION

In the case of increasing objectivity in the police officer selection process, the specifics of police organization were taken into account, especially in the field of human resources management. The main goal of the paper was to provide a description of the proposed AHP-MAIRCA model, as well as its applicability in the process of selecting human resources, pointing to the importance of the selection of human resources in the police organization. By examining the possibility of applying AHP-MAIRCA model in the process of police officer selection, the practical applicability of this approach has been established. The proposed model has been presented in a specific case of admission of a police officer. Based on the research results, in addition to applicability of the model, it can be concluded that it allows for the following:

- the reduction of subjectivity;
- spotting the discrepancy between candidates' real characteristics and the ideal characteristics.

1. Based on the research results, the model's applicability is clearly noticed. Besides that, the complexity of choosing human resources also implies the complexity of using methods based on expertise as well as a certain level of subjectivity. Ditto, the human resource selection process includes the selection of adequate experts, as well as the calculation of their proposals using adequate techniques and methods. Therefore, the AHP-MAIRCA model can be supplemented by other methods of multi-criteria decision-making. Furthermore, in addition to "ordinary" (natural) numbers in the process of selection, it is recommended to apply methods on other types of numbers (fuzzy, fuzzy interval valued (fuzzy), neuro-fuzzy, rough with or without fuzzy or other types of numbers). The combination of different types of numbers and different methods significantly increases objectivity in the selection and validation of the research results. In addition, this can have a decisive influence in the selection of adequate employees.

2. Besides advantages of the method, there is a possibility of error due to the low-level process automation. In order to improve the human resource selection process, we should consider a creation of appropriate software. The importance of the paper is reflected in the practical application of the AHP-MAIRCA model, not just in the police organization, but also in other organizations. Illustration of the simplicity of the model usage is another contribution of this paper.

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LEGAL ASPECTS OF POLICE ORGANIZATION IN BOSNIA AND HERZEGOVINA

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Abstract: Police are certainly one of the most important state organs, but many would claim they are the most important one. That comes from the type of jurisdiction that police have, and which reflects on all law subjects, more or less. In order for police to be able to fulfill their important role they need to be well organized. The police organization influences fulfillment of police functions on large scale as an important state service. A very important question certainly is how police organization should be legally founded, i.e. in accordance with the current legal acts, besides the actual model of organization. As we all know, Bosnia and Herzegovina has a very complex structure in many aspects but the culmination of it is most certainly the organization of police structures in the country. Basically, police agencies in Bosnia and Herzegovina are in contradiction of the Constitution of Bosnia and Herzegovina, which makes the functionality of police system in the country very inadequate. In order to change the situation for the better, it is necessary to coordinate the organization of police agencies with the Constitution and then move forward to improve the general functionality of this key element of state apparatus.

Keywords: police, organization, legal basis, police agency, police functionality.

INTRODUCTION

Modern democratic society abiding by the rule of law has been keeping the public law and order and protection of basic human rights and liberties as the most significant role. It is expected from police to be assisting citizens. So, modern society has numerous and diverse roles for police and to be able to expect from the police system to be functional, it is necessary that it is organized in accordance with the interests of citizens and interests of a country and aligns with the organization of the entire state or the union. The complex organization of the state presupposes a complex police system, but it does not necessarily presuppose

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a police system that is formally complex but complex in variety and numerous assignments (Jovicic, Setka, 2018:39).

Police have been highly important for every state since their foundation. Through the historical development of a state and society, the role of police was shifting towards stronger position. It led to the special emphasis within the modern society on the protection of citizens' interests. We need to be aware of the fact that contemporary police development brings more assignments and increases in numbers. Our country is an obvious example of that, as well as other countries in the nearest surrounding (Jovicic, Setka, 2018:40).

Therefore, the role and functionality of police in modern society is of extreme significance for each citizen and the whole society respectively. In the eyes of citizens police are the most visible representative of a state due to their ways, uniforms and presence unlike other state organs. An important segment of police-citizen relations is definitely the active role of citizens as subjects of security system. Citizens should by nature be interested in their own safety which contributes the safety of other people and the entire society. It means the security culture of citizens is extremely important in singular understanding of security significance and possible ways of achieving it. Citizens as subjects of security system and subjects of informal social control are expected to be cooperative with other subjects of security for the purpose of maintaining the satisfactory level of security in a community.

Police are certainly one of the most important state organs and the question of their organization is highly important. Police organizations are mostly understood as parts of the state organization. These organizations are complex and permanent, but most of all, human, as they consist of people that work and act to achieve the well established common goal (Milosavljevic, 1997:407).

THE TERM AND ELEMENTS OF ORGANIZATION

Organization begins with the first people, the beginning of useful production in order to produce the basic human needs. It is clear that humans use organization and belong to it their entire life – from birth till death. The word is derived from the Greek word organon, which means tool or instrument, musical instrument, and organ. It developed into Latin word organisatio, which means activity and claims to develop an organism (Setka, 2014:205). An **organization** (or **organization**) is an entity comprising multiple people, such as an institution or an association, which has a particular purpose. The meaning of organization is not limited only to productivity but also to entire work and life activity (Jovicic, 2011:48).

An organization that is established as a means for achieving defined objectives has been referred to as a formal organization. Its design specifies how goals are subdivided and reflected in subdivisions of the organization. Divisions, depart-

ments, sections, positions, jobs, and tasks make up this work structure. Thus, the formal organization is expected to behave impersonally in regard to relationships with clients or with its members. According to Weber's definition, entry and subsequent advancement is by merit or seniority. Each employee receives a salary and enjoys a degree of tenure that safeguards him from the arbitrary influence of superiors or of powerful clients. We can therefore define organization as a complex and connected group of people acting on the basis of a certain plan and work division in order to achieve a certain goal (Jovicic, 2011:48-49).

Since the organization represents the network of functions that should secure the achievement of certain goals (functionality), there are special functions within organization that secure permanent focus, coordination and organizational activity. The higher his position in the hierarchy, the greater his presumed expertise in adjudicating problems that may arise in the course of the work carried out at lower levels of the organization. It is this bureaucratic structure that forms the basis for the appointment of heads or chiefs of administrative subdivisions in the organization entrusted with the authority attached to their position. If the rules are not followed, sanctions are the result (Political encyclopedia, 1975:683).

The aim of each organization is to complete the programmed affairs within the shortest deadline, with fewer expenses and people involved, i.e. with as less diligence as possible. If this goal is not being achieved, organization will proceed to reorganization. By coordinated and planned cooperation of the elements, the organization is able to solve tasks that lie beyond the abilities of the single elements. An organization is defined by the elements that are part of it (who belongs to the organization and who does not), its communication (which elements communicate and how do they communicate), its autonomy (which changes are executed autonomously by the organization or its elements), and its rules of action compared to outside events. Organizations may also operate secretly or illegally in the case of secret societies, criminal organizations and resistance movements. It is also not rare to use the term – disorganization as a decomposition of the existing organization. And in some cases may have obstacles from other organizations but what makes an organization an organization is not the paperwork that makes it official.

Organizational connection (structure) represents the creation of relations among people that are connected with material use as a result of work division. The organizational structure is an element of organization founded by the activity of organizational process. It is needed to have in mind that organizing is not a routine but a thought through process which requires certain knowledge and knowing of analytic, synthetic and legal methodology and principles of organization (Talijan, Miletic, 2011:203-204). Due to the current situation in Bosnia and Herzegovina, it can be concluded that people with no knowledge or with only political interests in mind are in the position to deal with the police organization, as well as other parts of state organization. Therefore, knowledge is disregarded.

As far as the organization elements, the characteristic elements for all organizations apply to police organizations. Police organization is a specific managing

organization, primarily because the members of police can apply police authority which is different than any other state authority. That means the members of police can use the legally prescribed authority and force towards people that break the law. Without taking into account the difference between the police organization and other organizations, it can be said that it is determined by its key elements.

It is considered that to be an organization - police organization or any other - there must be five elements for existence:

- a goal in mind,
- a leader or committee making the decision,
- action involved,
- legal basis and status and
- communication and members. (Talijan, Miletic, 2011:206).

What makes an organization recognized by the government is either filling out Incorporation (business) or recognition in the form of either societal pressure causing concerns or being considered the spokesperson of a group of people subject to negotiation. Each element has a certain influence on organization functionality, but in this essay we will focus on the legal basis of organization in fulfilling its functionality.

THE ROLE OF ORGANIZATION IN POLICE FUNCTIONALITY

The efficiency of the police system is linked to the degree of compliance of its organization with the surroundings (relatively stable or turbulent). Paul Valery once said: "If the state is strong, it hates us. If the state is weak, we decay." The purpose of the organizational structure of each police system, as well as the organizational structure of the police agencies that make up the police system, is the achievement of the mission, goals and tasks of the police system. The organizational structure should enable the police organization a quick response to the challenges, risks and threats to security that brings the surroundings to enable the police to effectively and efficiently function, i.e. to achieve defined goals and desired results with the minimum expenditure of human, material and technical resources. There are many examples through history where the role of police becomes deviant and turns into domination as a key factor of political life (Puseljic, Jelenski, 2007:7-8).

Every organization, police included, despite differences in activity and goals, faces questions of formation of organizational units, how and with which forms they are connected in one unit, which methods and means secure unified planning, direction, coordination, control, responsibility and other questions of inner organization and functionality (Miletic, 1997:244).

The level of development of these relations between the state apparatus and citizens is considered one of the most important parameters of success and acceptance of any state institution in social system, and police is no exception. The question of police-citizen relation is very complex as it is considered to be the consequence of specificities of police functions, functionality and model of organization. Primarily, the police system is divided into closed and open. Closed systems are those characterized by a traditional way of management and whose basis is a hierarchical structure with vertical communication and the dominant role of leaders. In contrast to closed systems, open systems (models) are characterized by an emphasized role of providing recommendations and advice instead of orders, where you build partnership relations, which looks more like a business organization models.

We can further distinguish simple and complex police systems. If the police system of a country is organized so that all the police forces are subordinated to a single police department, then we are talking about one police organization and simple model of police systems. On the other hand, if in a country there are two or more police organizations, each of which is subjected to special centers (controls) which are autonomous - in that case it is a model of a complex police system. The model of complex police system is more present and one could say it is a typical structure of modern police organizations (Jovicic, 2011:63-64).

When we talk about models of police system, it should be noted that the centralized and decentralized police systems also occur as a model of organization of the police, and there are also combinations of these two models. Whether it is a centralized or decentralized police system depends on the influence the central government makes on the management. This is often difficult to determine, due to the rare application of one or another model in pure form. The main condition of functionality within the modern surroundings is the development and existence of the adequate model that will have a satisfying level of flexibility. The reason for this state of affairs is that the mundane surroundings is turbulent and its basic characteristic is discontinuity (Cvetkovic, 2010:111). In such complex conditions, police can respond properly to issues ahead only if it is well organized.

Organization is half the job done. That old saying is something we should remember as it is also showing the significance of organization in achieving police functionality. The success of police assignments depends on the way police structure is organized. So, the functionality of police agencies which make the police system is directly related with the way police system is organized. The efficiency of police system is related to the degree of coordination of the organization with the surroundings (relatively stable or turbulent). The purpose of organization of each police system (its organizational structure), as well as the agencies that it is consisted of, is the mission accomplishment, achievement of aims and police assignments. The way police are organized should achieve quick response of police organization to challenges, risks and security threats, to enable police for effective

and efficient functionality, i.e. achieving defined goals and desired results with low investment of human resources, time and material (Setka, 2016:105).

LEGAL BASIS OF ORGANIZATION

State, as the largest and most important organization, fulfills its functions through state organs which together make the state apparatus. The organization of state apparatus is founded in the Constitution, then legal and sublegal acts, meaning that the framework of a state and law is normative, and the role of norms is to secure the logic and no contradiction of legal system (and the whole state management), where citizens have legal security and legal system is efficient.

The existence and organization of any state organ, police included, must be clearly defined through the legislature and based on law. Only the organizations that exist and act in accordance with the law can legally perform their activities. The role of a state in modern conditions is to secure its branches of government to act in accordance with the incumbent legal framework. It is known that a state prohibits certain organizations and activities with its legislature, so even those legally founded can be banned if they step out off their limits proscribed by the incumbent regulations. As Hans Kelsen said: "Normative order has the highest norm at the top, its relevance is not derived from other norms, it is the source of all other norms within the order." So the entire state apparatus must be organized in accordance with the highest act of legislature, i.e. the Constitution (Jovicic, Setka, 2018:73-74).

Legal status is one of the elements of organization of public safety (police being the pillar of the system). It is what marks the position, i.e. the autonomy, de jure or de facto, of this segment of organization within the Ministry of Inner Affairs, as well as other organs of state and non-governmental subjects (Talijan, Miletic, 2011:215-216).

Law obliges those who create it, that is, the state and its organs, state officials that perform activities for and in the name of the state. Therefore, everything the state does needs to be legally based. In every serious country that is out of question. Let's take Croatia as an example. Their Ministry of Inner Affairs relations and activities are regulated to the smallest detail by legislature. From the legal point of view, the organization of the Ministry of Inner Affairs is determined by the Constitution of the Republic of Croatia, taking into consideration human rights and liberties. Therefore, the police system in Croatia is structured based on these regulations (Puseljic, Jelenski, 2007:13).

Modern states ground their organization on the Constitution as the highest legal act. Even those that are not jurists find nothing disputable in accordance of legal acts with the Constitution and that all organizations need to be founded within the limits of law. It is also undisputable that incumbent regulations need to be respected and following that everyone subjected to it must act accordingly. The

incumbent legislature (Constitution, law and sublegal acts) is obligatory for those it relates to. All activities performed must be in accordance with the incumbent legal framework and since the state applies the law, it is also obliged to respect the law in order to be legitimate.

CURRENT STATE OF AFFAIRS IN BOSNIA AND HERZEGOVINA

Modern Bosnia and Herzegovina was founded as a country by The General Framework Agreement for Peace in Bosnia and Herzegovina, signed in 1995. The country is largely complex and decentralized and comprises two autonomous entities: the Federation of Bosnia and Herzegovina and the Republic of Srpska. The Federation of Bosnia and Herzegovina covers 51% of Bosnia and Herzegovina's total area, while the Republic of Srpska covers 49%. The current Constitution is the Annex 4 of The General Framework Agreement for Peace in Bosnia and Herzegovina, also known as the Dayton Agreement. The institutions of Bosnia and Herzegovina have the authority to assist rulers in the coordination of behaviors and norms, enabling the international and legal recognition. National question has been resolved by disabling any domination and making all three constituent peoples state-founding.

The concept of a complex society and modern state were born from the need for cohesive organization, and a need for protection from external threats. States hold unanimous power to resolve disagreement and possess the mechanisms to coerce people as means to achieve order. In fact, institutions with flexibility to absorb different polities are crucial to the development and stability of an emerging state. The role of institutions is thus crucial in the implementation of standard practices to ensure cohesive order and rules for interactions. Certain authorities in Bosnia and Herzegovina with its sui generis political system which is originally something between a federation and confederation and 23 years later, following the various non-constitutional changes in jurisdiction, has moved up to the level of Bosnia and Herzegovina from the Entities level (Jovicic, Karan, 2018:150-152).

The Constitution of Bosnia and Herzegovina defines responsibilities of the Institutions of Bosnia and Herzegovina and the Entities (Article III, act 1). The following matters are the responsibility of the institutions of Bosnia and Herzegovina:

(a) Foreign policy.

(b) Foreign trade policy.

(c) Customs policy.

(d) Monetary policy as provided for in Article VII.

(e) Finances of the institutions and for the international obligations of Bosnia and Herzegovina.

(f) Immigration, refugee, and asylum policy and regulation.

(g) International and inter-Entity criminal law enforcement, including relations with Interpol.

(h) Establishment and operation of common and international communications facilities.

(i) Regulation of inter-Entity transportation.

(j) Air traffic control.

Since the Constitution of Bosnia and Herzegovina enumerated the responsibilities of the state union and its entities, what comes to full understanding is what professor Petar Kunic said: "The Constitution of Bosnia and Herzegovina accepted the concept (known in legal theory) that enumerates the jurisdiction of state institutions (positive method of enumeration), while everything else, non-specific in Constitution, is put under Entities supervision in the general clause" (Kunic, 2000:92).

As already mentioned, the Constitution of Bosnia and Herzegovina clearly designated that police activities are the responsibility of the Entities. The division of responsibilities is one of the key parts of any complex organization and its efficiency depends on it. As the state is a highly complex organization, the division of responsibilities is the basic condition of efficient functionality of the state organization. The main principle in modern states is to divide responsibilities in accordance with the constitutional regulations which prescribe the framework and define the institutions and area of their jurisdiction.

Despite the fact that the Constitution of Bosnia and Herzegovina clearly designated that police activities are the responsibility of the Entities, the structure of the police system is not harmonized with the Constitution. With time, the principles of the Dayton Agreement were abandoned in certain areas due to the tendency of transferring police jurisdiction from Entities to the level of Bosnia and Herzegovina. Since the structure of the police system is not harmonized with the Constitution, the transfer could not be finished despite years of persistence and international influence to adopt a different concept (Jovicic, Setka, 2018:252-253).

The regulations of the Constitution about the division of responsibilities within the complex country of Bosnia and Herzegovina have been disregarded as well as the territorial division within the country. There is no sovereign country which disregards its own territorial organization when organizing the police system (not to mention to organize it contrary to the territorial organization) if the goal is to have an efficient police system. Having in mind the significance of police in modern society, we can clearly see how police in Bosnia and Herzegovina cannot fulfill their role adequately.

Police system now consists of police agencies that are on the level of the common institutions of Bosnia and Herzegovina, the Entities, the Brčko District of Bosnia and Herzegovina (since 1999) and cantons (this level is represented only in the Federation of Bosnia and Herzegovina). These police agencies within the

Ministry of Security work as an administrative organization with operational independence. These agencies work within their territorial jurisdiction on the whole territory of Bosnia and Herzegovina. Formation of these institutions are in accordance with the law changes in the Bosnian Parliamentary Assembly and many of them find justification in those changes. Legally, that is absurd as these new regulations are contrary to the Constitution. Therefore, we live in a country where the highest organ of law enforces regulations which are not in accordance with the highest legal act – Constitution.

Having a police system which is contrary to the Constitution is something certainly unique in the world. Practically, this anomaly creates large problems in work and functionality, so instead of partnership, we have conflicts of jurisdiction and competitive relations (Jovicic, Setka, 2017:70).

Besides, police agencies including even the Ministry of Security of Bosnia and Herzegovina, are not in accordance with the incumbent Constitution, another important aspect of it is that this police system is multi-layered, slow, expensive and inefficient. Since the police system in Bosnia and Herzegovina consists of more police agencies on the level of joint institutions which have jurisdiction over the same part of the territory, as well as entity and cantonal police agencies, it can be concluded that the police system in Bosnia and Herzegovina is a complex uncoordinated police system. This means that the basic characteristic of complex uncoordinated police system is "co-responsibility for the action of a private police agency in the same territory". For example, the case of Flaming the Building of Presidency of Bosnia and Herzegovina, where the security of the Building was under jurisdiction of the Directorate for coordination of police organizations, and the responsibility was on the Agency for investigation and protection, and its director. "Absurdity is even bigger since the Directorate took over the responsibility from the Agency for investigation and protection when it was founded" (Setka, 2016a:196).

Bosnian police system completely neglects the basic principles of police work. An example of that is the principle of knowing people and territory, which is crucial in performing police activities. That principle cannot be applied in Bosnia and Herzegovina on the level of police agencies. The Agency for Investigation and Protection is present in only four cities in the country (Sarajevo, Banja Luka, Tuzla, Mostar), based on the regulation and the authority, so it does not have field operatives. As everyone knows that the database consists of local police organizations, it leaves us with question: How can someone believe that this agency can actually be efficient?

Even the Directorate for coordination of police organizations has not been able to achieve any special efficiency in its work for ten years. The reason is clear: since the police system in Bosnia and Herzegovina consists of more police agencies on the level of joint institutions which have jurisdiction over the same part of the territory, as well as entity and cantonal police agencies, it can be concluded that the police system in Bosnia and Herzegovina is a complex uncoordinated

police system. Therefore, the Directorate is unable to accomplish any results in such a system.

If any part of a state apparatus is not organized in accordance with the legal framework, and police system is one of the state's most important organizations, then such institutions are fragile. And where institutions are fragile, criminal is always on the rise. The interest of citizens of Bosnia and Herzegovina can hardly be to have instable institutions and high crime rate. We believe that citizens want to live in stability and order, no matter where they live in Bosnia and Herzegovina. So, here is the final question for the political elites: How do they perceive the order in the state if we currently have a legal disorder in the area of police system organization?

CONCLUSION

Police are certainly one of the most important state organs, but many would claim it is the most important one. The nature of police affairs and assignments is of interest to every citizen and entire society as a whole. The modern conditions give us new forms and sources of security threats assigning even more important role to the police.

In order to fulfill their important role, accepted from everyone, police need to be well organized. Organization is a dynamic category, as the quality of organization is something that is always the goal and should adjust to the changes within the society. Every organization has to be founded on certain principles and must have shared key elements. Among them, especially significant is the legal basis of the organization. Every organization must be legally founded and based on law regulations, which means it needs to be in accordance with the incumbent legal framework. Those organizations that may be legally founded but eventually cross the line of legal framework or change their activities, can be prohibited.

Bosnia and Herzegovina has a clear constitutional regulation when it comes to the police system. A complex coordinated police system is a police system where one police agency is responsible for one territory. an uncoordinated complex police system is a police system where more police agencies share the jurisdiction over one territory. This means that the basic characteristic of a complex uncoordinated police system is ''co-responsibility for the action of a private police agency in the same territory". Since the police system in Bosnia and Herzegovina consists of more police agencies on the level of joint institutions which have jurisdiction over the same part of the territory, as well as entity and cantonal police agencies, it can be concluded that the police system in Bosnia and Herzegovina is a complex uncoordinated police system. For Bosnia and Herzegovina, it is necessary to develop a police model that fits the current state of affairs in the country and not to depend on any political needs or tendencies. There are countries in Europe with more complexities and we can take them as an example to create an efficient

police system. There is no European state where police organization is not in accordance with the territorial division within the state.

There are no countries in Europe where organized police is not in accordance with the incumbent legal framework, i.e. with the Constitution and its regulations. Unfortunately, this only means that Bosnia and Herzegovina will not have efficient police working in interest of its citizens as long as it is organized contrary to the Constitution. It is necessary to enforce legal order in the country with application of positive legislature and not counter it. There will be no law and order in the society where law regulations are contrary to the Constitution of the state.

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USE OF THE KOTTER'S MODEL IN THE QUALITY AUDIT OF ORGANIZATIONAL CHANGES OF THE MOI OF SERBIA

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Abstract: Recent changes in the organization of the Ministry of Interior, which occurred at the end of 2018, imposed a need to check their effectiveness and justification. Without considering the question of what the political set is in power, the satisfaction of employees must be taken into consideration first and foremost. In particular, it must be borne in mind that, according to the data of some police unions, over 8,000 Interior Ministry employees have written complaints about new employment solutions. In order to check the quality of these changes, the Kotter's change management model was used to make them successful. Thirty years of research by leadership researcher John Kotter have proven that 70% of all major change efforts in organizations fail. Following the 8 Step Process outlined by Kotter, organizations can avoid failure and become adept at change. By improving their ability to change, organizations can increase their chances of success, both today and in the future. Without this ability to adapt continuously, organizations cannot thrive. Based on the changes that have been made, it can be determined whether they have been cosmetic, transformational or transactional changes. Or, maybe there were no changes.

Key Words: quality, change management, Kotter's model, employees.

INTRODUCTION

Job satisfaction is important in law enforcement because it promotes continuity of a professional and cohesive police force that works well together, follows proper policy and procedures and provides the services to the public. However, within the Ministry of the Interior of the Republic of Serbia, a relatively large

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number of dissatisfied members of the Ministry appeared at the end of 2018. Namely, then there were organizational changes and changes in job titles, as well as salary adjustments within the Ministry of Internal Affairs. The result of the above changes was that, according to some information, over 8,000 complaints from Ministry officials came to decisions on salaries and jobs.[3]

Without disturbing the correctness of these organizational changes, attention must be paid to how the changes were implemented, i.e. whether the procedure for performing quality changes is respected. Based on the opinion of the Serbian Police Trade Union, new solutions to many of the members of the Ministry were unknown at the time of the change, especially in terms of "unreasonable" coefficients (New coefficients, new systematization, 2018). The Government of the Republic of Serbia adopted the Rulebook on Internal Organization and Job Classification in the Ministry of Internal Affairs of the Republic of Serbia Int. No. 4685 / 18-13 of 13 June 2018 and Int. 01 No. 7777 / 18-5 of 30 July 2018 and Int.01 No. 11543 / 18-5 of 15 November 2018 and the Decree on the Salaries of Police Officers (Official Gazette of the Republic of Serbia No. 91/2018) and the Regulation on Career Development of Police Officers (The Official Gazette of the Republic of Serbia No. 42/2018 and 91/2018). Regarding the earlier systematization, in the new systematization, it refers to the harmonization of jobs in accordance with the nomenclature and the description of the jobs assigned to a single job directory, with the aim of achieving uniformity of salaries, status, benefits and access to the same or similar jobs or working positions.

Wage allocation for employees of the Ministry of Internal Affairs increased by 7.6% in total, although the number of employees in the Ministry was reduced by about 3.9%, compared to the same period last year, which leads us to a further account of 11.9% of the possible increase. Protesting meetings of police officers appeared in the organization of police unions. For example, 7 of the total of 16 police officers from the Prokuplje Police Administration have not yet signed a transfer to new posts, because, as they claim, they should have previously received remedial solutions that would clearly state the possibility of appeal, that is, the "legal remedy", which in no case happened (Mitić, 2019).

In addition, it is clear that a large number of employees, who did not complain, still provide the so-called "silent resistance" towards the new systematization and the rules governing the salary system. All these are clear indications that the change has not been prepared and done properly, and its quality is very questionable. In order to check the quality and validity of the implemented changes, that is, the most suitable model was used by Kotter's 8-Step Change Model.

Numerous research methods have been applied in the paper. The basis of the paper is dialectical-materialistic method. It is based on understanding of the world according to which phenomena in nature, in human society and in human opinion are qualitatively variable based on the struggle of internal opposites and are in a universal interconnectivity. It is in this research that this overall

3 https://www.policijskisindikatsrbije.org.rs/, transmitted to the site 11/05/19

connection is visible through the relationship between the situation in society, the material status of police officers, employee satisfaction and organizational change. Also, within this paper, the modeling method, which primarily refers to the Kotter's model of organizational change, is pervasive.

The comparative method is very significant in the research, in order to compare the current situation and organizational changes in the Ministry of Interior with the established Kotter's model of organizational changes. The analytical-synthetic method is very important in terms of analysis-disassembly into parts (steps) of current changes and re-synthesis-reaching the overall conclusion about the derived strands.

Qualitative research is any research that does not include numbers or numerical data, but in this case, existing numerical data were used, which, as part of quantitative research, gives an insight into how successfully the changes have been made. An assessment of the quality of the changes is given through each of the 8 steps regarding the Kotter's model.Finally, content analysis, more as a technique than a method, was used to obtain the necessary and relevant data on the success of organizational change in the Ministry of the Interior.

RESEARCH RESULTS

Kotter's model of change management

Heraclitus, more than two millennia ago, said: "Change is the only constant." There are many theories about how to make a change. Many originate with leadership and change management advocate, John Kotter. World-renowned change expert, Kotter introduced so-called eight-step change process in his 1995 book, "Leading Change." His eight steps for leading change are as follows.

Step One: Create urgency. To make a change, it helps if the whole company really wants it. Kotter suggests that for a change to be successful, at least 75% of a company's management needs to the change. Step Two: Form a powerful coalition. It is required to convince people that change is necessary. Managing change isn't enough - need to lead it. Step Three: Developing a Change Division. Create a vision that will help guide the effort to change and develop strategies to achieve that vision. Step Four: Communicate the Vision. What to do with created vision it will determine success. Message is likely to have strong competition from other everyday communications within the company, so it needs to communicate frequently and integrate with everything that's doing. Step Five:

Empowering Broad-based Action. Establish a change structure and continually check for obstacles. Removing obstacles can empower people you need to make your vision, and this can help move ahead. Step Six: Generating Short-term Wins. Give the organization a sense of winning at the beginning of the change process. In the short term, you want to have the results that your staff can see. Without

it, critics and pessimists can hurt your progress. Create short-term targets - not just one long-term goal. Step Seven: Don't Let Up. Kotter thinks that many projects are failing because the victory is prematurely announced. The real change is deep. Fast wins are just the beginning of what needs to be done to achieve a long-term change. Starting a new product/service using the new system is great. But if you can launch 10 products/services, this means that the new system works. In order to achieve this rush, it must continue to seek improvement. Step Eight: Determine the Changes in Organizational Culture: Continuously make efforts to ensure that the change is seen in every aspect of an organization. This will help to make this change in the culture of an organization.[4]

It must work hard to successfully change the organization. When carefully planning and building a sound basis, implementation of changes can be much easier, and you will improve the chances of success. If you show too much impatience, and if you expect too many results too early, your plans for change will probably collapse. Make sense of urgency, recruit important leaders for change, invent a vision and communicate effectively, remove or obstruct obstacles, create conditions for quick success and build your momentum. If things are done, you can help make the change an integral part of the organizational culture. Then a final victory can be declared, and then you can enjoy a long-lasting change.

Content of organizational changes implemented in the Ministry of Interior

Let's look at the whole process of change that has occurred in the last few years. Namely, the first announcement was that there would be changes in the Ministry of Internal Affairs in the course of 2015 and 2016 when changes in the domain of human resources in civil services and the application of salary grades were announced.[5] The application of the new method of calculating salaries in the public sector was expected since the Serbian Government had previously decided to postpone the implementation of the Law on the Public Sector Payroll System for 2020, as additional financial analyses are needed.

If we compare, in theory, the model of actual changes in the Serbian police and Kotter's model will determine the qualities of organizational changes. Primarily, it must be seen whether awareness of the necessity of change has really evolved. It is clear that the necessity of change was inevitable. The question arises: is there awareness of the urgency of change?

If we look at the statements of officials of the Ministry of Internal Affairs, it cannot be stated with certainty whether it was clear what kind of changes should

4 http://www.kotterinternational.com/KotterPrinciples/ChangeSteps/Step1.aspx (accessed on: June 11, 2019)

5 The introduction of salary grades for employees in public services is envisaged by the Law on the Public Sector Payroll System and the Law on Public Servants, which stipulates that the same job in each pay service will be the same. Implementation of the regulations on salary grades is postponed until January 1, 2020.

be made. In addition to salary grades, the most frequent mention of the existing shifts in the police was the need for more efficient fight against crime. Of course, organizational changes that were particularly visible were changes in terms of the increase in the number of sectors within the Ministry, and especially the appearance of the Human Resources Sector. Also, the development of the Sector for Analytics, Telecommunication and Information Technologies and the Sector for International Cooperation, EU Affairs and Planning is very important for the country to oppose contemporary forms of crime. Indeed, the issue of human resources, as one of the most sensitive and especially evaluation of their jobs should have been solved at the end of 2018. It can be said that police top managers have understood that change is necessary, but whether they have fundamentally understood the way of evaluating and grading jobs is a big issue.

Assessing the Quality of Organizational Changes Implemented in the Ministry of Internal Affairs of the Republic of Serbia Using Kotter's Change Management Model

If we look at the first phase of implementation of the Kotter's model and the way in which the changes were made in MoI, it is clear that the top management wanted to implement the changes. However, it is not clear if it was a purely political decision. Developing awareness for rapid and necessary changes has existed, but whether consciousness was developed to improve the work and status of employees in the MoI is not very clear. So, as far as the first phase is concerned, it can be labelled as clear and pronounced, since it was announced through the mass media that changes are necessary.

The problematic part in the implementation of the changes themselves is that they were led by a foreign citizen, namely the one who made the changes within the Ministry of Defense and the Army of Serbia. It is clear that the Ministry of Defense and the Ministry of Interior are similar, but not the same. Also, the changes were led by a foreign national, which is questionable in terms of motives.

As stated, the second phase (stage) relates to the creation of a coalition and a change team. The Government, through the minister, managed to draft a change team. It is unclear whether, in addition to political support, the minister received the support of a professional circle of people. At this stage there are three sub-components, which team members must have in mind: interest, awareness and decision-making. Interest is the motivation or drive that triggers the research. Consciousness is the point in which a manager is aware of the various available approaches and has enough information to make an informed decision on the sustainability of different alternatives. The decision point ends the research phase and asks the manager to evaluate the available information (Ford *et al*, 1999). Support for change was not fully provided by most managers. There were working bodies and committees that held regular meetings and where a good deal of supporters offered support to the ingoing changes. Probably was missing a larger number of so-called operational managers, i.e. managers who are in direct

contact with perpetrators. There are certain opinions that leadership influences resistance. Oreg and Berson claim that staff in his studies demonstrated more resistance to change when the heads of organizations adopted less transformational leadership and were less receptive to change (Oreg & Berson, 2011). Perhaps this was the case here as well.

Is there a clear interest in the management of the Ministry? That part can be said to be indisputable, because on several occasions there was a willingness on the part of management to change something. Was there interest in the changes? This is debatable because individually there is no real indicator for this. Globally, this is an indisputable fact, as management has repeatedly pointed it out. The decisions made by managers do not indicate potential changes, as in many cases it was a matter of waiting and last-minute decisions were made. Often decisions did not indicate any substantial changes. So, since the decisions did not indicate potential changes, this step is incomplete and one cannot speak of creating a coalition for change. It is already clear here that changes are beginning to cascade in terms of quality.

The third phase refers to defining the vision and strategy of change. This phase of change management is essentially the most important, as it defines how the changes in the organization will be implemented. If we look at the activity of the Cabinet of the Interior Minister, it is assumed that a change management strategy has been made. What follows is: but what was the strategy? Strategic plan is a formal statement of a set of unambiguous goals and their linkage to the strategic objectives. In most organisations, there are several levels of strategy. Ministry strategic management is the highest of these levels in the sense that it is the broadest - applying to all parts of the organisation. Divisional strategic management tends to focus on particular executioner's segmentation and their needs. Both give direction to organizational missions, objectives, goals, values and culture (Crawford, 2013). It is clear that the change strategy did not produce a result, since: above all, the perpetrators, but also a large number of operational managers were dissatisfied with the way the changes were carried out.

If one looks at newspaper articles and other content of public opinion, one cannot speak of a publicly proclaimed vision and strategy for change. There is no publicly stated vision and strategy for change, which is mandatory in organizations. This is a significant step in making changes so that employees are prepared and given certainty about future positions in the organization. So this step is completely wrong.

The fourth stage is communicating about visions to gain others for change. De Jager states that good change is due to good communication (De Jager, 2010). However, others assert that communication during change which does not contend with emotions is too rational and disregards this key factor in change at its peril (Palmer *et al*, 2009). Utilisation of communication would force through change. Vision communication in order to get as many employees as possible for change is fundamentally poorly done because many managers were unable

to talk to their subordinates. The question is: why has this happened? There are several answers: the fear of losing the possibility of man-ablation to subordinates, ignorance, the fear of loss of workforce, the fear of losing their own position, etc. Of course, there are managers who have interviewed their employees and asked them for an opinion on new appointments, i.e. new jobs. In such cases, employees who were later dissatisfied with their status were almost non-existent or were exceptional cases. It can be said that this was a crucial moment, and perhaps a key stage in making changes.

In terms of communication and recruiting other employees for change, it is clear that in some organizational units they are well implemented and have not even been started anywhere. In addition, a large number of complaints were filed, as well as dissatisfaction with a large number of employees. This step in implementing change has been largely misunderstood, as apparently a large number of employees have been deprived by their superiors in communication and support to implement change.

Empowering broad-based employees is the next phase of change management. It implies that everyone, or the vast majority of employees, is familiar with the changes happening, as well as their own roles in them. The question arises as to whether all the managers talked with their employees and whether they tried to explain the reasons and goals of the emerging ones. Pursuant to the Rulebook on the Implementation of an Internal Competition among Employees of the Ministry of Interior for the competition for certain key management positions, the selection procedure must be based on quality (Rulebook, 2016). On several occasions, MoI employees expressed dissatisfaction with the selection of some managers in internal contests. Some contests were accompanied by various controversies. Many managers are considered to have not been selected on the basis of quality, but on the basis of political acceptance or nepotistic lines. Although the best way to find the best in some of the key positions for police managers is properly conceived and regulated, it is clear that in some, and perhaps in many cases, a way has been found not to approach a quality selection of personnel.

It is especially devastating that employees know well which supervisors are appropriate for the job they are doing and which are not. In many cases, employees even scoffed at the selection of managers for certain managerial positions. The question of the relevance of competition for individual managerial positions is raised. The issue here is therefore political suitability before the profession and knowledge.

Highlighting visible improvements (short-term success) is the sixth phase of change management. This phase is not very visible in the Ministry because there were no visible short-term successes. Many police unions have expressed visible dissatisfaction with the changes they have made. In relation to the earlier systematization of newspapers in the new systematisation, it refers to the adjustment of jobs according to the nomenclature and the description of the jobs classified into a single job catalogue with the aim of achieving uniformity of salaries, status,

benefits and access to the same or similar jobs or jobs. The Decree on the Salaries of Police Officers also defines closer positions, ranks and total coefficients for calculation of earnings (Decree, 2018). A great enigma for police officers is a corrective coefficient, which represents an increase in salaries in accordance with special laws. The biggest unknown is the so-called "calculation method". This is a mystery in the payroll methodology, which depends on the percentage of increase and the degree of compliance of our wages in relation to the next period. The calculation method for harmonization is not an integral part of the salary coefficient and is not presented through the same, but its equivalent is expressed on the payroll sheet. Increases in salaries to police officers ranged from 3% to 17%, depending on the position, status, schooling and categorization of Regional Police Directorates. In order for a change to be accepted in one organization, it must be insensitive to all its members, in this case - MoI members. Most of the members of the Ministry were surprised with the new payment schedule, because, according to the police unions, police officers were in a finite situation. They had the right to complain only after receiving a payment decision. Every change must be transparent for each member of the organization so that they are ready to face and accept it. In most situations, there was no transparency, and everything was reduced to dubious conspiracy.

If we compare the seventh phase of Kotter's model: the consolidation of the achieved and the initiation of further changes and actual developments in the management of changes in the MoI comes to the realization of what will be said in the next few sentences. Have they consolidated the accomplishments of police managers - it's not very safe to answer this question, because what has been achieved by this change is employee dissatisfaction. The largest increase in salaries was supposed to apply to police officers working in police stations, but they are one of those who received minor increases. Following these changes, changes in the same "spirit" should continue. As far as it is known, there were no new changes related to the working-legal status of police officers, and concerning organization and job classification. It is logical that the question arises: was this a process or a project of change? If it's a process, then it should be constantly going on, but if the project was not a full capacity change then the change management gets a completely new meaning. It is obvious that the necessity of the change has not fully succeeded with the police officers. It is obvious that the necessity of the change has not fully succeeded with the police officers.

Of course, the consolidation of what has been achieved is not visible, because as the time passes, the dissatisfaction among employees increases, with police unions increasingly turning to the media.

The last step in managed changes, in Kotter's view, is the institutionalization of change and the making of changes to a sustainable one. The changes that followed have more to do with working methods and improving regulations. Also, the continuation of the change relates to cross-sectorial cooperation with other ministries, but it is expected that in the future, more attention will be directed to

the recruitment of new staff. The changes continued, but these changes do not relate to the organizational structure and systematization of jobs.

What has to be said as a positive thing is the recruitment of graduates of the University of Criminal Investigation and Police Studies, which has been going on for more than a year and is expected to continue this trend. However, objections can be made to the job adequacy and professional qualifications. In more than 90% of the cases, the degree exceeds the requirements of the workplace.

DISCUSSION

When we look at the statistical results, there can be many clues about how to manage the changes and the quality of these changes. Therefore, if we compare the total number of employees in the MoI and the number of complaints about job scheduling solutions, it can be considered that the changes were made in partially successful way. If we compare Kotter's change management model with the existing way of making changes in the MoI, it is obvious that the management of changes was done in a rather gruff manner. Preparing and obtaining support for changes was carried out in a very non-transparent way. Many employees until the last moment did not know whether they would receive and in what percentage they would get an increase in salaries.

The coalition to support change was absent in this case. But that problem was in top management and there was another problem. There are cases where mid and lower-level police managers conducted interviews with their employees and introduced them with upcoming changes. Moreover, some managers have fully explained to their employees what they could expect, and some were asked for opinion regarding expectations. This is a question of the behaviour of police managers, who had the opportunity to overcome their problems with their employees, which caused changes in both career and legal status. In this respect, the main problem is likely to arise at the coordinating and operational organizational level, both in the General Police Directorate and within other sectors of the Ministry of Internal Affairs. However, many police managers, who are on a coordinating, but also operational level, were not familiar with the details of their future, but also the status of their employees. This leads to the conclusion that the campaign for the preparation of employees for organizational changes has been conducted somewhat subtly but also non-systematic, non-standard - on a case-by-case basis. This leads to the conclusion that the issue of quality management of changes is really questionable, because the issue of standardization is one of the main items of quality management (Baltos, Chomata, Vidakis, 2018). Another important feature of the qualities is transparency. Regarding the implemented changes, there are controversies about the systematization of working positions, since individual work positions are still hidden from the public. And not only from the public, but also from police officers, which is at least unfair and immoral. But this is a long-standing policy in MoI.

The consequences of such a policy are far-reaching. There is still a constant conspiracy in business and relations among colleagues. It certainly should not happen, but it is the reality of police work. This kind of behaviour is quite non-standard, especially among colleagues, but the attitude of colleagues towards managers is deteriorating, and therefore there is no compactness and teamwork. Leaders (much more often managers) are the ones responsible for mishandling trust, destroying trust, and violating trust in their organizations. „Discussing the erosion of trust are in positions of authority and leadership can and does betray the trust of their constituents in highly destructive ways and with moral indifference" (Kutsyuruba, Walker, 2016). Particular distrust can be seen in police officers who demanded their rights through police unions. In this regard, the respectable Police Union of Serbia considers that despite significant funds, which the Serbian Government allocated from the money of all citizens of Serbia, citizens did not get more efficient and better police. In the opinion of their representatives, not a small number of executives, in the forthcoming systematization, they are placed on the principle of nepotism and corruption. Such a negative selection has caused a major revolt among employees in the MoI. They also compared the Budget Laws for 2018 and 2019 years and found that wage allocations for employees of the Ministry of Interior will increase by 7.6% in total, although the number of employees in the Ministry of Internal Affairs has been reduced by about 3. 9%, compared to the same period last year, which leads us to a further account of 11.9% of possible increase.[6] These are all indications that police officers showed extraordinary suspicion of mistrust in the changes.

According to several police unions, after the changes were made, over 8,000 complaints regarding the size of the salary coefficient were resolved, but the issues of the status itself were disputed. At the end of 2018, there were 41,157 employees of the Ministry of Internal Affairs, of whom 27,212 were imprisoned, and 12,198 non-uniformed members (Informatory, 2018:67). Let's take once more the fact that the exact number of complaints is correct, which would mean that 19.5% of employees in the Ministry of Internal Affairs were completely dissatisfied with the changes. The question arises, and how many members of the Ministry are really dissatisfied? From this, it is clear that at least so many employees are dissatisfied with the fact that at the very least there is a bad fact. Thus, there are numerous protests by police officers in the Republic of Serbia. One of these is a dozen police officers from the Regional Directorate in Prokuplje.[7]

All these data and assumptions lead to the conclusion that the changes that were made at the end of 2018 are in a rather problematic way. Namely, changes are a good idea, but the plan, or change management strategy, is extremely

6 Serbian Police Union requests review of solutions by new systematization for nepotism and corruption, 2018. (http://www.policijskisindikatsrbije.org.rs/izdvajamo/1354-policijski-sindikat-srbije-trazi-preispitivanje-resenja-po-novoj-sistematizaciji-zbog-nepotizma-i-korupcije).

7 The police officers of Prokuplje protesting for being transferred to other cities, https://www.juznevesti.com/Drushtvo/U-petak-protest-prokupackih-policajaca-zbog-premestanja-u-druge-gradove.sr.html.

bad. Likewise, many police managers, especially at the coordinating (middle) and operational (lower) level, were not adequately prepared for change, i.e. they did not meet their employees and did not try to prevent possible dissatisfaction. The problem was also due to the fact that there was basically no broad internal debate about the changes, as they were primarily related to the status issues of employees, but also to the systematization of jobs. The opportunity has been missed to properly prepare employees for change, which is the result, in some cases of incorrect, and in some cases unprofessional conduct of police managers.

CONCLUSION

The quality of the changes that took place during 2018 within the Ministry is very questionable. When Kotter's change management model takes over as a benchmark for derived changes, much of it becomes clearer in terms of validity. Since it is very important that, in terms of the concept of Total Quality Management, the process of carrying out the changes is made well from the enclosed one, it is evident that the very way of managing the changes was made inadequate.

The evolution of consciousness and the necessity and urgency of changes were mostly present, but the question is whether the reasons are well understood and recognized. At the stage of creating a team and a coalition for change, the top-management of the Ministry was to create a larger team and expand the front for change. In defining the vision and strategy of change, it is clear that they were not properly designed and that the biggest problem was communicating with employees about changes. This has created a high degree of uncertainty and fear among employees.

If we look at communication about a vision in order to gain others for change, it is clear that communication was poor or in some cases missed. The biggest problem was made by middle and lower level managers. The engagement of broad-based employees was largely absent. Although the excuse can also be found in the size and number of employees in the Ministry, however, some managers have had to invest more in providing staff support. Creating short-term success and consolidation of the achieved and initiating further changes exists, but the question arises as to what extent. A large part of the two phases of Kotter's model shows the politicization of change management. The achievements that have been achieved are indisputable, but not all of them are mentioned, and there are no clear connections about the initiation of further changes, which are in connection with the existing ones. Finally, the institutionalization of change exists, but it does not have full support among employees, and they often find them unfair and inadequate. With a certain degree of caution, it must be argued that, however, some employees have unrealistic expectations and demands.

In support of the unsuccessfully managed change management, it can be stated that there are numerous complaints and protests by police officers, which must be taken into account. Especially must be taken into account the reaction of the

police unions, which are very negative. All of the above leads to the conclusion that the changes are welcome and that it is good that they have come to them. The problematic part relates to their mode of performance, i.e. change management. Compared with Kotter's model, it is clear that change management was inadequate and with a lot of flaws.

To summarize: the changes are well thought out but very poorly implemented. The main problem is the lack of genuine political support and the overriding of political necessity over the genuine need for change in the police organization of the Republic of Serbia.

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QUALITY OF LIFE AND COMMUNITY POLICING: BETWEEN THEORY AND THE REALISTIC NEEDS OF THE CITIZENS[1]

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Abstract: The quality of life is an immediate *sustainability manifestation,* which refers to the capability of the place or the local community to meet the current needs of the citizens without jeopardizing the possibility for the future generation to meet their needs to the full extent. The quality of life is the identification of the key domains of human well-being in the community, i.e. the identification of the existing needs of its citizens. The needs of the citizens of one local community synthetize everything that the citizens recognize as a difference between the current and desirable situation. The need can be formulated also as a wish to improve the current situation or to correct the defect. Systems (services, institutions, agencies) for providing services to the citizens in the functional communities base their activities on defined priorities of the local community, they reduce the potential risks for the citizens, put their focus on outcomes (changes among citizens) rather than the processes themselves, maintain the existing and establish new social networks of help and support to individuals, while respecting their individual rights, include citizens (service users) in decision-making agencies, and others. Whenever various forms of community action and action are realized, it must take into account the specificities of the target groups and the characteristics of the community whose needs or deficits must be met. It is on these principles that a modern police organization bases its activities within community policing, dealing primarily with the security needs of citizens. The analytical approach in this paper deals with the implementation of a problem-solving strategy with the goal to reduce the fear of crime and the rate of crime, that is, with the measures and activities by which the police influences the quality of life of citizens in the local community.

Keywords: *quality of life, needs of the citizens, crime, community policing*

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INTRODUCTION: QUALITY OF LIFE AS A MEASURE OF SUSTAINABILITY OF LOCAL COMMUNITY

The research of any phenomenon, problem or event in the local community, the analysis of the functioning of institutions and agencies of the local community, and the perception of cause-effect relationships, correlations between occurrences in the community, directly or indirectly aim to improve the quality of life in the local community. Quality of life is more a direct manifestation of sustainability, which refers to the ability of a city or local community to meet the present needs of citizens without jeopardizing the ability of future generations to meet their complete needs (Committee on Identifying Data Needs for Place-Based Decision Making et al., 2002: 23).

Due to different conceptual approaches, quality of life has been the subject of numerous studies in various fields of research, such as economics, sociology, political science, psychology, philosophy and medicine. The first approach sees the quality of life through the means and goods available to the individual – quality of life is based on objective resources that allow people to exist. This approach began to be applied in Sweden, during the 1960s, as the so-called *level of access to life* (Erikson, 1974, 1993; Erikson & Uusitalo, 1987). The approach implies the ability of an individual to control resources such as money, property, knowledge, mental and physical energy, social relations and security, on the basis of which he or she can consciously direct his or her living conditions**.**

The second, alternative approach to the study of quality of life, relies on the notion of subjective well-being (Poggi et al., 2011). The concept of quality of life corresponds to the concept of a good feeling, that is, a subjective condition in terms of happiness and satisfaction. This approach is rooted in the tradition of American social psychology, developed in the 1960s and deals with the quality of life in terms of meeting needs. The quality of life according to this concept should be defined based on the observed results achieved during an individual's life rather than the availability of social and material resources (Frey & Stutzer, 2000).

The third conceptual direction was founded by Sen (Nussbaum & Sen, 1993). The quality of life can be understood in terms of "individual ability to achieve different valuable functionalities". The quality of life does not rely solely on the availability of resources, although this issue has been recognized as a key element for achieving well-being in several domains. On the contrary, quality of life should be related to achieving real freedom, which allows people to achieve their goals, as far as possible, and choose a way of life through which they will prove themselves in all domains.

The age of the recession and the global crisis have put in the focus the problems of poverty, unemployment, social differences, personal security, food security, health and social security, and so on. These changes assume the transition from the conceptualization of the quality of life as a result of the inevitable progress of civilization on to the idea of quality of life as a common and balanced pro-

cess (Poggi et al., 2011). A new understanding of the quality of life as "prosperity" implies the development of this concept based on meeting the needs of citizens of local communities.

Systems (services, institutions, agencies) for providing services to citizens in communities base their activities on defined community priorities, reduce the possibility of risk for citizens, put the focus of their work on outcomes (changes among citizens) rather than the processes themselves, maintain the existing ones and establish new social networks of help and support to individuals, include citizens (service users) in decision-making agencies, and others. In doing so, whenever various forms of community activity and social work are realized, account must be taken of the specificities of the target groups and the characteristics of the community in the community whose needs or deficits must be met (Ife & Fiske, 2006). It is on these principles that a police organization bases its activities within the concept of work in the local community.

THE NEEDS OF CITIZENS AS A PROJECTION OF QUALITY OF LIFE IN A COMMUNITY

Each assessment of needs or their identification begins from the basic Maslow's hierarchy of human needs, a psychological theory, first published by Abraham Maslow, an American psychologist in 1943, in *A Theory of Human Motivation*. Maslow's hierarchy emphasizes that human needs can be sorted into groups and that there is a clear hierarchy between these groups. The needs of lower level of hierarchy must be satisfied before the demands of higher levels are activated. Maslow's hierarchy of human needs consists of five sets of needs, which are, from the lowest to the highest: physiological needs, the needs for security, the needs for belonging, the needs for appreciation and the needs for self-realization (Figure 1.)

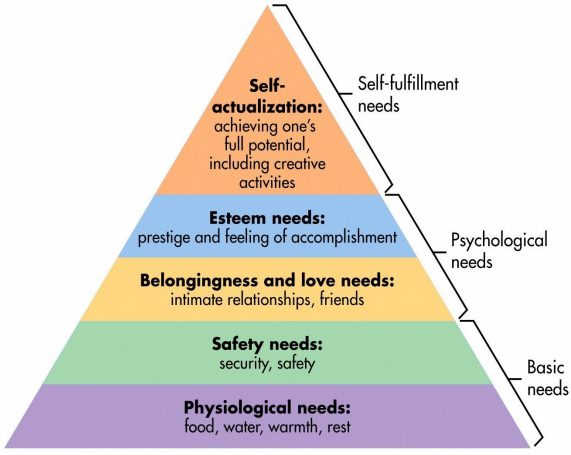


Figure 1. *Hierarchy of human needs*

For Maslow's theory it is assumed that it is based on the cultural values of America. In Denmark, Sweden and Norway, social needs are more powerful than self-realization and self-respect. In China, Japan and Korea, where collectivism and collaborative work are valued more than individual achievements, belonging and security are more important than meeting the needs of growth. Therefore, although the needs identified by Maslow may be a universal, logical or hierarchical order differs from culture to culture (Jovanović et al., 2003). However, in every culture, in the order of necessity, immediately after basic, physical needs, there are people's security needs, that is, the protection of basic human values (life, bodies, etc.).

The founder and creator of the needs assessment model, Roger Kaufman, defined the need as a "gap in results". According to him, in order to conduct an assessment of needs with high quality, it should first define the current state (result); then the desired result is articulated, where the distance between these two results represents a real need. Kaufman's model identifies gaps - needs at the community level (Kaufman et al., 1993: 8). Kaufman identified 13 indicators of social well-being, which can lead to loss of life, a decrease in the level of well-being, possibility of survival and quality of life in general: 1) war, insurgency or terrorism; 2) lack of shelter; 3) unplanned, people-induced changes in the living environment or sources of energy; 4) murder, rape, crime or violence, robbery, or destruction of property; 5) violent behaviour; 6) disease; 7) pollution; 8) hunger or nourishment; 9) abuse of children; 10) partner, marriage or abuse of the elderly; 11) destructive behaviour towards children, partner, spouse, elderly people; 12) discrimination based on different criteria, including skin colour, race, religion, gender, nationality, age or place of origin; 13) poverty. This means that the prerequisite for the quality of life, that is, for social welfare, is the protection of citizens from these forms of endangerment of their security.

In general, as the main areas in which intervention of community institutions is required, or as phenomena that jeopardize the functionality of the community, in the so far conducted research (Singletary & Powell, 2003; Glashan & Malinak, 2010; Marcusson, 2011) were recognized: the rise of violence among young people and other categories of citizens; financial aspects of meeting the needs of residents in the community; availability of health services; mobility of the population, the need for the help of others, etc. In relation to this the most notable are the following services, institutions and public services whose engagement is of particular importance in the community: health institutions, social services, police, school institutions, transport services.

RESEARCH OF QUALITY OF LIFE AND SAFETY NEEDS OF CITIZENS

The research base of this topic in Serbia is poor and inconsistent. Studies conducted since 2000 have been carried out as part of broader project activities, mainly by the Ministry of Health, the Institute of Public Health, organizations

dealing with environmental protection or economic, and financial institutions. We find determining the security needs of citizens as the subject and goal orientation of research studies in Serbia only in the public opinion polls carried out by the Organization for Security and Cooperation in Europe (OSCE) in Serbia in cooperation with the Ministries of the Interior or Defence. Within these studies, each year, the degree of confidence of citizens in individual institutions is assessed and the security risks that citizens perceive as the most present. Studies dealing exclusively with the relationship between the quality of life of citizens, their security needs and the community policing as a strategy of police work in the local community do not exist in research bases in Serbia.

The analytical approach in this paper is based on the findings of certain researches carried out in the world that dealt with quality of life across the domain of local community security and personal safety of citizens, taking into account their perception and assessment of the effectiveness of community policing as a strategy of police work directed towards improving the quality of life. Improved quality of life would mean that there is no fear of crime among citizens of research communities, nor need for protection from violence, but trust in the work of the police. A number of studies have sought to identify indicators that police organizations use to assess the contribution, that is, the quantitative and qualitative results of their activities in the context of the implementation of the community policing strategy in order to improve the quality of life of citizens in the local community (Nikač, 2012; Đurić, 2013).

In these surveys, the quality of life of citizens in local communities and their security needs are operatively defined through the dimension of general safety of community life, personal security of citizens, degree of fear of different types of crime, and identified forms of community violence and citizens' attitudes towards police officers of the local police organization. The attitude of citizens towards police officers and their manner of performing police affairs in local communities pointed to the existence of a gap between what the police do and what citizens expect from them (Spasić et al., 2013). The existence of the gap (gaps, defects) is being operationalized as a need to be met in order to raise the quality of life of citizens to a higher level.

COMMUNITY POLICING AND THE QUALITY OF LIFE: WHAT POLICE PRACTICE EXPECTS AND WHAT CITIZENS EXPECT FROM IT?

The definition of community policing has been the subject of much debate. Agencies, practitioners, and researchers tend to define it differently, though most definitions contain similar principles, including problem solving, community involvement, and organizational decentralization (Adams, Rohe, & Arcury, 2002; Chappell & Lanza-Kaduce, 2004; Skogan, 2004). Quality of life and crime preven-

tion are also emphasized (Community Policing Consortium, 2006). The concept of community policing involves the association of citizens and police in the fight against crime, that is, the concept of performing police tasks that places emphasis on the formation of a partnership between the police and the community in order to reduce crime and strengthen the safety of citizens (Champion 2003: 2). When the concept was experimentally introduced into the work of the US police in the 1970s, it was meant to provide an answer to the problems of crime, disorder and conflicts of citizens and police in the local community (Trojanowicz & Bucqueroux 1990; Chappell 2009).

Today, however, the concept has taken on the characteristics of social-service work in the local community, and is directed primarily towards addressing the requests and needs of the local community, that is, improving the quality of their lives in the community (Spasić et al., 2013). It is precisely on the difference between the objectives and results of the traditional work of the police and the modern strategy, that is, community policing, possible to identify and evaluate the impact that community policing has on the quality of life of citizens in the local community.

"Traditional" police departments have long defined their primary mission and measured efficiency in terms of enforcement and enforcement of laws, primarily on the basis of initiated investigations and the arrest of criminals. As a result, police efficiency depended on the number of arrests taken and the percentage of detected crimes (Xu et al., 2005: 149). Accordingly, statistical reports of crime represented the "most visible" measure of the effect of the police organization (Bayley, 1994). However, this approach, according to some theoreticians, could have led to the ignoring of real problems in the community, that is, the security needs of its citizens. When discussing the responsibility of the police, Trojanowicz (1998) raised several essential questions relating to the primary objectives of police work in the community: 1) Is the primary function of the police to fight crime or to maintain peace in the community? 2) What is primary - to arrest a criminal or to prevent crimes?

Regarding community response to crime, the primary role of the police can be "problematic" and debatable for several reasons: firstly, how the real state of crime in the community can be assessed if a large part of crimes remains unreported. Second, can the police and to what extent influence the crime rate? And thirdly, is crime prevention and suppression the only indicator that ordinary citizens use to assess the effectiveness of police work? Bayley (1994) also points out that what most people consider as "security" is difficult to measure and does not mostly relate to what the police are doing, while, at the same time, what the police are doing is easy to measure, but it often does not refer specifically to the security needs of citizens and the quality of their lives in the community.

In contrast, the community policing strategy uses a more comprehensive approach and includes a more inclusive concept, i.e. quality of life, as the ultimate goal of police work (Skogan & Hartnett, 1997). The definition of community po-

licing by Trojanowicz recognizes the need to "look" beyond the focus of the traditional criminal justice system in order to find the conditions that generate crime and solutions for their eradication. When social conditions are included in the assessment of the scope and possibilities of reducing crime, a more accurate picture of "cost of crime" is obtained, i.e. its objective consequences. The issues of quality of life, which were previously neglected, were included in the calculation of "cost of crime". This new way of thinking analyses crime in a holistic sense by bringing its "cost" into account with general social conditions and its impact on reducing the quality of life in the community. For the work of police in the community, the fight against crime is not an end in itself, but the quality of life of citizens is the ultimate outcome of all forms of police work. Arresting criminals is just one means of reaching this goal. This change in the paradigm in the philosophy of police work requires changes in the police work strategy. This means that for the efficient work of the police it is not enough just to "cure the symptoms of crime", but, more importantly, to eliminate the causes of this "disease" by changing the social conditions that generate crime, that is, they create a fear of crime in the citizens.

This expanded community policing concept aims to help the community create a secure environment in which its basic institutions (family, churches, schools) can function effectively, improve and influence the quality of life of its citizens. This also affects the expectations that citizens have in relation to the police in the community – in addition to demanding the arrest of criminals, it is expected that the police influences, with their activities, the reducing of fear of crime and raising the quality of life in the community. In this sense, the work of police in the community implies a holistic and synergistic approach and a "higher level of thinking", a new relationship to the philosophy of police work, that is, according to functional, organizational and personnel issues, but also to measuring the effectiveness or impact of the police organization. Spasić and Radovanović (2019) summarize the essence of modern police work as a need to help citizens feel safe in their communities and to have confidence in the work of the police.

MEASURING THE EFFICIENCY AND PRODUCTIVITY OF POLICE WORK

Moving from a traditional to a modern, problem-oriented police work, also brought change, i.e. redefining of the standards for measuring and evaluating the work of the police. The factors used to measure and assess the way the police conduct their mission evolved from the traditional measurement of the productivity of the police to complex measures that assess the impact of police on the quality of life in the community they serve, and to what extent problems in the community are solved (Langworthy, 1998). Traditional police departments measure their performance in terms of productivity (the number of arrests, the value of smuggled goods confiscated, the number of calls sent to the police service, the average response time on calls, etc.). Although these types of indicators are simple, clear

and legitimate to measure specific police activities, there is no clear consensus between theorists and police experts as to whether there is a link between police productivity and the reduction or improvement of public safety and citizen security (O'Brien, 1996). Traditional police departments can have objective results in arresting criminals, but this does not mean, by itself, that they are effective in accomplishing a police mission to reduce crime and improve quality of life (Alpert & Moore, 1993).

Police organizations that focus on the work of police in the community have a different approach to measuring performance than organizations that are traditional. Police organizations that implement the community policing strategy can report some of the traditional actions of arrest or the average response time to citizens' calls, but they focus on measuring the police's performance in terms of quality rather than productivity. The quality, simply put, is "compliance with the customer's needs", which is the basic component of the police work in a community where the customer or consumer is a local community. Quality, in this context, means "quality of life", which includes many conditions and factors that affect everyday life in the community (Wilson & Kelling, 1982). The quality of life is "the subjective state of well-being in the collective mind of the community" and represents a measure of police effect. Accordingly, the community policing strategy is conceptually based on the hypothesis of the cause-and-effect relationship and the existence of correlation, i.e. the impact of results of the police on the quality of life (Trojanowicz & Bucqueroux, 1990).

Measuring community policing effects focuses on the role of the police as a social control mechanism in the community. However, a more systematic and complex discussion of this role of the police should include the wider context and all relevant parties in social control, such as the "big six" – police, citizens, media, politicians, public and private organizations, and business community. In reality, all parties should contribute to the effectiveness of the community policing strategy.

Academics and practitioners often disagree about the best way to measure community policing program successes, while studies offer mixed results on whether these programs improve community conditions. Data from Seattle show that community policing is rarely successful in achieving effective collaborations between community members and police (Herbert, 2006). Scholars have also punctured the broken windows rationale of community policing by arguing there is no direct relationship between disorder and more serious crime (Sampson & Raudenbush, 1999). Conversely, other researchers suggest that community policing can in fact reduce rates of serious crime (Connell, Miggans & McGloin, 2008; Spasić & Milojević, 2016).

Some research suggests mixed findings can be expected given that community policing looks differently depending on police leadership, the geographic area, and the demographic characteristics of communities (Thatcher, 2001). Other studies claim police departments have simply relabelled old tactics as community policing, making little structural change to police activities (Morabito, 2010).

More sceptical work highlights the fact that community policing "seems much less practiced in disadvantaged neighbourhoods" (Reisig & Parks, 2004). Another explanation for differential community outcomes as a result of community policing is the lack of true partnerships between the police and particular communities (especially in communities where ethnic, racial and language barriers exist). Evidence from a review of 11 community policing programs across the country finds there is widespread disagreement among police and community members regarding (a) a shared goal of public safety and (b) how much authority and force police should utilize in everyday policing (Thatcher, 2001). Thus, a gap between police and the community regarding the roles and goals of policing can hinder the implementation of community policing strategies (Spasić & Radovanović, 2019)

Objective consideration and measurement of police performance at the organizational and functional level should also be based on the perception and assessment of police work by the citizens of the local community. According to Bayley (1994: 95), citizens' surveillance of police work should be based on: 1) assessment of citizen satisfaction (publicity) by the police service and trust of citizens; 2) assessment of the adequacy of the responses of police patrols to citizens' calls; 3) assessment of the satisfaction of victims of crime by the attitude and treatment of police officers; 4) the relationship of reported and illuminated criminal offenses; 5) the speed of answering the telephone calls of citizens; 6) the satisfaction of citizens who report the criminal offense committed by police officers; 7) speed of reaction in emergency situations; 8) assessment of the satisfaction of all citizens who have contact with the police; and 9) criticisms and complaints on the work of the police. The use of feedback from citizens is important in the context of indicators of the results of police work that directly affect the quality of their lives in the community.

CONCLUSION

There are fundamental differences between the way that "traditional" and modern police organizations view the work of the police. Community policing denies the view that with the arrest of criminals and the return of stolen property the police can permanently influence the reduction of crime rates. Instead, the advocates of the community policing concept claim that if the police solves the problems of physical disorders in the community and set the basis for social control, it can influence the reduction of crime rates. Thus, while the police mission remained identical to that of the traditional police work, modern forms of community policing imply involvement in resolving community problems that lead to improving the quality of life of its citizens. Consequently, improving the quality of life in the community entails and a new role and task for police administrators – to monitor and measure the performance of their officers. Accordingly, the impact of the community policing strategy on the quality of life of the individuals in the community imposes the imperative of strategic changes in the police orga-

nization. Changes imply a new police model, a new philosophy of work and new management in the police.

A prerequisite of all changes in community policing strategies and their impact on the quality of life of the citizens is a territorial decentralization of the police organization. The police organizations have to function in a society as an authority of formal social control and a public service which acts in line with the citizens' needs, with the distinguished decentralization of the management, competencies and authorizations, with strong and stable finance and support sources, qualitative personnel and material resources, continuous training and system of remuneration and evaluation of the police work. The community policing concept is an efficient strategy which can positively affect the quality of life in the community, which numerous police models research and world experiences have shown. At the same time, acceptance of the concept by the police organizations as a strategy of work in the local community and balanced functioning of its organizational elements, with the knowledge of the community specificities and the characteristics of its security problems, create, by applying it, the conditions to overcome the gap in the citizens' security needs and affect the quality of their lives (Spasić & Radovanović, 2019).

Research and practice need to place a greater emphasis on studying and implementing police oversight, which is a less-often practiced component of community policing. Future studies on community policing should incorporate engaged research methods that include the valuable input of community members regarding their experiences, needs, and concerns pertaining to contact with police. One way police departments can reach the community is through building connections with grassroots community organizing groups that are comprised of residents and have meaningful and sustained relationships with other community members (Cossyleon, 2019).

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FACTORS RELATED TO CRIME RECORDING BY THE POLICE: CONDITIONS AND CHALLENGES IN MACEDONIA

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Abstract: Whether and how much crime data can be trusted and how much those data are objective, confidential and accurate, are frequently asked questions among criminologists and among those researchers who investigate crime numbers. Part of such research should focus on the factors that influence police officers in recording reported crime because they have a strategic role in the creation of police statistics. We divided them into three groups: related to the legal framework, related to the organizational structure and capacity of the police, and related to the discretionary decision-making of police officers. In that sense, by the Faculty of security – Skopje was carried out the study "The process of recording and statistical presentation of conventional crimes by the police" (Stefanovska, Gogov, Peovska, 2019). Certain findings and conclusions are presented in this article.

Key words: reported crime, crime recording, police, crime rate, police statistics.

INTRODUCTION

Police crime statistics are a starting point for understanding crime rate and scope in every county. They are important not only for the public in order to improve their trust and perception in the police regarding crime control and prevention, but also much more in relation to the police so as to improve their performance, efficiency and crime detection. Therefore, the process of police crime recording is research issue in many studies within the expert and scientific community. And because the police crime statistics are a product of police practices to record crime, the question to measure, count and record all reported crimes in objective and accurate manner get serious challenges and weaknesses. Actually, whether and how much crime data can be trusted and how much those data are objective, confidential and accurate, are frequently asked questions among criminologists and among those researchers who investigate crime numbers. The basis is that, like many other phenomena, crime is also a product of social processes, and the criminal justice system plays a significant role in its social construction.

In this respect, any data collected by the police should be treated as a subjective measure of a social process. Consequently, one of the ways in which crime is constructed by the police is through official statistics. On the other hand, the crime numbers are produced to meet certain organizational goals which mean that the statistics do not reflect the real picture of crime, do not describe them, nor tell about the phenomena that they refer to (Patric, 2014, Jupp, 1989). In fact, the main problem in interpreting official crime statistics recorded by the police is that they are incomplete and with prejudices.

CERTAIN RESEARCH RESULTS

The manner and process of police crime recording are the subject of many researches within academic community around the world. In this respect, given that police crime statistics are a product of police practices for crime recording, today more and more scholars think that it is not possible to set up an objective and accurate picture of the current state of crime in a society. In doing so, it is concluded that several factors of different nature influence decision making process. For example, Coleman & Moynihan (2002) talk about several factors related to the social and political context, to the organizational and situational context. Social and political context refer to whether the crime rate is a political issue and subject to political pressure. For example, some studies suggest that drug-related offences, prostitution and gambling criminal activities are highly sensitive to police action or that police officers feel certain pressures to "censor" the numbers of offenders to meet someone's political interests or to show a good picture of police effectiveness. Under the organizational context, researchers imply factors related to the organization and capacity of the police, such as working practices and personnel, the degree of professionalization of the police department etc. Situational context means certain characteristics of reported crimes, their severity, characteristics of both, the victims and offenders, the situation circumstances of the crime place (Eterno, Verna & Silverman, 2014).

Taking into account the influence of certain factors, scientific and expert community is aware of possible misconceptions, manipulations and errors of police statistics and crime reports. Sulejmanov writes about unintentional and intentional mistakes in his *Criminology (2003)*. Unintentional errors are divided into: (a) errors in police responses (for example, one event will be recorded as a crime, but later will be clarified that the reported event does not fit the legal definition of certain crime (no recognizable crime) and (b) errors in the collection and data processing. Intentional mistakes are made due to daily political reasons to hide the increase in certain types of crimes, to calm the public or to reduce the fear among potential tourists (Sulejmanov, 2003: 74). In addition, certain data show that the number of reported offenses is proportional to the number of police officers in one sector (or at one police station). If there are more police officers, the number of reported and recorded crime is greater and vice versa (Marvell &

Moody, 1996). Another example is that increased juvenile crime may not have a significant link with the increased number of criminal activities of young people. They can be an expression of changes in the juvenile justice law or might be result of increased police attention towards certain groups. Such focused police detection might be a result of increased public pressure or of particular media or political campaign (Carrabine at all, 2009). Or, in relation to some situational characteristics of the place where crime occurs, the data indicate that reported events to the police are less likely to be recorded as crimes in poor and disorganized neighbourhoods (Varano, Schafer, Cancino & Swatt, 2009). On the other hand, certain stolen items can be recorded as lost property, serious crimes as less serious (for example, robbery as theft), crimes as minor offences etc. Based on that, the main conclusions from most researches related to police recording practices are that the process to decide whether to record an event as a crime is complex. There are a number of external factors that may affect the likelihood of an event being recorded as a crime, and some of them serve the purpose of obtaining better crime detection and clearing up rates by the police (Walklate, 2005).

In this regard, the question that often arises is whether the increase or reduction of official crime statistics really results from the increased crime or is a consequence of specific police activity? The question arises due to the fact that those statistics largely depend on the quality, rationality and objectivity of statistical records conducted in the analytical services within police organisational structure. The main consideration is that the accuracy, objectivity and the confidentiality of crime statistics should be subject to more extensive scientific research. A part of such research should focus on the factors that influence police officers in recording reported crime because they have a strategic role in the creation of police statistics.

Actually, the crime event in order to become part of the official police records should pass two obstacles. First, it has to come to the focus of the police. Then, the police must record it as a crime. Hence, there are many reasons, both legitimate and illegitimate, that prevent reported events from becoming official police records (Lomell, 2010: 124). For example, one research done by Sparks, Genn and Dodd (1997) shows that only 1/3 of the reported crimes end up as a statistical number (state in Jupp, 1989: 95). Therefore, statistics could not be used, for example, to make crime prognosis or to assess the effectiveness of the criminal justice system. But they should not be ignored either. Their value lies, not in the figures themselves, but in the questions posed by different theoretical perspectives. Hence, Maguire in his work *Data and Statistics on Crime (2002)* states two major recommendations: (1) crime statistics are not simple reflections on "facts", but one of many possible tools for gaining a greater understanding of complex and rapidly changing forms of behaviour that can be described as a crime and (2) crime statistics are not immune to political and social changes and to the manner in which crime data are collected, analyzed and presented (Maguire, 2002: 294-295).

In that sense, we have carried out study "The process of recording and statistical presentation of reported crime by the police" (Stefanovska, Gogov, Peovska, 2019). One issue that was investigated and analysed were the factors that are related to the objectivity of the recorded crimes. We divided them into three groups related to the (1) legal framework, (b) organizational structure and capacity of the police, and (c) discretionary decision-making powers of police officers. Moreover, in trying to find a certain connection with the possible "distortions" of the objective picture of crime, the first question that arises is whether we can speak about objective statistics on crime? In the answer to this question, two aspects are significant. Firstly, the objective picture of statistical data can be monitored and analyzed only through official, publicly available and disseminated statistical data on criminal offenses. Citizens, including the academic community, can rely exclusively on those figures that build trust in the police and affect the safety of citizens and their sense of security. Secondly, although the police run and use internal police statistics, they are confidential, secret, not published, and are therefore not considered as official. Such internal data are not commented and analyzed by the public and the academic community and, so far, are not subject to scientific research and public debates.

Therefore, under *objective official statistical data on reported and recorded crim*e we understand the reported events by both, the citizens or the police, that are found to fulfil the elements of crimes and which are: (1) recorded in the official police records, (2) properly qualified as certain crimes and (3) entered into the official police statistics. Such crimes receive a statistical figure and become part of the official rates for the reported crime in one country.

Because, in order to obtain an objective picture of the reported crimes, certain decision-making processes need to pass, any misclassification, qualification or non-recording of the reported crimes violates that image. And these decision-making processes are influenced by different organisational, social and situational factors. In particular, the police officer is a person influenced by certain factors related to the organization, goals, values and priorities of the environment where he/she operates. Also, in performing his/her tasks, he/she is guided by specific rules, legal norms and practice. Thirdly, discretionary decision-making is conditioned by the way the police officer perceives the reported event, by his/her individual value judgments, as well as by his/her knowledge and professionalism to assess whether and what crime has occurred. Bearing in mind that, most frequently question is whether the data show true or false picture of crime. The answer depends on many issues: adoption of police recording standards to harmonize different police practices and to establish legal rules and guiding principles, determination of organizational goals and priorities within certain period, establishment of police performance indicators, cognitive and other capabilities of police officers etc. Those issues are very important in order to perceive the accuracy, reliability and objectivity of crime statistics.

METHODS

The issue related to possible factors that influence police crime recording practices was considered within the project ""The process of recording and statistical presentation of conventional crimes by the police" (Stefanovska, Gogov, Peovska, 2019) undertaken by the Faculty of security – Skopje (February 2018 – May 2019). The main goal of the research study was to identify strengths and weaknesses in the process of police production of official crime statistics. In that sense, the study was aimed to investigate possible factors that impact crime recording practices, competencies and challenges that police officers encounter. In doing so, we have set up several research questions: Are there standards for recording the reported crimes that provide an objective picture of their scope and prevalence? What factors influence the discretionary decision of the police officers? Whether and which organizational goals, priorities and capacities of the police service are related to the design and construction of crime statistics? Does the personnel potential of the police services provide an objective presentation of crime?

Those questions are analyzed through a qualitative analysis of the content of both, the attitudes of the interviewees and certain strategic documents, reports and laws.[1] The sample (respondents) consisted of 56 respondents and they were selected in two ways: the first group (42 respondents) police officers (uniformed and un-uniformed) were selected from the local police stations and from Crime Investigation Police Departments at Skopje City level. The second category of respondents was employers in the police statistical departments at local and national level (14 respondents) (Department for statistical research and documentation). For the purposes of data collection, semi-structured protocols for interview were developed. All respondents interviewed gave their written consent that their participation in the research study is voluntary. With regard to audio recording, each respondent was requested prior consent before recording. The collected data were categorized into three basic categories (thematic areas) and several subcategories: a) Legal framework for recording, i.e. not recording of crime: legal basis, rules for crime counting, rules for re-qualification of the crime, b) Police discretionary practices in classifying, qualifying and not registering crime and c) Organizational structure and capacities of the police.

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RESULTS AND DISCUSSION

Legal framework for crime recording

The first area to be considered when analysing the objectivity of crime data is the legal framework, that is, the rules and standards that should be observed when counting and measuring crime. The stipulated rules and other written methodology do not mean that they ensure objective counting and recording of crime. If we agree with the thesis that both the rules, i.e. the laws are written and serve to achieve certain organizational goals, either of the police or of the governing structure, then the question is: whether the legal framework provides an objective data? The answer is: not completely. In fact, the analysis of the legal framework shows certain legal gaps or unwritten rules that "distort" the reality of the reported crime.

Legal basis

Based on the analysis of the legal framework related to the recording of the reported crime, as well as on the basis of the respondents' views, the following findings were obtained:

The crimes of private lawsuit are not part of the official statistical records. Criminal offenses prosecuted on a private charge, even though they are recorded in certain police records and documents are not included in official statistical reviews and reports. To the question: why the crimes that are prosecuted under a private lawsuit are not part of the official statistics?, the frequent answers are: "these crimes have never been commented", or "it is inherited (police) practice". Some of the respondents just "shrug their shoulders" to show that they don't know the answer.

When there is no official victims (damaged person by the crime), there is no official offense. For a criminal offense to be recorded in the official records, the damaged party should report the crime that has to be recorded in certain reporting document in the police. When there is a need to inspect the crime scene, then, depending on the offense, the consent of the injured party is required. Hence, as long as the injured party does not sign the reported crime in official police record or does not agree to process further the reported event, that event is not officially recorded as a criminal offense and cannot be counted in the statistical evidence of crime. To illustrate such claims we refer to the following statements from the interviewed persons:

(1) If he does not want to report, we cannot force him to report it. (2) If there is no report, there is no crime. (3) They (crimes) do not exist, they are invisible to us. (4) If there is no damage, there is no crime, (5) It's (the crime) invisible and you cannot count it. (6) If you do not have a damaged (person), you do not have a crime... officially. (7) It's not an official offense... we may have it, but how we will prove the

crime, the public prosecutor wants from us to have a record (Statements by interviewed persons).

In this regard, the police statistical records do not count the reported crimes when: (1) the victim reports the crime, but gave up from further prosecution, (2) a third person reports the crime, but the victim refuses to make an official statement to the police, (3) the victim reports the crime, but he/she is unavailable to the police to make an official statement. So the objective crime is based on reported, recorded and prosecuted crimes. Based on that, we can conclude that written and signed records (for receiving an application for a criminal act) constitute the basis for further processing and further, the basis for obtaining a statistical crime number. Those statistics do not reflect the real crimes reported to the police, but rather they are refection of the police work to record and process them.

Counting Rules for Crimes and Perpetrators

The counting rules for crimes and offenders are necessary for the unification of police practice in crime recording, particularly in more complex criminal cases. For example, when several crimes are committed simultaneously (multiply offences) or in a certain time interval or when there are more perpetrators or victims. In this part, police have no clear rules and written standards and therefore there are different police practices in counting and crime recording. For examples, when one offender commits several crimes within one event, each crime is recorded and counted in the databases. But, when we have multiple offences, it is better to adopt a hierarchical rule or a *rule of main crime* that will be counted in crime statistics.

Prequalified and dismissed criminal offenses by the public prosecutor are not corrected in monthly police statistics.

Monthly statistical reviews prepared by the police statistical department are not corrected when the public prosecutor re-classifies the crime or dismisses the criminal charge as unfounded in the further criminal procedure. For example, data show that the number of dismissed criminal charges by the public prosecutor has increased over the years, so in 2014 that percentage is 22% (Trajkov, 2016: 95). The rejected crimes remain to be part of the police official statistics.

Year	Submitted criminal charges to the public prosecutor office	Dismissed criminal charges by the public prosecutor
2010	11.823 100%	1.277 11%
2011	11.519 100%	1.403 13%
2012	10.806 100%	1.625 15%
2013	11.444 100%	1.637 16%
2014	11.268 100%	2.451 22%

Police discretionary practices in classifying[2] and qualifying[3] reported events

Based on the research findings, several factors can be identified that influence the decision making process of the police officers for classifying the reported event. They are:

a) *The manner of presenting the reported event to those who decide about classification and qualification of crime event.* The manner how the event is presented to the police inspectors and the public prosecutor's office is of great importance in the process of classification because through that representation and description they receive a picture of whether the reported crime has occurred. In certain cases, one detail or element related to the circumstances under which the event occurred may exert key influence in decision whether the reported event is crime. In doing so, the intent of the perpetrator are of primary importance, and in some cases, when is not clear what the perpetrator wanted to do, is difficult to determine the crime motivation, having in mind that the largest percentage (can reach up to 99%) of the reported events (mainly property offences) are with an unknown (NN) perpetrator. Therefore, many of the respondents agree that the way of how the information related to the crime is transmitted to senior police officers is of great importance so as to properly classify the reported events. The omission to report or the silence of certain details related to the event by field police officers may also occur due to incompetence or desire to display the event in one way or another. For confirmation we quote the following statement:

The prosecutor sits in the office. He will make a decision depending on how I will present him (the crime event) from the field ... if I want to get something in some direction, I will present him so... He will say ok ... He gets a picture, depending how you will transfer it (the elements of crime).

Taking into account possible mistakes and abuses, whenever possible, the factual situation of the reported event should be determined by the police inspectors from the departments of property or violent crimes.

b) *Personal capacities, knowledge and expertise of police officers.* In fact, the actual situation of reported events is result of the perception and cognitive abilities of the police officer. In addition, the police officer is required to possess knowledge, professionalism and expertise to identify the legal elements, traces and circumstances associated with the committed crime. Therefore, the classification and qualification of the reported event under a particular article of the Criminal Code should not be left to a free assessment of the police officers who do not have special knowledge and skills in that field. Dilemmas in determining the elements of crime must not be detrimental to both, the injured party and the public confidence in the police. Therefore the experience, knowledge and commitment of po-

2 Classifying in this sense means to classify the reported event as crime, misdemeanour or just complaint according to police classification scheme.
3 Qualifying in this sense means to qualify the crime under certain article of Macedonian Criminal code or to give it legal qualification.

lice officers have a significant role in classifying and qualifying the reported event. But, according to the statements of the respondents, the police are facing certain problems due to incompetence and disinterest, especially among the young police officers. In that sense, the respondents had divided opinions about the quality and expertise of the police officers. According to them, a part of young police officers (usually, those with less than five years work experience) are motivated, but the other part is disinterested, unmotivated and not enough qualified. These findings are supported by the following statements:

Field officers are very uneducated... I'm not satisfied, 50-50%.

Weak, very weak, as they come, (the new police officers) they are weaker.

I am satisfied with the "new children."

The majority are good, others are not active, they are not interested, they do not ask.

There are many good children... There are solid ones.

*Usually inexperienced colleagues know to ma*ke mistakes.

(Statements by interviewed persons)

Therefore, police can face more challenges in the long run if the basic criteria for recruiting police officers are not met by the police human resources policy.

c) Circumstances related to certain elements of crime. Certain elements related to both, the offender and the victim can exert certain influence on decision-making process whether to report the crime. For example, the police officer may decide to classify the crime as misdemeanour if the victim does not want to file criminal charges against the perpetrator. Or, if the victim does not submit medical documentation for heavier bodily injuries, the reported event might be recorded as minor offence, such a "physical attack" against the public order, which is prosecuted under the Law on misdemeanours.

Organizational structure and capacities of the police

As part of the organizational structure and capacities of the police service, based on the statements of the respondents, we list the following factors that are related to the recording of reported crime: workload, insufficient number of police officers, motivation and pro-activity of police officers and papyrology and huge administrative work.

Workload

Police stations of general competence (PSGC) cover a large number of police tasks, regular and extraordinary activities. They are responsible for: (1) public order and peace, (2) securing crime place, public protests, facilities, sports competitions and other public events, (3) assisting people in certain situations, (4) detained persons in police stations, (4) foot patrol, (5) crime prevention and (6),

detection and apprehension of the perpetrators etc. In addition, police assist in natural disasters and in executing court orders. Apart from those regular and extraordinary police activities, the police stations also perform administrative work: filling police records, notes, data bases, preparing plans, reports and other written assessments.

Such a workload (operational, preventive, and administrative) affects the quality of primary police work and marginalizes those activities related to detection and determination of legal elements of crime in order to record the reported crime. Although, generally, the respondents agree that due to the excessive workload, the efficiency in detection and deterrence from the crime is reduced, however the workload is directly and/or indirectly related to the quality and objectivity of crime recording. Moreover, the workload affects both the motivation and the proactive action of the police to detect and report crimes. In this regard, some of the respondent state:

You know why your work plan cannot be entirely (fulfilled)... Because the securing football matches is out of the plan, no protests, no summits, no natural disasters... With those (additional activities), the primary police work is accumulating... That's the problem. No one can foresee the police work, it does not exist.

We are too occupied (with protests)... That means we generally have little police work, because we are preoccupied with citizens, complaints (neighbour disputes), too many superficial things we do, from complaints... mourning of citizens, rather than with crime... (we are) overcrowded (with crime), and you have to clear it.

(He) cannot make contact with the citizens... He is constantly engaged in other activities, protests and the like.

Every policeman is cluttered with obligations, he is doing everything. That is. The policeman does everything from the postman to ... one intervention, another, they are assembling,

(Statements by interviewed persons)

According to above statements, a large percentage of the police work is not regular (on a daily basis), and on an annual level, even 50% of the daily police activities refers to extraordinary activities. Apart from them, the work of the police is further burdened with increased crime, especially with heavy thefts and burglaries in apartments in some parts of Skopje city. Their detection and clearing up, in order to be more efficient should be in accordance with adequate personnel and technical capacities of the police, which mean more human resources, more vehicles, more sophisticated equipment, and more funds. Because, in the existing present conditions with limited personal, technical and material capacities, the police efficiency is reduced, and there are possible mistakes in the process of recording, classifying and qualifying the reported crime event.

Insufficient number of police officers

The increased workload in correlation with the insufficient number of human resources in the police service is linked to the "objective image" of the recorded crime. In fact, the number of police officers has always been a problem in the Macedonian police organisation. According to certain statements of the respondents, at the Skopje police level, the uniformed part of the police is filled from 35 to 40% of the expected full capacity, which mean that the entire city area cannot be covered with adequate number of police officers and other police intervention groups (called ALFI). Moreover, those police officers who need to be declaratively present in a certain security area, due to engagement and relocation on other extraordinary activities, are not able to perform the regular foot patrol or crime detection activity. Hence, because the police stations are not completely "covered" with police officers in accordance with planned job systematization, some other police priorities and urgent activities within police stations on a daily basis might decrease the quality of crime recording. For illustration are the following statements from the respondents:

Our people are trying to be present, but we are in lack with policemen. Everywhere is that problem, and now normally, when there is no presence, when there is no preventive action, crime is ruling, our people cannot reach.

We work with minimal forces.

(Statements by interviewed persons)

Motivation and pro-activity of police officers

The motivation and pro-activity of police officers can significantly affect not only the clearing up rate, but also the process of recording, properly classifying and qualifying criminal offenses. According to the majority of the respondents, police officers are not very motivated and proactive in performing their activities, but they are de-motivated and "passive", as most of the respondents state:

They (policemen) do not work, they are afraid... Reality is a disaster... I am a policeman. I'm afraid... they need to be motivated, and the only motivation is money.

Why to risk, if it is not valued.

Some of them show interest, some of them think they are coming for a salary.

Because there is no variable, there is passivism... It does not come in correlation with the discovery power of the police.

There are no rewards for the cleared crimes.

No interest, no one is chasing you, no one punishes you, is the same... You will take (the same) salary.

(Statements by interviewed persons)

Papyrology and huge administrative work

The recording of each undertaken action by the police related to crime in certain forms, records, databases or automatic data processing systems is the basis for further analysis, processing, statistical research and crime documentation. Written documents are necessary for recording the factual situation related to crime, perpetrator and victim. In that sense, an important feature of the police is that it is characterized by formalism: keeping notes or records for each activity. This is part of the basic police work, which includes a significant part of the working day. Since all police activities must be recorded and documented (otherwise, omission to record is punishable), the respondents complain that "*real or right*" police work is going down significantly. This situation has been identified and often criticized by the police officers. For illustration, we quote the following statements:

> *The writing work is extensive... and that sector needs to be larger (more employees).*
>
> *It's a lot of administration, in seven books...*
>
> *This (recording) is not a problem... The problem is that the job is lagging behind ... For the police it's a lot because an event is unnecessarily recorded in seven books that are unnecessary.*
>
> *Overburdened with records and books, and you cannot accomplish to do the right police work that needs to go out on the field, to talk to people, with citizens, with damaged ones.*
>
> *Everything is hand-made, it's not normal to have a lot of papyrology; everything is turning around in a circle.*
>
> *Too many events, too much administration ... I fill six (6) forms for one "called" person, it's too time consuming... We are overly administrative for an event ...* We are overburdened with transcripts.
>
> (Statements by interviewed persons)

The extensive and manual administrative work has been identified in *the Police Development Strategy (2016 – 2020)*. It states that the documentation and exchange of documents within Public Security Bureau are carried out in a paper-form which has a significant negative impact on police efficiency. There is no electronic centralized archive for storing all documents. In that context, the huge administrative police work reduces its operational and preventive function. Also, police officers in the Operational Communication Centres and police stations, due to insufficient upgrading of the electronic system, are forced to enter the same data (for example related to one crime) manually into several police records, which substantially consume human resources in administrative matters and reduce the efficiency. Therefore, introduction of an Electronic Document Management System (DMS) is considered as a top priority in the strategic documents for police reforms that will speed up the flow of daily information and will shorten the process of internal communication. At the same time, it will facilitate

the transmission, storage, search and inspection of official documents that will reduce errors, save administrative costs and unify the police practice, particularly in crime recording.

CONCLUSION

Based on project findings and conclusions, the police face certain challenges that should be considered. Main conclusions are: (1) there are different police practices in legal definition of reported crimes. They can be calculated by the police officers in order to show smaller number of crimes that are prosecuted ex officio, to decrease their obligation for detection and clearing up, to show bigger clear up rate etc; (2) Police don't have proper methodology and other unified standards for counting and measuring crime figures; (3) Crime recording in many cases depends on the victim's will, which distort the objective image of reported crimes in certain circumstances; (4) Crimes prosecuted by private lawsuits are not part of the official crime statistics; (5) Police officers are burdened with many police tasks and administrative work during their daily activity that is related to proper registration and detection of reported crimes; (6) Police officers lack specific in depth knowledge in criminal law, criminology that is necessary for proper recognition and classification of reported crimes.

In order to gets comprehensive perception of police recording practices; a critical examination should be done at national level, which means in all local police stations across the country. This will help to consider all challenges that police officers meet within their recording practices. Another task is to develop and adopt unified methodology for counting and measuring crime and to established certain standards and principles, such as: prima facia model, rule of major offence, victim-oriented approach in crime recording, counting units, classification schemes etc. This is important in order to set legal rules and procedures which protect against legal uncertainty and possible abuse of discretion in decision-making by the police. They also ensure consistency and harmonization of the various police practices in recording crime, which, on the other hand, increases the confidence in the objectivity of police statistical records. In addition, training of police officers is imperative that seek more training hours for recognition, classification and registration of reported crimes.

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POLICE MANAGERS' CHARACTERISTICS OF IMPORTANCE FOR SUCCESSFUL ACHIEVING OF THE COMMUNITY POLICING CONCEPT

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Abstract: For the effective implementation of the concept and practice of community policing, it is very important for it to have an immanent management. This implies the need not only to adapt the known forms and styles of management that are applied to the police, but also to select the appropriate managers. It is necessary for these systems and methods to be carefully thought-out in the context of the community policing, and to even find and build-new ones, as well as that the criteria of selection and deployment of managers are adapted to the functions and organization of the community policing. This paper attempts to point out to the said needs and to present ideas aimed at finding adequate police management for effective implementation of community policing, i.e. the style and characteristics of the persons in charge of management.[1]

Keywords: community policing, police management, characteristics of police managers, style of police managers.

INTRODUCTION

Since it has become more apparent that cooperation with citizens and the local community is necessary in order to fight crime effectively, the implementation of the community policing concept is one of the strategic goals of the Serbian police and at the same time one of the priority tasks of police management. Community policing as a new model of police work has a local, problematic, partnership-oriented, cooperative and proactive approach and, as such, requires a different police organization (and management). Community policing shifts the focus of police action from responding to the existing problems of citizens to elimination of their problems [Feltes 2002]. This explains the need for different police management

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from which it is expected not only to articulate the philosophy of the community policing, but also to operationalize and implement it. The police management which is recommended for community policing is characterized by: decentralization, customer service orientation, long-term strategies, proactive management, training and education. Evaluation is an indispensable part of the process of such management (Simonović, 2006: 321).

Police officers who implement the community policing concept are expected to "establish legal and realistic frameworks for improving the relations between the police and citizens" (Simonović, 2004: 34), while at the same time putting all of its potential into the function of revivification and accepting of police community models, so it would not be perceived as an imposed model of behavior and labor, reducing resistance to this concept within the police organization itself and reducing the suspicion as to its positive achievement (Talijan & Ristović, 2012: 370).

The traditional way of police management which is characterized by hierarchy, rigidity, bureaucracy, obedience and autocratic style is counterproductive for community policing, and it is necessary to change the form and style of management, but also the personal characteristics and properties of the police manager (Nikač, 2014: 41-43).

In addition to formal conditions relating to professional education and professional experience, the manager must also have many intellectual, character, moral and other personality traits, as well as the necessary knowledge about the concept and basic components of community policing, its organization, management and value system.

How much the implementation of the community policing will be successful predominantly depends on the "personality of the manager, the style of his work, his dominant characteristics, the conditions in the organization and the nature of the job" (Luft, 1969: 226). Police management in community policing implies readiness for changes, and not for partial and superficial changes, but for profound changes, which would change the whole organization, the way of working and thinking of all employees. The form and style of police managers should be such that it is adaptable to the security issues of the local community and the needs of citizens.

Implementation of the community policing concept is a big challenge for police management because its structure, form and style must change, as well as the personal characteristics of the police managers themselves.

THE FORM AND THE STYLE OF POLICE MANAGEMENT WITHIN THE COMMUNITY POLICING FRAMEWORK

Within the entire police organization, and especially in the implementation of the community police concept, the need to change the police organizational

structure has been recognized, which will be followed by a different form and style of management. Instead of a linear form of police management characterized by rigidity and an absolute hierarchy, decentralization is advocated, and instead of an autocratic style characteristic of the police organization, what is advocated is the participative management style. This is because the current form and style of police management contradicts the basic idea of community policing that the police must adapt to the specificities of each community and become more involved in decision-making on the local level in respect of the criminality problems.

Linear form of organization and police management is not immanent to the community policing. It is based on the principle of absolute hierarchy, strictly adhering to the principle of unity of command. The traditional way of policing prefers this form because "the police system corresponds to a high level of discipline and mobility that can be achieved by this type of management, which emphasizes the authority of a manager, his ability and responsibility" (Ristović, 2015: 167). Poor communication with subordinates, while communication with citizens almost does not exist, uncritical adherence to established procedures and prescribed rules, unconditional execution of orders, as well as resistance to any change, are characteristics of this form of police management.

This form is more appropriate for a centralized police organization, in which community policing cannot exist. The community policing concept prefers decentralization because it allows deeper and more direct consideration of the security specifics of each local community and problem-oriented policing applied accordingly. Therefore, the decentralization of the police organization is often cited as a prerequisite for successful implementation of the community policing concept.

A decentralized approach enables the transfer of authority and responsibilities to lower levels of management and executors at the local level. Instead of "top to bottom" communication (when issuing orders, instructions, requiring reports), what must be established is "bottom-up" communication in order to open channels for suggestions, opinions, ideas, initiatives, creative solutions, proactive approach in work, etc. Decentralization contributes to greater accountability of all police officers, because police in the field becomes more independent, and managers take on the role of coordination, guidance and support, encouraging policemen at the operational level to be disciplined, but creative in taking the initiative and providing the means necessary to effectively solve the problem [Skolnick & Bayley, 1988: 4].

One of the ways to gradually begin to delegate authority is to create opportunities for lower police management and police officers to devise the content of their work and participate in decision-making, thus demonstrating their expertise, ability and skills. The next way is to transfer competencies to carry out certain customary tasks, and thus the responsibility for their execution. After that, they are left to work using their knowledge, experience and creativity. In addition, the transfer of authority to a subordinate is a good motivating tool because in that

way police officers show greater responsibility, greater job satisfaction and better results.

Delegation of authority implies increasing of the discretionary power of employees in decision making. One reason to justify transferring of authority is the need to quickly make a decision (and effectively implement it!), and this is best done by those who know most about certain issues, and they are often at lower organizational levels (Robbins & Coulter, 2005: 443). For this reason, police officers on the ground, i.e. those who are in direct contact with real life and security problems, must be given the opportunity to make decisions on their own in order to respond quickly and efficiently. Decentralization enables the operational level of police management that implements the community policing model to comprehensively perceive specific security issues and needs in the local area and to apply problem-oriented policing accordingly. They must be given greater authority to show initiative and independence in decision-making and taking concrete actions, because their longer standing in a certain territory has the consequence of many personal acquaintances and the establishment of various connections and relations with citizens and other official and unofficial representatives of the community, which enables better communication and the flow of information between them, and therefore, as the end result, the best knowledge of specific security issues.

Traditional police are characterized by an autocratic style, as the dominant style of police management, which is not desirable in the realization of community policing. This is because it is characterized by the dominant role of a manager as an individual, as an autocratic and bureaucratic personality, who uses his position to make decisions and manage independently, without consulting the associates and seeking opinions or suggestions of his subordinates (Holden, 1994: 16). Such a manager has resistance to change and unconditionally adheres with the prescribed rules and procedures. Management with power, as well as independent decision making by police managers, reduces the initiative, autonomy and commitment of the employees, and thereby also their effectiveness.

Community policing is based on completely opposite principles and prefers the participatory management style in which the managers consults and respect - essentially, not declaratively and formally - the initiatives, suggestions, opinions and advice of their associates and subordinates. This style implies relations of cooperation, mutual respect and trust. With this style, a police manager will assume his real authority. On the other hand, police officers are additionally stimulated by this approach: they feel respected, and all of this positively influences the acceptance of the community policing concept, and consequently, their commitment and efficiency. In a contemporary society - a knowledge society, decisions should be made by people immediately in charge, such as knowledgeable workers, and for the implementation of this postulate, the police must prepare their organization and their management, primarily in the area of community policing.

According to the theory of two-dimensional management style, there are two types of management: people-oriented and task-oriented.[2]

With people-oriented management style, the manager strives to develop motivation to work through interest of his associates, their problems, at work and beyond, is ready to help, develops a spirit of community, tries to eliminate conflicts and create a positive working climate. When task-oriented, the manager is focused to the technical side of the job - on procedures and standards. He is focused on expert knowledge and skills that are best to accomplish the task, while neglecting interpersonal relationships, which can lead to accumulation of problems of employees, misunderstandings, conflicts and their dissatisfaction. Although people-oriented management has proved to be more effective, according to some researches, it has not unequivocally received more favorable marks than task-oriented management (Kotler & Keller, 2006:68). For community policing, both people-oriented management style and task-oriented management style are important. The first one, because the implementation of community policing implies that a police manager has a relationship of trust and respect with his associates and subordinates, that he seeks their opinion for decision-making and engages their potentials to achieve it. However, the task-oriented style is important too, because a manager appears in the role of someone who provides conditions and means of work, provides support to police officers on the ground and facilitates work (i.e. removes obstacles), is flexible in everyday management, and helps in finding creative approaches to performing tasks.

Each police manager should create his own style, which will be characterized by the balance and absence of a commanding approach, but also the absence of lenient behavior towards his subordinates. They should also strive to open space for new ideas, encourage creativity in the work and feedback of their associates.

THE TRAITS OF POLICE MANAGER WHO APPLIES COMMUNITY POLICING CONCEPT

What features a police manager must have in applying the community policing model is one of the unavoidable questions of successful implementation of this concept. It is indisputable that he must possess specific knowledge, abilities and skills, as well as positive personality traits that are necessary to initiate, start and direct the functioning of community policing.

Several features that are essential for the successful realization of any managerial function can be distinguished, e.g. knowledge of work, giving good suggestions, general intellectual ability, information, personal reputation, ambition, leadership motivation, decision making ability, acceptance from the

2 The creator of this theory is Likert and it is based on the results of research which he conducted with associates at the Michigan University in 1961.

group, influence on higher level of management, communicativeness, readiness to accept "rational risk", health, readiness to listen to personal problems, use praise and criticism, and readiness to ask, consult, and if necessary, issue an order (Mihailović, 2005: 226-229).

In addition to the aforementioned, as desirable qualities and abilities for police managers, the following may also be added: inspiration; good judgment; morality; competency; confidentiality; positive character; equity and righteousness, patriotism and humanity; flexibility; courage and self-confidence; resourcefulness and inventiveness; results orientation; boldness of spirit, courage and fearlessness; professional attitude; ability to analyze and synthesize; organizational and coordinating skills (Talijan, Talijan & Ristović, 2014: 271).

Each of these characteristics is of different importance and desirability for different levels and types of management, and also for the implementation of community policing. However, the properties are not static and unchanged. And while for some of these traits their current advantage depends on numerous social, political or other factors, others have preserved their continuity and are always important and desirable, such as: education, righteousness, respect for colleagues and the police force as a whole, modesty, courtesy, willingness to help.

When appointing police managers, as well as those who apply the community policing model, the background from which they are selected within the police environment should prevail. It is desirable that they have a managerial experience in the police. This is because police management is not possible only based on school knowledge and theory, but it also requires knowledge, direct experience and knowledge of the organizational and functional activities of the police, the nature and character of the police work.

By introducing career development and career advancement, there is no longer the possibility of early and extraordinary promotion, but only the advancement in terms of clear and publicly defined procedures, equal for all employees in the Ministry. Conditions for the career development of police officers have been created as a system that is based on the principle of competence management and employee performance that ensures that only the best, in expert, moral and professional sense, can advance in career and occupy the most responsible jobs (Ristović, 2018). For police managers applying for a transition to an operational or directly higher management level, training for an appropriate level of management and passed professional examination for direct higher management is required (Law on Police, "Official Gazette of RS", 6/16, 24/18 and 87/18). All training programs and exams for appropriate levels of management and ranks must include areas and topics devoted to community policing. While police managers at the strategic and high level of management need conceptual skills and understanding of the mutual relations of organizational units of the police and the impact of police activities on the community and citizens, medium and operational level of management need skills of managing police work with an understanding of the methodology of community policing, managing projects

that enable the sustainable development of community policing, as well as specific knowledge and analytical skills (Community Policing Manual, 2017: 26).

Furthermore, it is necessary to upgrade the existing knowledge and skills with additional knowledge about the methods and principles of problem-oriented policing, partnership with citizens, prevention through community policing, and wider scope of skills, such as, e.g.: communication, confidence building, mediation in conflicts, creative problem solving in the community, conflict solving and management, motivation of citizens to cooperate with the police, gathering information, analyzing security situation, designing preventive programs, involving the community in solving security problems, accepting cultural diversity and the elimination of prejudice and the like.

For police management in the context of community policing some of the most desirable characteristics are the knowledge and skills related to: teamwork, interpersonal skills, initiative and creativity and realization of the role of mentors.

Each police manager, and especially the one that implements the community policing, needs partners - collaborators. No one, not even the police and or police management, can function on their own. Because of this, the focus is increasingly placed on team work. A team can be defined as a group whose members have complementary skills and are gathered around a common purpose or a set of work goals, for the achievement of which all of them are equally responsible (Grinberg & Baron, 1998: 274). Given that one person cannot know everything, the need for creating teams and the increasing development of teamwork as a primary way of solving professional duties is emphasized. In regard to this, a police manager must organize good working teams composed of high-quality and capable people, who will develop with the aspiration of achieving outstanding results (Adižes, 2008). Creating teams for the implementation of community policing is also important because "teams are usually self-governing to a certain degree, i.e. they have the freedom to determine their goals, the tempo and the desired approach to work without the intervention of the administration" (Grinberg & Baron, 1998: 274). Creating a team is not an easy task, because it requires not only the right combination of professionals, but also individuals who are willing to work with each other within the team.

For the community policing, it is very important that the manager has enough knowledge and skills for working with people, i.e. the ability to cooperate, as well as tactical behavior in dealing with his subordinates. Skills related to the conduct towards other people can be defined as the ability to cooperate well with others. Managers who possess these skills successfully work in groups, encourage others to express their thoughts and feelings, have understanding of the needs and attitudes of other people, listen and communicate very well. Skills of behavior towards other people are equally important for all levels of management, from first-line supervisors to the highest level (Williams, 2010: 14). Relations with subordinates involve the richness of interpersonal relations based on mutual

respect and trust. Being a manager does not just mean having the right and authority over police officers, but also involves responsibility for them, taking care of them, maintaining continuous and dynamic contacts, sharing good and evil with them, being familiar with their desires and possibilities, being able to critically use their own and others' experiences, to draw maximum work, commitment, talent and inventions from their associates when performing work tasks (Ristović, 2015: 178). What is expected from the police manager who is superior to the police officer on the ground is to provide support, initiative, innovation, motivation, encouragement of team work, problem solving with factual analysis, leadership on a new basis, and especially mentoring.

For police managers within the community policing it is of particular importance to have a high level of inventiveness and creativity and thus get rid of the routine approach, which stifles initiative and reduces the efficiency of the police. Possession of these traits will enable it to successfully adapt to the particular local community and its security needs and problems. The creativity of the manager is reflected in: introducing new ideas; forming and implementing new programs; applying a more free style in dealing with subordinates; decision-making and managing in a democratic manner; avoiding routine and introducing innovations in everyday work; putting up new rules; prediction and planning the future in terms of scope of work, working methods, creation of teams, phases of implementation of ideas, further flow of actions taken, rewarding the best, etc.

Community policing removes prejudices about police managers as conservative and inflexible. It does not correspond to rigid, intolerant, inflexible or authoritarian managers, but those who will quickly and competently identify, define and solve the problem creatively. The essence is to act preventively and focus attention on the conditions and causes of crime and other forms of socially undesirable behavior, and not react only when the consequences occur. For this kind of police work, it is necessary to change the form and style of police management, which follows the new system of values, appropriate training programs, cooperation and respect for community attitudes, security prevention, motivation, team work, and the like.

One of the important roles of police managers in community policing is the role of mentor, which allows him to help subordinate police officers to adopt the necessary theoretical and practical knowledge and develop their creative abilities. Mentoring is a process in which the mentor advises and in other ways stimulates the personal development of new workers. Mentors provide much needed emotional support and security to those who are just beginning to work and are not always sure of their abilities. They prepare them to be successful at work, suggest advancement, and give them the opportunity to show their competencies. They offer useful strategies for achieving work goals, often protect their subordinates from punishment for errors and help them avoid situations that may pose risk for their careers (Grinberg & Baron, 1998: 199). In this sense, one of the main tasks of police managers is to achieve the role of mentor which is

reflected in the guiding and advising police officers, their teaching and developing creative abilities, providing assistance and removing obstacles in order to perform the duties of a police officer in a satisfactory manner in the community policing setting. Their advisory role, energy, experience, and ability will enable them to extract maximum work, dedication, talent and creativity from their subordinates.

The stated characteristics and abilities are of varying importance and desirability for the implementation of community policing. However, even the best-made lists of desirable characteristics are not a sufficient guarantee that, if selected, police managers will be successful in achieving community policing. Desirable characteristics must be enriched by the knowledge, skills and experience acquired in the concrete application of this model of work and developed throughout the entire police service.

CONCLUSION

Police management within the community policing demands readiness for substantial changes that alter the whole organization, the way of work, the value system, and the thinking of all police managers.

The experience of countries in which the community policing concept is applied suggests that the role of police management in this process is irreplaceable, and that police management itself will necessarily be transformed and innovated in accordance with the concepts of organization and functioning of community policing. Implementation of the community policing concept will influence the change of form and style of its management, in which the focus will no longer be on the use of force and the primarily on the application of police special work skills, but rather on knowledge, experience, innovation, prevention, creativity and partnership in solving security problems.

It can be assumed that it is possible to make a special model of police management - management for the realization of the community policing concept in the near future. It will be characterized by the practice of indivisibility of direct implementation and management. Each employee will also be a manager, and every manager will be an employee in charge of the most complex police jobs and tasks.

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MODELS OF SPECIALISED ANTI-CORRUPTION INSTITUTIONS WITH A SPECIAL EMPHASIS ON ANTI-CORRUPTION MODEL IN THE REPUBLIC OF SERBIA

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Abstract: Specialized anti-corruption institutions are not product of the new age. First specialized departments in fighting against corruption went into effect in the middle of last century, but the beginning of creation of these departments has been connected with founding of the most significant specialized institutions. Although its effects on democratic institutions and economic and social development have long been apparent, the fight against corruption has only recently been placed high on the international policy agenda. The UN Convention Against Corruption, which came into force in 2005, is the most universal in its approach; it covers a very broad range of issues including the formation of specialised bodies responsible for preventing corruption and for combating corruption through law enforcement.It is the author's intention to present to the public the organizational solutions of the anti-corruption bodies predicted in the UN Convention against Corruption and folloving standards to act effectively. On the one hand, this text represents models of specialized anti-corruption bodies in the world, and on the other hand, it contains display of institutional anti-corruption model in Republic of Serbia as well, with the focus on the Department for Corruption Suppression (OBPK) in the Ministry of Interior.

Keywords: The prevention of corruption, Combating of corruption, The UN Convention Against Corruption, Criminal Law Convention on Corruption, Specialised anti-corruption bodies, Department for Corruption Suppression (OBPK).

INTRODUCTION

One of the most important foundations for successful functioning of all types of organizations is the existence of a clearly defined organizational structure. In addition, it is essential that there is a defined organizational structure, this must

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be unique for a given organization, according to business areas or activities engaged. However, if we analyse scientific discourse about fight against corruption, we can notice significant number of works whose subject is phenomenological researching of corruption, respectively conditions and causes as a fertile ground for corruption, as well as works whose main objective are attempts in defining this serious social problem, which is definitely the content of anti-corruption struggle. On the other hand, it is evidently lack of works which have organizational form as a subject of their research, which could offer structural patterns for establishing anti-corruption bodies.

The main goal of this paper is to represent properly the basic organization model of the anti-corruption bodies to scientific, professional and broader public, implement the analyses in their different functions and virtually effect, identifying „the best practices" or else schemes for establishing more efficient forms of anti-corruption bodies. It basically means that the topic of the analysis are main factors which could bring to success or else failure in functioning of specialized anti-corruption bodies. If we realize true meanings of organizational structure in managing anti-corruption bodies, we can get the conclusion that the selection of management model and form is strategic activity.

Inventory of the existing models shows numerous anti-corruption bodies worldwide with tendency to grow. Recently approved international contracts demanding from member states to establish such bodies, and that will increase the number of those specialized anti-corruption bodies.

Whether or not preventive or repressive in their anti-corruption function, such organizational units need to take into consideration the full range of anti-corruption functions, including the following: Policy development, research, monitoring and co-ordination; Prevention of corruption in power structures; Education and awareness raising and Investigation and prosecution (OECD, 2008: 9-10).

Standards established throughout international conventions, in spite of proclaimed organizational solutions, also define its eligibility criteria for more effective specialized anti-corruption bodies. Both the United Nations (Article 6) and the Council of Europe anti-corruption conventions (Article 20) as their yardsticks define: independence, specialisation, adequate training and resources.

Independence – this qualitative criterion primarily means that the anti-corruption bodies should be shielded from undue political interference. Therefore, clearly expressed political volition for fight against corruption is one of the key prerequisite. This is particularly important for law enforcement bodies. Yet, we have to underline that none of the independent bodies can act on their own in fighting against corruption. The cooperation among department, therefore the cooperation with organizations of civil society is necessary, as well.

Specialisation – implies the existence of employees with special skills and appropriate mandate for fight against corruption. The Council of Europe Criminal Law Convention on Corruption clarifies the standard for law enforcement bod-

ies, which can be fulfilled by the creation of a special body or by the designation of a number of specialised persons within existing institutions. Such approach will vary from country to country. The picture of experience in developed countries shows that the specialization is often provided in frame of existing agencies (bodies), while the countries in development take their efforts in forming of new specialized anti-corruption bodies. The reason for last one is high level of corruption in existing agencies.

Resources and Powers – in frame of this criterion the training and the budget are most important how their operations would be effective. Also, the splitting of jurisdictions and right work focusing is crucially. In some models, as useful showed up splitting of jurisdictions in important and high-level cases of corruption. In addition to the above, it is necessary that these institutions have enough jurisdiction with their investigative capacities, resources and contemporary methods, to develop evidence, and ultimately, put together a case for prosecution of offenders.

The foln addition to the most significant criterions listed to establish effective anti-corruption institutions, there are numerous factors which being weaking, or even disabling functioning of these bodies. The analysts of anti-corruption institutions worldwide have identified various reasons why many initiatives to set up and administer specialised anti-corruption institutions fail. While the reasons differ in depth and length, they generally refer to a list of political, economic, governance, legal, organisational, performance and public confidence factors, also known as "Seven Deadly Sins" (Doig, 2004: 145).

This paper is structured as follows. Based on the literature on corruption, we will first discuss about models of organization structure of anti-corruption institutions at global site. In chapter three we are explaining single organization forms of anti-corruption bodies. The fourth part deals with the organizational form of anti-corruption bodies in the Republic of Serbia. Establishing special department for fight against corruption (OBPK) in frame of Ministry of interior is the central part of the study in the fourth section. The last section concludes the discussion and summarizes lessons to be learned related to the importance of organizational forms of anti-corruption bodies.

MAIN ANTI-CORRUPTION INSTITUTIONS

Specialized anti-corruption institutions are not product of a new age. First specialized departments in fighting against corruption showed up in the middle of the last century, but the very beginning of the formation of such authorities is related to the establishment of the most important specialized institutions such as in Singapore or Hong Kong in the late seventies (De Speville, 2010: 47-70; Cupic C, 2013: 193-210). In addition to the above, which are certainly an example of a popular image successful, independent and multi-purpose anti-corruption agencies, there are many more anti-corruption bodies operating in different countries.

Considering the many anti-corruption institution around the world, as well as their various functions, it is difficult to identify all significant structural patterns. Such a process of development of anti-corruption institutions did not bypass our country and is directly connected to the process of political democratization and economic liberalization, as is the case in many parts of the world. Of course, we should also keep in mind the fact that the efforts are being made to build the rule of law and administrative management in post authoritative and post-conflict environments (as Serbia is) should be more expressed and more effective, because such political and economic transition give a fertile ground for corruption.[2] That actually means every new institution must be tailored to a specific national environment, considering different cultural, legal and many other circumstances. However, viewed from the organizational side, both the United Nations and the Council of Europe anti-corruption conventions have a significant role in creating and identifying the main models, which can then be described or analyzed in accordance with the its main functions.

Considering the multitude of anti-corruption institutions worldwide, their various functions and actual performance, it is difficult to identify all main functional and structural patterns. It is impossible to identify "best models" or blueprints for establishing anti-corruption institutions. Any new institution needs to be adjusted to the specific national context taking into account the varying cultural, legal and administrative circumstances. However, some trends can be established and main models identified. A comparative overview of different models of specialised institutions can be summarised and analysed according to their main functions, as follows (OECD, 2008: 11; Mitchell, Z et al. 2013: 3):

- Multi-purpose agencies with law enforcement powers and preventive functions;
- Law enforcement agencies, departments and/or units;
- Preventive, policy development and co-ordination institutions.

Multi-purpose agencies

This model represents the most complex organizational form of anti-corruption institutions, given integrated all key pillars both repression and prevention of corruption. Complexity of such form is reflected in that an organization can develop a policy to fight corruption, analysis of the situation in the field of fight of corruption, technical help in prevention, informing the public, monitoring, as well as the investigation of corrupt criminal offences.

2 More about corruption research in the Republic of Serbia see in publications: USAID Survey on citizens' perceptions of fighting corruption in Serbia, USAID, 2018. The publication is available at: http://www.mc.rs/upload/events/2018/decembar/CeSID_%20USAID_GAI_prezentacija_111218_SR.pdf. Petrus C. et al, *Corruption policy in Serbia - From black box to transparent policy making*, Wolf Legal Publishers,October 2012. Posted on the site The Anti-Corruption Council Republic of Serbia.

The most prominent example of such anti-corruption bodies are the Hong Kong Independent Commission against Corruption and Singapore Corrupt Practices Investigation Bureau. A number of other agencies (e.g. those in Lithuania, Latvia, New South Wales, Australia, Argentina, Korea and Ecuador) have adopted elements of the Hong Kong and Singapore strategies.

Law enforcement agencies

This organizational model is most often applied in practice and it could contains different forms of specialization, i.e. can be applied in bodies for the investigation of corruptive acts but also in the bodies of the public prosecutor's offices. Also, this model can have a combination of specialized investigation and prosecution authorities in one body.

This is, perhaps, the most common model applied in Europe. Examples of such models include Germany (Department of Internal Investigations), United Kingdom (Metropolitan Police/Anti-corruption Command), Romania (National Anti-Corruption Directorate), Hungary (Central Prosecutorial Investigation Office), Croatia (Office for the Prevention and Suppression of Corruption and Organised Crime), Belgium (Central Office for the Repression of Corruption), Spain (Special Prosecutors Office for the Repression of Economic Offences Related Corruption) etc. The most prominent example in Republic of Serbia of Law enforcement type institution is specialized organizational unit in the Ministry of Interior - Department for Corruption Suppression (OBPK).

Preventive, policy development and co-ordination institutions

Organizational form of these anti-corruption bodies is based on division on one or more anti-corruption prevention functions. They can be responsible for research in the phenomena of corruption; assessing the risk of corruption; monitoring and co-ordination of the implementation of the national and local anti-corruption strategies and action plans; reviewing and preparing relevant legislation; monitoring the conflict of interest rules and declaration of assets requirement for public officials; elaboration and implementation of codes of ethics; assisting in the anti-corruption training for officials; issuing guidance and providing advice on issues related to government ethics; facilitating international co-operation and co-operation with the civil society, and other matters.Examples of such institutions include the United States (Office of Government Ethics), France (Central Service for the Prevention of Corruption), Serbia(Anti-corruption Agency), Bulgaria (Commission for the Co-ordination of Activities for Combating Corruption), Albania (Anti-corruption Monitoring Group), Republic of Northern Macedonia (State Commission for Prevention of Corruption) etc.

ANTI-CORRUPTION INSTITUTIONS OF REPUBLIC OF SERBIA

Many countries within Europe apply the second of the OECD (2008) anti-corruption models: the law enforcement type institutions (LETI). These institutions apply different forms of specialization including detection, investigation and prosecution. Specializations can be utilized in separate bodies or combined within the one agency. The LETI model can also include other functions of prevention, co-ordination and research.

Looked up on pattern from main European countries Republic of Serbia in its first line in fighting against corruption strengthens the law enforcement type institutions. No wonder for these kind of organization considering the 2018 Corruption Perception Index (CPI), ranks the level of corruption within Serbia's public sector as 87 out of 180 countries, with a score of 39 out of 100 (Transparency International, 2018). Also, the report of a Group of countries against corruption (GRECO)- body of Council of Europe for 2015 and 2016 which concerns compliance in preventing corruption in relation to the deputies, judges and prosecutors, as the most sensitive branches of authorities, contains a conclusion that Republic of Serbia did not satisfactorily implemented or acted upon recommendations for preventing corruption (GRECO 2015; GRECO 2017). This result gives us the right to deem Serbia as country in which the level of corruption is high, needed more to strengthen the efforts for anti-corruption struggle. Surely, fight against corruption in Republic of Serbia is placement for other state institutions and organizations, as well. In order to present the institutional framework of anti-corruption institutions, we have created a table describing those belonging to the law enforcement type institutions, as same as, those classified in the group of Preventive, policy development and co-ordination institutions (see Table 1.).

Table 1. *Republic of Serbia Anti-corruption Organzations/Institutions*

Anti-corruption Agencies	**The OECD models**	**Function**	**Relevant legislation**	**Oversight**
The Anti-corruption Agency (ACAs)	Preventive, policy development and co-ordination institutions	Preventive functions, including integrity plans in public administration and control of financing of political parties	Law on The Anti-Corruption Agency	The Serbian National Assembly

The Anti-Corruption Council	Preventive, policy development and co-ordination institutions	Expert, advisory body of The Government with a mission to see all the aspects of anti-corruption activities and to make proposals for bringing regulations	Constitution of the Republic of Serbia	The Government of RS
The Prosecutor's Office: The Anti-corruption Departments The Prosecutor's Office for Organized Crime	Law enforcement type institutions	Identification, investigation and prosecution of corruption offences	Law on organization and jurisdiction of government authorities in suppression of organized crime, terrorism and corruption;	The Republic Public Prosecutor's Office
Department for Corruption Suppression (OBPK) (Criminal Investigation Directorate, Ministry of Interior)	Law enforcement type institutions	Police investigations of corruption offences	Law on organization and jurisdiction of government authorities in suppression of organized crime, terrorism and corruption; The Criminal Procedure Code;	Ministry of Interior
Service for Combating Organized Crime (SBPOK) – Department for High-Level Corruption (Ministry of Interior)	Law enforcement type institutions	Investigating and probing high-level corruption cases, i.e. corruption cases related to highest state officials	Law on organization and jurisdiction of government authorities in suppression of organized crime, terrorism and corruption; The Criminal Procedure Code;	Ministry of Interior

Figure 1 demonstrates that Serbia has an abundance of legislation that is employed by a significant number of anti-corruption agencies. In addition, the fallowing institutions have a significant anti-corruption function: Administration for the Prevention of Money Laundering,[3] Tax Administration (Tax police sector),[4]The Republic Commission for Protection of Right in the Public Procurement Procedure[5] and State Audit Institution (SAI)[6].

The bodies listed in Table 1. represents Republic of Serbia response to key international treaties that have been requested by the signatory to form a body or bodies that prevent corruption, or a body, bodies or persons specialised in combating corruption through law enforcement.

Republic of Serbia has ratified the United Nations (UN) Convention against Corruption in 2005, Council of Europe - Criminal Law Convention on Corrup-

tion in 2002, and the Council of Europe - Additional Protocol to the Criminal Law Convention on Corruption ratified in 2007.). This elements form an integral part of Serbia's anti-corruption framework.

Furthermore, we will present legal and institutional framework of the most significant representatives of the law enforcement type institutions with a special review on Department for Corruption Suppression (OBPK) which been created within the framework of Criminal Investigation Directorate in the Ministry of Interior. The Serbian story about the creation and the implementation of the national anti-corruption strategy could be interesting not only because it illustrates institutional and legislative peculiarities of the "transitional" period of the society, but also due to the fact that the Serbian state tries to combine different models of anti-corruption activities that come from both the West (the North American and the West European experience) and from the East (Hong Kong's anti-corruption practice).

Legal and Institutional Framework

The Department for Corruption Suppression (OBPK) established in 2018, is a special body within the Criminal Investigation Directorate in Ministry of Interior with a mandate to direct police investigations corruption cases. The criminal offences under the OBPK's jurisdiction are strictly enumerated by the Law on organization and jurisdiction of government authorities in suppression of organized crime, corruption and other severe criminal offences (ZONDO) which provisions went into effect on March 1, 2018. New and specialized anti-corruption body have been created by this law - The Anti-corruption Departments within the Prosecutor's Office. Although these both mentioned type of institutions do not have independent preventive function, detection and prosecution provides a strong deterrent against corruption, helping to reduce incentive to commit bribery. It is important to notice that the OBPK, by its leading role in fighting against corruption, also coordinates work of all remain organizational units within the Ministry of Interior which are in charge for investigating criminal acts against economy, finance and official duties.

Legal basis for forming the law enforcement type institutions were found in the third part of ZONDO where organization and jurisdiction of state authorities in combating corruption are defined. In article 13.are defined next institutions competent for suppression of corruption:

1. Special departments of the Higher public prosecutor offices for the suppression of corruption);

2. Ministry of Interior – a specialized unit responsible for combating corruption;

3. Special departments of the Higher courts for the suppression of corruption);

According to the ZONDO, OBPK is a specialised unit established for the whole territory of Serbia. The OBPK became nominally operational in March 2018, when ten sections formed by the act on systematization, nine operational sections and one Section for coordination. The substantive jurisdiction of the OBPK is limited to the offences enumerated in the ZONDO, respectively the area of corruption and corruption related offences. The public prosecutor offices also has detached regional offices in four major Higher public prosecutor offices throughout Serbia, namely Beograd, Novi Sad, Niš and Kraljevo.

The new law also envisages modern forms of cooperation between public prosecutor office and the police. Ratio legis for their implementation into the law is growing complexity of criminality, especially in the area of corruption and financial crime, so it is necessary to find adequate mechanisms for their suppression. These mechanisms are: financial forensic service, liaison officers and impact teams (Krstic, 2017: 78).

CONCLUSION

Selection of organizational structure and operational models of specialized anti-corruption institutions, first of all low enforcement institutions, represent strategic activity, at the same time tells us about the importance of organizational structure in the operations of such institutions. Prevalence and the number of corruptive offences is the evidence that the prevalence of anti-corruption bodies is insufficient to reduce corruption. Needless to say, an organisation, no matter how well structured and equipped, cannot fight corruption on its own. Apart from a dedicated and professional agency like the Law enforcement agencies, there are several important factors without which the battle against corruption could not be won. Primarily, this includes independence and adequate training and resources.

Comparative analysis of organizational structures of anti-corruption institutions in developed countries in which are implemented the key elements of anti-corruption functions (prevention and education, so repression as well) is related to country's ranking results according to the leading corruption perception researches. The examples of Singapore, Hong Kong and Australia best showing mentioned above, having in mind the corruption perception index of these countries and their leading roles with low level of corruption in them. The reasons for this are most often linked to respecting the basic principles of anti-corruption policy, and above all, principle of transparency, specialization, training and adequate leverage of power which could provide strong enough both preventive and repressive influence. The approach applied by Republic of Serbia in the matter of anti-corruption struggle raises a question of whether this is the most successful way to achieve the stated objectives. The legislator put emphasis on amendments to the law in the aim of incrimination, strengthening the penal policy also, but the

implementation of the action plan for the fight against corruption and adoption of an anti-corruption strategy were not at the center of interest.

There is no single solution in fighting corruption. Every country has to examine its unique circumstances and come up with a comprehensive strategy, which should embrace the three pronged approach deterrence, prevention and education. Ideally there should be a dedicated and independent anti-corruption agency tasked to co-ordinate and implement such strategy, and to mobilize support from the community. The Hong Kong experience offers hope to countries which have a serious corruption problem which appears to be insurmountable. Hong Kong's experience proved that given a top political will, a dedicated anti-corruption agency and a correct strategy, even the most corrupt place like Hong Kong can be transformed into a clean society.

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MEASURING THE PERFORMANCE OF THE POLICE

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Abstract: This paper aims to present a model for identifying and describing the performance measurement. Performance management is a system that makes it possible for the police organization to achieve effectiveness and efficiency in a mission accomplishment. Choosing the right measure is crucial for the development of the police and the improvement of services. By analyzing the relevant literature and the case studies related to the practical implementation of performance management in defense, which is part of the public sector, a model for identifying the performance measurement in the police is drafted in this paper. The model allows the identification of performance and its measurement, which leads to the development of the police and the satisfaction of stakeholders.

Keywords: performance management, performance measurement, outcomes, police.

INTRODUCTION

Defining goals and objectives is crucial for managing an organization because this is how guidelines are given for the future. This should provide long-term sustainability and productivity to an organization in a changeable environment. But, it is even more difficult to measure the effectiveness and efficiency of an organization and to establish a connection between the defined goals and objectives on one side and the required outcomes from the stakeholders' point of view on the other side. Measuring efficiency and effectiveness of a profit organization is quite clear, because profit is the major measurement.

On the other hand, a non-profit organization such as the police does not generate a profit, so we have to find measures in order to evaluate successfulness level in accomplishing missions as well as the perception of stakeholders on the way an organization accomplishes missions. It is a great challenge to find and establish a good measurement system which will make it possible for the police to measure their successfulness in accordance with effectiveness and efficiency.

Performance management as a management, evaluating, control and measurement system allows the measurement of effectiveness and efficiency, as well as achieving accountability and transparency in budget allocation. Furthermore, it establishes long-term links between current activities conducted by an organization and its defined goals and objectives. Those drifted lines enable the police organization to stay connected with the future requirements and to change in accordance with the environment, as well as to improve its work.

There are lots of performance management systems that are developed for this purpose. Some of those are balanced scorecard, planning, programming, budgeting and execution, activity-based management, etc. For all performance management systems, it is crucial to define the right measurement indicator and the right measurement system, but to avoid going to metric mania. The metric mania can produce a lot of side effects such as a loss of focus and overload of the organization resources.

POLICE PERFORMANCE MANAGEMENT

The police are part of the national economy, which includes the general government as well as non-financial enterprises under government control (public enterprises) primarily engaged in commercial activities (Budget System Law, the Republic of Serbia, 2015). In essence, the purpose of the public sector existence, as well as the police as a part of the public sector, is to perform activities of general interest.

In the last two decades, special attention has been paid to police reforms in order to reduce the public sector and to improve the results of their activities. The improvement of results in the police can be achieved through performance management.

In practice, the government of the United States of America has been using performance management from the 1990s. It was implemented as a part of a series of laws aimed at improving the federal government management Act of 1993 (Public Law 103-62), and later it was improved by a new government-wide framework Act of 2010 (Public Law 111-352) including long-term federal government priority goals, revised federal government performance plan requirements, quarterly priority progress reviews, a government-wide performance website. The Budget System Law of the Republic of Serbia regulates a programmed budget for the first time in the Republic of Serbia, which enables performance management in the public sector to be developed and used (Budget System Law of the Republic of Serbia, 2015).

A large number of professional literature on management indicates that planning is the key function in the management process. Planning is a process that estimates the business environment and the system condition, determines the objectives of the business system and the actions to accomplish the objectives, while allocating resources and eventually preparing the guidelines that indicate how the actions that lead to the achievement of the objectives must be conducted (Lois, 2005).

To successfully define the objectives that should be achieved, it is necessary to assess not only the environment but also the business system conditions. The evaluation of the environment makes it possible to examine how the environment of the business system would look like in the future, which enables a planned change in the business system and its continuous adjustment to a dynamic environment. The assessment of the business system conditions is done with the aim to identify problems in internal business-doing, and to see whether the conditions of the business system corresponded to the defined long-term goals. A problem in the business system represents the difference between the current and the desired situation of the system. To identify a problem in the business system is one of the major challenges placed before the management process. Some problems are easily noticeable. On the other hand, identifying problems, especially in large systems, is very difficult (Stephan, 2007).

In order to identify the problems of the business system, it is necessary to determine the desirable characteristics of the system, which lead to achieving the goals of the business system. Those characteristics are called performance. In management, performances refer to the desired result and behavior. This refers to the amount, level and quality of labor by which the employee performs the assigned task (Bahtjarevic-Siber, 2001). It can be concluded that the performance represents the characteristics of a system, which makes the link with the desired effect of required labor.

Quite a few definitions of performance management can be found in the management literature that helps us understand how the performance management works and where its focus is. Robinson (2007, p. 26) defines performance management as the broad and systemic use of formal information to improve police sector performance, especially in the areas of human resource management, strategic planning and budgeting (Robinson, 2007). Frumpkin and Galaskiewicz (2004) and Robinson (2007), among others, note that government organizations have the least direct control over inputs and the least precise indicator of outputs of all organizations. Performance management is often hampered by the lack of control of the quality and quantity of some inputs and the difficulty in finding appropriate output measures. Ambiguous causal relationships, environmental contingencies and lag times contribute to the uncertain link between the production of outputs and attainment of outcomes (Havens H., 1983; Heinrich, 2004). In the case of the police, good outcome measures are problematic. Keeney and Gregory (2005) state that measures of objectives should be unambiguous, comprehensive, direct, operational, and understandable.

One of the most popular performance management systems is the balanced scorecard. Robert Kaplan, a professor at Harvard Business School and director of the Palladium Group in 1990, developed the concept of "balanced scorecard" that allows measurement of the condition of business systems and identification of a problem. This concept is based on the quantitative measurement of the specific performance of the business system to determine its status, based on the difference

between the desired situation and the current situation and identify the problems of the business system. In this way, the "balanced scorecard" creates a link between long-term goals of the business system and the current actions in the system.

"Balanced scorecard" was originally developed for profitable business organizations and enabled the identification of key system performance, as well as the direction of the business system development towards achieving the greatest possible profits through the satisfaction of stakeholders (Kankaraš, Stojković, Kovač, 2014). On the other hand, the aim of the police is not to gain profit but to execute assigned missions or tasks. This is why the "balanced scorecard" in the police has always been difficult to implement, and the results of its implementation subjected to criticism. However, the problems faced by the police today, which are related to the insufficient financial resources and the requirements for spending transparency, impose a need for effective and efficient management of the development in the police.

Performance management in the police is a systematic approach to improving results through evidence-based decision-making, continuous organizational learning and a focus on accountability for the expenditure of funds in developing performances. Performance management is integrated with all aspects of the process in management and policy of organizations, transforming the practices of an organization in the way that it focuses on improving the results which are of the public interest (National Performance Management Advisory Commission, 2010).

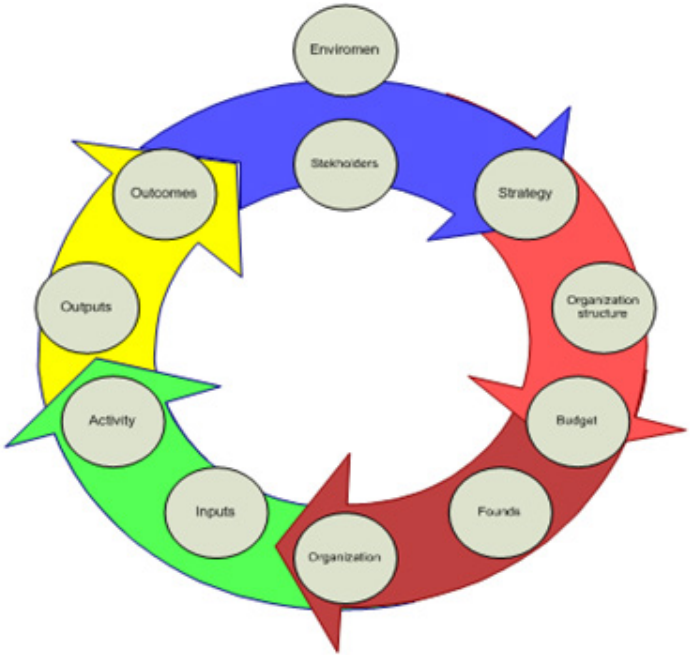


Figure 1. *Circular flow of police sector performance management (Taken and modified: Angelis &Webb, 2009)*

Key criteria in the police are not financial ones, but those are the effectiveness of executing a mission. However, the effectiveness of conducting a mission is not a static and unchanging parameter. Organizations in the police usually have a major mission that consists of a certain number of submissions. At some point, some submissions can be more significant than others. The establishment of priorities among submissions is one of the main tasks of strategic planning. Performance management in the police can be described by using the methodology presented in Figure 1.

The process of performance management begins with the evaluation of the environment and the assessment of stakeholders. This provides information on how the future environment will look like and what kind of organization stakeholders can expect from the police organization. Strategic planners use previous estimations to develop a strategy, which defines a mission, vision, goals and objectives leading to the required organization structure. After the strategy is drawn up, the budget is approved, and funds are allocated to the organization to purchase the necessary inputs (equipment, services, infrastructure, labor, etc.). The inputs are used by the organization to produce outputs, which are required to achieve the desired outcomes. Finally, the desired outcomes must have an impact on the environment in order to shape it and/or expectations of stakeholders.

Efficiency, as a qualitative characteristic which indicates the possibility of successful execution, without loss of time, money and energy in the present model is reflected in the steps that range from the inputs, through the activities to the outputs. Instead of focusing on the process of budgeting, efficiency requires an understanding of the value of the output, including the possibility of their measurement, as well as connecting with the input values that are used for their generation. Efficiency answers the question of: Are we doing things in a good way?

The effectiveness is shown in the model from an output to an outcome. Effectiveness indicates how well the output value corresponds to the strategy and strategic objectives being taken by the organization. Effectiveness answers the question: Are we doing the right things? The outcomes in the present model are consequences, effects or impacts that are important to stakeholders. Results or outcomes depend on the generated output value, and on interactions between outputs and the environment, as well as interpretation of this interaction by stakeholders.

IDENTIFICATION OF PERFORMANCE

Before we measure the performance we have to understand what we want to do. What are the desired outcomes? We need to link our strategic goals and objectives to the desired outcomes and we need to define what we mean by "success" at the strategic level.

Outcomes are not what the agency itself did but the consequences of what it did. For example the number of patients treated and discharged from a state mental hospital (an output indicator) is not the same as the percentage of discharged

patients who are capable of living independently (an outcome indicator). Outcomes may be something the program wants to maximize, such as safety in public places, or to minimize, such as crime rates. Some outcomes are financial, such as reducing the number of incorrect payments for personnel in the organization. As long as outcomes are important and can be tracked, they should be included in the performance measurement system, even if they are not clearly identified in the program mission and objective statements, which usually include just the central, most vital ones. For example, complaints against police officers should be tracked as well as crime clearance rates.

The model of performance measurement development process is presented in Figure 2.

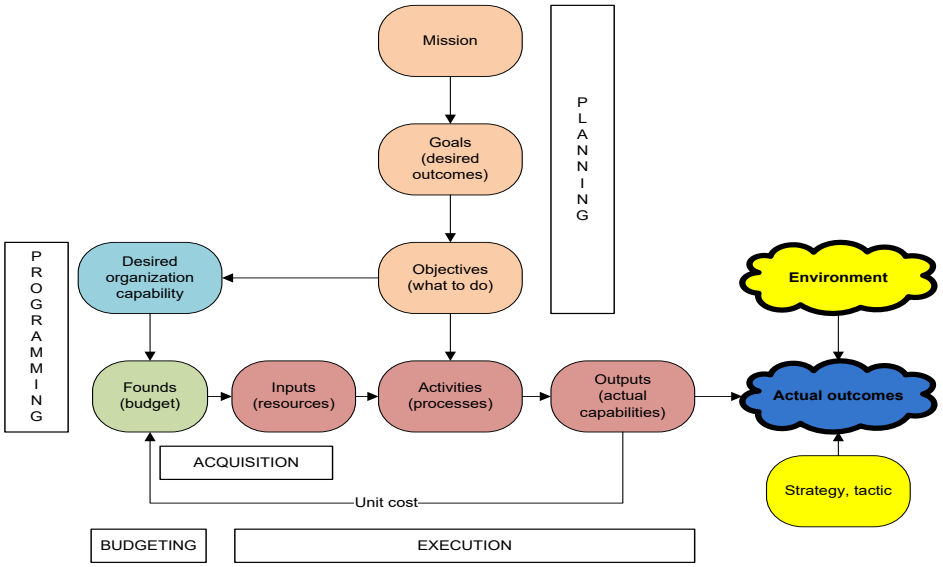


Figure 2. *Model of public sector performance management (Angelis, 2016)*

To identify the desired outcomes, leaders of the organization must assess where the organization is and where they want it to be in the future. This environmental scan and stakeholders' analysis should help validate or shape of the vision of an organization (the desired future state) and mission (the purpose of an organization).

The first issue to consider is that leaders and managers who wish to define and use a better system for results and performance measurement and management are defining and reviewing the mission of an organization before metrics are applied to tell them if they are improving or moving in the right direction. It is necessary to understand the mission and vision of the organization. The mission defines the purpose or broader goal being in existence. On the other hand, the

vision is the desired future state, and sometimes, a time frame. It describes what will be achieved if the organization is successful.

Goals are the desired end state, and they are connected with the vision of the organization. The achievement has two factors, where a goal is either achieved or not; it cannot be partially achieved. Sometimes, a goal may be defined in terms of a threshold. Objectives are linked with goals and present an outcome of a decision whose maximization or minimization supports the achievement of a goal. The direction (max/min) of the objective expresses its preference. Goals and objectives must be broken down across all organization levels, enabling performance management to provide cascading and measurable goals. We then consider how goals can be modified so that they are horizontally aligned.

To identify outcomes, the process should begin with the outcomes of the desired end, or the "what to do" outcomes. This gives us the answer to the question: What is a success from the customer's perspective? These outcomes are connected with the vision of the organization. The process of identifying outcomes follows then with "how to do" desired, often intermediate, outcomes, which are connected with goals and objectives. At each stage, a desire to get measurable and verifiable desired outcomes such that success or failure on each is absolutely indisputable and not open to interpretation. Outcomes developing should give cascade-connected outcomes such as presented in Figure 3.

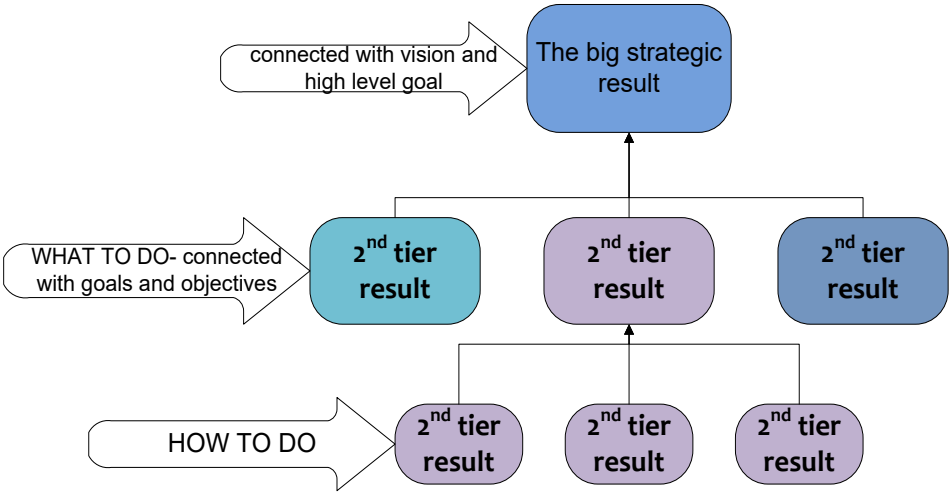


Figure 3. *Outcome hierarchy*

Another step in creating performance measurement is to find out what we need to do to get the desired outcomes and how much it costs. To achieve this, the first required outputs are identified and connected with the desired outcomes (figure 4).

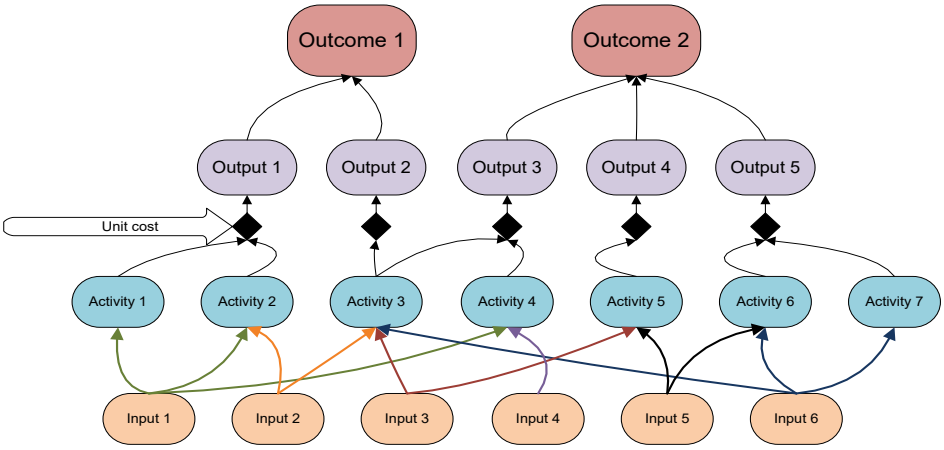


Figure 4. *Connection between outcomes, outputs, activities and inputs*

Then, we must find out what we need to do to get to the required outputs, which lead to activity identification. An activity is a task or set of tasks that contributes to the production of an output. Finally, all identified activities use some inputs. Inputs are resources required to produce an output. The organization costs flow between inputs and activities to outputs. The methodology to get unit cost established in this way allows the final construction of performance metric and choice of indicators.

CONSTRUCTION OF PERFORMANCE MEASUREMENT

The effectiveness management requires that we understand what we need to do to achieve the desired outcomes (goals and objectives). We define operational measures of "success" in a cascade from outcomes to outputs, to activities, and sometimes to inputs. How well we achieve our outcomes will be influenced by the effectiveness of our outputs, the effectiveness of our outputs will be influenced by the effectiveness of our activities, and so on.

Outputs by themselves do not tell anything about the results achieved, although they are expected to lead to desired outcomes. The central function of any performance measurement process is to provide regular, valid data on indicators of performance outcomes. But performance measurement should not be limited to data on outcome indicators. It should also include information that helps managers measure the incoming workload and gain insight into the causes of the outcomes.

In order to evaluate their performance, the police should measure results (outcomes). But it is difficult to measure the true, unambiguous outcomes generated by the police because police employees do not produce these outcomes directly. The police need to measure what their employees actually produce, and those

are outputs. These outputs have to be related to the outcomes, and the required metrics must be connected with goals and objectives, and to show if the police are effective and efficient. Developing good metrics requires a certain understanding of the types and characteristics of measures. There are three types of measures used for performance measurement: natural, constructed and proxy measures (Keeney, 2005)

Natural measures are widely used and have a generally accepted interpretation. They also allow direct measurement of the degree of goals and objective accomplishment. For example, if the goal is to reduce costs, direct measurement in a particular currency (Dinars, Dollars, Euros, etc.) can be measured, as well as how the objective is achieved.

In many cases, there is no clear picture of how the performance of the police should be measured, and for that reason it is necessary to use designed measures to describe different levels of performance and achievements, and attach a numerical value to each level. The lack of constructed measures is their subjectivity, and it is therefore essential that the levels of measures are well described in order to prevent ambiguity. This requires good expertise while designing the measure. There are a number of different ways to get a constructed measure, and some of the measures are a defined measure, a quality-quantity measure, a value model, a weighted measure and a picture (Richter, 2016).

A defined measure can be described as two or more levels carefully defined by the subject matter of the expertise. For example, the assessment scale of injuries might include 5- fatal injuries; 4- the injuries that permanently prevent engagement; 3- injuries that prevent engagement; 2- injuries that cause absence from work; 1 - injuries that require first aid (Angelis & Webb, 2009). The quality -quantity measure can be used to measure some quality performance with its quantity measure, where quality and quantity measures are related. For example, the quality of life can be measured with the number of years of life. The value model is similar to the defined one and is presented with the scale (verbal, visual, numeric etc.). For example, the value model of measures can be the pain intensity scale. The weighted measure defines a measurement instrument by attaching different weights to different types of measures, or performance. Finally, a picture can be a good measure of performance if the performance can be visually described. The picture model of measurement uses the visual description of some performances, presented through an appropriate picture, to define different levels of performance (for example, Beaufort force or air quality).

Often, especially in the police, it is difficult to find a suitable natural measurement. In such cases, proxy measures can be used. The performance that is not possible to be measured directly by constructed or direct measures because of its complexity can be measured by proxy measures. Proxy measures are linked to the objective of performance, but it is not measured directly. The essence of proxy measures implementation is to use direct or constructed measures to measure another performance, which is related to the performance that we want to mea-

sure. This makes proxy measures suitable for measuring outcomes by measuring outputs and analyzing the relationship between outputs and outcomes (Figure 5). For example, if we want to measure the safety of personnel, we can take the number of accidents or injuries as an indirect measure.

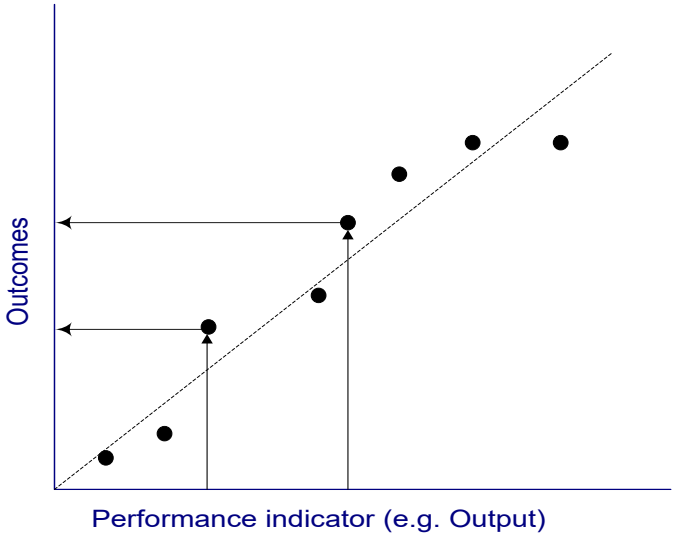


Figure 5. *the Proxy measure of outcomes*

The development and selection of performance measures is the most difficult and most complex activity in the police performance management (Subošić, Nešić, 2017). Due to its complexity, performance measurement in the police requires the usage of proxy measures. In this case, the proxy measures are measured indirectly by direct or constructed measures. This requires historical data of outputs, to calculate the function between outputs and outcomes.

Finding the right measure requires careful consideration of many parameters. In addition, some proper measures must have the following characteristics (Keeney, 2005):

Unambiguous - the relationship between the measure and the performance objective should be clear and easy to interpret;

Comprehensive, which means that all possible levels of performance are covered by the chosen measure;

Direct, as characteristic, means that the measure must ensure that the desired effect is measured directly using the selected measures;

Operational refers to the accessibility of data being used for measuring, as well as that the cost and effort invested in information obtaining are reasonable;

Understandable means that an agreement about the measure was reached and everybody understands what is measured and how it will be measured.

CONCLUSION

Performance measurement in the police provides better accountability for spending funds and transparency of operations, where the quality of services is constantly improved. It is crucial to understand the relationship between outcomes and outputs, and in addition to that, to include the measurement of inputs and activities. In this way, the building of performance measurement begins with analyzing what the police, from stakeholders' point of view, must achieve and it also must contain the environmental changes that can have an impact on how the stakeholders might interpret the results and/or real outputs.

Firstly, we must know what we need to measure in order to develop a good performance measure. For the police, the real measure is in outcomes, because only they are important from the stakeholders' point of view. However, measuring outcomes is not easy for a non-profit organization, such as the police. Outcomes can be measured with proxy measures by connecting outcomes with outputs that produce them and by measuring appropriate outputs. As can be seen, the development of performance hierarchy starts with proxy measures of outcomes, connecting it with outputs measurement. The described measures are conducted in order to achieve the effectiveness measurement. To get to efficiency measure, performance hierarchy must go deeper into an organization structure and measure activities and inputs of the organization. This brings up the issue on the unit cost of some outputs, which is crucial for measuring the efficiency of the police.

This methodology allows establishing the performance hierarchy to measure the effectiveness and efficiency of the police by linking different data from the organization activities and inputs, to organization outputs and outcomes. A good measure, on the one hand, has to provide decision makers with useful information, while on the other hand, it has to steer the organization to the desirable behavior that contributes to the achievement of the goals and objectives of the police.

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ADMINISTRATIVE CONTRACT AS A NEW LEGAL INSTITUTE IN THE LAW ON GENERAL ADMINISTRATIVE PROCEDURE OF THE REPUBLIC OF SERBIA

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Abstract: It is a known fact that, in addition to substantive acts, the administration adopts legal documents. The theory of administrative law has introduced the division of legal documents issued by the administration into documents pertaining to administration (administrative acts) and documents pertaining to businesses (contracts). The theory of comparative administrative law, and French administrative law in particular, makes a distinction in respect of contracts, dividing them into private law contracts and administrative contracts. Rules of law on obligations apply to private law contracts, while administrative contracts are subject to special rules of administrative law.

There is no universal agreement in comparative law regarding the issue of administrative contracts. Different solutions to this problem indicate that differences in the historical development of a specific society have influenced the acceptance of a specific solution.

Speaking about Serbia, the administrative contract was first mentioned as a separate legal institute in the new Law on General Administrative Procedure 2016. It has been envisaged as a form of legal action of a relatively independent legal regime.

The paper gives a general overview of administrative contracts, some comparative law solutions, and introduces this legal institute in the light of legal provisions of the Serbian law.

It is still early to speak about effects of these solutions in respect of the institute of administrative contract, given the fact that the full implementation of the Serbian Law on Administrative Procedure started on 1 June 2017. In any event, it is necessary to give a chance to the solutions offered in relation to this legal institute.

Keywords: administration, legal act, administrative contract, legal institute, breach of contract, type of administrative action, administrative procedure.

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INTRODUCTION

In addition to substantive documents that the administration uses to manage its activities, it also adopts legal documents in the course of its functioning. The legal documents of administration may be administrative ones, in which the administration - in respect to the other party - has stronger will, and contracts, when the administration has equal will as the other party to the contract. The administrative law theory knows the division of legal documents of the administration into the documents of government, i.e. administrative acts and business acts, i.e. contracts. The theory of comparative administrative law, and French administrative law in particular, makes a distinction in respect of contracts, distinguishing between private law contracts to which the rules of the Civil Code apply and administrative laws to which special rules of administrative law are applied.

As part of the public administration reform, Serbia has passed a new Law on General Administrative Procedure (the Law) introducing the institute of administrative contract into its legal system. The Law came into effect on 9 March 2016, and its full implementation started on 1 June 2017.[2]

This paper offers a general overview of administrative contracts, some of the administrative law solutions, and presents this legal institute in the light of the legal provisions within Serbian law.

ADMINISTRATIVE CONTRACT – GENERAL OVERVIEW

There is no universal agreement in comparative law regarding administrative contracts. As far as France is concerned, there are contracts concluded by the administration (*contrat de l'administration*) and administrative contracts (*contrat administratif*)[3]. The former are subject to the regime stipulated by the Civil Code and disputes related to them are resolved by the court of general jurisdiction. The legal regime which applies to administrative contracts is governed by special administrative law rules and disputes arising from them are resolved by administrative courts. As for administrative contracts, it is important that one party is always the state, i.e. the relevant state authority, that the contract is concluded concerning the functioning of the public service and that the contract includes the provisions that depart from the general rules of private law (*clauses exorbitantes du droit commun*).

In French law, administrative contracts are subject to a specific legal regime from the conclusion to the fulfillment or termination of a contract that is different from the general rules on contracts. This legal regime gives the administration,

2 See: Law on General Administrative Procedure, *Службени гласник РС*, бр. 18/2016.
3 See: Jean Rivero, *Droit administratif*, Dalloz, Paris 1970, 35; André de Laubadère, *Tratté théorique et pratique des contrats administratifs*, 3 vol., Librairie générale de droit et de jurisprudencem, Paris 1956; Georges Péquignot, *Théorie générale du contrat administratif*, Pedone, Paris 1945.

on the one hand, broader powers in respect of the other party, and on the other, it imposes certain obligations and restrictions regarding the procedure for concluding a contract. Greater powers, but also greater restrictions and obligations are in the spirit of the principle that the administration must protect general interest.

The departures of the regime of administrative contracts from the regime of private law contracts, whereby the administration is either favoured or restrained, are known in French law and practice as different modalities: a) accession contracts (*les contrats d'adhesion*), b) the theory of unpredictability (*la théorie de l'imprevision*), etc.[4].

Examples of the main administrative contracts in France include: public work contracts (*les marchés de travaux publics*), public services contracts (*les marchés de fournitures*), contracts for the carriage of passengers and goods of public importance (*les marchés de transports*), contracts on concessions of public service (*la concession de servie public*), public loans contracts (*l'emprunt public*), etc.

French administrative law has developed the theory of administrative contracts because France has a special administrative judiciary whose jurisdiction encompasses the settlement of disputes arising from administrative contracts. Disputes arising from private contracts concluded by the state are settled by a court of general jurisdiction, not a separate administrative court. However, it should be borne in mind that, if we look at these matters from the perspective of comparative law, we shall see that there is no universal solution to this issue.

Consequently, certain contracts shall be regarded to be administrative contracts in France, whereas the same contracts in Italy have the nature of private contracts. In some countries administrative contracts exist only when it is specifically stipulated by the law[5]. In the law of Switzerland, the disputes arising from administrative contracts are settled by the court of general jurisdiction. In legal theory, there is also no unique view regarding the issue of determining which contract is private and which is administrative one. Sometimes the terminology itself is not uniform. In France, these special contracts are referred to as administrative contracts, whereas in Germany and Austria these are public law contracts (*öffentlichrechtlichen Vertrag*), although the term administrative contract is also used (*Verwaltungsrechtliche Vertrag*).

The distinction is also made between the administrative contracts which are 'coordinative' in which there are equal wills of the parties and the 'subordination' contracts in which the state appears with stronger will[6]. On the other hand, in Germany, for certain contracts - that would be considered to be public law con-

4 See: Charles Debbasch, *Institutions administratives*, Librairie génerale de droit et de jurisprudence, Paris 1966, 151; André Buttgenbach, *Manuel de droit administratif*, - er Partie F. Larcier S. A. Bruxelles 1966, No 381-ter, 358; Велимир Иванчевић, *Теорија административног уговора*, Информатор, Загреб 1969, 83; Marcel Waline, *Précis de droit administratif*, No 838, Montchrestien, Paris 1969, 430-443.

5 See: Enrique Sayagues Laso, *Traité de droit administratif*, Librairie générale de droit et de jurisprudence, No 349, Paris 1964, 530.

6 Hans Julius Wolff, Verwaltungsrecht, I Verlag, C. H. Beck, München 1968, 281-282.

tracts in some countries - there are authors who may claim that such a contract is not a public law contract, but "an administrative document upon request" or by voluntary subordination (*Verwaltungsakt auf Unterwerfung*). In this sense, there are also theoreticians in Germany, Switzerland and Italy who, for instance, do not see concession as a public law or private law contract, but an administrative document 'upon request' or an administrative document by which a party voluntarily agrees to be unequal[7]. However, it should be pointed out that there are authors who are opposed to such views as they find it necessary to look for new instruments that will better suit the transformation of the modern state and its administration and who perceive administrative contracts as such instruments[8].

ADMINISTRATIVE CONTRACT IN THE LAW OF YUGOSLAVIA

a) Period until the establishment of Yugoslavia in 1918

Before the creation of the First Yugoslavia, until 1910, the legal regime in Serbia for contracts concluded by the state was the same as for all other contracts to which the rules of the Serbian Civil Code applied. Disputes arising from all contracts were settled by the court of general jurisdiction. However, the State Accounting Act of 1910 included certain provisions relating to procurement contracts which departed from the rules of the then Civil Code. In this way, the Civil Code had subsidiary significance for these contracts concluded by the state[9].

b) Period from 1918 to 1941

Apart from some exceptions, there was not much writing or discussion regarding administrative contracts in the theory of administrative law of this period[10]. At that time, the papers and attitudes of our national authors regarding administrative contracts were greatly influenced by the French theory of administrative law. Yet, realistically speaking, they were aware that, given the substantive law of the time, it was premature to construct administrative contracts of French law in the existing circumstances in our country at that time[11].

The law and practice of this period did not recognize administrative contracts. The procurement contracts concluded by the state were subject to the Civil Code

7 Hans Kelsen, *Zur Lehre vom öffentlichen Rechtsgeschäft*, Archiv des öffentlichen Rechts, T. XXXI, H. 1, 25 и даље; Петко Стайнов, *Теорията за административния договор и социалистическото право*, Годишник на Софийския Университет, Юридически факултет, T. LVI, 1965, 48.
8 Martin Bullingen, *Vertrag und Verwaltungsakt*, Stuttgart 1962, 237.
9 Лаза Костић, *Административно право Краљевине Југославије*, књ. II, Београд 1936, 36.
10 Михаило Илић, *Административно право (литографисана предавања)*, Београд, 138-173; Иво Крбек, *Управно право*, књ. II, Загреб 1932, 59-92; Љубомир Радовановић, *Управни уговор*, Архив, књ. XIII (XXX), 1926, 181-192 and 281-298.
11 Л. Костић, *ibid.* 39.

regime, and all disputes arising from such contracts were under jurisdiction of courts of general jurisdictions, and not administrative courts.

c) Period following 1945

After 1945, there was almost no discussion of administrative contracts in Yugoslavia. An exception in this regard was Prof. Velimir Ivancevic, who in a concise and transparent way pointed out to the importance and meaning of French theory on administrative contracts, as well as Prof. Dragas Denkovic[12].

However, although there was is no mention of a special administrative contract in either our substantive law or in judicial practice, because all disputes related to contracts are settled in keeping with general rules of civil law, there are still examples from which it can be noted that our substantive law regulates many controversial situations regarding some contracts in a manner similar to the rules of the French theory of administrative contracts (the theory of unilateral changes of contractual obligations in the public interest, the theory of unpredictability, etc.). Observed in this way, all of this supports the motion which claims that there are reasons for us to introduce administrative contracts, especially as we also have an the institute of administrative dispute which is under the jurisdiction of the Administrative Court and which can be resolved in a dispute of full jurisdiction.

ADMINISTRATIVE CONTRACT IN THE LAW ON GENERAL ADMINISTRATIVE PROCEDURE OF THE REPUBLIC OF SERBIA

A decades-long dilemma that existed in Yugoslav and Serbian law has been resolved by the new Law, which provides for the administrative contract as a legal instrument.

The Law (Art. 22-26) in a most general way regulates only specific legal issues relating to all administrative contracts (their permissibility, modification due to changed circumstances, the right of the authority to terminate the contract, the party's objection due to failure to fulfill contractual obligations and the application of the Law and other laws governing obligation relations). In this way, as regards administrative contracts, three legal regimes will be applicable. First and foremost, for the particularity of certain types of administrative contracts, special laws in certain administrative areas will be appropriate. Issues regarding administrative contracts that are not regulated by the Law or by a special law shall be covered by applicable subsidiary regulations of the Law on Obligations (Article 26).

12 Велимир Иванчевић, *Теорија административног уговора, Уговорноправни аспекти уговора о инвестиционим радовима југословенских предузећа у страним земљама*, Инвестиције, Уредио др. А. Голдштајн, Информатор, Загреб 1969, 71-87; Драгаш Денковић, „Управни уговори и облигациони односи радних организација које врше јавна овлашћења", *Анали Правног факултета у Београду*, бр. 1-2, 1970, 45-72.

The Law provides only for the basic elements of legal regulation of administrative contracts, as they are to be introduced only by special laws in the specific legal areas. It remains for special laws to gradually introduce administrative contracts into our legal system in keeping with the provisions of the Law, in order for this new legal instrument to have the desired effect. In this way, administrative contracts, as a new form of administrative activities within our administrative law, should contribute to a more effective regulation of certain public-law relations. As a bilateral legal act, a contract concluded regarding an administrative matter between a public law authority and a party, the administrative contract is primarily related to the field of concessions, public-private partnership and public services, but may also be used in other areas if provided for by a special law. The only limitation is that its content must not be contrary to the public interest or the legal interest of third parties.[13] In that sense, Article 22 of the Law stipulates as follows: "The administrative contract is a bilaterally binding written document which, under provisions of a special law, is concluded between an authority and a party and which creates, changes or reverses a legal relationship in an administrative matter. The content of the administrative contract must not be contrary to the public interest or the interest of third parties."

Administrative contracts are a kind of administrative documents, which, as we have already pointed out in the paper, are also recognized in comparative law. These are the contracts concluded between public law entities, on the one hand, and a private law entity, on the other. The objective of the administrative contract is the realization of the public interest. For example, it may be the construction of a motorway through a concession contract or the provision of public services (public transport, water supply, electricity supply) through a public-private partnership contract. The administrative entity concludes this type of contract for the purpose of achieving a public interest and certain public benefits in a certain area of social life for citizens and legal entities. Their legal specificity is reflected in departures from the general regime of contractual (civil) law. Regardless of the fact that it is a bilateral legal matter, the contracting parties are not equal, given the need to satisfy the public interest. Powers of a public law entity are more extensive in relation to the other party to the contract.[14]

The following provision of the Law show that the contracting parties are not equal: "If due to circumstances arising after the conclusion of an administrative contract that could not have been foreseen at the time of concluding the contract, fulfillment of the obligation should become significantly difficult for a contracting party, it may demand from the other contracting party to modify the contract and adjust it to the existing circumstances. The authority rejects the request by a party in a decision if the conditions for amending the contract are not met or if

13 See: Драган Васиљевић, *Облици управног поступања по новом Закону о општем управном поступку Републике Србије*, Правни живот, бр. 10/2017, Том II, Београд, pp. 351-362.

14 See: Зоран Р. Томић, Управни уговори-елементи правног режима у Србији, Правни живот, Београд, 2017, бр. 10, Том II, pp. 249-265.

the change of the contract would cause damage to the public interest that would be greater than the damage suffered by the party" (Article 23).

It is clear that this provision places the authority in a more favourable position in relation to the other contracting party. It is possible that the newly arising circumstances significantly impede the fulfillment of obligations on the part of the authority, when it will request the other party to the contract for consent to amend the contract and adjust it to the arising circumstances. If the contracting party agrees, they will amend the contract and adjust it to the arising circumstances. Otherwise, if there is no consent, the authority can cancel the contract, due to what in their opinion constitutes the changed circumstances. However, it is possible that the new circumstances may significantly impede the fulfillment of obligations, not on the part of the authority, but the other contracting party. At its request, the authority may give consent, and the contract may be amended so as to adjust it to the arising circumstances. As the authority is the guardian of the public interest, it may adopt a decision to decline such a request of the party if it assesses that the conditions for amending the contract have not been met or if the change of the contract would cause damage to the public interest that would be greater than the damage suffered by the party. In such a situation, the other party may resort to administrative law means of protecting its rights and interests. This can be an appeal in the administrative procedure and/or a lawsuit in an administrative dispute, depending on the position of the authority that made the decision within the hierarchical ranks of the administration.

It should be pointed out that the provisions of the Law pertaining to the authority's right to terminate a contract place the authority in a more favourable position in relation to the other contracting party. In this regard: "The authority may terminate an administrative contract: a) if the party fails to agree on amending the contract due to changed circumstances; b) if the party fails to fulfill contractual obligations; c) if it is necessary to prevent a serious and imminent threat to life and health of people and public security, public peace and order or to eliminate disruptions in the economy, and it cannot be successfully resolved by other means that less affect the vested rights. The authority terminates the administrative contract by a decision in which it explicitly states and clearly explains the grounds for termination" (Article 24).

The fact that the right to terminate the contract and the assessment of the fulfillment of the abovementioned grounds for termination is reserved only for the authority, places it in a more favourable position in respect of the other party. However, the authority is obliged to state and clearly explain the reasons for termination in the decision on termination of the contract, which restrains its arbitrariness. The other contracting party may challenge the decision on termination of the contract in order to protect its rights and interests by administrative law means. This may be an appeal in the administrative procedure and/or a lawsuit in an administrative dispute.

The Law does not provide the other contracting party with the right to terminate the contract but allows it to raise an objection if the authority fails to fulfill its obligations. Thus: "If the public law authority fails to fulfill its obligation, the party cannot terminate the administrative contract, but it can file a complaint" (Article 25).

The complaint is a remedy which can be declared within six months from the failure of the authority to fulfill the obligations under the administrative contract. The rule is that the complaint is made to the head of the authority who will decide upon it in a decision that is passed within 30 days from the receipt of the complaint. The head of the authority may decide on the filed complaint in one of the following ways: a) to reject a complaint which is not timely, not permissible, or not filed by an authorized person and which is not regulated within the deadline set by the authority; b) to reject a complaint if it is not founded; c) to heed a complaint if it is found to be well-founded.

If a complaint is adopted as founded, then the decision will specify the way in which the undertaken contractual obligation shall be fulfilled and decide on the claim for compensation of damages.

There are administrative-law means to protect the rights and legal interests of a dissatisfied party against the decision made regarding the filed complaint. These include an appeal in the administrative procedure and/or a lawsuit in an administrative dispute.

Administrative contracts have also been introduced within the legal systems of Croatia and Montenegro, the states formed in the territory of the former SFRY, whose administrative procedures stem from the same legal tradition as the ones in Serbia. In this place, we shall discuss their solutions.

ADMINISTRATIVE CONTRACT IN CROATIAN LAW

The General Administrative Procedure Act of Croatia introduces the administrative contract as a new legal instrument[15].

Part Six of the Act focuses on the administrative agreement (Art. 150-154) in respect of which it regulates the following issues: conditions for concluding agreements and the subject thereof, invalidity of administrative agreements, amendments to the administrative agreement due to altered circumstances, cancellation of administrative agreements, and objections to the administrative agreement[16].

In the law of Croatia, an administrative agreement is concluded in writing between a public law authority and a party for the purpose of performing the rights and obligations determined under a decision (administrative act) by which an administrative matter is settled, when the entry into such agreements is stipulat-

15 See: http://www.zakon.hr/z/65/Zakon-o-op%c4%87em-upravnom-postupku, accessed on 9 March, 2017.

16 Иван Копрић, *Упознавање са новим Законом о опћем управном поступку*, Загреб 2010.

ed by law. If the administrative agreement has a legal effect on the rights of third persons, it shall be legally valid only upon the written consent of these persons.

An administrative agreement may not be contrary to the disposition of the decision, mandatory regulations or the public interest, nor to the detriment of third parties.

Administrative agreement is invalid in the following cases:
1. if it is contrary to the decision for the enforcement of which it was entered into;
2. due to reasons of invalidity laid down by the law regulating civil obligations;
3. when part of the agreement is invalid, save when the agreement would produce legal consequences without the part concerned.

An administrative agreement shall not produce any legal consequences, and its invalidity must be established by the court competent for administrative disputes. In order to achieve this, the complaint must be filed with the court either by the party or the public law authority.

If due to circumstances arising after an agreement is concluded, which could not have been foreseen at the time of its conclusion, fulfillment of the obligations becomes extremely difficult for one of the contracting parties, this party may request that the amendment be made according to the new circumstances. Parties must agree on the amendment or otherwise no amendments may be made.

Cancellation of an administrative agreement is also possible. Thus the public law authority is entitled to unilaterally cancel the agreement in the following cases (Art. 153):

1. when a public law authority and the party do not reach an agreement on the amendments to the agreement or when the public law authority or a third party included in the administrative agreement do not consent to those amendments;
2. when it is necessary to prevent a serious and immediate threat to the life and health of people and the public safety, when it cannot be prevented by other means which would involve smaller interference with the obtained rights;
3. when the party fails to meet the obligations arising under the administrative agreement.

The public law authority cancels the administrative agreement by a decision which must include the reasons for cancellation and the amount of damages if the public law authority incurred damages through the party's failure to meet the obligations stemming from the administrative agreement. A decision on the cancellation of an administrative agreement may be subject to an administrative dispute.

However, when the public law authority fails to meet the contractual obligations, the party may file a complaint which may also request the award of damages incurred from the failure to fulfill contractual obligations. The complaint is filed with the body responsible for supervision of the work of the public law authority. The body deliberates on the complaint in a decision. An administrative dispute may be instituted against such a decision.

ADMINISTRATIVE CONTRACT IN THE LAW OF MONTENEGRO

Montenegro adopted a new Law on Administrative Procedure towards the end of 2014, and it came into force on 1 January 2016[17].

The second part of the law (administrative activities) and its chapter two focus on the legal institute of administrative contract (Art. 27-30) and regulate a number of issues related to it (an administrative agreement between a public law authority and a party, cancellation of an administrative agreement, amendments to and cancellation of an administrative agreement due to changed circumstances, unilateral cancellation of an administrative agreement).

The law of Montenegro envisages that an administrative agreement between a public law authority and a party is to be concluded in writing. It is concluded for the purpose of establishing, altering or cancelling a specific legal relation in an administrative matter within the scope of the public law authority jurisdiction when it is laid down in a special law, when concluding such an agreement is in the public interest and when the agreement does not threaten the rights of third persons.

Once concluded, an administrative agreement may be cancelled due to the following reasons:

1. when the conditions for the conclusion are not met;
2. in cases in which there is mandatory cancellation of a decision in accordance with the Law on Administrative Procedure.

The cancellation of an administrative agreement is deliberated on in an administrative dispute when a procedure is instituted by the party or the public law authority.

Changed circumstances or other reasons may lead to a change or cancellation of an administrative agreement. Thus the administrative agreement may, due to circumstances arising after its conclusion which could not be foreseen at the time of conclusion, and which significantly impede the fulfillment of contractual obligations or for other reasons, be changed or cancelled in accordance with a special law.

The public law authority has the right to unilaterally cancel the administrative agreement when:

1. the party fails to meet the obligations arising from the administrative agreement;

2. it is necessary for the prevention of threat to the life and health of people or property or when such a threat cannot be prevented in other way. In the aforementioned cases, the administrative agreement is cancelled by a decision which must include and explain the reasons for the cancellation of the administrative agreement. A party may institute an administrative dispute against such a decision.

17 See: http: //www.ti.gov.me/biblioteka, accessed on 9 March, 2017.

CONCLUSION

From this concise overview of the regime of contracts concluded by the state it may be noted that there is no complete agreement in jurisprudence, either national or international, on the legal nature of these contracts. The diversity of solutions regarding this issue suggests that differences in the historical development of a certain society influence the acceptance of a certain solution. It was due to the rich practice of the National Council that French administrative law influenced the questions of the existence of administrative agreements. It should be noted that this problem occurred in French law because of a practical reason, i.e. special administrative courts demanded more extensive theoretical justification. Given the influence of French legal science in comparative law, it is natural that certain theoreticians in other countries, under such influence, posed the problem of a theoretical explanation for the existence of a separate administrative contract. Hence the contradiction in theoretical explanations of the legal nature of the administrative contract and the uncertainty in justifying the existence of these contracts in countries where there is no special administrative judiciary.

Bearing in mind that legal science in comparative law has not yet achieved a unified theoretic view on the legal nature of the agreement concluded between the state and other public law entities, it is obvious that the solution to this question is factual and that it will depend on an assessment of all circumstances which solution would be best suited to each particular state.

In our country, this dilemma has been resolved by the new Law on General Administrative Procedure, which in the most general way regulates specific legal issues related to administrative contracts. Special laws from specific administrative fields shall apply to the features of special kinds of administrative agreements. The countries in our neighbourhood (Croatia and Montenegro) have acted similarly. This is understandable, given that Croatia and Montenegro, just like Serbia, have innovated their laws on administrative procedure, harmonizing them with the European Union law, so that we, in a way, had the same models and acted upon the same recommendations. Similarly, the fact should be noted that these three countries have a shared legal tradition and that they had applied the same Law on General Administrative Procedure before the adoption of these laws, with small amendments.

It is still too early to speak about the effects of these solutions related to the institute of administrative agreements given that the Serbian Law has been fully applied since 1 June 2017 and in Croatia and Montenegro the implementation of the relevant acts is not long enough to draw valid conclusions. In any event, bearing in mind that it is a new institute, for its successful implementation in practice, it is necessary to give a chance to the provisions offered by the Law regarding this institute, as it is gradually introduced by special laws in respective administrative areas.

When adopting or amending such special laws, their compliance with the relevant provisions of the Law should be ensured. Otherwise, there is a risk that the provisions of the Law pertaining to administrative contracts could remain 'a dead letter' and that in practice various regulations are applied to the same kind of contract or that there are different interpretations, which would create legal uncertainty and exacerbate the business environment, thereby rendering the new legal institute pointless.

In any case, the real defence against this is to be provided by the legislator taking precautions when introducing the administrative contract in specific administrative areas by adopting special laws.

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VOLUME II

Topic IV

SOCIAL, ECONOMIC AND POLITICAL FLOWS OF CRIME

IT IS HEROISM TO TELL THE TRUTH – EXAMPLES OF HONEST SWISS ARCHIBALD REISS AND DICK MARTY[1]

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Abstract: Numerous atrocities were committed against Serbs by the Austro-Hungarian Army and its allies. A Swiss criminologist Archibald Reiss, Ph.D. documented them. He did not only make the expertise of the crimes, but also informed the world about the crimes and the perpetrators by publishing papers in the Western press of the period almost simultaneously when they happened. No advertising machinery could manage to oppose the truth that Reiss presented.The paper attempts to establish a historical vertical of Reiss's struggle for the truth about the Serbian people with the report of another Swiss – Dick Marty, PhD. Less than a century from the World War I, he submitted the report to the Parliamentary Assembly of the Council of Europe about the crimes against the kidnapped Serbs by the so-called "Kosovo Liberation Army" and trade with human organs just after the end of the NATO aggression to FRY in 1999 and establishing of the UN protectorate over that part of Serbia. Dick Marty published the book about it "A Certain Idea of Justice" (2018/2019).

Keywords: Archibald Reiss, World War I, war crimes, KLA, NATO aggression on FRY in 1999, Dick Marty, historical parallel.

INTRODUCTION

Actions of two Swiss regarding the atrocities against Serbs are presented by implementation of the document content analysis in the paper: the criminologist Archibald Reiss, Ph.D. and the lawyer, former cantonal prosecutor, then the member of the Swiss Council of States and the reporter of the Parliamentary Assembly of the Council of Europe Dick Marty. The former reported about the crimes during the World War I, just at the time when they happened. The latter presented to the world public just a part of atrocities over Serbs committed in

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Kosovo and Metohija by the so-called KLA[3] after the end of NATO aggression in 1999. Although their roles were historically different, it is certain that both of them deserve credit regarding the cognition of the Serbian suffering.

REISS'S RECORDS AND THEIR IMPORTANCE

Friendships from war last forever. It is understandable: a fellow soldier keeps the head of his friend. However, an unusual friendship, even more than that, was born during the World War I between one man and one whole nation. The Swiss of German origin Rudolph Archibald Reiss (*Rudolph Archibald Reiss*, 1875-1929) came to Serbia, on invitation of Pasić Government, to investigate Austro-Hungarian atrocities on the front in Macva and Pocerina. Reiss is the father of criminology as a scientific discipline, the founder of the Institute for Criminology in Lausanne and such a request was a professional challenge for him. Besides, by giving a professional report and its publishing, he would contribute to acknowledgement of the truth about the actions on the front in Europe and in the world. Describing his first meeting with Nikola Pasić in his memoirs *What I Saw and Lived in Great Days*[4], Reiss wrote that by the end of war he remained "the official and neutral investigator of Serbian government and army", but also when he saw "at front all the atrocities suffered by Serbian people from their cruel enemies, when I heard enemy's bullets and shrapnel whistling around my head and I could not respond due to my neutral position, I soon left that position and became a Swiss volunteer of Serbian Army, a friend of magnificent warriors of Sumadija, Danube, Morava, Drina, Timok and Vardar. However, this new position never made me to abandon my objectivity of a professional and sworn investigator in front of the courts of my country and elsewhere. I made an oath to tell 'the truth, nothing but the truth'. Now, ten years after the end of the war, I can say that I have not failed" (Reiss, 1997: 24). The first invitation to Reiss was to make a "questionnaire" about the atrocities of Austro-Hungary against Serbs in the summer of 1914. It should be noted that in methodological sense Reiss did not implement just a standard questionnaire, but rather an investigation method, the interview technique (see Milosavljević, Radosavljević, 2000: 506; Šuvaković, 2000: 102-113). However, considering the quoted memoir of Reiss, one might say that he implemented another sociological method that gave much deeper results when used correctly, just in the way Reiss did, which is – observation with participation "in the role of scientific observer" (s. Milić, 1996: 440). Of course, Reiss completely mastered the criminology techniques, so that he opened tombs, exhumed corpses, examined the abused and his reports based not only on sayings of others (captives, witnesses, wounded, soldiers, field marshals...), or on what he personally could see, learn,

3 In Serbian - *"Ослободилачка војска Косова" (ОВК)*, in Albanian - "*Ushtria Çlirimtare e Kosovës" (UÇK)*

4 The first edition of this book, translated from French by Veljko Milićević, was published at the beginning of 1928, a year and a half before the death of Reiss in Belgrade. Reiss put the signature on the front page of the book: "R. A. Reiss honorable captain of Serbian army"

notice, feel, and he documented the allegations about the committed atrocities. "I was not pleased with investigations of hundreds of Austrian captives and hundreds of witnesses; I went to venues, sometimes in the middle of grenades, in order to report on everything that was possible to determine. I opened tombs, examined corpses and wounded, visited bombed cities, entered houses and performed a technical questionnaire according to the most scrupulous method; in short, I did everything in order to determine and check the facts displayed in this paper" (Reiss, 2014a: 37). Remaining in the Serbian army throughout the war, he made a complete report – a case study about the atrocities of Austro-Hungarians, Germans, Bulgarians (see Krstić Mistredželović, 2014) throughout the war. His records were used as findings of a professional about the atrocities of occupants in Serbia and their violation of the Hague Convention and the international Law of War at the peace conference in Paris. However, he did something else, something unusual regarding the expertise. Understanding the scale of atrocities performed by occupants and conquerors against the Serbian people, he immediately informed the world public. "Reiss was not waiting to submit an official report, but he, as the war correspondent of the already mentioned magazines, informed the world about the atrocities as soon as he acquired the knowledge about them. In this way, by informing the world, he tried to act preventively – if atrocities were revealed, maybe systematic commitment would stop" (Suvakovic, 2016: 7-8).

Reiss did not write only about the committed atrocities, he also reported on the discoveries as regards the ways atrocities were committed, and the attempts to endue them with a legal form of defending the Austro-Hungarian army from, for example, falsely accused Serbian villagers near Kosovska Mitrovica to be "Serbian Komitadji" allegedly having weapons, which was strictly forbidden and the punishment was – shooting. An Albanian local battalion excelled in such imputations for "justifying" atrocities (Reiss, in Pršić, Bojković, 1997: 276). It is evident from the reports that Reiss sent to Nikola Pasic on that occasion that this veracious Swiss was horrified by the atrocities committed against the Serbian civilian citizens, even disguised by giving them false legal forms. Actually, such actions supported at Kosovo and Metohija by one foreign force – the war enemy of Serbia[5], were just a precursor of the contemporary concept of *ethnic cleansing* (see Šuvaković, Rakić, 2017) that Kosovo Albanians systematically committed against the Serbs living there in continuity from the return of Kosmet to Serbia in Balkan Wars until today (Šuvaković, 2011; Šuvaković, 2014).

However, Reiss did not just document the most severe crimes – those including murders, persecutions, rapes, bombing civil objects and similar, but determines the smallest infringements of the international law, especially of the international

5 In the Reiss's era these were Austro-Hungary, Germany, Turkey, Bulgaria, Albania and Italy, during the World War II these were Germany, Italy and Albania, while in the last decade of the last and the first two decades of this century it is NATO guided by America. Therefore, foreign patrons of Albanian atrocities over the Serbian citizens changed in accordance with the changes of international circumstances, but the continuity of the atrocities has remained, as well as the constant protection of the perpetrators by powerful forces, with the aim of destabilization of Serbia and this part of Europe.

law of war (s. Surlan, 2016), trying to sustain them not only by declarations of witnesses, but also with material evidence. For example, when performing his "questionnaire" he faced the statements of citizens of Palanka and Grocka that the Serbs from former regions of Austro-Hungary, "who have become Serbian citizens, as well as the Serbian refugees from the other side of the Sava and the Danube, were recruited to Austro-Hungarian army", which represented an infringement of the international law of war, more precisely of the Hague Convention on laws and conventions of war ashore (Art. 23 Item 2 of the Convention) (s. Knežević-Predić and others, 2007: 311). He established from a discovered Austro-Hungarian document dated 19 January 1918 that a shepherd Paso Oglu Idris was recruited in a platoon of Austro-Hungarian army, from the canton Kosovo, and concluded: "Canton Kosovo is Serbian from 1913 and Paso was recruited in 1916. Therefore, there is no doubt that this Austro-Hungarian document tacitly recognizes recruiting of a Serbian citizen to army of the enemy. Since people from Vienna and Budapest acted in the same manner with Serbs from Kosovo, since Paso surely was not the only one that was recruited to the army of the late Dual Monarchy, the statements of witnesses from Palanka and Grocka are surely also true" (Reiss, in Pršić, Bojković, 1997: 304). Reiss also indicated to confining of civil citizens, with example of Prishtina that was "immediately divided into Bulgarian and Austro-Hungarian part, with the river running through the city as the border. Then they started to confine citizens, especially clergymen, not leaving even one... A notable Turk, H..., told me that he mourned Serbian authorities, since they never acted like Germans and Bulgarians" (Reiss, in Pršić, Bojković, 1997: 244).

Portraits given in a special part of his memoirs titled "Serbian Chiefs" about King Peter, Regent Alexander, the dukes Putnik, Misic, Stepa Stepanovic and Bojovic represent a special part of Reiss's documents. However, it is not everything: he also wrote about the general Sturm, in the "Letters from Serbian-Macedonian Front" in which he described the funeral of the duke Vuk with undisguised admiration the spirit of Serbian people, etc. illustrating Serbian leadership, stressing the peasant origin that he highly appreciated, he naturally saw them as leaders of the people in a great epic. According to his conclusion, they "saved Serbia and created the Kingdom of Serbs, Croats and Slovenians. Civil chiefs could not do that, it must be said, because they could never completely forget their quarrels of party politicians, and in order to save the country from the terrible situation in which it was, a complete unity was required to sacrifice everything to a single idea: salvation of the country" (Reiss, 1997: 263).

What is obvious is that Archibald Reiss did not write anything about the Albanian Golgotha. He presented the following explanation for that in his memoirs: "I am very sorry, but I had to exclude the terrible, but yet so glorious drama of the retreat through Albania. That subject is too big, so deep, it is impossible to speak about it in a necessarily limited chapter of a work comprising the whole war. If the circumstances allow, I will dedicate a whole book to this great event" (Reiss, 1997: 11). Unfortunately, Reiss had died before he wrote this book, so we have no data from him about this epic of the Serbian army and the people, except for frag-

mentary data, still expressing his estimation of that event. "Attacked from Austro-German forces, supplied with all the contemporary war instruments, Serbia was occupied and its army, followed by numerous citizens, was retreating through the cold and hostile Albania. I will describe in a special book how terrible this retreatment of a whole army and whole people was, who lost their country, but were not defeated" (Reiss, 1997: 110). Obviously polemicizing with someone who criticized retreatment through Albania, he wrote the following on 14 June 1917: "It is true, Serbia is still today under the occupational yoke, but I am sure that tomorrow it will be free, due to the victims of the retreat through Albania. Some reproached to the Headquarters for not performing this retreat with less victims. It is easy to criticize now, but was it not the performance of this retreat a miracle? Could other armies perform it? I do not believe. And, regardless the moral characteristics of Serbian people, was it not that the work of the Headquarters managers that contributed a lot to this miracle?" (Reiss, 1997: 213). Therefore, although he did not write the "report" about the Albanian Golgotha, as he did it regarding the other sufferings of the Serbs in the World War I, Reiss gave a doubtless historical evaluation of this historical foray, being the participant himself.

We present here the examples of testimonies that the honest Swiss left as the evidence about the atrocities committed during the World War I. However, they had at least three important functions: except for a) fulfillment of the basic duty of Reiss, which was to establish crimes as a sworn witness and criminology expert, their volume, infringement of the international law of war, etc. and b) representing the legal (peace conference in Paris) and historical source (for all researchers, primarily in the field of historical, but also other sciences), they had another, not the least important function: c) counterpropaganda[6]. Namely, already with the beginning of the World War I, for which in the serious historiography the Vidovdan assassination in Sarajevo is considered the *occasion*, Serbia was accused by the Central Powers to be *the offender* and *the cause* of the outburst. Unfortunately, such accusations are actualized again, approaching to the centennial of the outburst[7]. Archibald Reiss, without any doubt, parried such accusation more than a century ago. He took over the duty of a war correspondent for the magazines published in Switzerland, France and Holland: *Gazette de Lausanne* (Lausanne), *Le Petit Parisien* (Paris) and *De Telegraaf* (Amsterdam). Performing the duty of a war correspondent was equally important for the "Serbian cause" as the criminal expertise he was performing. Namely, the war propaganda was at that time, as well as a century later, against Serbia and Serbian people. It was necessary that someone with a serious authority in the public opinion of western countries testify about the truth, confirm that it was not as Austro-Hungarian and German

6 Issue of propaganda in war, using media for mobilization of "ours" and spreading defeatism to "theirs" is very actual in contemporariness. It is considered that Fuller's theory of warfare was the one that "for the first time seriously considered the importance of media war and propaganda as the integral part of warfare" (Sekulić, 2011: 141; see also Jevtovic, Aracki, 2013).

7Christopher Clark, professor of history at the University of Cambridge, published in his book the most famous revisionist allegations (2012).

media of that period were presenting it. Reiss was the perfect person for such an attempt. He published 108 articles just in the Lausanne magazine *Gazette de Lausanne* in the period September 1914 – October 1918 (Reiss, 2014b).Their value was in their immediate publishing, they represented reports from the first lines of front, opposing the war propaganda of occupying powers. In that sense, it is important to point out that it is surely brave to tell the truth, but it is even bigger if it is announced timely. This is the great importance of Reiss's attempt. In his letters he did not write only about atrocities against Serbs during the war; he also gave a genesis of the conflict. For example, in his public polemic with Dr. Turtulis, Reiss explained the relationship between the Serbian and the Albanian states and indicated that great powers were constantly using Albania as instrument against Serbia, testifying also about Kosovo Albanians using as instrument: "The bloodiest conflicts that the Third Serbian Army fought near Ferizovic (later Urosevac, near Kosovo), as well as the Ibar Army near Novi Pazar, were just against Albanians" (Reiss, 2014b: 103, 105). Other than the relationship with Albanians, he explained in his letter the ethnogenesis of Dalmatian citizens, presented the interview with Nikola Pasic, described the visit to King Peter, eagerly polemicizes and keenly presenting facts. Everything in the period when things were overtaking each other. "He was describing crimes, explaining situation in Serbia, mutual relations between Serbia and allies, future of South Slavs, relations between Serbia and Albania, but also between the states – participants in Balkan Wars that were extremely complex" (Subošić, Zec, 2017: 483).

NATO AGGRESSION IN 1999 AND SERBIA WITHOUT REISS

A little more than a century after the outburst of the World War I, Serbia is struggling again for the survival. Extortion of a part of its territory is at stake – the Autonomous Province Kosovo and Metohija, where the local Albanian separatists unilaterally declared the so-called "independence" in 2008. Of course, it was just a part of the process of breakup of Yugoslavia, which started in the nineties of the 20th century (Šuvaković, Stevanović, 2018), and unfortunately still lasts (Šuvaković, 2012). However, Serbia did not have Archibald Reiss in that period, who would place the truth about the local events to the world. Indeed, there were journalists trying to do this, but their information – which was later confirmed to be truthful – was very soon buried with piles of propaganda lies published in *main stream* media[8]. Even when Serbia alone was managing to excel the enemy propaganda by placing only the truth – the television broadcasting of the "results"

8 As known, the so-called massacre in Racak was the *cassus belli* for the NATO aggression on the FRY. However, the French journalists Christophe Chatelot (Le Monde) and Renaud Girard (Le Figaro), as well as the team from AP TV that was making the film – anti-terroristic action of the Serbian police in Racak, witnessed that there was no massacre in Racak. However, the statement of William Graham Walker already went around the world and took title pages of main media, so that their reports remained unnoticed.

of NATO aggression in 1999 - the western aggressors decided to stop that. They did it in a drastic, criminal way – by rocketing the building of the Radio Television Serbia, killing 16 employees there. After establishment of the new authorities on 5 October 2000, they managed to avoid responsibility for those who ordered the crime, but for the general manager of RTS because he did not "evacuate the building". It is forgotten, of course, that the headquarters of a television station cannot be a military target[9], as well as it could not be the passenger train in Grdelica canyon that was rocketed, together with its passengers, killing on the spot 13 passengers, with an explanation that it was a "collateral damage". A target could not also be little Milica killed in Batajnica while she was sitting on her chamber pot. Practically, there was no foreign reporter during the NATO aggression that would dare to testify about crimes, let alone a criminalistic expert who would document them all[10]. Even worse: the verdict was brought in front of the district court in Belgrade for the atrocities committed during the 78 days of the NATO aggression against the leaders of the North Atlantic Alliance and member states, establishing the responsibility, among others, for killing at least 546 killed soldiers of Yugoslav Army (YA), 138 policemen (members of Ministry of Internal Affairs - MI) and 507 civilians[11], 1191 people in total. However, the DOS authorities after

9 Trying to revise the history, NATO promoters in Serbia spread various disinformation, in order to try to justify the crime of rocketing the building of RTS. One of them, Zoran Ostojić, recently contended that members of the Yugoslav Army were in the building of RTS, which made it the target for NATO (sic!). See https://www.balkaninfo.rs/emisija/aktuelno-istina-o-zlocinima-i-izdaji-srbije-zoran-ostojic-i-uros-suvakovic-24-3-2019/ 1:02:17 - 1:02:23 (approached on 13/04/2019). Unlike him, the organization Amnesty International immediately published the report indicating that the rocketing of RTS was a war crime, antithetical to the provisions of the Article 52 (2) of the Protocol 1 of Geneva Convention (see AI, June 2000). After the terroristic attack on the Parisian satirical magazine Charlie Hebdo (Charlie Hebdo) in 2015, the professor Noam Chomsky compared that crime, condemned by the whole world, with NATO rocketing of the RTS building, which was almost concealed: "The reason has to do with the concept `living memory`, a category carefully constructed to include Their crimes against us while scrupulously excluding Our crimes against them -- the latter not crimes but noble defense of the highest values, sometimes inadvertently flawed" (Chomsky, 2015)

10 Not only that there was no one who would *truthfully* testify about atrocities against Serbs, but also experts were found who were forced at that time to support in their reports the false accusation of William Walker regarding the "massacre in Racak" committed by Serbs. The Finnish pathologist Helena Ranta testified in her memoirs that she had succumbed to such a pressure. Her remorse, of course, came too late. In the context of scientific explanation and creation of the typology of American war propaganda, the uncommitted "massacre in Racak" is determined by researchers as "mythical bloodshed" (see Herman, Peterson, 2010: 95-101; Barbulović, Jevtović, Popović, Lakićević, 2004: 113-122).

11 The verdict K. No. 381/2000 of the District Court in Belgrade. This verdict implied the atrocities in the period 24 March 1999 – 10 June 1999 committed by NATO and/or KLA, since the court considered that this terrorist organization during the aggression had actually the role of NATO infantry. Namely, NATO was not only giving a logistic support to KLA (arming them, training their members in military camps in Albania, etc.), but also was giving a fire support in their clashes with regular forces of the YA and MI, making their actions actually – the armed concurring. The verdict integrated all the atrocities for which it was possible to perform investigation (which means until 10 June 1999 when Serbian bodies were precluded to perform investigations at the territory of AP K&M), and regarding the category of civilians those who were killed on the spot were integrated, so that the number did not comprise

the 5 October 2000 terminated this verdict, in order to cover the number of deceased and provide amnesty for the responsible.

A SWISS AGAIN TESTIFIES ABOUT ATROCITIES AGAINST SERBS – DICK MARTY'S REPORT

The consequences are horrible: accused of crimes that were not committed systematically, Serbia had to accept protectorate of the UN over Kosovo and Metohija (K&M); the thing it did not need to do, but it did under the pressure of the West, was the surrender of the whole state, military and police leadership to the so-called Hague Tribunal, where they were prosecuted for defending their country. Regarding the crimes of Albanians against Serbs, during a centennial period, and especially during the NATO aggression and just after it when around 250000 Serbs and non-Albanians were deported from the territory of the southern Serbian province –there was silence. The silence was interrupted again by a Swiss, Dick Marty (Dick Marty)[12], a senator in his country and the Special Rapporteur of the Parliamentary Assembly of the Council of Europe. In his Report "Inhuman treatment of people and illicit trafficking in human organs in Kosovo" at the end of 2010, adopted by the Parliamentary Assembly of the Council of Europe at the beginning of 2011, he connected detentions of a great number of Serbs and "disloyal" Albanians (regarding the so-called KLA) with extraction of human organs, sustaining allegations that these were taken in the territory of Albania and sold to rich clients; he connected the leaders of Kosovo Albanians with this and oth-

those who died from wounds e.g. few days later. The number of killed established by the court DID NOT COMPRISE: a) members of the YA and MI killed during the antiterrorist struggle against KLA from the 10 February 1998 to 24 March 1999. Therefore, if those victims are added, the number is 1002 killed, only the members of the YA and MI forces of Serbia and FRY (Milošević, 2000: 8). In that case, the number of killed would be 1509. b) civilians registered as missing persons, in most cases without any knowledge about them even today, 20 years after the NATO aggression, so that it can be established that they were killed. There are 1398 kidnapped and missing civilians in the period 1 January 1998 – 1 November 2011, and 43 members of the YA and MI. It is interesting to notice that the greatest number of civilians was kidnapped after the arrival of the international forces to Kosovo and Metohija (K&M), even 82.6%, (the Government of the Republilc of Serbia, 2001). c) Numerous victims should also be added to this, suspected to be victims of the consequences from radiation caused by effects of the ammunition with depleted uranium, which is the subject of a parliamentary investigation in Serbia; d) finally, this number does not comprise killed terrorists, members of the so-called KLA – citizens of Serbia, whose death as a rule was not reported to our authorities. As later investigations showed, more soldiers and policemen were killed in conflicts with the so-called KLA, than from the impacts of NATO forces that, on their side, killed more civilians, even more morally disqualifying the North Atlantic Alliance (Stevanović, 2019: 106-107).

12It should be admitted that, before him, Carla del Ponte (Carla del Ponte), the Chief Prosecutor of the so-called Hague Tribunal (ICTY), in her book of memoirs "Madam Prosecutor" (2008), after termination of that international function, revealed the initial doubts and data about the crimes regarding the organs sale, committed by members of KLA. However, while she was the prosecutor, when she had the power to do something regarding the disclosure of committers and punishment, she did not do it.

er committed war crimes, as well as other criminal activities (drug trafficking, among other things). His conclusion was that it was necessary to investigate and punish those crimes (Marty, 2010). According to Marty, collecting data for his report was more than hard, confronted with numerous obstructions, threats and messages: "It was told to me between the lines that there was no interest to dig into those old cases and that it would be good not to reveal some aspects from the past. Serbs are evil and it must not be changed: it may jeopardize even the stability of the region... The quest for witnesses was very difficult, much more difficult than during the investigation regarding the CIA prisons. In addition, it was more dangerous... among the witnesses we met, one of them confessed that he participated in crimes. Due to his testimony, we could describe how organs, primarily kidneys, were extracted from the bodies of killed Serbian prisoners" (Marty, 2019: 247, 256). The investigation was conducted on basis of Marty's analyses, primarily by EULEX mission, since Marty's report was not similar to a criminalistic report, but contained only clues and directions for some future investigation. However, the fact that he had the experience of the prosecutor in his country and legal knowledge surely helped him in performing the tasks imposed on him by the Parliamentary Assembly of the Council of Europe. Marty himself indicated that he had performed interviews with a great number of witnesses when he was preparing the report, claiming that those were "direct witnesses of events, who were able to testify about what they saw and heard personally" (Miloradović, 2011). However, anxiety for the safety of the witnesses of those crimes arises from this and other interviews of Dick Marty.

Establishing of an *ad hoc* court that should elucidate these crimes was initiated only in 2014, while in the middle of 2017 "conditions were acquired" for this court to start working. The first requests for KLA commanders to give their statements were sent at the end of 2018. An impression is irresistibly imposed that enough time is left for discovering identity of witnesses, so that they can be removed. An accusing fact illustrates the obstruction of international scale, again displayed by Dick Marty himself, that evidence about organ trafficking performed by the so-called KLA in K&M and in Albania, collected within the investigation of the so-called Hague Prosecutor's Office, the so-called Hague Tribunal destroyed[13].

It is possible to notice that this report has arrived with a great delay. Dick Marty truthfully resented what he acknowledged, but eleven years later, when many traces of crimes were removed and witnesses disappeared (Surlan, 2016: 22). The guilt is not his, but of the so-called international community that evidently tried to relinquish Albanian atrocities against Serbs at K&M to oblivion with the passage of time. "The time goes against the research for the truth. With good reason

13 "Evidence, collected on the assumed crime scene, was simply thrown away to garbage... According to the official explanation, TPY was not authorized to perform investigation on basis of these crime accusations. They happened in Albania, therefore outside the court's jurisdiction. Even more, events happened allegedly after 15 June 1999, the date after which possibly committed crimes were not under jurisdiction of the International Court. Therefore, it is not our business!" (Marty, 2019: 257)

we ask ourselves if this is what is wanted" (Marty, 2019: 261). There was no political will of powerful Western countries that supported the so-called independence of Kosovo to face the public of their own states with crimes committed by their wards from the so-called KLA. Therefore, his report did not even try to flush the blemish that Western media had fathered on Serbia as perpetrator for all events in the Balkan region, especially at K&M[14]. In a way, he was trying to establish a symmetry between those that were destroying the country for the secession of a part of its territory (even supported by the most powerful military alliance in the world at that time) and those that defended it, proving the thesis that there were crimes on both sides, but not realizing that there were crimes also on behalf of the so-called KLA and NATO even before 10 June 1999. He investigated only the period after the official cessation of NATO aggression. Indeed, it should be noticed that the greatest part of missing persons disappeared just in the period of establishing the UN protectorate on K&M (see footnote 8).

In his book, according to his saying written at the moment when he had doubts how much time he was left due to the illness, he wanted to record his acknowledgements. Marty exposed some other important attitudes, conclusions and suspicions regarding Kosovo: the NATO aggression to FRY in 1999 was "contrary to international law" due to absence of the competent decision of the United Nations Security Council (Marty, 2019: 252); geostrategic aims of the NATO intervention "requested by USA" – "Balkan is in the crossroads of gas pipelines... NATO obviously has tendency to expand to the East" (Marty, 2019: 253); he established that there was a suspicion that Camp Bondsteel near Urosevac "served as a secret CIA prison within the war against terrorism" (Marty, 2019: 254)[15]; KLA is financed by racketeering Albanian diaspora or the funds "originated from drug trafficking and prostitution" (Marty, 2019: 254); Hashim Thaci was "engaged as the agent of French intelligence service" (Marty, 2019: 254); he indicated to the systematic corruption and economic interests of the highest American officials, like Madeleine Albright, for whom he said that it was "discovered that she had economic interests in the former Serbian province, especially in the Kosovo telephone company" (Marty, 2019: 264), the American ambassador to K&M Christopher Dell, who provided the construction of highway to American company Bechtel "which will provide for him a well paid function" (Marty, 2019: 248), the American general Steven Schook, UNMIK Deputy Chief, who became an advisor for Ramush Haradinaj (Marty, 2019: 248). He does not disguise the contempt for

14 In his report, quoting its parts also in his latest book, Marty wrote that "population of Albanian ethnic origin has suffered terrible violence, which was the consequence of the crazy politics of ethnic cleansing ordered by the dictator from Belgrade of that time" (Marty, 2019: 252). Therefore, he has no doubts about the media *main stream* version, according to which the guilt is on Serbia and president Milošević, but he accepts that as the starting premise. Simply, he does not want to discuss that he wants "neutrally" to find reasonable evidence for committed crimes against Serbs, as well after 10 June 1999, which was the task accredited by the Parliamentary Assembly of the Council of Europe. Therefore, Marty's focus is just on that, outside the complete context of the event and its revision.

15 Author of this paper expressed this suspicion even in 2014 (Šuvaković, 2014: 104)

Thaci and the so-called Drenica Group, indirectly suggesting their responsibility for the crimes for which he submitted his Report to the Parliamentary Assembly of the Council of Europe, which he quotes in his book: "Indicators of the collusion between crime and persons with political responsibility and institutional functions are too numerous and serious to be ignored" (Marty, 2019: 259). These observations from his book – that are similar to Reiss's observations other than the main course of investigation – still indicate that he is aware what the so-called "Kosovo independence has brought", how and why this project was created. However, he writes about it only at the moment when he expects to depart from his life; almost a decade before writing his memoirs, he just fact-oriented indicated to the evidence of atrocities for which he should submit a report.

CONCLUSION

Historical parallel between Reiss and Marty is necessarily imposed: it is a heroic act to tell the truth, even late. If Marty's report results in convictions for the crimes committed after June 1999, it is certain that we shall not wait long to ask questions about the crimes of the so-called KLA before this date and indisputably the main question is whether the "right" (to secession in this case) be based on the crime. Legal theory gave an answer to this question a long time ago. However, establishing the relation of ethnic imperatives between the two Swiss, there is no doubt that Reiss's is much higher. Marty acts bureaucratically, legally; there is no attempt in his report for a critical consideration if Serbs were victims and in which period and, if they were, to show solidarity with them. He deals just with one special case, submitting the report about it, but not disputing the lies that preceded that crime against Serbs, but records them as truthful and – goes on. Indeed, in his memoir book he mocks proponents of the so-called "humanitarian interventions" like Kouchner and Bernard-Henry Levy, expressing his attitude against the so-called "Kosovo independence", again explaining that by legal reasons, without entering the merit of the Kosovo issue – that it is the region of the essential importance for the existence of the Serbian national identity. Reiss with no doubt bespeaks "neutrality is not possible in front of the crime"[16]. However, from the ethnical point of view, Reiss's moral imperative does not leave a possibility for comparison with anybody's actions before or after him. He does not act like a clerk, which he is not, nor like a scientist of positivist orientation – which he is, but like a man with a clear attitude based on the principles of humanism, announcing the attitude immediately, at the moment when the conflicts takes place. If the complete mechanism of international community, incarnated in the so-called Hague Tribunal and its Prosecutor's Office, has taken Reiss's ethical imperative, perpetrators of atrocities against Serbs and other nations during 1999

16 Archibald Reiss started his lecture with this sentence at Sorbonne, on the theme "About behavior of Austro-Hungarians in Serbia, where they interposed", held in the beginning of 1916. See Rudolphe Archibald Reiss, *What I have Seen and Lived in Great Days* (Belgrade: Mladost turist, Itaka, 1997) 68.

and later, when our southern province got under protectorate of the UN, would be processed and convicted a long time ago. Instead, international community was very biased in this situation (as well as in many other issues during the Yugoslav crisis regarding the relation with Serbia and Serbs), showing unconcern, soft-spoken, for the atrocities committed against Serbs. Therefore, the act of Dick Marty, regardless the referred limitations of his Report, is sublime. He had enough strengthened will to establish a) that such a monstrous crime of organ trafficking from the kidnapped Serbs from Kosovo and Metohija was performed, even in an organized manner, b) that it was performed by the so-called KLA and with the knowledge of the leaders of that organization, who are now civilian leaders of Albanians at K&M, c) that the territory of the adjacent state – Albania was also used for the commission of the crime. He managed to d) make the Parliamentary Assembly of the Council of Europe accept such the Report and all his recommendations, which created the basis for criminal prosecution of perpetrators by other bodies of the international community. Finally, e) publishing his memoir book in 2018 in Switzerland and the Serbian translation in 2019 which represents an important supplement of that report, both from the aspect of remembering the atrocities against Serbs committed by KLA and the aspect of understanding the "achievements" of NATO regarding the so-called "Kosovo independence". In the atmosphere of stigmatization of Serbia, it is a great and heroic act.

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CRIMINAL LAW ENVIRONMENTAL PROTECTION IN THE EUROPEAN UNION AND SERBIA IN THE LIGHT OF CHAPTER 27

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Abstract: Although environmental protection was only part of the European Union policy in the early seventies, it quickly became one of its most comprehensive and dynamic activities. In the first period of development of EU environmental law, environmental degradation was sanctioned by measures of administrative and civil law. Criminal protection only occurs later in response to the expansion of ecological crime, which poses a serious threat to the survival of the human species. Accordingly, in the paper, apart from the Council of Europe's Convention on the Protection of Environment through Criminal Law is also analyzed in detail the Directive 2008/99/European Community on the Protection of the Environment through Criminal Law. In the second part of the paper, the authors focus on the criminal law protection of the environment in Serbia, as well as on key legislative, institutional, economic and other challenges in the process of assuming obligations under Chapter 27 – Environment and Climate Change, and hence faster accession to the EU.

Key words: environment; criminal law protection; EU; Directive 2008/99/EC; Chapter 27; Serbia.

INTRODUCTORY CONSIDERATIONS

At the time of the establishment of the European Coal and Steel Community (Treaty signed in Paris on 18 April 1951, came into force on 23 July 1952) and the European Economic Community - EEC (Treaty signed in Rome on 25 March 1957, came into force on 1 January 1958), due attention was not paid to the protection of the environment, so that all activities in this field took place on the national level. However, raising awareness of the global consequences of

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environmental destruction, perceived environmental legitimacy and the need to align human behaviour with them, as early as at the beginning of the seventies, unambiguously indicated the need to overcome such a situation. Accordingly, the Single European Act (Treaty signed in February 1986, came into force on July 1987) defined the role of the Community in the protection of the environment and normative rules of protection were standardized. The established contractual basis for the introduction of environmental protection policy at the Community level was gradually expanded and improved through successive contracts. The Maastricht Treaty, i.e. The Treaty on European Union - EU (Treaty signed on 7 February 1992, came into force on 1 November 1993) specifies that the task of the Community is to encourage a harmonious and balanced development of economic activities, sustainable and non-inflationary growth, taking into account environmental protection. The Treaty of Amsterdam (the Treaty signed on 2 October 1997, came into force on 1 May 1999), as the Community's objectives, provides a harmonious, balanced and sustainable economic development and the promotion of a high level of protection and improvement of the quality of the environment. The Lisbon Treaty - Treaty on the Functioning of the EU (Treaty signed on 13 December 2007, came into force on 1 December 2009), whose Chapter XX (Articles 191-193) is dedicated to the environment, has special significance for the development of EU environmental law. According to Article 191, paragraph 4, EU objectives in this area are: preserving, protecting and improving the quality of the environment; protection of human health; cautious and rational use of natural resources; promoting a global plan of measures to deal with regional and planetary environmental problems, as well as the fight against climate change. Although summarized, an overview of the most important primary sources indicates that the EU environmental law during this previous development sustained upward trajectory, which has significantly contributed to environmental protection in the EU and to the fight against climate change in which the EU is becoming a global leader.

At the earliest stages of the development of EU environmental law, the environment was protected by regulations adopted in the area of civil and administrative law, aimed at providing adequate compensation in cases of pollution, as well as the introduction of an initial regulatory scheme in order to avoid damage and enabling the protection of public health (Lukić, 2011: 238). However, accelerated scientific and technological development, more intensive use of nuclear energy sources, the construction of industrial capacities that often use "dirty" technologies, excessive exploitation of natural resources and uncontrolled urbanization have resulted in the true expansion of ecological crime that poses a serious threat to the survival of the human species. The main features of environmental crimes - above all, more dangerous forms of their manifestation, the fact that the environmental damage has effects beyond the borders of the country where the offense was committed, a significant profit for the perpetrators, minimal risk of detection and prosecution (extremely high "dark figure"), transnational character and connection with organized crime (Kostić, 2009: 175; Bjelajac, Dašić & Spaso-

vić, 2011: 574) - unequivocally point to the necessity of criminal law protection of the environment. A criminal law reaction is qualitatively different in nature in relation to administrative sanctions or a compensation mechanism of civil law. In this way, a stronger signal is sent, with a significantly greater effect of deterrence to potential perpetrators. For example, administrative or other financial sanctions do not have a disincentive effect if the offenders are free or financially powerful. Also, there is an additional guarantee of the impartiality of investigative authorities, since other authorities may be involved in the investigation, and not the same administration authorities that issued permits for the use or allowed pollution to the permitted level (Ibidem: 244-245).

In response to the geometric progression of environmental crimes, on 19 November 2008 the EU adopted the Directive 2008/99/European Community (EC) on the Protection of the Environment through Criminal Law, which established the foundations of European ecological criminal law. Before the detailed analysis of the Directive, we will look at the most important aspects of the Council of Europe's (CoE) Convention on the Protection of Environment through Criminal Law (opened for signature on 4 November 4 1988 in Strasbourg), the aims of which are covered by the Directive.

CONVENTION ON THE PROTECTION OF ENVIRONMENT THROUGH CRIMINAL LAW

Environmental crime is a serious and widespread problem at a global level. Accordingly, in addition to establishing civil and administrative liability for damage caused, in certain situations it is also necessary to apply criminal law protection as an *ultima ratio* in order to suppress behaviour most dangerous to the environment. The first attempt to establish a comprehensive environmental protection through criminal law at the international level is related to the Convention on the Protection of Environment through Criminal Law. The Convention (systematised in four sections with a total of 21 articles) was signed by 13 member states of the CoE and was ratified only by Estonia. In order to enter into force, it is necessary to deposit at least three signatures on the ratification of the member states.

The basic objectives of the Convention, as proclaimed in its Preamble, are: the need to conduct a common criminal policy for the protection of the environment; the requirement that the life and health of humans, flora and fauna, as well as other natural resources, be protected by all available means, including the criminal justice response; the need to contain the uncontrolled use of technology and excessive exploitation of natural resources, which pose a serious threat to the environment, to measures coordinated between SE member states; the necessity to treat violating the principles of environmental protection as a criminal offense subject to appropriate sanctions; encouraging international cooperation for the more efficient prosecution and punishment of perpetrators of environmental of-

fenses, as well as the introduction of criminal or administrative sanctions against legal entities for endangering the environment.

The Convention requires Member States to nationally standardize new crimes against the environment defined in the Convention, provide for clear sanctions in the event of intentional or negligent execution, as well as to criminalize incitement to commit, or aiding in the commission of these offenses. Depending on the severity of the criminal offense against the environment, imprisonment and fines may be imposed, as well as the measure of compulsory return of the environment to the situation in which they were before committing the crime. Also, the Convention establishes jurisdiction of national courts, norms the possibility for environmental organizations to be involved in criminal proceedings for acts against the environment, lay down the principles of liability of legal persons, principles of coordination, international cooperation, etc. It is undoubtedly that the innovative solutions contained in the Convention represent the first attempt to establish a unified and comprehensive environmental protection law on the European continent and a completely different approach to the liability of natural and legal persons for criminal and other punishable offenses in this field. Although it has not yet came into force, the Convention has served as an inspiration and a good starting point for Directive 2008/99/EC on the Protection of the Environment through Criminal Law.

DIRECTIVE 2008/99/EC ON THE PROTECTION OF THE ENVIRONMENT THROUGH CRIMINAL LAW

The most important source of environmental protection through criminal law in the EU is Directive 2008/99/EC (19 November 2008), which, as we already pointed out, is starting from the objectives proclaimed in the Convention on Criminal Law Protection. The Directive (made up of 12 articles and Annexes A and B) was adopted in response to EU member states' enormous increase in the number of ecological crimes and their consequences that are increasingly beyond the borders of the country in which they were carried out (Drenovak-Ivanović, Djordjević & Važić, 2015: 62). The previous Directives had a limited range, i.e. by their content did not address the issue of criminal acts and environmental damage. In other words, the system of sanctions that existed before the adoption of the Directive did not ensure full compliance with the environmental law. Such respect, as stated in the Preamble to the Directive, could have been strengthened by the existence of criminal sanctions which show a social conviction of a qualitatively different nature compared to administrative sanctions or remuneration mechanisms within civil law.

Directive 2008/99/EC provides for minimum substantive standards which must be incorporated into the national criminal legislation of the Member States, without prejudice to the matter of the procedural criminal law. Annexes A and B contain a list of already adopted EU legislation, the violation of which constitutes

unlawful conduct under the Directive, and which should be the subject of criminal-law protection at Member State level. Illegal behaviour is also a violation of the laws or decisions of the authorities of a Member State that have been adopted for the purpose of applying the legislation set out in Annexes A and B.

In accordance with the Directive, Member States have an obligation to ensure that certain acts are deemed to be a criminal offense, if they have been committed (or have been enforced incited or assisted) by unlawful and intentional, possibly consciously negligent. Those are:

(a) the discharge, emission or introduction of a quantity of materials or ionising radiation into air, soil or water, which causes or is likely to cause death or serious injury to any person or substantial damage to the quality of air, the quality of soil or the quality of water, or to animals or plants;

(b) the collection, transport, recovery or disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including action taken as a dealer or a broker (waste management), which causes or is likely to cause death or serious injury to any person or substantial damage to the quality of air, the quality of soil or the quality of water, or to animals or plants;

(c) the shipment of waste, where this activity falls within the scope of Article 2(35) of Regulation (EC) No 1013/2006 on shipments of waste and is undertaken in a non-negligible quantity, whether executed in a single shipment or in several shipments which appear to be linked;

(d) the operation of a plant in which a dangerous activity is carried out or in which dangerous substances or preparations are stored or used and which, outside the plant, causes or is likely to cause death or serious injury to any person or substantial damage to the quality of air, the quality of soil or the quality of water, or to animals or plants;

(e) the production, processing, handling, use, holding, storage, transport, import, export or disposal of nuclear materials or other hazardous radioactive substances which causes or is likely to cause death or serious injury to any person or substantial damage to the quality of air, the quality of soil or the quality of water, or to animals or plants;

(f) the killing, destruction, possession or taking of specimens of protected wild fauna or flora species, except for cases where the conduct concerns a negligible quantity of such specimens and has a negligible impact on the conservation status of the species;

(g) trading in specimens of protected wild fauna or flora species or parts or derivatives thereof, except for cases where the conduct concerns a negligible quantity of such specimens and has a negligible impact on the conservation status of the species;

(h) any conduct which causes the significant deterioration of a habitat within a protected site;

(i) the production, importation, exportation, placing on the market or use of ozone-depleting substances.

Under the Directive, Member States are obliged to take the necessary measures to ensure that perpetrators of these offenses are punished with effective, proportionate and dissuasive criminal penalties.

The Directive also introduces the liability of legal entities for the criminal offenses that exist if the offense was committed by any person holding a leading position in a legal entity, regardless of whether it operated on its own or on behalf of a legal entity and the offense was committed for the benefit of a legal entity. A legal entity shall be any legal entity that, in accordance with national law, has the status of a legal person, other than the bodies that perform the functions of state authorities and bodies of international organizations. Otherwise, the liability of a legal entity does not exclude criminal proceedings against natural persons who have committed or instigated the commission of environmental offenses. As in the case of natural persons, Member States are obliged to take the necessary measures to ensure that responsible legal persons are punished with effective, proportionate and dissuasive penalties.

CRIMINAL LAW ENVIRONMENTAL PROTECTION IN SERBIA AND CHAPTER 27

Starting from the modern tendencies in the science of criminal law and comparative legal solutions, our Criminal Code (Criminal Code - CC, Official Gazette RS, 85/05, 88/05 - corr., 107/05 - corr., 111/09, 121/12, 104/13, 108/14 and 94/16) provides for criminal offenses against the environment within a special head. In Chapter XXIV, besides new criminal offenses and those from the secondary criminal legislation, some existing criminal offenses that were in the head of criminal offenses against the economy were - forest theft, illegal hunting and illegal fishing (Stojanović, 2006: 599). A protective object for environmental offenses is the right of a man to a healthy and preserved environment. The culpable environmental protection in our country rests on a biocentric concept, which treats the environment as a protected good per se, in contrast to the older and today transposed anthropocentric conceptions that defined the environment as a resource in the function of satisfying human needs (Lilić & Drenovak-Ivanović, 2014: 52). Otherwise, the right to a healthy environment, as well as the right to timely and complete notification of its condition, is guaranteed by Article 74, paragraph 1 of the Constitution of the Republic of Serbia (Constitution of the Republic of Serbia, Official Gazette RS, 98/06).

Starting from the CC and other laws, these offenses are usually divided into:

(a) general environmental offenses - environmental pollution (Article 260), non-implementation of environmental measures (Article 261), unlawful construction and putting into operation of facilities and installations that pollute the environment (Article 262), damage to facilities and devices for environmental protection (Article 263), environmental damage (Article 264), destruction, damage, removal abroad and the entry into Serbia of a protected natural property

(265) and violation of the right to information on the state of the environment (268);

(b) criminal acts related to hazardous substances, introduction of dangerous substances into Serbia, and unauthorized processing, disposal and storage of dangerous substances (Article 266) and unauthorized construction of nuclear installations (Article 267);

(c) offenses against plant and animal life - killing and abuse of animals (Article 269), transfer of contagious diseases to animals and plants (Article 270), negligent provision of veterinary assistance (Article 271), production of harmful means for the treatment of animals (Article 272), pollution of food and water for feeding or feeding of animals (Article 273), destruction of forests (Article 274) and forest theft (Article 275);

(d) offenses of illegal hunting and fishing - illegal hunting (Article 276) and illegal fishing (Article 277).

At this point, it should be noted that the negotiations on Serbia's accession to the EU started in the sixth year, but that Chapter 27 - Environment and Climate Change, despite numerous announcements, is still not open. Experience shows that the negotiating process regarding Chapter 27 is the most demanding because of its size and significant backlog of candidate countries in terms of environmental standards in relation to the EU. It has about one third of all EU acquisitions. The European Environmental Agency (EEA) estimates that close to 90% of national environmental legislation directly stems from over 500 secondary sources of EU environmental law (directives, regulations, decisions, recommendations and opinions) adopted by the European Commission, the European Parliament and the Council EU (Halpern, 2014: 215). The importance of the issue to which Chapter 27 applies is also confirmed by the fact that 20% of the procedures initiated by the European Commission before the European Court of Justice against Member States concern non-compliance with environmental regulations (Delivet, 2013: 227).

The EU expects Serbia to provide guarantees regarding the deadline and the way in which the full transfer, implementation and effective implementation of EU acquis in this area, and also Directive 2008/99/EC, will be ensured. Accordingly, in the working version of the negotiating position for the intergovernmental conference on the accession of the Republic of Serbia to the European Union for the negotiation chapter 27 - Environment and Climate Change, in the part referring to the Directive 2008/99/EC, points to the following:

(a) The Directive has been partly transposed into the Criminal Code, the Law on the Liability of Legal Persons for Criminal Offenses (Law on the Liability of Legal Persons for Criminal Offenses - LLPCO, Official Gazette RS, 97/08) and the Law on Nature Protection (Law on Nature Protection, Official Gazette RS, 36/09 and 88/10);

(b) The Ministry of Justice is the leading responsible institution for the harmonization of national legislation with the Directive. The Normative Affairs Di-

vision is responsible for monitoring the EU requirements and harmonizing domestic legal acts within the competence of the Ministry with EU acts. One person is in charge of the Directive;

(c) The competent courts, the Public Prosecutor's Office and the Directorate for Inspection Affairs shall be responsible for the implementation. Criminal reports of criminal offenses may be filed by any person or inspection service to the competent public prosecutor's office, which is authorized to prosecute ex officio. Courts of general jurisdiction are competent to conduct criminal proceedings in relation to criminal offenses against the environment;

(d) Legal persons may also be prosecuted for criminal offenses, including criminal offenses against the environment. LLPCO stipulates that a legal person is liable for criminal offenses committed in favour of a legal person by a responsible person or for acts arising out of the lack of supervision or control by a responsible person who allowed the commission of a criminal offense in favour of a legal entity by a natural person which operates under the supervision and control of the responsible person. Criminal liability and sanctions for legal entities do not call into question the criminal liability of the responsible person;

(e) Public prosecutors and courts shall be responsible for the implementation of the provisions of the CC. These bodies also carry out systematic collection and analysis of statistical data on criminal prosecution and court proceedings for each environmental offense;

(f) A complete transposition will be achieved in 2020 through amendments to the CC. Amendments will transfer other offenses referred to in Article 3 of the Directive which are not currently covered by the CC, and will be in accordance with the Istanbul Convention and the Directive;

(g) Capacity building for environmental authorities responsible for enforcement of environmental legislation will be continued in order to provide for more effective implementation of judicial and administrative procedures related to environmental crimes. Institutional strengthening measures are foreseen in the National Judicial Reform Strategy for the period from 2013-2018 (National Judicial Reform Strategy for the period from 2013-2018, Official Gazette RS, 57/13). The Government of the Republic of Serbia adopted the National Judicial Reform Strategy 2013-2018 aimed at providing that the judicial system, with the effective management and use of judicial resources, management of the trial and cases within reasonable time, applying legally prescribed procedure and respecting the human and minority rights and freedoms guaranteed both by national and international regulations. The National Judicial Reform Strategy is supported by the Action Plan. One of the main goals of this strategy is to increase the quality of work of courts and public prosecutor offices and strengthen the independence and accountability of judiciary, aimed at strengthening of the rule of law, democracy, legal certainty, bringing the justice closer to citizens and regaining the public trust in the judicial system. The abovementioned changes will enable more effi-

cient implementation of regulations and the Directive 2008/99/EC in the cases involving environmental protection;

(h) The implementation of the requirements of the Directive relates to the further transposition of its provisions and the efficiency of the work of the courts, public prosecutor's offices and relevant inspection services. Therefore, amendments to some of the existing criminal offenses provided for in the provisions of Articles 260-277 will be amended CC. The training of representatives of the judicial system in charge of the implementation of criminal law will continue.

Exposed data on the current situation and plans for harmonizing the legislative and institutional framework with EU acquis in this area indicates that the complete transposition, implementation and effective enforcement of Directive 2008/99/EC are an extremely complex process, burdened with numerous problems. As a binding legal instrument of the EU and an extremely important segment of Chapter 27, the Directive defines the results to be achieved in the field of criminal justice protection of the environment, putting our country ahead of legislative, institutional, economic and other challenges that require an adequate and thought-out response. Undoubtedly, the Directive represents a good basis for the establishment of criminal law protection of the environment, but its ultimate reach depends on the quality of implementation and realization of defined standards, as well as the development of ecological awareness.

CONCLUSION

The environment is primarily protected by civil and administrative law, but the expansion of environmental crimes has required the need for criminal-law protection of the environment. Therefore, in addition to establishing civil and legal liability for damage caused, in certain situations, it is also necessary to apply criminal law protection as an *ultima ratio*, in order to suppress behaviour most dangerous to the environment. In other words, criminal law protection is taken into account when certain environmental values cannot be protected against threats in any other way.

The autonomous ecological jurisdiction of the EEC, established at the beginning of the seventies of the 20th century, resulted in Directive 2008/99/EC on the Protection of the Environment through Criminal Law, which starts from the objectives proclaimed in the Convention on the Protection of the Environment through Criminal Law. The Directive, as we pointed out in its analysis, establishes the foundations of European ecological criminal law. As a part of the EU accession negotiations, Serbia will be opening the Chapter 27 - Environment and Climate Change, which important segment is Directive 2008/99/EC. The Directive defines the results to be achieved in the field of criminal justice protection of the environment, putting our country ahead of legislative, institutional, economic and other challenges. Undoubtedly, the Directive represents a good basis for the establishment of criminal law protection of the environment, but its ultimate

reach depends on the quality of implementation and realization of defined standards, as well as the development of ecological awareness.

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OPERATIONAL RISK MANAGEMENT IN BANKING AND BUSINESS FORENSICS

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Abstract: In everyday business, banks are exposed to a large number of risks. A special type of banking risk is an operational risk, which due to its form is present in every business activity of the bank. Operational risk represents the risk of loss in the course of business operations, which arise due to inadequate procedures and failed internal processes, human factors, systemic or external events. This is the risk with which scams are most often connected and which tend to develop and take on new forms. Scams not only jeopardize the performance of one bank in terms of its financial status, but significantly affect its reputation. In this paper we discuss the management of operational risk in banking with emphasis on the importance of forensic methods in detecting fraud. The aim of the paper is to point out through the basic theoretical settings and examples from modern banking practice the potential of forensic business in terms of reducing the risk of fraud.

Keywords: banks, operational risk, fraud, business forensics. Introduction

INTRODUCTION

Banking risk represents any uncertain situation in banks' operations, or the likelihood of loss (reduction of profits) arising from the effects of uncertain events in the operations of banks. Of all possible types of risks that threaten financial institutions, operational risk is the most dangerous and it is most difficult to predict. Unlike other risks (market, credit) that are typically a characteristic of individual business lines, operational risks are present in all business processes of banking.

Operational risk management is a key component in financial management and risk that affects net income, capital management and customer satisfaction. It also allows anticipating adverse circumstances or events that could hinder the

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attainment of the objectives of the institution and direct control procedures and limited resources to key areas of activity and related risks. If the risk is controlled under strict control, even though it is managed properly, resources and capital are released and an opportunity to generate income is created. There is no doubt that management operational risk is becoming increasingly important in financial institutions. Therefore, banks are increasingly specialized in its application. In the banking sector, this is a new area of governance, full of challenges.

Business forensics is the field of forensics which implies the application of knowledge and methods in the fight against business fraud of all kinds and against corruption, includes the investigation, the detection and proofing of not only fraud that is directly visible in accounting, but also those in which there was a violation of the legal norms of some companies such as fraud in business contracts, fraud and deception of customers, consumers and suppliers, evasion of taxes, fraud in the quality of products and services, various types of embezzlement, bribery and money laundering. Business forensics is a general term used to describe any economic investigation, which outcome can later lead to legal or other consequences. It also includes forensic accounting, but is often used to highlight the part of forensics that is not included in forensic accounting in the narrow sense.

DEFINITION, CATEGORIZATION AND IMPORTANCE OF OPERATIONAL RISK

The risk can be defined as the probability that an unfavorable event will occur, which will negatively affect the business (fulfillment of objectives) (Fabris, 2006). The existence of a risk is conditional on a minimum of two possible outcomes. On the one hand, there is a possibility of making a loss, while on the other hand, the gain may be lower than expected. Considering the fact that there is always a risk in the operations of banks, risk management is an integral part of the bank's business policy. This is a discipline of a recent date and can be defined as the function of a bank for risk insurance (The Law on Banks, The Official Gazette of the Republic of Serbia, Nos. 107/2005, 91/2010 and 14/2015).

The bank is obliged to identify, measure and evaluate the risks to which it is exposed in its operations and to manage those risks in accordance with the Banking Law, other regulations and acts. The bank is obliged to establish a comprehensive and reliable system of risk management, which is included in all business activities and which ensures that the risk profile of the bank always complies with the already established risk aversion.

The key risks faced by banks are: credit risk, country risk and transfer risk, market risk, interest rate risk, liquidity risk, currency risk, legal risk and reputation risk, and operational risk (Vunjak, Kovačević, 2006).

Operational risk represents the risk of losses arising from inadequate procedures and failed internal processes, human factors, systemic or external events. This definition of operational risk is embedded in the New Capital Adequacy Framework - Basel II and is the result of a longer debate between regulators and industry from multiple jurisdictions on the scope of the concept of operational risks (Bank for International Settlements, 2009). Although the Basel Committee for Banking Supervision published its definition of operational risk, it left the national regulators and central banks the ability to set their own operational risk definition. Thus, the National Bank of Serbia shaped its understanding of operational risk in the following way: "Operational risk is the possibility of adverse effects on the financial result and capital of the bank due to omissions in the work of employees, inadequate internal procedures and processes, inadequate management of information and other systems in the bank, as well as due to unpredictable external events. "Such a definition includes the legal risk that constitutes the possibility of loss due to penalties and sanctions arising from litigation arising from failure to comply with enforcement and legal obligations, as well as due to sanctions imposed by the regulatory body, excluding the reputation risk that presents the possibility of losses due to the negative impact on the market positioning of the bank, and excludes the strategic risk that represents the possibility of loss due to the lack of a long-term development component in the management and management team banks (Dragosavac, 2012).

One of the definitions of operational risk states that operational risk is a risk that arises from errors or unforeseen events that occurred during the performance of business activities of companies. Sources of this risk can be very wide: fraud, legal risks, environment, terrorist attacks, etc.

Since the definition of operational risk is very broad, it is necessary to categorize events and link them to all relevant information. According to the definition of operational risk, there are four main causes of operational risk events (Milenković, 2011).:

1. People (employees) - within this category are assigned losses caused by employees (fraudulent actions, unauthorized actions, unauthorized approvals, losses due to poor employee behavior and losses in transactional proceedings). This category also includes losses resulting from non-compliance with the Labor Law, internal procedures and acts (litigation with employees).

2. Processes - this category includes losses caused by unintentional errors and omissions in the work of employees, negligence or inadequate business practices.

3. System - within this category, losses are incurred due to errors or defects in software, hardware, system of technology (due to system development and servicing), system overruns for system development and other technologies (misuse of technical infrastructure of the bank). This category includes all the losses that reflect the bank's dependence on technology.

4. External events - this category includes losses arising from events caused by external factors that the bank cannot influence (natural disasters, changes in

political and economic conditions, legislation, public activities or the work of business partners, clients).

In accordance with the regulations of the National Bank of Serbia, and according to Basel II principles, events or sources of operational risk are divided into seven basic categories:

- Internal frauds are losses due to intentional activities or omissions involving at least one person working for a bank or a bank. It is important that there is an "intention" to gain personal gain. Subcategories are: unauthorized activities, theft and fraud, and internal security system.

- External frauds are losses due to deliberate actions committed by third parties, where there is a prevailing intentional and malicious concept, and therefore involve fraud and misappropriation procedures, or avoidance of laws and regulations, regulations and policies of the bank. Subcategories are: theft and fraud, the external security system and other deliberate activities.

- Failure in relation to employees and in the occupational safety system are losses due to the non-enforcement of labor laws and other regulations related to work, employment, health and social and workplace safety. Subcategories are: relationships with employees, workplace safety, diversity and discrimination.

- Problems with customer relationships, product placement and business practice are the losses resulting from deliberate or unintentional omissions in meeting professional obligations towards clients or due to the nature or construction of the product. Subcategories are: convenience, transparency and confidentiality, inadequate business or market practices, product and service defects, selection, sponsorship and client exposure, advisory activities and accidents, and general safety.

- Damages on physical assets are damage to fixed assets due to natural disasters and other events. Subcategories are: natural disasters, human factor catastrophes, political and legal risks.

- Business overdue and system failures are losses due to the inaccessibility and inefficiency of IT systems and providers of utility and information services, and losses due to poor functioning of hardware and software, structural inadequacy, telecommunications deficiencies, etc. Subcategories are: inadequacy, inefficiency, poor performance or system crashes, and unavailability of providers.

- Execution of transactions, delivery and process management are losses due to unintentional errors associated with processes and/or management support. Relations with business partners, customers and suppliers are also included. Subcategories are: process management, transaction engagement and execution, monitoring and reporting, customer acceptance and documentation adequacy, customer account management, business partners, and sellers and suppliers.

Due to its form, operational risk is present in every business activity of the bank and as such occurs in every business unit of the bank, which implies certain assumptions that must be fulfilled to ensure efficient management of

operational risk. First, it is necessary to provide a precise definition of the function of managing operational risk in terms of clearly defined roles and responsibilities of all participants in the process. Secondly, an adequate organizational structure in the bank should be provided in terms of operational risk management. Thirdly, a precise and comprehensive framework for managing operational risk should be established.

Bearing in mind its nature, operational risk management must be seen as a process consisting of two key components (Chorafas, 2004).:

- A proactive approach - which allows proper insight on all business lines, a sufficient level of economic capital and the required level of education and communication of employees;

- Phase structure of decision-making - which enables adequate coverage of the process, since it links the realization of the goals defined by the bank strategy with the day-to-day decisions in operations and operational risk management, at all levels of the management structure.

Risk management is not an end in itself, but a key tool that helps the management to realize corporate goals. The objectives of operational risk management are:

- prevention from a potential event that manifests operational risk,

- mitigate the effects that have arisen within the operational risk and reduce its impact,

- adequate control of the damage incurred in case of manifestation of an operational event (Dragosavac, 2012).

Thus, this process seeks to avoid insolvency of the bank as well as to maximize the rate of return on capital with correction for risk.

FRAUD RISK MANAGEMENT

Fraud involves a wide array of manifest forms of irregularities and illegal acts that are characterized by deliberate misrepresentation or misrepresentation, which are carried out with the aim of achieving unlawful benefits for an individual or organization, where the fraudster may be outside or within the organization. The term fraud is used to describe actions such as deception, forgery, extortion, corruption, theft, misappropriation, unlawful appropriation, giving inaccurate information, hiding material facts, false representation, confusion, etc., resulting in property benefits for the perpetrator, organization or the other at the expense of the organization, individuals, communities, etc.

Fraud is just one of the many risks the bank faces. The frequency and diversity of fraud as well as the fraudulent losses have increased significantly in the last decades, especially due to the greater interaction of all market participants, globalization and the application of modern technology in business. In all processes involving a human factor, a certain degree of risk of fraudulent actions is exposed

organizations. Of the following factors, the degree of exposure to the risk of criminal activity depends on:

- the inherent risk of a fraudulent behavior inherent to the business itself;
- measures in which effective internal controls are available to prevent or detect fraud;
- the honesty and integrity of the persons involved in the process (Singleton, Singleton, Bologna, Lindquist, 2010).

The goal of fraud management is to reduce the likelihood of potential fraudulent activity and their negative impact. The activities undertaken by the organization to reduce or mitigate risks are control activities. The purpose of risk mitigation is to enable the continuation of risk-taking activities, while taking measures (controls) to maintain risk at an acceptable level. Control activities are based on written rules and principles, procedures and other measures that are set up to achieve the goals of the organization by reducing risk.

The conditions for fraud should be reduced to the minimum. The fraud is like "virus" - which slowly, seamlessly penetrates into the body and infects it. Symptoms may include high temperature, headache, drowsiness, etc. Some are recovering after taking antipyretics or antibiotics while for some organisms the consequences are fatal. The virus is being adapted, new forms appear, and new problems persist. It should be pointed out that the virus is activated and comes to the fore when it comes to the smallest opportunity (weakened or decreased immune system). Similarly, fraudsters use every weakness, failure in the organization's protection system. Thus, the cure for this problem is effective internal control, adequate management support and fraud prevention procedures. Antipyretics and antibiotics can be effectively used as a preventive or for treatment. Similarly, the anti-fraud procedure and business forensics, which would be hired as needed, should also have a preventive and corrective aspect. No organizational part is excluded from the risk of fraud, it is worn by all employees at all levels of management from top to bottom and vice versa.

FRAUD RISK ASSESSMENT

The fraud risk assessment is a process aimed at proactively identifying and locating organization's vulnerability to internal and external fraud. For each organization, the process of assessing the risk of fraud is often more art than science. What is gained by the assessment and how to adapt the assessment to the organization? The risks of fraud are constantly changing. This is why it is important to understand that the fraud risk assessment is a continuous, dynamic process (Association of Certified Fraud Examiners – ACFE, 2018).

In general terms, the goal of fraud risk assessment is to help the organization identify what makes it most vulnerable. Through an assessment of the risk of fraud, the organization is able to identify the place, business activity where it will

likely become scam, allowing for the application of proactive measures, in order to reduce the chance that this can happen.

Each organization should conduct a fraud risk assessment. Evaluating the risk of fraud can be a great tool for the organization to start communication and raise employee awareness. Employees are reminded that the organization is concerned with preventing fraud and that there are certain sectors, services within the organization, authorized to declare if they suspect that a fraud has taken place. Open communication and awareness of fraud can deter potential cheaters by increasing their perception that there are professional services that can identify their activities and report them.

Fraud triangle containing three basic elements:

- pressure/motive/need,
- opportunity/opportunity,
- justifying attitude/rationalization.

The fraud risk assessment is the starting point in fight against all types of criminal acts and misconduct in business. Scam researchers, auditors, need to understand criminal schemes, be cautious about indicators that point to criminal action and ways to prevent criminal activity. A key factor in committing fraud is an opportunity. Existence is a situation that management can directly cite while pressure and attitude are human factors that often go beyond the direct impact of the organization. Occasions often trigger features or policies that make misconduct possible or reduce the likelihood that fraud will be detected or punished. Fraud opportunities can be classified either as personally created or organically created. Personally created opportunities happen when there are weak controls, and employees know very well the jobs they perform and believe they can conceal their scam. An employee is often in a position to be trusted when work independently and are closely with suppliers and other key people. Organized opportunities arise from the lack of administrative, business control, processing control and document control. These conditions are characterized by a rapid change of key employees, inadequate employee rehearsal policies, dominant top management, the state of constant crises, internal relations, low morale, and the absence of policies and procedures.

It is extremely important to notice the main cause of fraud in the organization. This makes it easier to assess the risk of fraud, and provide adequate corrective and future protection procedures. In many cases, professional investigators are required for testing or other factors. Maybe it's necessary to talk to lawyers. When deciding who will take part in the investigation, it is necessary to carefully define the role of internal audit in terms of assistance to the investigation and the preparation of the report. When fraud is discovered, a complete investigation must follow. Investigation into fraud is done in order to recover the lost amount of money, to release or punish the perpetrators, to prevent its repetition, and innocent peo-

ple to free suspicions. Fraud investigations must provide proof of loss, dishonesty and allow preparation for a criminal complaint.

BANKING CHANNELS AND MONEY LAUNDERING - EXPLANATORY FORMS WITH EXAMPLES

Banks are particularly vulnerable to fraud, and this is regardless of their size. Since fraud is most often associated with operational risk, banks must account for this risk. Banks rarely emphasize the risks of fraud, although they are exposed to more than other organizations and institutions. In practice, fraud cases are rarely communicated in public because most financial institutions want to avoid negative publicity. This reduces the prospect of prosecution and makes it difficult to deter future fraudsters. However, the big losses of banks that appeared in many financial scandals of the bank were the cause of the collapse of not a small number of banks.

The global financial system has been significantly shaken by numerous banking scandals over the last two decades, largely due to the fact that the risks faced by banks (primarily internationally active banks) have become more challenging and more complex. Large-scale operational losses during the aforementioned period have led to a bankruptcy, a merger, or a significant drop in the price of capital of many world-renowned and recognized financial institutions (Bering Bank declared bankruptcy, in 2008 due to a huge loss resulting from fraud, Societe Generale Bank reported a loss in in the amount of € 4.9 billion (about $ 7.2 billion) as a direct result of unauthorized transactions made by only one employee - a low-level broker, the Riječka banka outburst that erupted in 2002 went missing about € 75 million and through unauthorized transactions). At the end of 2017, there were bankruptcies and liquidations for 24 banks in Serbia. Part of the property was offered by the Deposit Insurance Agency, Privredna Banka Beograd, Agrobanka, Investbanka, Jugobanka, Razvojna Banka Vojvodine, Kosovska Banka, as well as many others (Čudan, Nikoloska, 2018).

Typical examples of fraud involving banks are related to the money, fraudulent crediting, covering debts owed to unauthorized transactions, that is, collecting bills, taking money and writing off; collection of written-off accounts and non-declassification; and deliberately creating a confusion in posting to hide the trail of funds for transfers transferred to the importer's account, failure to comply with procedures and internal procedures, etc. (Stanišić, 2014).

Banks and other financial institutions are the most vulnerable because they do business with money, and are also exposed to the high risk of fraud in various ways. These scams can be made by insiders, i.e. bank employees and managers, or by external scams, whether it's physical or legal persons (often in conjunction with insiders), and lately more and more frauds are spread over the information systems. There are more elaborate classic "schemes". Another danger is the general

misuse of the financial system and financial intermediaries, where banks are most exposed, for "money laundering", which comes from various illegal activities.

Nevertheless, since banking operations are regulated by a positive law in which banks are founded and operated, it represents suitable grounds for various misconduct related to money laundering. Money laundering is still at the center of the attention of the financial and banking sector, because it is precisely in this sector that the occurrence of money laundering is likely to occur five times higher than in other sectors of the economy. The banking sector is used extensively to hide money that is illegally due to the evasion of taxes, corruption, economic crime and other criminal activities, with the aim of including these funds through legal money flows through money laundering. On this path, the funds thus obtained must go through a bank account. The tendency is, therefore, that nothing is left to the case and that the traces are successfully masked, especially in the international business, using the banking sector, so financial experts, lawyers and accountants who devise complex transactions are hired, which effectively hides traces and illegal origin of money (Radojčić, 2013:368).

Typical cases of money laundering are:

1. Placement - deposits at the client's account; purchase of various forms of payment instruments; investing in jobs where the most cash is used as a cover for depositing dirty money into banks; changing banknotes of smaller denominations into banknotes of larger denominations.

2. Layering (concealment) - transfer of money abroad or cash deposited in international banking systems.

3. Integration - early repayment of loans, payment of counterfeit bills; a complex network of international transactions that makes tracking the original source of funds impossible.

In banking operations in Serbia in the past period, numerous abuses in the field of credit policy were observed: the placement of dinar loans to some companies with inadequate guarantees, non-verification of the creditworthiness of the beneficial loan, non-mortgaging of their mortgages, or non-taking of loan security measures. On the other hand, as a guarantee for repayment of loans, some banks accepted bills that were impractical due to insolvency or opening of bankruptcy proceedings. Loans are redeemed based on false documentation. Beneficiaries made false use of received funds with falsified accounts and other relevant documentation, especially for the purposes for which the loan was granted.

The following text will show cases of fraud, misuse, forgery and other incriminated actions in banks, which represent classical examples of operational risk due to fraudulent actions and omissions in the work of employees, inadequate internal procedures and processes, as well as disregard for them, etc. resulted in great damage / loss for banks and other institutions, and the property benefit for the perpetrators of fraudulent actions:

According to indictments for abuse of office in Metals bank and the Development Bank of Vojvodina, which has been in bankruptcy for more than a decade, twelve persons responded. This is a malware indictment with thirty-nine loans, worth about 1.6 billion dinars, which are granted to companies associated with the bank. There are now six former managers of the bank who are accused, as well as one director of a private company.

The Prosecutor's Office for Organized Crime filed an indictment for seven persons, including the Chairman of the Credit Committee of Privredna Banka Beograd, the members of the Credit Committee, the Deputy Credit Committee member of the aforementioned bank and the financial director of the domestic company. According to the allegations of the criminal charges, the suspects are charged with obtaining unlawful property benefits from the domestic company as responsible persons of Privredna Banka Beograd by unlawful reprisal of ten loans. Given that the loans were not returned to Privredna Banka Beograd, it was damaged by about fifteen million euros and about 60 million dinars. During the realization of the credit placement, the bank did not possess adequate security means, uneconomic bills were used as cover (Čudan, Nikoloska, 2018).

In May 2008, the cashier of the Raiffeisen Bank in Kragujevac, who was aware of the lack of internal procedures, unlawfully withdrew from the bank's account of 1.1 million euros. The money, which the cashier unlawfully lifted from the account, had to return it to the bank (Barjaktarović, 2013).

Police officers in Belgrade arrested a bank employee because of the suspicion that, as a liquidator of the bank, he made counterfeit payment orders for vehicle registration, which he filled in with data on vehicles and owners and authenticated by the seal of the bank and his initials. It is suspected that in the period from the beginning of 2014 until the end of 2016, he had forged a payment for 511 registration of motor vehicles and obtained a material benefit in the amount of about 3,750,000 dinars, to the extent that the budget of the Republic of Serbia, the Ministry of Internal Affairs, the National the Bank of Serbia and the budget of the Municipality of Sopot (https://www.alo.rs/vesti/hronika/bankarka-uhapsena-zbog-falsifikovanja/100668/vest).

Members of the Ministry of the Interior filed a criminal complaint against one person because of the suspicion that he committed the crime of fraud. He was suspects that by falsely presenting facts about his financial situation and creditworthiness, demanded and received four loans with several commercial banks in February and March 2017, in the total amount of 5,672,500 dinars. After obtaining loans and raising money from bank accounts, he, as suspected, left the territory of Serbia, and commercial banks damaged the amount of 6,480,925 dinars in the name of the debt.

Two people were arrested on suspicion of attempting to obtain unlawful property gain with false documentation. It is suspected that, by handing over forged documents to the National Bank of Serbia, they tried to obtain unlawful material gain in the amount of several hundred thousand euros. At the burden, a crime of

fraud is attempted. This was prevented thanks to the multisectoral cooperation and efficient operation of the prosecuting prosecutor, the police, and the National Bank of Serbia, who immediately reported this event.

ANALYTICAL PROCEDURES AND TECHNIQUES FOR FORENSIC RESEARCH

The decision on engaging forensic accountants can be made by the bank's management, company, owner of capital, creditors, investors, etc., if they need objective, independent and expert judgment regarding the existence of fraud in the organization. The choice of goals for forensic analysis depends on its purpose, which is determined by the contracting authority itself. For some purpose the assessment of a potential partner is sufficient for assessing forensics about possible, major irregularities, and a high level of fraud risk. When there is a suspicion of fraudulent actions, the goal is to determine whether it has already happened or happens and determine who its executor is. Therefore, the initiation of criminal responsibility is a necessary, valid proof of irregularities or fraud. In support of disputes, the client is the one who sets the goal. Forensic analysis has the following basic goals:

1. detection of areas of possible irregularities or fraud, narrowing of the search area for certain irregularities, or locating the area of irregularity or fraud,

2. detection of specific irregularities or fraud or methods of execution, assessment of the level of risk of established irregularities or fraud, or assessment of the danger of irregularity or fraud committed (intentionally, unintentionally, high or low level of irregularity, big or small risk of fraud)

3. the production of evidence, i.e. the provision of material and other evidence that the irregularity or fraud has been committed and the manner of the breach (Muminović, 2011).

The tasks of forensic accountants are to analyze, interpret, summarize and present interconnected business-financial positions, so that they understandable and properly corroborated. Forensic accountants participate in the following activities:

- investigating and analyzing evidence of fraud committed;

- developing computerized applications that will serve in analyzes and presentations on financial evidence;

- presentations of the results of the research in the form of reports and completion of documentation;

- assisting in legal proceedings, including testimony in court as expert witnesses, and preparing visual means to serve as evidence at trial (Dimitrijević, Danilović, 2017).

For the detection of fraud, specific knowledge and experience are needed, that is, specialists need to know the technology and method of doing business in certain areas, as well as the regulations governing the same, and then the forms of fraudulent actions and the method of proving them. The development of forensic accounting has enhanced the specialized knowledge and skills necessary for a more effective fight against fraud. It implies the application of all accounting, auditing and other financial skills and knowledge in clarifying relationships, facts and economic transactions that may or may already be the subject of judicial proceedings, and the like. There are several possible models of forensic accounting: involvement of a forensic accountant in the audit team during a regular annual audit of the financial statements; the introduction of a compulsory forensic audit for all entities of public interest; the introduction of a sudden forensic audit according to the principle of random choice for all entities of public interest; implementation of a reactive or proactive forensic audit at the request of the shareholders, and performing a forensic audit on the basis of a report or a suspicion of fraud (Tušek, Klikovac, 2013).

Forensic accountants combine their accounting knowledge with auditory, investigative techniques, and other skills, all for the purpose of detecting fraud. During the investigation of possible fraud, forensic accountants use various analytical techniques to analyze the relationship between the elements of financial statements. These analyses are used for a later detailed analysis of business transactions if the initial analysis of the elements of the financial statements points to the possibility of fraud. Analytical procedures in forensic accounting, as a rule, are applied phase-based, graded from the most general to extremely direct. Each of these segments of the analysis has its specific objectives, such as: preliminary (preparatory) analytical procedures, as the most general, are used to identify areas of high risk of fraud, acquiring insights into nature and the time of manipulation, as well as assessing the degree of necessity of applying appropriate forensic procedures to prove them; independent analytical procedures are used to obtain evidence, by comparing and harmonizing specific data, as well as establishing the credibility (correctness) of documentation, posting and accounting, and final analytical procedures, as the most direct, which serve to make conclusions about the impact of problematic transactions.

The most common techniques used by forensic accountants are based on various techniques of financial analysis, such as:

- horizontal analysis - compares items from the current period with the same items from the previous period;
- vertical analysis - compares the percentage shares of individual items in the financial statements;
- comparison of detailed items in the financial statements - with the same or similar items from the previous periods;
- analysis of relationships - in the financial statements in the areas of profitability, liquidity, solvency, activity and value creation.

- Forensic accounting, besides the traditional accounting technique, intensively applies some specific techniques:

- Benford's law - shows the likelihood that a figure is found in the right place in the number. The essence of Benford's law is that certain figures appear more often than others in datasets;

- Beneish's model - used to estimate the potential level of fraud in the financial statements based on eight variables (indexes);

- Computer-Assisted Audit Techniques (CAATS) - is a practical application of information technology in forensic audit work;

- Data mining techniques - a set of techniques designed to automatically search for large amounts of data for the purpose of finding information that will help detect fraud;

- Ratio analysis - has a great analytical role in forensic research. Each of the ratios is a fairly reliable trace in detecting potential fraudulent actions.

Forensic accounting has some disadvantages. Engagement of forensic accountants is expensive, there is the possibility of leaking confidential information, upsetting the reputation of the company and losing the confidence of employees (Lazović, 2014). Every engagement of forensic accountants requires a certain cost for the company it engages, because the analysis uses procedures that require the use of computer software and work of accountants. Loss of information that they possess, as well as unprofessional handling of a database, can be a blow to the real-time reports.

CONCLUSION

The operational risk in the bank's operations stems from fraud, inadequate practices, procedural errors due to human factors, and infrastructures and systems. For these reasons, it is necessary for every bank to perform a quality risk assessment of fraud and establish a comprehensive and reliable risk management system.

Banks are particularly vulnerable to fraud, and this is regardless of their size. Since fraud is most often associated with operational risk, banks must take care of this. In practice, it is not rare that fraud cases are not publicly disclosed, as most financial institutions want to avoid negative publicity. This reduces the prospect of prosecution and makes it difficult to deter fraudsters.

For the purpose of more efficient fight against fraud, a new scientific discipline and activity was born - forensic accounting as part of business forensics. Firstly, the need for forensic accountants' services was felt in banks, insurance companies, and lately, primarily in the police and investigative institutions for the prevention of economic crime.

Cheating activities in banking operations are becoming more complex and more difficult to discover. Since fraud is the risk of very significant losses, it is important to understand the motives of such activity, the ability to detect fraud, the means to reduce the risk of fraud and the role of business forensics in detecting and preventing fraud. Therefore, the underlying goal of forensic accounting is the continuous development of detection methods and fraud protection mechanisms.

The key message of this paper is to point out the need to involve forensics in the management of operational risks, in the field of prevention and fraud detection, all with the aim of more efficient protection of the banking sector from fraudulent actions. It is therefore necessary to make additional efforts to promote the importance of forensic accounting and encourage its development, in order to minimize the number of frauds. The process is not cheap, but it is certainly beneficial for society as a whole.

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TAX FRAUD IN SERBIA (NORMATIVE AND PRACTICAL ASPECT)

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Abstract: Tax fraud is one of the most sophisticated forms of illegal behavior of taxpayers. Illegal behavior is reflected in the avoidance of tax obligations, which directly affects the amount of collected revenues. The state was then deprived of the amount of funds that would have been charged if the taxpayers had settled their obligations in a timely manner. This illegal behavior directly threatens the tax-fiscal state system. Taking into account the high degree of social danger that this criminal act brings, this paper examines the concept, characteristics and basic elements of tax fraud in the positive criminal legislation of Serbia. Statistical data describes the processing of tax evacuators to judicial authorities in the territory of Serbia in the period from 2006 to 2017. The aim of the survey is to determine whether tax fraud in Serbia is the most common form of taxpayers' financial non-taxation, to point out the efficiency of cooperation between the prosecuting authorities and the Tax Police, whether or not the public prosecutors have resorted to a diversionary model of conduct, and to show what kind of penalty policy was carried out.

Key words: tax fraud, investigation, conditional opportunity, penal policy

INTRODUCTION

At this level of civilization development, the functioning of the government as well as the provision of numerous public services is unthinkable without obtaining public revenues, primarily taxes. However, despite the unquestionable importance of timely payment of taxes and other fees for the continued financing of vital functions of the government, such as the military, the police, the judiciary, and the financing of public services, such as education, health, infrastructure, in practice there are numerous modalities of tax resistance. Taxation reduces the economic power of the taxpayer, because part of his disposable income is involved. Trying to reduce or completely eliminate their tax burden, taxpayers resort to various forms of tax evasion. In order to reduce their tax liability, taxpayers

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can undertake various activities while complying with tax laws. Thus, through the tax avoidance, they use all legally permissible options, such as refraining from consumption, changing their place of residence, changing their activities, moving to tax havens, etc. Unlike these cases, which are "acceptable", there is also an "unacceptable" legal evasion involving misuse of rights. In modern governments, this form of legal evasion has been sanctioned, although in practice it is difficult to precisely divide them, and thus to recognize whether this is an unauthorized exercise of rights, when the activities of the taxpayer are directed solely to cautiously and skillfully avoid paying taxes, not achieving business or economic goals, for example by concluding simulated legal transactions.

Unlike legitimate evasion, the so-called illegal tax evasion leads to unlawful conduct. Taxpayers, through breach of tax regulations, consciously and deliberately undertake procedures in order to reduce or completely fail to fulfill their tax obligations. The activities that the taxpayer undertakes in order to avoid paying taxes are criminalized as tax offenses. These are tax violations that represent the most serious forms of unlawful conduct of taxpayers.

Due to the numerous harmful consequences of tax evasion, which also have a financial effect because the state treasury remained deprived of the amount of income that would have been charged for all taxpayers to comply with the tax obligation, modern states are undertaking a series of measures to prevent tax evasion. The aim of the preventive policy is to create a positive attitude of the taxpayer in relation to the obligation to pay taxes, and this is achieved through numerous activities and measures aimed at encouraging voluntary tax payments. In case of unlawful conduct of taxpayers, which violate tax regulations, repressive measures are applied. The type and severity of repressive measures depends on the severity of tax delicts made.

Proper regulation of the subject matter of taxation, both with respect to substantive laws and other regulations, as well as with respect to tax procedural regulations, is not a guarantee for their implementation in practice. Many circumstances, and thus the overall environment in one country, affect the compliance of tax regulations.

SUPPRESION OF TAX FRAUD - A COMBINATION OF PREVENTIVE TAX POLICY AND REPRESSIVE MEASURES

Modern states devote a great deal of attention to preventive measures to curb tax evasion, and thus to tax fraud as its basic form. By attempting to create a positive attitude of taxpayers in accepting and fulfilling tax obligations, the traditional concept of relations between tax authorities and taxpayers is abandoned, where tax authorities are active and taxpayers are a passive party. Nowadays, with changes in the state administration sector under the influence of the idea of *New*

Public Management there is a modification of the tax-law relationship. Instead of the treatment of tax authorities from the position of state power, in the ambience of contemporary democracy, which proclaims the protection of human rights and freedoms as a special social value, the rights of taxpayers have received greater attention. In addition, by achieving a service-oriented concept of work, the modern tax administration creates preconditions for the voluntary acceptance of tax obligations, which will ensure a higher amount of public revenues collected (Димитријевић, 2008: 137). This is especially important given that modern countries have a constant need for a greater flow of funds from public revenue collection, facing the problems of the budget deficit. Instead of the traditional relationship of modern jurisdiction, they are "approaching" the taxpayer. The basic reason for this can be explained by Kolber's observation, which compared the skill of taxation with the goose-grazing, so that as few feathers as possible, he gets as much feathers as possible (Анђелковић, 2002: 171). Modern trends provide a service-oriented concept of work of tax administrations, where the taxpayer appears as a user of their services. The Tax Administration applies new methods and techniques in its work using modern information technologies to provide the necessary information and educate taxpayers, for example, by publishing information on the website of the Tax Administration. Furthermore, they use different types of electronic communications with taxpayers, for example, in some countries, taxpayers receive filled tax return forms in advance. The procedure of taxation should be based on a relationship of respect of personal and professional dignity of the taxpayer and the tax should be paid in a manner and at a time that best suits taxpayers depending on the inflow of revenue. Bearing in mind the economic circumstances in Serbia, due to which many taxpayers face financial difficulties, the legislator introduced the possibility of postponing the payment of the due tax. Under the terms and conditions prescribed by law, a taxpayer may ask tax authorities to settle their tax liability over a longer period of time, thus placing them in a more favorable position than settling their obligation at once and in full. The legislator's intention by prescribing this benefit was to encourage taxpayers to pay tax on a regular basis (Илић-Попов, 2017: 653).[3]

Modern trends in the approach to tax administration signify abandoning the concept of intimidating taxpayers and their compliance with tax obligations because of fear. Modern countries try to popularize taxes, tax propaganda impacts on raising taxpayers' tax awareness.[4] Since taxation reduces available income, it is understandable that taxpayers' resistance to comply with a tax obligation is understandable, that's why popularization is aimed at indicating the purpose of

3 However, in practice, some taxpayers have used this legislature to avoid forced collection of taxes. In addition, exemptions from the general regime impair the equality of taxpayers before the law and encounter resistance of conscientious taxpayers who duly fulfilled their tax obligations.

4 Significant progress in popularizing tax payments has also been made in Serbia. Advertising spots on national television stations can, of course, contribute to the change of citizens' awareness that has been rooted for many years, partly as the rest of the socialist period in which the fiscal system had a different structure and role.

taxation. Taxes are acceptable for taxpayers because they are intended to finance public goods of which they are beneficiaries. As Piketi says, taxes are not good neither bad by itself, it all depends on the way they are taken and what they are used for (Пикети, 2015: 517). For example, Nordic countries have a high tax burden, measured by the share of tax revenues in GDP, precisely because of the higher allocations from the budget for financing the social security system, due to the developed role of the state, which ensures a satisfactory level of existence and dignity of the population. Transparency in taxation is also important for voluntary compliance with the tax obligation. Interruption in the taxpayer's private sphere during the taxation process must be based on the right, both in terms of determining the tax liability and in the tax procedure applicable to the determination of a tax liability. Tax regulations should be precise, clear, stable, without frequent changes, so taxpayers would have insight into their tax situation and timely perform their tax obligations. Hence, in order to reduce the resistance of taxpayers, their trust in the tax system is important, the belief that the tax system is fair. Since their attitude towards the reduction in economic forces created by taxation is determined by their relationship to the purpose of taxation, the expectations of taxpayers that the tax burden will be evenly distributed are quite justified. However, in the last two decades, there are new trends in the formation of some tax forms, such as income taxes, which indicate a departure from equity of taxation. *Flat tax* and dual income tax introduce a different tax treatment of income from labor and income from capital, providing a more favorable tax treatment of capital gains. This distorts horizontal equity, as taxpayers of the same economic power, depending on whether they earn income from labor or income from capital, pay different amounts of tax. It also affects the vertical equity of taxation, which implies that taxpayers of stronger economic forces should bear a higher tax burden. The introduction of a lower rate for capital gains can jeopardize vertical equity, especially as capital revenues tend to concentrate on the upper income levels (OECD Tax Policy Studies No.13: 136).

On the other hand, in order to maintain the same level of income, due to a milder taxation of capital, income countries are going to increase the tax burden on other tax base, including the transfer of the tax burden on labor income. Thus, the greatest benefit from the introduction of these two models of income taxation have the richest layers, and the burden of taxation falls on the majority of the population, as most taxpayers earn income from work. This is potentially very harmful to tax compliance, Piketi claims, especially within a middle class that pays higher taxes then upper classes (Пикети, 2015: 505). The large tax reform of the 1980s was the result of an effort to address the shortcomings of the then tax system. The large dissatisfaction with the tax system, due to high tax burden, has led to a growing evasion in some countries (for example, in the US and Australia, while in Ireland, workers protested in Dublin and other cities in 1980 due to the unjust tax burden that fell on them) (Cedric, 2000: 160).

If there is no compliance with the tax obligation, the state will have repressive measures when it will take penal policy measures, depending on the type of tax

delict. In Serbia, the forms of unlawful conduct of taxpayers are criminalized as tax offenses by criminal legislation (tax fraud, non-payment of tax on deduction and smuggling) (Law on Amendments to the Criminal Code - CC, Official Gazette of RS, 94/2016) and tax law (unfounded disclosure of tax refund and tax credit, endangering the collection of taxes and tax controls, illegal traffic of excise goods and unauthorized storage of goods) (Law on Tax Procedure and Tax Administration of the Republic of Serbia, Official Gazette of RS, 80/02, 84/02, 79/03, 55/04, 61/05, 85/05, 62/06, 61/07, 20/09, 72/09, 53/10, 101/11, 2/12, 93/12, 47/13, 108/13, 68/14, 105/14, 91 / 14, 112/15, 15/16, 108/16, and 30/18). The criminal offense of tax fraud occurs in the basic form and two heavier forms, for which a cumulative fine and imprisonment is envisaged, whereby the line of delimitation is the amount of evaded taxes. The objective requirement of incrimination in the basic form of tax fraud is the unpaid amount of tax over 500,000 dinars, and it is fined and sentenced to five years in prison. The first heavier form of tax evasion, where the unpaid amount of tax amounts to over 1,500,000 dinars, is fined and sentenced to imprisonment of 1 to 8 years. For the other, the form of tax fraud, where the unpaid tax amount exceeds 7.500.000 dinars, is imprisoned and sentenced to 3-10 years imprisonment.

For easier forms of tax violations, penalties and protective measures (for example, seizure of licenses for performing activities) are imposed by the tax authorities and executed by tax authorities, whereas for tax offenses, courts impose imprisonment and fines. As in most modern states, even in Serbia, a system of relatively specific penalties has been adopted, in which the legislator determines the type of punishment and its minimum and maximum amount for each individual crime. When imposing a sentence in a specific case, the court is obliged to move within these, legally prescribed, borders and impose a punishment bearing in mind the purpose of punishment and taking into account all circumstances that influence the punishment to be greater or less (mitigating and aggravating circumstances), in particular: the degree of guilt, the initiatives from which the offense was committed, the past life of the perpetrator, his personal circumstances, his detention after the committed crime, and other circumstances pertaining to his personality (CC, Official Gazette of RS, 94/2016). For criminal offenses, strict sanctions are prescribed, that is, penalties of imprisonment in certain ranges and fines. Tax offenses fall into that line group of offenses for which the legislator explicitly prescribed that the court with mandatory imprisonment and imposed a fine, which emphasizes their lucrative nature (Кулић & Милошевић, 2011: 323). The prosecution and punishment of tax evaders should result in his punishment for illegal tax evasion, as well as special prevention, which implies that such of punishment, imprisonment and a fine, will deter the tax evader from committing such criminal acts in the future. The amount of the fine imposed should exceed the amount of unpaid tax, because the tax evader assesses the expected benefits of non-payment of taxes and the possible cost that he will have if caught and punished (Милошевић, 2006: 76). On the other hand, the processing and adequate punishment of tax evaders is also important from the aspect of

general prevention, because it produces a psychological effect on other taxpayers. Namely, it can lead to the emulation effect on tax evaders who remained undetected, unpunished or with very minor penalties. Hence, the implementation of adequate penal policy measures should be a warning to other taxpayers to properly and timely perform their tax obligations (Dimić & Đukić, 2017: 65).[5]

TAX FRAUD AT JUDICAL PRACTICE IN THE TERRITORY OF THE REPUBLIC OF SERBIA IN THE PERIOD FROM 2006 TO 2017

Table 1 . The ratio of reported basic tax offenses against the total number of reported and reported economic crimes in the period from 2006 to 2017

Year	Applications					Relationship between applications					
						Tax fraud		Failure to pay tax on deduction		Smuggling	
	Total number	Economy crime	Tax fraud	Failure to pay tax on deduction	Smuggling	Part. in total	Part. in ec. crim.	Part. in total	Part. in ec. crim	Part. in total	Part. in ec. crim
						%	%	%	%	%	%
2006	105.701	2.868	615	/	112	0.58	21	/	/	0.10	3,90
2007	98.702	2.663	695	/	182	0,70	26	/	/	0,18	6,83
2008	101.723	3.009	940	/	249	0,92	31	/	/	0,24	8,27
2009	100.026	3.131	1.092	/	252	1,09	35	/	/	0,25	8,04
2010	74.279	2.479	658	48	414	0,89	27	0.06	1.93	0.55	16,70
2011	88.207	2.957	938	105	241	1,06	32	0.11	3,55	0,27	8,15
2012	92.879	3.221	1.132	103	141	1,2	35	0.11	3,19	0.15	4,37
2013	91.411	3.397	1.051	106	106	1,14	31	0.11	3,12	0.11	3,12
2014	92.600	3.347	712	62	98	0,77	21	0.06	1.85	0.10	2,92%
2015	108.759	3.526	715	63	155	0,66	20	0.05	1.78	0.14	4,39%
2016	96.237	3.333	734	52	121	0,76	22	0.05	1.56	0,12	3,63%
2017	90.348	2.939	649	30	96	0,72	22	0,03	1,02	0.10	3,26%
In total	**1.140.872**	**36.870**	**9.931**	**569**	**2.167**	**0,87**	**27**	**0,07**	**2.25**	**0,19**	**6,13%**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

Based on the data set out in Table 1, it is noted that among the basic tax offenses set forth in the Criminal Code of the Republic of Serbia, in most cases the reported criminal offense is tax fraud. The smallest number of reports were present in the criminal offense of non-payment of tax on deduction, in the observed twelve-year period, only 569, while smuggling was reported in a slightly larger number, 2,167. Criminal charges for tax evasion have the highest percentage of participation, both in the total number of reported cases and in the total number of reported economic crimes. Of the total number of reported criminal offenses,

5 The application of some of the modern institutes of criminal law, such as the agreement on the recognition of a criminal offense, in fact leads to the lowering of the sentence below the prescribed ones, which means that the penalty policy for tax evasion is becoming even smoother, which is not desirable either from the aspect of special or general prevention.

criminal charges for tax evasion amounted to 0.87%, which is twelve times higher than criminal charges for non-payment of tax on deduction, and four times the total number of reported smuggling cases. Of the total number of reported economic crimes, tax evasion applications amount to 27%, which is twelve times higher according to the participation of the total number of applications for non-payment of tax on deduction in reported economic crimes, and four times, according to the share of reported smuggling in the total reported economic crime.

Depending on the assessment of the public prosecutor, the procedure can continue until the final report is received, but due to the lack of evidence, obsolescence and other reasons envisaged by the Code of Criminal Procedure, it can be suspended or otherwise terminated. Table 2 shows the data indicating the stages of processing tax evaders, and then in Table 3. the focus is on the reasons for rejecting criminal charges, not in the entire observed, but for a three-year period from 2015 to 2017, and in Table 4., in the number of cases due to the lack of evidence, the investigating judge, and later, when the investigation was received by the prosecuting authorities, the public prosecutor suspended the investigation. Table 5 refers to the type of criminal sanctions imposed by tax evaders in the same observed period.

Table 2. The proceeding of tax fraud in the period from 2006 to 2017

Year	Registered	Rejected	Investigation interrupted	Investigation suspended	Indictment	Rejecting judgment	Liberation judgment	Suspension procedure	Convicting judgment
2006	615	77	2	13	190	25	18	45	102
2007	695	95	17	34	284	25	34	32	193
2008	940	109	17	60	410	43	57	31	279
2009	1.092	164	22	43	438	49	53	42	293
2010	658	95	/	32	208	32	33	24	119
2011	938	155	1	37	449	69	61	57	262
2012	1.132	283	1	33	499	94	87	71	246
2013	1.051	285	/	40	705	178	110	22	290
2014	712	341	/	12	788	156	96	140	396
2015	715	341	/	24	778	143	101	85	449
2016	734	367	4	21	643	104	46	74	419
2017	649	309	/	16	551	67	52	40	392
In total	**9.931**	**2.621**	**64**	**365**	**5.943**	**985**	**748**	**663**	**3.440**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

Table 3. Denial of criminal charges in the period from 2015 to 2017

Year	Total number of rejected criminal charges	Conditional opportunity	Work is not a crime	Obsolescence
2015	341	180	51	8
2016	367	158	43	10
2017	309	113	43	14
In total	**1.017**	**448**	**137**	**32**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

In keeping with the principle of legality, the public prosecutor is obliged to undertake criminal prosecution after receiving a criminal complaint, if all the conditions for the same have been fulfilled (Мирков, 2016: 64). In a number of cases, we see that prosecutors treated the offenders according to the principle of opportunism according to the principles of tax fraud, which is an exception to the principle of legality. There are many reasons to be guided when acting opportunely. From 2006 to 2015, the reason for the dismissal of criminal charges was mostly a pardon because of the unreasonably prosecution. In the next three-year period, the main reason for the dismissal of criminal charges was the fulfillment of obligations that the public prosecutor ordered the suspect of tax fraud. The institution of conditional opportunity was applied, which was amended by the CPA since 2009, by shifting the upper limit of imprisonment for criminal offenses in which it can be applied (until 2009, up to three years in prison, since 2009, from three to five years in prison) (Илић & Киурски, 2013: 242). Thus, in fact, a large number of tax evaders as no harmless criminal offense have not been prosecuted, but the cases have been settled out-of-court, by fulfilling the imposed obligations, which do not have the character of criminal sanctions in the context of the diversionary model of solving the criminal matter. Regarding the obsolescence of prosecution, the institution of conditional opportunity was used as a reason for rejecting criminal charges in fourteen times more cases, and in approximately three times the number of cases, in relation to the lack of elements that make one behavior a criminal offense.

Table 4. Suspension of the investigation due to the lack of evidence for tax evasion in the period from 2006 to 2017

Year	Total number of suspended investigations	Suspension of investigation due to lack of evidence
2006	13	4
2007	34	11
2008	60	25
2009	43	23
2010	32	25
2011	37	6
2012	33	11
2013	40	11
2014	12	3
2015	24	5
2016	21	8
2017	16	14
In total	**365**	**146**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

Among the legal reasons for the suspension of the investigation (the work is not a criminal offense, exclusion of prosecution) (Бејатовић, 2008: 397), the largest part is the lack of evidence. Approximately 40% of cases resulted in the suspension of an investigation due to lack of evidence. The investigation of tax offenses carries certain specifics, since it is in the midst of financial crime, which requires

that not only the public prosecutor, but also the expert bodies, follow the financial transactions in order to collect evidence. The Tax Administration, the Tax Police, and MUP officials are professionally trained in detecting illegal financial transactions in the coordination with the public prosecutor (Strategy of financial crime investigation for the period from 2015 to 2016, Official Gazette of RS, 43/2015). In relation to the total number of filed criminal charges for tax fraud, the number of suspensions of the investigation due to the lack of evidence is not alarming, but it is in relation to the total number of suspended investigations. The only way to overcome this evidentiary deficit is to have a continuous and firmer co-operation among these institutions. The evidence deficit is particularly evident in 2008, 2009 and 2010, when the investigator was still an investigative judge. Later, it is noticeable, in line with international standards, that there is greater, but not sufficient, effort to overcome these problems.

Table 5.Criminal sanctions imposed on perpetrators of tax evasion in the period from 2006 to 2017

Year	Prison sentence	A fine as the main penalty	A fine as a secondary one	Conditional conviction	Work in the public interest	Security measures
2006	11	9	53	78	/	6
2007	26	3	95	146	/	/
2008	36	28	144	213	/	/
2009	48	14	174	210	1	/
2010	17	8	63	94	/	/
2011	31	16	183	212	1	/
2012	44	13	151	193	1	/
2013	50	11	190	225	/	/
2014	115	25	228	255	/	/
2015	68	23	283	341	/	/
2016	72	12	306	300	/	/
2017	71	13	301	264	/	/
In total	**589**	**175**	**2.171**	**2.531**	**3**	**6**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

The structure of criminal sanctions for persons convicted of tax fraud in the mentioned twelve-year period constitutes almost all sanctions that criminal legislation prescribes for adult perpetrators. Conditional conviction is pronounced in most cases, in the least, work in the public interest, and it does not lag behind the security measures, which were imposed only 6, and only in 2006. For every form of tax fraud with the imprisonment sentence as the main one, a cumulative and a fine is prescribed as a secondary one, and as can be seen from the table, this legal imperative does not depart from the practice of our judicial authorities. In relation to the fine as a subsidiary, the fine as the principal is expressed in twelve times less cases. Table 6 shows the duration of sentenced prison sentences, and in Table 7, the amount of fines imposed as the main penalty, as tax evasion damages the state budget, and the monetary amount that the tax evader is obligated to pay some kind of compensation for the damage.

Table 6. Duration of imprisonment imposed on perpetrators of tax evasion in the period from 2006 to 2017

Year	2-3 months	3-6 months	6-12 months	1-2 years	2-3 years
2006	3	8	/	/	/
2007	2	12	10	2	/
2008	6	11	9	9	1
2009	8	14	15	9	2
2010	3	6	3	4	1
2011	7	6	8	8	2
2012	6	15	11	10	2
2013	6	19	15	9	1
2014	8	40	43	18	6
2015	2	23	28	14	1
2016	4	13	37	12	6
2017	1	18	33	16	3
In total	**56**	**185**	**212**	**111**	**25**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

From the duration of the sentences of imprisonment, it is noted that all three forms of tax evasion were covered by the conviction. The CC of the RS for the first, basic form, prescribes imprisonment for a term of six months to five years, for another, a severe form, a prison sentence of one to eight years, and for the third most severe, a prison of two to ten years (CC, Official Gazette of RS, 94/2016). Most often, courts impose a sentence of imprisonment of 6 to 12 months, and the lowest for a duration of 2 to 3 years, which indicates the rarity of committing more serious forms of tax evasion. However, in general terms, the courts conduct a mild criminal policy, bearing in mind the consequences that result from the commission of this crime.

Table 7: *The fine as the main tax evasion in the period from 2007 to 2017*

Year	up to 10.000 rsd	10.000 to 100.000 rsd	100.000 to 200.000 rsd	200.000 to 300.000 rsd	300.000 to 500.000 rsd	500.000 to 1.000.000 rsd	1.000.000 to 10.000.000 rsd
2007	2	1	/	/	/	/	/
2008	4	21	2	1	/	/	/
2009	/	11	3	/	/	/	/
2010	/	8	/	/	/	/	/
2011	2	7	6	1	/	/	/
2012	/	12	1	/	/	/	/
2013	/	9	1	/	1	/	/
2014	6	14	2	2	1	/	/
2015	2	14	6	/	/	/	1
2016	1	10	1	/	/	/	/
2017	/	10	2	/	1	/	/
In total	**17**	**117**	**24**	**4**	**3**	**/**	**1**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

It was omitted from the above table in 2006, because different ranges of fines were prescribed at that time. In five cases, it was pronounced in the amount of 10,000 to 50,000 dinars, in two, in the amount of 50,000 to 100,000 dinars, in one, from 100,000 to 200,000 dinars, and in one, from 5,000 to 10,000 dinars.

In the period from 2007 to 2017, a fine of 10,000 to 100,000 dinars is usually imposed, and in only one case, in the amount of 1,000,000 to 10,000,000 dinars. And here is noticeable mild penal policy, since most fines belong to a smaller amount.

Table 8: *Ratio of the number of convictions for basic tax offenses against total convictions and number of convictions for economic crimes*

Year	Convictions					The relationship between convictions					
	Total number	Economy crime	Tax fraud	Failure to pay tax on deduction	Smuggling	Tax fraud		Failure to pay tax on deductible		Smuggling	
						Tot. conv.	Ec. conv.	Tot. conv.	Ec. conv.	Tot. conv.	Ec. conv.
						%	%	%	%	%	%
2006	41.422	1.464	102	/	49	0,25	6,97	/	/	0,12	3,35
2007	38.694	1.161	193	/	107	0,50	16,62	/	/	0,27	9,22
2008	42.138	1.287	279	/	90	0,66	21,68	/	/	0,21	6,99
2009	40.880	1.228	293	/	111	0,72	23,85	/	/	0,27	9,04
2010	21.681	589	119	3	74	0,55	20,20	0,01	0,51	0,34	12,56
2011	30.807	999	262	9	119	0,85	26,22	0,03	0,90	0,39	11,91
2012	31.322	932	246	24	78	0,79	26,39	0,07	2,57	0,25	8,37
2013	32.241	1.169	290	22	112	0,90	24,80	0,07	1,88	0,35	9,58
2014	35.376	1.543	396	44	72	1,11	25,66	0,12	2,85	0,20	4,67
2015	33.189	1.609	449	30	95	1,13	27,90	0,90	1,86	0,29	5,90
2016	32.525	1.592	419	20	108	1,13	26,31	0,06	1,26	0,33	6,78
2017	31.759	1.448	392	23	78	1,12	27,07	0,07	1,59	0,25	5,38
In total	**412.034**	**15.021**	**3.440**	**175**	**1.093**	**0,83**	**22,90**	**0,04**	**1,16**	**0,26**	**7,27**

Source: http://www.stat.gov.rs/oblasti/pravosudje/punoletni-ucinioci-krivicnih-dela/

The final assessment of the share of tax evasion in total and economic crime, as well as its relation to basic tax crimes, can be made on the basis of the number of convicting judgments, that is, at the last stage, when the proceedings are terminated legally. In the observed twelve-year period, there was a noticeable increase in the reported tax fraud, and furthermore, regardless of their rejection, interruption, suspension of the investigation, rejection of the charges, there is also an increase in the number of convictions.

CONCLUSION

By analyzing the data on the number of reported criminal offenses of tax fraud in Serbia for the period from 2006 to 2017, a conclusion can be drawn on the highest representation of tax fraud in relation to other tax crimes, as well as the constant slight increase in its share in the total number of criminal offenses.

Based on the data on the processing of tax evaders for the observed period, it can be concluded that an institution of conditional opportunity was applied, in which amendments to the 2009 CPC were moved to the upper limit for penalties for criminal offenses for which it can be applied from 3 to 5 years imprisonment, whereby a large number of tax evaders are not prosecuted. Court practice shows that, in most cases, the application of this institute was the reason for the dismissal of the criminal charge, subject to the fulfillment of the obligations imposed. Conditional postponement of the prosecution by the public prosecutor achieves economical and simplified work of the courts, but the question arises as to the extent to which special and general prevention for the criminal acts of tax fraud can be achieved, because the obligations imposed by the public prosecutor do not have the character of criminal sanctions.

By comparing data on the number of suspended investigations due to the lack of evidence in tax fraud in relation to the total number of suspended investigations, it points to the problem of the evidentiary defect in the processing of these criminal offenses. As financial crime is concerned, the investigation of tax evasion is specific because it requires continuous cooperation between several bodies (public prosecutor, Tax Police and Tax Administration), as well as professional development for the analysis of financial documentation and monitoring of financial transactions.

Analysis of the data and shows that a noticeable upward trend of criminal charges for tax fraud, as well as the increase in the number of convictions, regardless of the negligible number completion of the procedure in other ways during the prosecution of the perpetrator. A small number of convictions for tax fraud in relation to the total number of convictions indicate that the penal policy is weak. Regarding the structure of criminal sanctions in the observed period, all sanctions were imposed according to the law. Regarding the duration of the imprisonment sentences, it is noted that the most common sentence is 6 to 12 months, which indicates the rarity of the execution more serious forms of tax fraud, but also on the mild criminal penal policy of the courts. Also, usually a lower fine is imposed. Bearing in mind the consequences that result from the execution of this criminal offense, there is also a noticeable minor criminal policy. Since tax fraud damages the state budget, the monetary amount that the tax evader is obligated to pay should constitute some kind of compensation for the damage.

There is noticeable progress in preventive activities being undertaken in Serbia. A special emphasis is placed on tax propaganda, which aims to create a posi-

tive attitude of the population according to the obligation to pay taxes. However, a large number of tax fraud reports indicate an increase in tax crime. Leaving aside the need for upgrading Serbia's tax system in some of its segments, to achieve its greater equity and efficiency (which, along with stable and clear tax regulations, contribute to the voluntary fulfillment of tax obligations), there remains a question of more organized taking measures to curb tax evasion. In addition to the undoubted importance of preventive politics by taking a number of measures and activities, the government must also deal with repressive policies. In this respect, the analysis of the system of criminal sanctions for tax fraud shows that there is an adequate normative framework for taking criminal policy measures. However, the data from the court case are disturbing, as they indicate that the judicial authorities apply a mild punitive policy. Mild punishment of tax evaders does not have a positive effect from the aspect of eliminating the causes of tax criminality, because the criminal policy must, in addition to punishing a tax evader, send a warning to other taxpayers to properly perform their tax obligations.

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ECONOMIC ANALYSIS OF THE CRIMINAL OFFENCE

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Abstract: With establishing the Economic Analysis of Law, the conditions have been created for applying the economy in the analysis of legal institutes, which were intangible until its appearance. The topic of the paper is economic analysis of the criminal offense, the effect of punishment on the perpetrator and the implications of crime on individual well-being and social welfare. While the law insists that the perpetrator of the criminal offense be found, prosecuted and adequately punished, the economy analyzes the level of costs that the offense causes. The forcible transfer, destruction of wealth, opportunity costs of resources that crime absorbs reduces the welfare of victims as well as society. Subsequently to material damages, criminal offenses also cause non-material damage. In this paper we use the economic models that the economy developed in the analysis of criminal offence.

Keywords: *criminal offense, individual well-being, social welfare, opportunity costs, damages, punishments.*

INTRODUCTION

With the development of the Economic Analysis of Law it is pointed out on the importance of analyzing legal institutes, applying economic methods and models, as in analyzing the legal system in general, as well as in certain areas of the law. Although disputed, and in some countries still insufficiently present and applied, economic analysis of law is a scientific discipline and its development and application, in its full extent, is just expected to happen. Unlike in Europe where the interest in economic analysis of the law is less, and the progress is slower, in the United States of America economic analysis of law has become a dominant discipline, which is why many aspects of its analysis are characterized by specifics characteristic in the precedent law.

Economic analysis of law connects two mutually conditioned and important areas of human action, enabling them into better understanding. Combining eco-

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nomic life with legal principles and the application of economic methods in the branches of law that have economic thinking (labor law, tax law), as well as in those that they don't have it in its basis (criminal law, civil law), economic analysis of law perceive the law from a new angle and in a new way. Observed from the economic point of view, law represents a stimulating system which influence can be, on behavior of individuals, positive and also negative. Stimulations are related both to their economic activity and to actions that are not in accordance with the law or they represent its violation.

Economic crime analysis determines the reasons why the perpetrators of criminal offense decide to commit a crime, as well as the stimulations that the legal rules create for the potential perpetrators of criminal offenses. The topic of the paper is an analysis of criminal acts and the consequences that such actions caused from the economic point of view.

This paper analyses the penal system by indicating on economically justified punishments, but also indicates the way that the amount of resources absorbed by the area of a crime and the activities on its suppression could be corrected. The basic criterion for evaluating the effectiveness of the penal system represents a level of social welfare.

BASIC QUESTIONS OF ECONOMIC CRIMINAL ANALYSIS

The fact is that the criminal offence, above all, is the legal institute, and it imposes the question of why is it the subject of economic analysis, respectively reasons are being sought for the inclusion of the economy in the field of crime and criminal law. There are several reasons for the interest of economy in this field, and one of the most important is that the criminal acts significantly influence the individual well-being of the victims, respectively those persons who are directly affected by the criminal offence, but also has significantly effect on social welfare. By individual well-being we mean the level of usefulness that an individual enjoys in all that provides them a sense of satisfaction, while social welfare represents the sum of individual well-being (Popović, 2009: 3). The greatest burden of the criminal offense and its consequences are born by the victims, but a part of the burden is transferred to the society as a whole. In order to protect citizens and their rights, the state must provide an efficient model of financing the police, the judiciary, etc. which absorbs the budget funds, thereby transferring the burden of the committed criminal offense to all social subjects, respectively taxpayers.

Although the legislator has made a significant efforts to prevent and reduce the volume and types of criminal offences, we indirectly daily witness crimes that for result have material or non-material damage, and very often both. The perennial economic crisis, the impoverishment of a large part of the population, the high unemployment rate and the inability to meet the existential needs which

signify the end of the 20th and the beginning of the 21st century in our country, have caused the increase of crime rate and hence the number of criminal offences take dramatic volume and dynamics. Modern living conditions and accelerated technological development have created the conditions for the phenomenon of cybercrime, and the increase of crime is also contributed by the increased threat to global security which is personalized in and by terrorism.

The question of crime is contemporary and significant for the theory and practice that the crime considers as a challenge, as well as for everyday life, from a reason that most of the people sees crime as a danger to well-being, wealth, and even life (Cooter and Ulen, 2016: 454).

The basic criminal law issues, which are subject to the economic analysis, are related to the definition of the acts that should be prevented, prohibited or punished, and adequate penalties to sanction them. Determination of the penalties and their effects on the behavior and volition of perpetrators of criminal offense is one of the most important issues in the society, respectively of the legislative and the executive authorities (Cooter and Ulen, 2016: 454).

Although the theory of a crime was the subject of analysis, even before the appearance of Becker (Becker) and his article published in 1968, when his conceptual framework was put in place. The decision of the potential perpetrator of the criminal offense according to the model elaborated in the article is determined by the potential benefits and costs expected from the commission of the criminal offense.

The baseline of the Baker's model relates to the *rationality* in the behavior of individuals, expressed in the aspiration to achieve benefit in its maximum. Considering that dealing with crime is a risky activity with an uncertain outcome, it is aimed in maximizing the expected value (Becker, 1968). The term *expected benefit*, and not the *benefit* indicates uncertainty, because the perpetrator of the criminal offence can't have knowledge whether or not have they will benefit from the crime. The assumption of a rationale for a decision maker is the basis for defining economic models and economic theory in general, whereby rationality implies stable and transitory preferences of decision makers. (Begović, Labus and Jovanović, 2008). Behavior of the perpetrator of a criminal offense can be considered rational if he behaves in a manner that maximizes his own advantage.

The assumption of the rationality of the perpetrator of the criminal offence is subject to criticism. There is a doubt about the rationality of decision making and raises the question of what kind of rationality is that if the perpetrators commit serious crimes. Observed from the society angle and from the vast majority of individuals there is no rationality. But the rationality in decision making by the perpetrators of the criminal offense is not in the interests of the society, but it is in the benefits that the perpetrator of the criminal offence accomplishes. If the object of the perpetrator of the criminal offense is a material benefit, which if they commit could usurp it, then the decision to do so is rational. In addition to the material benefits, the commission of a criminal offense can increase the psy-

chological benefit of the perpetrator of the damage, and the decision to commit a criminal offence from the perspective of the perpetrator of the offense is rational (Begović, 2015: 27).

The second assumption of the Baker's model refers to the lack of moral limitations of the perpetrator of the criminal offence (Becker, 1968). While a person strives to freedom in its widest sense, the moral limitations that each of one has in themselves constitute a limiting factor in the decision to commit a crime or not to , regardless of the incentives created by the system. On the other hand, individuals who don't have a problem to violate moral norms regardless of systemic constraints appear as perpetrators of criminal offenses.

The decision of the potential perpetrator of a criminal offense to commit a crime is influenced by several factors. The decision is determined by the level of the expected value of the criminal offense, but also with the expected value of performing legal activities. The expected benefit from the criminal offense in Becker's model is represented by the expression:

$$EU_j = p_j U\,(Yj - f\,j) + (1 - pj)\,U\,(Yj)^2 \tag{1.1}$$

If we exclude, from the previous condition, the penalty imposed for performing the activity *(f)*, we receive the expected usefulness of the individual from the activity that is in accordance with the law.

$$EU_j = p_i U\,(Yi) + (1 - pi)\,U(Yi) = U\,(Yi), \text{where it is } i \neq j \tag{1.2}$$

Since the starting assumption of the model is the rationality of the individual, the potential perpetrator of the criminal offence, by comparing these values, will determine which of them brings a higher level of usefulness and in accordance to that will make a choice.

In economic literature, attitudes have been developed according to which the level of crime is in the function of probability of capturing perpetrators of the criminal offense and imposed penalty. A number of studies, that for the subject of the analysis have had the impact of these factors on the level of crime, have established a link between these values. The increased expectancy of being caught and bearing the consequences of the criminal acts they caused reduced the crime rate. Ann Witte has analyzed the impact of the probability of arrest and the severity of sentences on former convicts 3 years after their release from prison. The analysis

2 The markings in the model are presented*: E* - expected value, *U* - useful function of the potential perpetrator of the criminal offense, *Yj* - total value of the committed criminal offense (it may be monetary, but also represent some of the form of satisfaction), *fj* - monetary equivalent to the penalties foreseen by the law for the committed criminal offence (expressed in amount that the perpetrator of the criminal offense is prepared to pay in order to avoid punishment), *pj*-the probability of punishing the perpetrator of the crime.

included a sample of 641 men, and the obtained results indicated a link between imposed penalties and crime rates (Witte, 1980).

Ehrlich's analysis of the robbery in the USA in the period from 1940 to 1960 established the link between the probability that perpetrators of the criminal offense would be caught and punished and distract from dealing with crime (Ehrlich, 1973).

Ehrlich in his model, which is a modified Baker's model, pointed out to the benefits of legal and criminal activities and included the leisure as a possibility of allocating workforce. According to the model, the perpetrator of the criminal offense generates income from legal or criminal activities, where the level of net incomes is in the function of engaging time spent in each of the activities. The balanced offer of crime which was analyzed by Ehrlich is presented graphically between points A and B which show the level of income if the total time is engaged in performing one of the activities (legal or criminal). In the case where the limiting value of the penalty doesn't exceed the difference between the limiting values of the above mentioned activities, the balance is established as an extreme solution, since the total working hours of the potential perpetrators of criminal offenses is allocated to the conduct of criminal activities (Begović, 2015).

The amount of the composite goods is shown on the axis, which includes the total benefits from the performance of the mentioned activities, respectively financial and psychical benefits from the engagement.

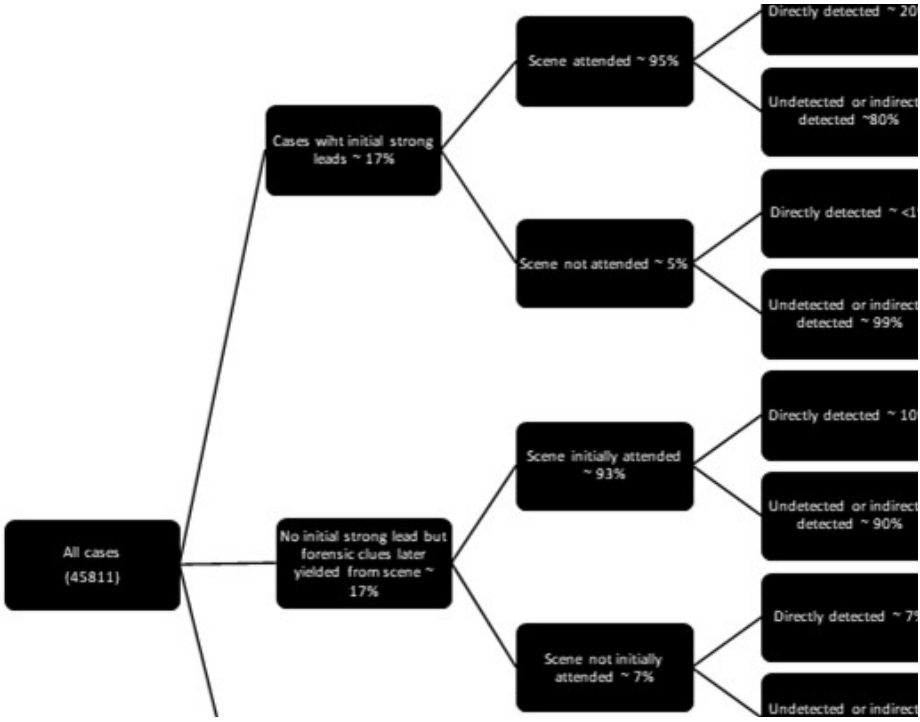


Chart 1. *Balanced crime offer*

The quantity of the composite good $X_{b=} W' + W_i(t_i) + W_l(t_l)$ represents the benefit that is obtained in the case of probability $1\text{-}p_i$, respectively, $X_{a=} W' + W_i(t_i) - F_i(t_i) + W_l(t_l)$ in case of probability p. The total expected benefit is the value of a good that is obtained by criminal activity corrected by the probability of punishment if the perpetrator of the criminal offense is discovered.

The Ehrlich's model is an unavoidable basis for the economic analysis of crime.

Decision of a potential offender to commit a criminal offense besides to the above mentioned factors is influenced by the *asymmetry* of *information* and tendency to *risk* (Labus, Begović and Jovanović, 2008: 359 and 375).

Due to the fact that they do not have sufficient or adequate information about the likelihood of being caught and punished, but also with the penalties, the potential perpetrators of the damage are often too optimistic in making decision to commit a criminal offense. If individuals are open to risky behavior, decision to commit a criminal offence will be made easier and vice versa.

Decision to commit a criminal offense is determined by a number of factors. The ability to affect some of them is limited or such action can be accomplished during a long period of time. This implies to social changes, the creation of an economic environment in which working within legal activities can generate greater benefits than in criminal areas, etc. The probability that they will be caught and punished and that they will bear the consequences for their behavior, as well as determining the penalties that will discourage potential perpetrators of committing a criminal offense may be effective in a shorter period. Increasing the capacity of the police, increasing the efficiency of the judiciary, and increasing the amount of penalties are some of the measures that create stimulus for individuals not to deal with crime.

PRIVATE AND SOCIAL COSTS OF CRIMINAL OFFENCES

Committed criminal offences cause costs in terms of destroyed property or loss that are conditioned by violation of subjective rights of individuals, as well as social costs related to *prevention* and *hinder* of crime. By economic analysis of the criminal act of burglary, we point out to the legal and economic consequences of this act on individual and social welfare.

The starting assumption of the analysis is that the burglary has occurred in the house and that on that occasion the owner was damaged (picture, technical device, etc.) in the amount of 5,000 euros. The owner received the stolen object-property as a gift from his parents and for emotional reasons (affection) he valued the stolen object more than its real market value, more precisely for 7,000 euros. The burglars wanted to get rid of the stolen goods as soon as possible and they sold it on the "black market" below the market value, more specifically for 2,000 euros. Since the value was not reallocated on voluntarily basis, it is consid-

ered as a *forced transfer*. In addition to the losses arising from the forced transfer, the consequence of the committed criminal offence represents *destruction of the wealth* of the owner, because when entering the house, a window (or door) was destroyed through which the burglar had entered the house. In that manner, the value of the wealth of the owner of the house was reduced, as well as the total social wealth as the destruction did not increase the wealth of the burglars. Destroying the door or window was not the target of the burglars. The intention was on the path of achieving the goal, that is, stealing the property that was in the house.

The reduction of social welfare due to the committed criminal offense also arises from the resources involved in burglary. Thus, the resources that the crimes absorb have *opportunely* cost, which mean that their use for productive purposes can create a new value. Resources relate to the burglar who represents a workforce whose engagement in legal activities could create a value that would increase the level of social welfare, as well as the resources spent by the burglar to acquire knowledge and skills in order to be able to do burglaries successfully.

In addition to the mentioned costs of resources that have been caused by criminal offences, it is important to point out to the resources involved in the combat against crime. In this case of burglary the engaged resources are being used in the way that burglar could be found, processed and adequately punished, which means the involvement of the police and the judiciary. Hence, after the report of the committed criminal offence, the police collect the evidence and engage in searching and detaining of the burglar. After finding the burglar, a new amount of resources in the field of justice is being engaged, in order to determine their responsibility and impose an adequate punishment. If the decision of the court determines the responsibility of the burglar, a punishment for the respective criminal offence is a prison sentence, which means that a new amount of resources is being engaged, within prison capacities, in engagement of staff, psychologists, nutrition needs of prisoners, health care, etc. According to an assessment which has been done in the USA, the direct costs of safekeeping of one prisoner are in amount of 40,000 $ per year. The amount increases if the prisoners are over 55 years old (due to the cost of treatment) and it cost up to 100,000 $ (Cooter and Ulen, 2016).

The above mentioned example of the criminal offense of burglary is pointed out from a reason of the economic aspect of one criminal offense. A large number of committed crimes during the year multiplies the amount of engaged resources and increases the cost of society, but also involves the engagement of a large number of individuals. According to the official data of the Republic Institute for Statistics in Serbia, in 2017 90,348 adult criminal offenders were registered (2019). The number of criminal offenders does not show the number of crimes, as there is no functional connection between the committed criminal offenses and the offender. This means that one individual can be a perpetrator of more than one criminal offense, but also one criminal offense can be committed by more than one individual. The basis for the disagreement in the number of committed crim-

inal offenses and the number of perpetrators is the judicial statistics, which basic unit of observation is an individual (Begović, 2012). The data indicate the fact that a significant part of the labor productive population of Serbia is not included in economic activities where the level of well-being can be increased.

The concept of economic analysis of the crime indicates the need to reduce the amount of resources engaged in crime. Reduction can be achieved *ex ante*, which means preventive action that implies in investments and increased efficiency of the judicial system, as well as increased police capacities, or *ex post* approach, which implies remedying the consequences of criminal offenses. As the loss of serious crimes (murders) couldn't be repaired or compensated, allocation of resources in preventive is a rational choice. Preventive action on reduction of criminal offences allows general prevention, but also increases the level of security in society and trust in institutions.

GOALS AND EFFECTS OF PUNISHMENT-ECONOMIC ASPECT

The committed criminal offence represents an unlawful act which implies the punishment of the perpetrator. Numerous rules which provide the punishment of a perpetrator of a criminal offense are defined in the form of laws, regulations, etc. have the aim that perpetrator of a criminal offense to pay the "price" of his conduct, respectively for the act committed. The level of punishment for the committed criminal offense should be in accordance with the severity of a crime. Conversely, if the perpetrator of the criminal offense does not bear the burden of their behavior, or if the value that they benefit from the committed criminal offence is greater than penalty they pay, the stimulus will be missing in order to stop those acts in the future.

Modern criminal justice systems see the main purpose of punishment in: *retribution, disabling, special prevention, resocialization* (Shavell, 2004).

The purpose of the *retribution* is to determine the punishment by which the usefulness of the perpetrator of the criminal offence is reduced. It could be established a connection between the reduced usefulness of the perpetrator of the criminal offense and the usefulness of the victim, so that the increase in the usefulness of the victim will be the result of a decreasing the usefulness of the perpetrator of crime (Begović, 2015). The economy indicates the level of the total costs of the committed criminal offense and the necessity of determining a penalty which, in addition to the costs of direct victims, should include the costs of third parties and the total social costs.

With *disabling,* as a punishing mechanism, the perpetrator of the criminal offense is physically prevented from repeating the criminal offense. This type of punishment represents a prison sentence. Physical disabling of the perpetrator has its advantages, in order to reduce the possibility that the crime will repeat, but

also has its disadvantages, as it enable the acquiring of new knowledge in the field of crime. Due to the large amount of resources that imprisonment absorbs, it represents an economically ineffective way of punishment, and it should be replaced by alternative penalties whenever the purpose of punishment allows it.

The relatively modest effects of prison sentences and the significant amount of resources that prison facilities cause it also conditioned the emergence of new penalties known as *alternative* sanctions. In 1986, the European Union recognized the need to find alternatives to imprisonment by defining *modified institutional sanctions* and *noninstitutionalized* sanctions (Stevanović, 2012: 213). Observed from the economic point of view, the financial form of punishment, i.e. fines, represent an alternative to penalty set by the law, and it should be used in cases (except for the most serious crimes) in which it can be adjudged. Benefits of financial punishments are reflected in the zero transfer costs and the reduction of budget expenditures.

The excessively number of prisoners and the constant need for new prison facilities, as well as the insisting on human rights and increased demands for better conditions in prisons has influenced finding a solution which caused that punishment by imprisonment is applied only when all other possibilities of the punishment are exhausted. By applying alternative sanctions, financial sanctions, even in the criminal acts for which are foreseen the life sentences, as well as the procedures in which the prosecutor communicates directly with the perpetrator of the criminal offense, the Netherlands significantly reduced the number of adjudicated sentences (Radojković, 2014).

In the 1980s, the Netherlands had 23 prisoners on 100,000 citizens, and in 2008 the number reached 130 prisoners on 100,000. This increase in prison sentences exceeded the existing prison capacities by 23% and represented a clear signal that the problem must be solved systematically (Allen 2012: 13). In addition to the above mentioned measures, the solution to this was probation, shorter prison sentences, etc. the Republic of Serbia, has 142 prisoners on 100,000 inhabitants, and it is 2.5 times smaller population and about 20 times smaller gross domestic product, and should apply the experience of the Netherlands and other countries, also adapting to the characteristics of our penal and judicial system.

Special prevention means the application of sanctions in discouraging a persons from dealing with the crime who have already committed a criminal offense and on which these measures have already been implemented (Begović, 2015: 88).

The establishment of the goals *of resocialization* related to the correction, re-education or adaptation of potential perpetrators of criminal offenses is a justified concept. Accomplishing the resocialization and "returning" of members of society who have "slipped" from it is difficult, and often impossible (Atanacković, 1988: 130). With rationalization the convicted perpetrators of crime are referred to education (Knežević, 2017) in order to increase their human capacity that allows them to earn income from activities that are in accordance with the law, thereby reducing the possibility of their return to crime. In addition to education

in the process of re-socialization, the morale of the convicts is being developed and moral restrictions incorporated (Begović, 2015).

The number of factors influencing the decision to commit the criminal offence and the number of factors at which the level of crime is determined indicates the possibility of action on each of them in order to bring crime to a socially acceptable level, which would reduce the amount of resources that crime absorbs. The decision on selection of punishment for the perpetrator of a criminal offence in addition to the requirements for justice and equity, should be adopted in accordance with the principle of efficiency.

CONCLUSION

Punishment and criminal repression are a necessity. The legal rules, the severity of sentences, as well as the increased probability that they will bear the consequences of their actions, create stimulus for potential perpetrators of criminal acts to choose not to be engaged in criminal activities. By selecting an adequate penal system, the level of resources that this area absorbs can be significantly reduced. The economic analysis of rights in the field of crime, the traditional understanding of law and the establishment of punishments, based on justice and equity, is expanded by the economic resonance, or by applying the criteria of efficiency, because the achieving of justice and equity has its own cost. From the economic point of view from the solution is effective, but also lawful, if it increases the level of individual and thus the level of social well-being.

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VOLUME II

Topic V

FORENSIC LINGUISTICS AND LANGUAGE FOR SPECIFIC PURPOSES

SPECIFIC FORMS OF INDIVIDUAL PRODUCTION IN SPEECH EXPRESSION - FORENSIC IMPLICATIONS

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Abstract: In this work, possible individual productions in speech expression are explained, together with their importance in biometric and forensic identification of a speaker. With the term specific individual productions it is meant that there is a visible variance from typical speakers production in some of the analyzed occurrences in speech. Even though, the native speakers of one language acquire common articulation base both with the environment in the language they are exposed to, personal biological and psychological characteristics of every individual cause various forms of individuality in speech production. Apart from personal biological and psychological characteristics, variance might be caused by specifics of communicative situation. In forensic analysis individuality is researched and it can be expressed in a few features which might be important markers. This work discusses the most important individual characteristics, for example: voice quality, articulation quality, basic tone pitch, specific features of certain speech segments articulation (voices and voice connections, strange words, together with prosody characteristics) tempo, rhythm and scope of international variations and loudness variations). The speaker may produce variances in some of the given markers, and may vary in a few markers because some of them by cause and effect are mutually connected, as for example tempo and articulation quality are connected. With various examples in the real productions (cases) demonstrating a greater number of such speech manifestations, it was emphasized how great their importance is in biometric and above all for forensic analysis in case of speaker identification.

Keywords: speech expression, specific production forms, segment variance, prosody variance, forensic identification of a speaker.

INTRODUCTION

Speech communication is a very complex process. Its sense is in multidimensional interaction among people with which there is a transfer of not only conscious information, but also information on statement, intention, emotions, mood, and other interpersonal relations. Under *conscious information* we mean giving speakers idea to his co-speaker through voice and speech, expressed verbally, using adequate linguistic code. This type of communication enabled a human to have social, creative and intellectual development, i.e. - civilization development (Jovičić, 1999).

When a human speaks he or she behaves as a source of acoustic (speech) signal which is heard by a listener. He or she detects and understands in the intellectual plan thanks to linguistic code which is used both by speakers and listeners. Therefore, *linguistic information* transfer is in question. Anyhow, through this and such communicational channel there are transfers of many other *nonlinguistic information* which is found in literature as *extralinguistic information* and *paralinguistic information* (Mozziconacci, 1998; Scholtz, 2002; Jovičić et al., 2006; Schuller and Batliner, 2014). Extralinguistic information is characterized by the speaker as a source of information, that is, he or she is identified as a specific entity in human population. It is about physical and physiological features like gender, age, pathology in voice, health condition, specific manifestations in voice and speech, etc., which points to speakers identity. On the other hand, paralinguistic information describes speakers complex psycho-emotional state at the moment of speaking. It is about affective manifestations which are transferred through the variety of vocal qualities, like emotions, intentions, adaptations to the topic and ambience of conversation, etc. All the given information is transferred through speech channels simultaneously and that makes up richness of speech expression. The fact that it is not like the case, that only linguistic information transferred to speech would be "robotized", sounding as if it has no emotions. Examples of people who were born deaf and who did not have feedback acoustic channel, they speak with unnatural prosody, without speech expression of emotions and other attributes which makes spontaneous speech natural.

On the other hand, this information enables speech of a human to appear as one of biometrical features (Woodward et al., 2003) which automated systems of authentication and identification of a person are based on. With such features voice and speech became very interesting for forensic analysis and recently they have become very important arguments in Legal Practice (Rose, 2002; Hollien, 2002; Jessen et al., 2007). If biometrics and forensics are based on the same voice and speech features there is an important difference between them. Biometry is applied in situations which are prior to events like access to restrictive resources or subject verifications, by the rules they happen in controlled conditions, with the cooperation of subjects, by the rule, it is automatized. Forensics activates after occurrences like crime act, preconditions for forensic analysis are not controlled and subjects are often non cooperative. However, the fact is that biometric methods are used in forensics, as well, but the use of expert knowledge means something forensic cannot do without.

Intra-speakers variations in speech production are a problem for biometrics and forensics. On the other hand greater intra-speakers variations lower inter-speakers distance and they can greatly influence reliability of identification of a person. However, there is a very specific production in individual voice and speech which can be very important forensic markers and they can contribute greatly to expert assessment and decision on subject identity. We will show one set of such manifestations which are not present in voice and speech of every subject, but some of them, because of which they are very strong individual forensic marker.

SPEECH PRODUCTION MODEL

In order to better understand specific forms in speech production, let us first look at the model of speech production shown in Figure 1 (Jovičić and Zdravković, 2019). A subject who wants to communicate some information to its surroundings must first in its conscience form an idea what it is that he or she wants to verbally communicate. Then this idea is coded in cognitive level, with linguistic language code in which the subject communicates. This process is very complex, because of this *linguistic programming* means all the mentioned linguistic information: linguistics, paralinguistics and extralinguistics. As Figure 1 shows, some of these pieces of information have influence in certain segments of speech production model. The next step in the formed linguistic message involves inserted certain prosodic rules which should"make alive" speech message through verbal expression. With it the preparation completion for generating motor commands through nervous impulses leading to articulation organs produce speech signal by fine action.

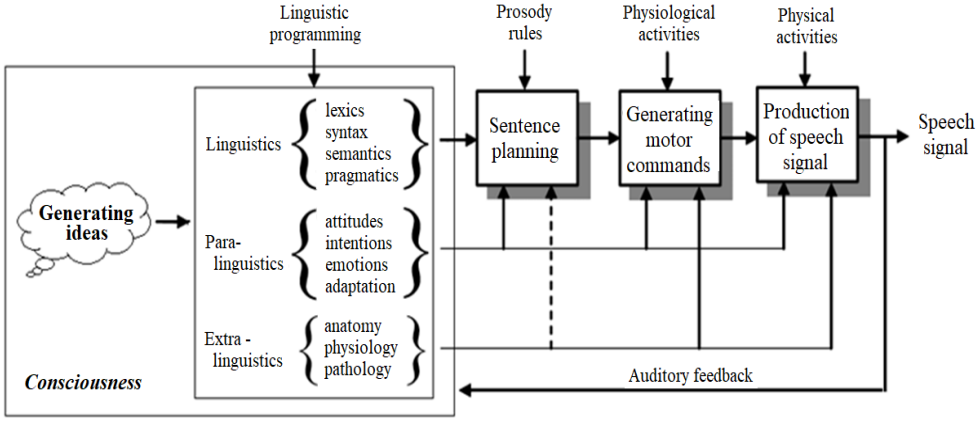


Figure 1: *Speech production model.*

In any segment of voice and speech production a subject may intentionally and most often unintentionally bring additional information. For the listener this information may be but most often is not of any communication importance.

Because of that, we named them in this work as ”specific forms in speech expression” which may be of great importance for biometrics and in forensics they may appear as a key forensic markers. We have classified these specific forms in expression in three categories: *specific manifestations in articulation*, *distortions in articulations* and *language particulates (individual particularities in spontaneous speech)*. In further text we will show many examples of these specific forms in verbal expression, examples from forensic practice, with interpretation of their origin and importance for forensic analysis.

SPECIFIC MANIFESTATIONS IN ARTICULATION

Under the term *articulation organs* we mean all speech organs which participate in speech signal production from lungs to nostril openings and mouth openings. *Articulation* is a process of articulation organs activity. In production of speech signal the glottal system, mouth cavity and nasal cavity are of primary importance. Functioning of these subsystems of speech apparatus together bring *articulation quality* and *voice quality*. In Jovičić (2008) the concepts are defined in this manner:

> “*Articulation quality* defines smaller or greater muscular tension of articulator during speech production (Laver, 1980). So, we could conditionally talk about “strong” (tense), normal and “loose” (relaxed, unclear) articulation. For example, expressions with imperative semantic features and threatening expressions are characterized by extremely tense-strong articulation. Strong articulation occurs in speech expression of strong emotions, while relaxed-loose articulation is one of the more important proofs of weak emotions expression, but it also indicates depression, hangover, etc. So, articulation quality as an individual characteristic of the speaker expresses his or her temperament and/or automatized habits and as such certainly and partially participates in general voice quality. *Voice quality* is individual characteristic of a human and as specific auditory colouring of voice is recognisable feature in continual speech. Subjective impression on voice quality is contributed by features generated by phonatory system, phonetic habits, and social and regional context and situation. Voice quality can be willingly controlled in order to be used as linguistic, and most often paralinguistic speech means of communication (for linguistic distinction and phonological contrasts in some languages, for realisation of diverse regional distinctions, and functions as paralinguistic features in speech expression of emotions) but it is, at the same time, an innate individual characteristic of a speaker. Quality of voice is obviously multidimensional characteristics which may be viewed from various aspects - a constantly present fundamental feature of speech which identifies the speaker as an individual as a changeable category during speech process.”

These are a few examples of various and specific manifestations in voice quality and articulation.

In Figure 2, waveforms of one and the same sentence produced with various voice quality is shown: neutral voice, breathy voice, creaky voice, harsh voice and tense voice. Very different forms can be seen in speech signal. For example in creaky voice and harsh voice we see important irregularities, while with tense voice importantly different signal dynamics in comparison with neutral voice exists. These characteristics in speech signal may be important forensic markers in characterization of the subject voice as their inherent characteristic or characteristics of a specific psycho-emotional or health state.

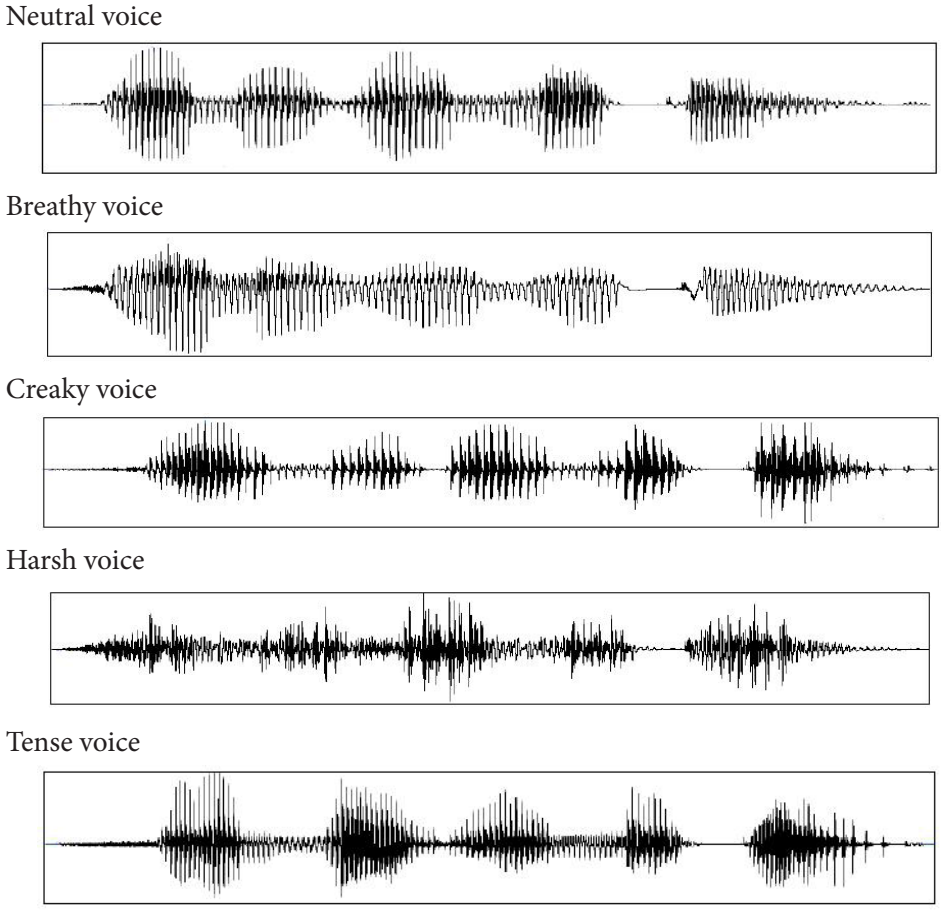


Figure 2: *Waveforms of the same sentence with different quality in pronunciation.*

The next examples shown in Figure 3 are characteristics of an older person, a person under physical and psychological burden. The occurrence of *creaky voice*, Figure 3a, most often happens at the end of pronounced segment/voice, when it happens that articulation relaxes and especially voice chords relax. In that case fundamental voice frequency (F0) abruptly lowers most often close to half of its nominal value (in spectrogram it can be seen by important scattered glottal im-

pulses). Usual occurrence of creaky effect in voice of a person maybe one of forensic markers.

Inspirium in voice, Figure 3b, happens with stronger inhale most often caused by obstruction problems in the respiratory tract, when it is independent from speech tempo. However, it can happen sporadically with speakers of fast tempo when because of speech acceleration the speaker cannot breathe so easily. Similar noise effect can happen as a typical individual characteristic in expirium form at the end of particular words, Figure 3c.

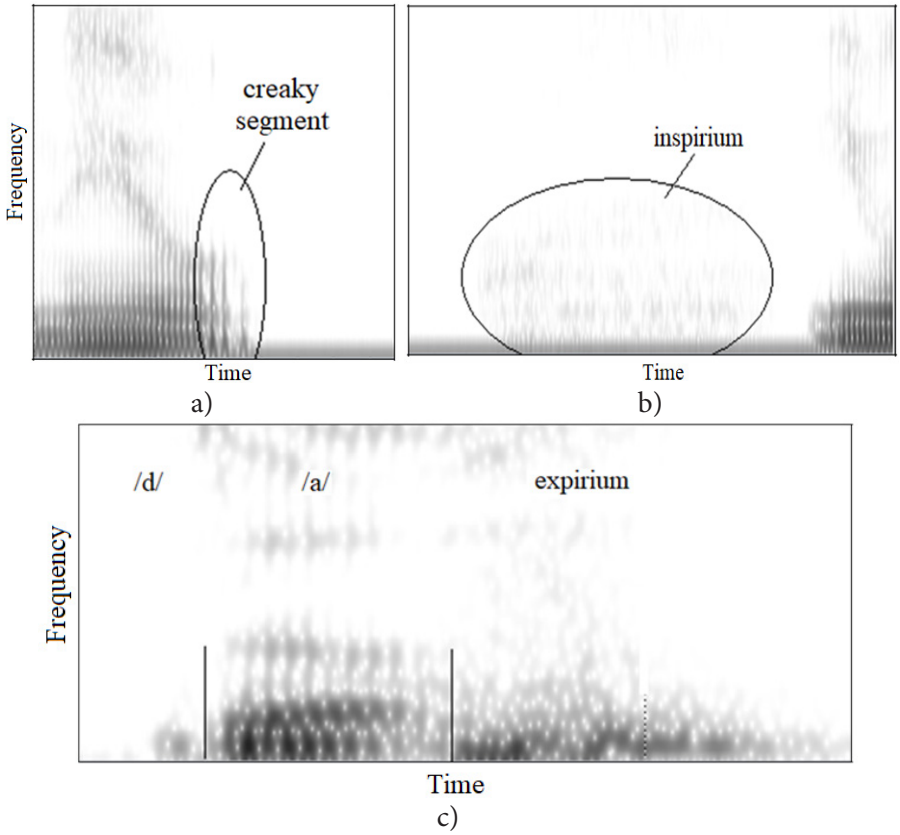
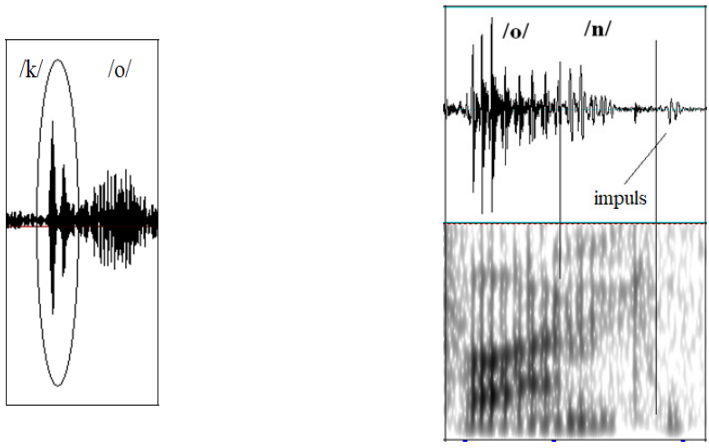


Figure 3: *Some specific manifestation in voice: a) creaky voice, b) inspirium and c) expirium.*

In Figure 4a an example of distortion in plosive /k/ is shown. Explosive segment of plosive /k/ in co-articulation with vowels most often has too short acoustic impulses. This explosive segment happens after opening occlusive barrier which with velar voice /k/ is made by back part of the tongue. With production of this voice, the tongue strongly glues to hard palate and it is necessary to have certain air pressure from glottis in order for it to unglue. Than the giving impulses happen by separating specific tongue structures from the palate. When a person has difficulties over control of tongue muscles, then stronger pressure is needed

in order to separate tongue from the palate, while stronger acoustic impulses are generated.



a) b)

Figure 4: *a) Intensive realization of the explosive burst of the plosive /k/ and b) impulse disturbance in final alveolar voice /n/.*

In Figure 4b we show waveform and spectrogram of speech signal of final parts of words /telefon/. In speech signal after final nasal voice /n/, we noticed an impulse which systematically happened with given subject in more positions in questioned and suspected recordings. The subject was established to wear braces and understanding correlation of tooth braces and seen impulse was such: after pronunciation of an alveolar voice /n/ the top of the tongue touches braces, which is vacuumed to the palate, in the place where it normally touches alveoli. At the end of voice expression /n/ the tip of the tongue is separated from the braces, draws and then returns to the first position. With this an impulse signal is generated which in the recording appears as a disturbance.

DISTORTIONS IN ARTICULATION AND IN VOICE

With the production of specific voice, the articulation organs take place in a certain position in the vocal tract. This position defines acoustic characteristics of produced voice. If the position of the articulation organs is not adequate that induces the change of acoustic picture of the given voice. The changed acoustic picture in softer form shows *distortion in articulations*, and if it is about important change of acoustic picture then *pathology in articulation* happens and consequently pathology in voice. One should mention that distortions in articulation may sporadically happen in normal speech too, especially with fast speakers or speakers with transient and specific psycho emotional state. However, forensic

practice has proved that innate or acquired distortion of articulation is a strong individual characteristic of a speaker. Next examples demonstrate that there is a variety of forms of exceptions in voice articulation

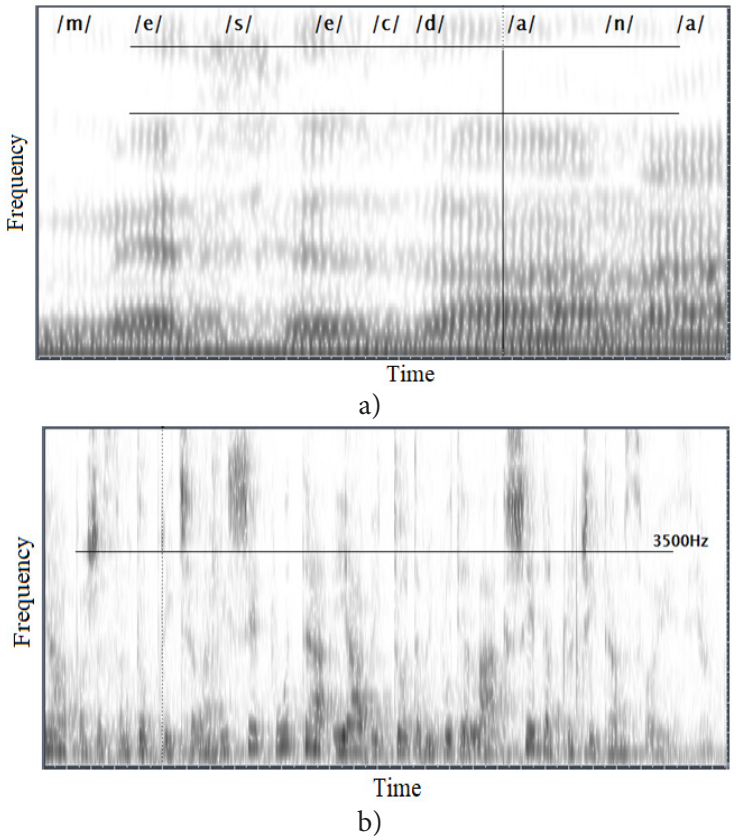


Figure 5: *a) nasalization and b) sigmatism in speech signal.*

A spectrogram in Figure 5a shows one speech segment of a subject which has expressive effect of nasalisation. This effect happens when the uvula, which is a very movable organ positioned in the depth of the pharynx in the place where the mouth cavity and nasal cavity connect, does not perform its function. However, with normal production of all voices except nasals, the uvula closes the nasal cavity, so air flow from the lungs comes through the mouth cavity. With the nasal production, the mouth is closed and air flow comes away from the vocal tract through the nose. In that case the uvula opens the nasal cavity, so air flow goes away from the vocal tract through the nose. When a problem in functioning of the uvula occurs, it is relaxed and it cannot qualitatively close the nasal cavity with production of such voices, so air flow comes through mouth cavity and nasal cavity at the same time. The presence of nasal cavity with production of all other voices has the effect of weakening the part-of-speech spectrum. It is shown by a very bleak part of spectrum between two parallel lines, Figure 5a. Nasalization

effect is characteristic of older persons, but also of persons who have the problem in physiological control of normal functioning of the uvula and it is very stable distortion of articulation.

The next distortion in articulations is produced by irregular position of the tongue in the mouth cavity. Because of that, the geometry distortion of the resonant cavities in the anterior part of the mouth cavity and irregular spectral deformations in the spectrum of speech signal are seen. This distortion in articulation is called *sigmatism*. Depending on the position of the tongue in the mouth cavity, there are various forms of sigmatism, but that is a question for speech-language pathologists (SLPs) and we will not take into account this topic in this paper. In Figure 5b, one form of sigmatism is shown when the upper part of a spectre of speech signal is importantly strengthened, beyond 3500Hz, and which is auditively perceived as "lisping".

A special form of sigmatism is the so-called *stridents*. It happens very often with speakers and this is why we have pointed it out. With pronunciation of dental and palatal fricatives and affricates tip of the tongue is in the correct position, groove in the middle of the tongue exists but it is too deep so that during the friction, the sound similar to whistling occurs. Groove may disappear as a consequence of not enough activities and synchronisation of the tongue muscles work. It can be very intensive and unpleasant to listen. On the other hand, potential occurrence may happen in the normal communication, but if it happens systemically in speakers speech then it may be an important forensic marker.

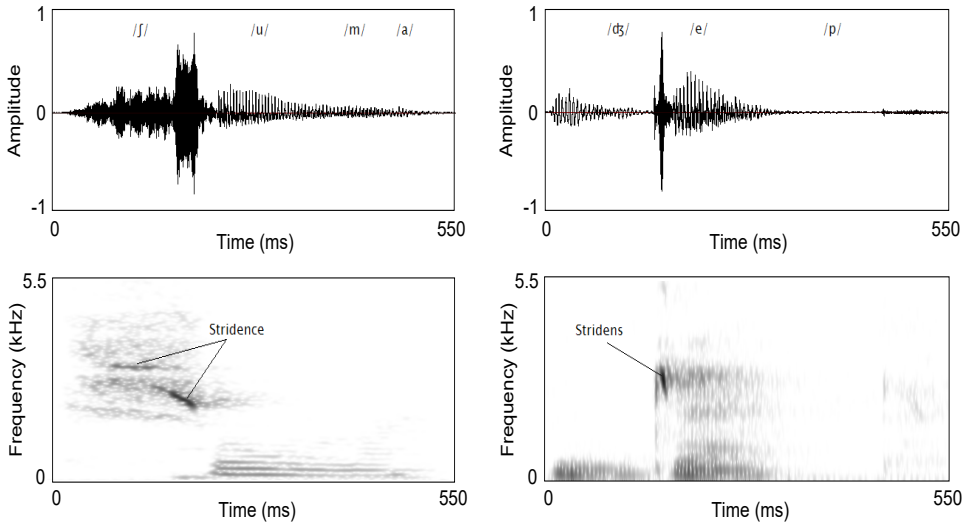
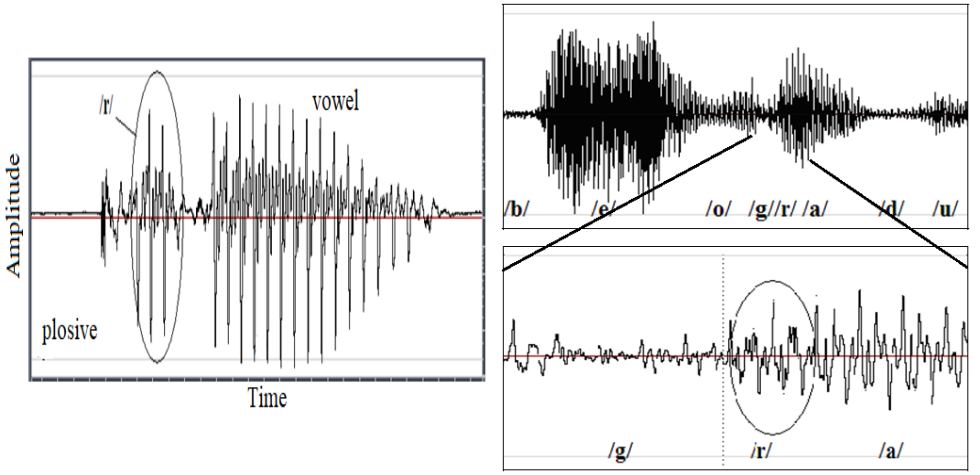


Figure 6: *Two examples of stridens.*

Figure 6 depicts different forms of stridents. With fricative /ʃ/, Figure 6a, strident occurs as two resonant occurrences changeable in time and in spectrum. With affricates /dʒ/, Figure 6b, stridens occur as very short and intensive whistle.



a) b)

Figure 7: *a) normal realization of /r/ and b) atypical realization of /r/.*

The next example of articulation distortion is *rhotacism*, in other words untypical pronunciation of vibrant /r/. In normal speech voice /r/ is realized in one, at best three impulses, as a consequence of vibrating the tip of the tongue. In Figure 7a, normal realization of voice of the /r/ is shown with one impulse. However, with persons with label loose articulation or with a problem in muscle control of the tongue, articulators are not able to separate voice /r/ from the next voice. In Figure 7b, the case of co-articulation of voices /r/ and /a/ are shown. In magnified speech segment, it is visible /r/ that is completely integrated with a vowel /a/ and in the context, voice /r/ is still auditively well heard. With harder distortion, when the tip of the tongue is not movable, there can be an omission of voice /r/. With such pathological cases, they may occur in other voices too.

In the end, one should point out that multiple distortions might happen in practice. In our current research we have analyzed perception in distortion of duration and intensity of fricative /ʃ/ .This kind of research is important in speech therapist practice with SLPs work in habilitation and rehabilitation of children with problems in speech. However, they are important for forensic experts as well who in listening to recordings should see specific qualities in speech of a person and accept these as forensic markers or not.

In Figure 8, two dimensional (2D) identification surface is shown in perception of variation of duration and intensity of fricative /ʃ/ in the word /ʃuma/. The result is important because it shows what are the boundaries of normal value of

a certain feature in analyzed voice, as an interaction of distortion of one feature to another.

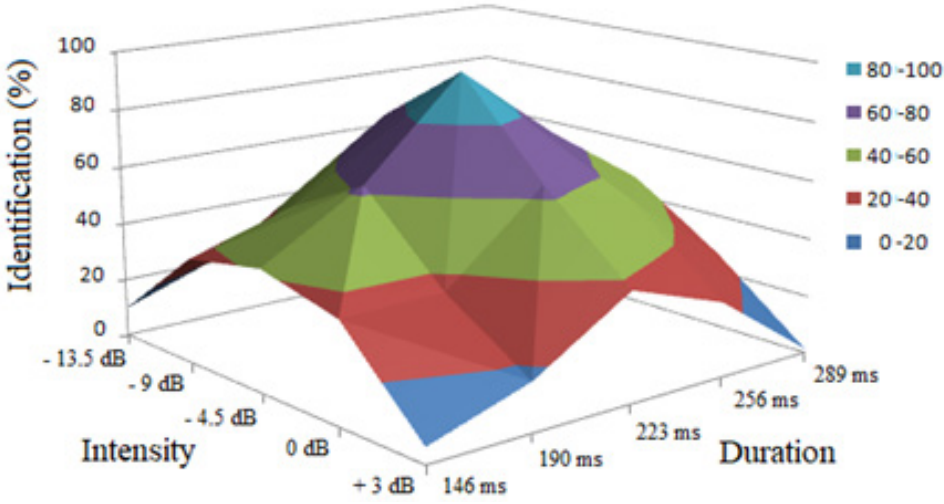


Figure 8: *2D identification surface in perception of variations in duration and intensity.*

INDIVIDUAL SPECIFIC QUALITIES IS SPONTANEOUS SPEECH

Individual variations in the plan of speech expressions are simply saying personal speaking features of every human according to which he is different from other humans, because great similarities of speech features occur only in monozygotic twins. The group of individual speech characteristics presents *phonetic capacity* of one person. Phonetic capacity of every individual determines anatomical and physiological characteristics of his system of speech organs, but also the ability or inability to use natural advantages and abilities or inabilities to compensate weaknesses with phonetic compensations (Kašić, 2000b). With forensic analysis of questioned or suspected samples of speech, from linguistic aspect the individual markers in spontaneous speech are most often determined. Therefore, this questioned samples most often happen in a dialogue which occurs spontaneously between a speaker and co-speaker. Suspected samples occur in controlled conditions, so they are not usually spontaneous. But experts may manage in suspected recordings (according to their experience and according to knowledge of spontaneous occurrences in speech) a separate parts of spontaneous speech in order to compare forensic markers in both questioned and suspected recordings, because of inclusion or disconnection of similarities between this questioned and suspected speaker.

VARIANCE IN THE LEVEL OF SEGMENTS

The specificities of speech quality and articulation of particular sounds, which are determined by acoustic analysis, are analyzed in the previous part of this work. In given examples of variance of voices pronunciation, characteristics are following in certain speech segments in spontaneous speech. Most often special manner of speech of specific consonant clusters occurs as a marker (Kašić, 1997). Speakers of shtokavian dialect with imprecise articulation, often pronounce clusters with connection between dental and alveolar sounds in a specific way. When dental fricative and alveolar lateral are in connection, then the other element of a cluster, that is lateral, is not precisely pronounced (or not pronounced at all), so there are cases *misim, sično, sabo*… instead of *mislim, slično, slabo*...etc. However, when dental plosive is in touch with alveolar nasal then the pronunciation lacks the first cluster member that is plosive. Examples for this happened in real cases (*nevno, nevnik, jeno, svejeno*… insted of *dnevno, dnevnik, jedno, svejedno*…). Most typical cases with specific pronunciation of consonant clusters are given. In the analysis, all types of clusters are subject in observation as an individual characteristics especially in the strangest types of pronunciation. Irregularities in speech of clusters are an important marker for native speakers of shtokavian dialect, because of the phylogenesis of this type of composition, derivation and forms of morphological system of shtokavian dialect, in this articulation base there is the numerous two elements and more complex consonant clusters (Kašić, 2000b).

Special type of divergence in pronunciation of segments are the remains of automatism of dialect articulation base. Namely, articulation base is automatized up to the age of seven, so with speakers who have separated geographically and in speech from their native dialect, a dialect expression of certain segments may happen (Kašić, Đorđević, 2009b). This marker is recorded in famous cases with English language native speakers (Rose, 2002). Dialect markers with native speakers of shtokavian dialect, such as: non differentiating of affricates couples, voiceless sonant /v/, specific pronunciation of lateral /l/, fricative /š/ affricate /č/, open and closed pronunciation of vocal of middle range, reduction of vocal in short syllables ... are valuable in excluding similarities between speakers, while with proving similarities there must be used with special care, that is, there is little evidence of value in proving similarities (Kašić, Đorđević, 2009a).

VARIANCE IN THE LEVEL OF SUPRA SEGMENTS

In the scope of prosodic features of speech, that is supra segments (syllable stress, tempo, loudness, intonation, rhythm), which by definition are produced by the variance of basic acoustic parameters (Kašić, 2000a) we determine important individual markers in identification and profiling of speakers.

When *syllable accent* is in question with a native speakers of shtokavian dialect, individual markers may happen in automatisation in one of the existing regional accent types - four accent system, two accents type with declining accents or one accent - dynamic. Each one of the existing types has its subtypes. However, regional types and double forms of long accents are not a reliable marker because of general conspicuousness. This general conspicuousness enables speakers, while giving suspected samples for expert analysis, to sensibly mask this characteristics. Very often speakers use the exceptional regional characteristics for masking this personal speaker characteristics in questioned samples of speech. So, during the analysis of syllable accident in forensic analysis, it is necessary to determine the clear criteria of differentiating between regional occurrences and individual markers in order not to be trapped for identification. Regional accent characteristics because of early automatisation are a valuable marker when determining the profile of an unknown speaker, and in identification they can help for excluding similarities between speakers. With speakers who in great measure acquired standard speech, a forensic phonetician may use inconspicuous remains of automatism in articulation base for identification; one of the most important markers in this domain is automatism of one of double forms of short accents because both forms are standard, and since the difference between short accents for laymen is almost indistinguishable, both speakers and co-speakers are unaware of, so they do not try to make a distinction in acquiring the standard, and they cannot use it in masking that speech.

Speech *tempo* as automatized personal speech characteristics and features of the temperament (Kašić, 2000a), which can be fast, moderate and slow, gives reliable and inescapable possibilities of determining individual markers in certain sequences of productive continuous speech. And when the speaker tries to disguise and slow the tempo, he/she very often very quickly passes to his or her natural fast speech. The speed of tempo is most often measured by average number of pronounced syllables in unit of time. Even though in our articulation base of shtokavian dialect more than two voices can occur and occur, this measure is in real cases proven as a reliable, proving fastness of speech.

Very often a fast tempo is caused by imprecision of quality of articulation. With fast speakers it is mirrored in the occurrence of non producing certain sounds, sometimes in occurrence of overlapping of syllables, and sometimes only the first part of the word is pronounced and then the second word is pronounced. With very fast speakers it is perceived that this occurrence happens before breathing pause producing unexpectedly a lengthy vowel (*gdee, bratee, samoo, maloo*…). Comparison to the given occurrences with fast speakers contribute to reliability of the speaker identification. A very slow tempo may lead to articulation deformities which also may be one of the forensic markers.

Rhythm, in the most general sense is organised alternating of sound segments and pauses in speech (Kašić, 2000a) that gives the possibility of determining individual markers in speech production. Fluent rhythm means continuous speaking

with adequate breathing breaks which follows syntactic and semantic structure of an expression. However, the given type of fluency is not always possible to make out, so the speakers try to find the solution for too long breaks in speech in different ways. Variance of manners solving too long breaks in spontaneous speech enables determining more reliable individual markers in this domain. In too long breaks speakers often, as automatized habit, produce various speech segment which can represent only voice or word, syntagm, and sometimes the whole expression. In real cases of sample analysis of speech the given possibilities were recorded: /ə/ *neutral vowel* - short or prolonged, *ovaj, onaj, ovoga, vidi, znaš, kako se zove*….. In Figure 9 the spectrogram of /ə/ *neutral vowel* is shown in trying to find the solution to the break in speech.

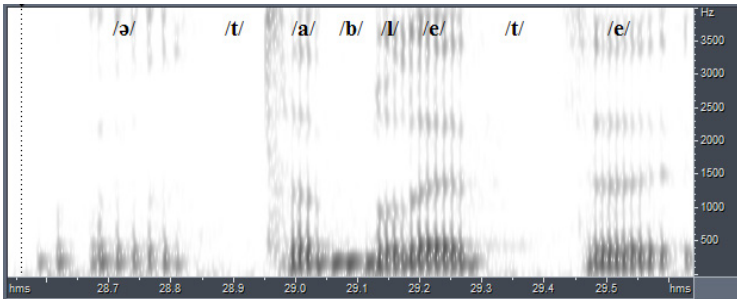


Figure 9: *Occurrence of neutral vowel (Jovičić, 2008).*

Because these sequences are usually automatized, with their analysis one can reach important individual markers. Therefore, these productions may be compared in questioned and suspected recordings, and give possibilities that the voices in syllables in them compare two voices in the similar surroundings in this questioned and suspected samples of speech if there is the possibility that the speaker masks him or herself with language means.

Rarely there occurs the complete non-fluency or stuttering, according to statistics, stuttering occurs 1 of 100 speakers (Golubović, 2000). This type of non-fluency is characterized by long breaks, difficulties with the beginning of a production and similar. In Figure 10 there is a presentation of a spectrogram of "successive" repeating of one sequence through trying to solve the two long break.

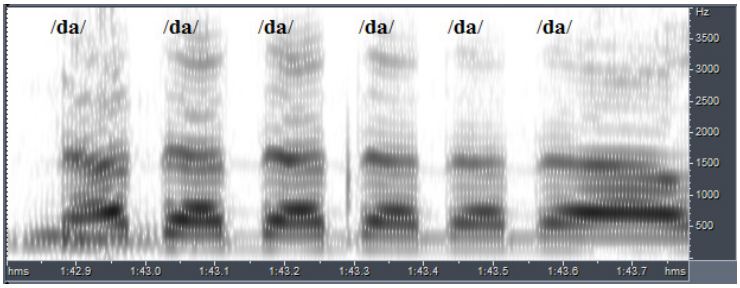


Figure 10: *The occurrence of "successive" repetitiveness of the same word.*

Furthermore, the number and length of pauses, as a way of beginning of articulation after a pause (attack or performance) maybe one of the distinctive characteristics. A distinctive feature is made up of a specific individual coarticulation variation caused by rhythmic international organisation of speech.

In estimation of a fluent speaker, the scope of intonation and intensity variations are analysed because in a natural spontaneous, well-organized speech, the scope of these variations is very great.

In a certain way *loudness* (speech is perceived as quiet, moderately loud or too loud), as a feature of temperament and as a feature of cultural habits which may happen (in working with other markers), determines individual characteristics of a speaker. Because of different cultural habits in the domain of loudness of speech and difference in personality characteristics which brings to various expression automatized degree of loudness in speech production, this suprasegment is also valuable in identification and determining the profile of an unknown speaker.

CONCLUSION

The paper has analyzed the most important specific forms of individual production in speech expression that are determined as forensic markers in real cases of identification and profiling of speakers. During the forensic identification of a speaker, it is inescapable to do the analysis of voice quality, articulation quality, the basic tone pitch, articulation specific activity of certain speech segments (voices and voices linkage), as with prosodic characteristics (syllable accent, tempo, rhythm and scope of intonation variations and loudness variation).

It is especially important to point out that because of intraspeakers variations in speech production, it is necessary to determine connected markers in order to determine the identity of a speaker. It is also pointed out that in forensic identification of a speaker, an interdisciplinary approach is valuable with acoustic and linguistic aspect in order to be more reliable.

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UTILIZATION OF VOICE ANALYSIS METHOD IN CRIMINAL INVESTIGATIONS

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Abstract: Contemporary technological and educational achievements enable the emergence and development of completely new identification methods based on individual physical characteristics of persons. Today, forensic voice identification is a powerful tool in the fight against crime, in situations where it is necessary to identify a suspect or to acquit an innocent person. Just as there are no two identical fingerprints, two identical retinas, or two identical handwritings, there are no two identical voices. Based on 20-30 seconds of effective speech, forensic experts can perform a voice expertise and identify with high reliability whether a particular voice belongs to a particular person. Comprehensive analysis results in a large amount of data, so by using the statistical analysis method, the necessary forensic markers for forming the final expert opinion are obtained. In this type of expertise, interdisciplinary approach is applied in which several scientific disciplines are included - linguistics, phonetics, acoustics, speech-language therapy, psychology, mathematical statistics, law and criminalistics. It is not only the voice of the speaker that undergoes a detailed analysis, but also the speech on the whole. This means that not only the voice quality (loudness, pitch, harshness, nasality), but also the characteristics of language (Morphology, Semantics, Syntax and Lexis) are examined.

Keywords: crime, voice analysis, forensic expertise, identification.

INTRODUCTION

By listening and analyzing of voice recordings, based on series of specific speech characteristics, forensic experts are able to make a suspect's profile and establish their identity. Based on detailed analysis, it is possible to determine the

part of the country in which the suspect was born, lived or went to school, create their socio-linguistical profile (verbal capacity, education background, colloquial speech), as well as psycho-linguistic profile (temperament, expressiveness, composure). These are the actual facts that provide full scientific meaning to the Socrates' quote "Speak, so that I may see you".

Uniqueness and singularity of each human voice happens to be the result of a long path of evolution lasting for millions of years and standing as one of survival factors of human kind. Voice of a particular person is determined by a person's anatomy and physiology (Chermak, Bellis & Musiek, 2007). Through voice, one can express deepest emotions and complex intellectual thoughts. It is the voice we use to choose our friends or partners and randomly create an image of the speaker. Voice is actually a designation of our identity, just as there are no two identical fingerprints, handwritings or eye retinas, there are no two identical voices. Identifying a particular person based on their voice is called forensic speaker identification. Today, this form of identification is a powerful tool against various forms of crimes. It is used for identification of voices recorded in kidnapping, drugs manufacturing and dealing, threats, extortions, human trafficking, war crimes being recorded on a video tape and other criminal actions (Gibbons, 2014). The main task is to listen to the recorded voice and perform detailed analysis of the speech signal and consequently identify array of speaker-specific information serving as strong forensic "markers" to confirm the identity of a perpetrator with high reliability. There are several things which may serve as forensic markers: some form of speech pathology, use of filler words or characteristics and specificities of each particular voice. There have been frequent demands to identify whether someone disguised their voice, closed their nose, put a handkerchief over mouth or was impersonating someone. Voice record analysis depends on the recording quality, conversation duration, whether it was masked by any background noise coming from other sources (traffic noise or coffee shop hum). Distortions and background noise not only mask certain particularities of the speech signal, but influence the alterations in speech characteristics. Psychoactive substances like alcohol and drugs can also cause significant changes in speech characteristics resulting in misleading conclusions when such voice is being compared with a disputable sample.

Development of technical systems for voice recordings analysis and invention of special software for voice comparison have significantly improved the identification based solely on voice identification. However, although advanced software programs can be applied, human factor which comprises knowledge and experience of experts and professionals still remain irreplaceable (Cooper, 2005). According to the international standards, ts specific expertise can be executed solely by an expert holding academic degree in the field of speech along with some expertise in the field of electro acoustics. In Serbia there are no legislative regulations, technical standards or protocols (or at least available to general public), resulting in executing of the expertise in accordance with the Code of the The International Association for Forensic Phonetics (IAFP).

PROCESS OF EMERGENCE OF VOICE AND SPEECH

Speech is a continuous process in time and its elements should be regarded as segments being parts of a wider whole. Thus, through analysis we will obtain fuller characteristics of isolated segments. In a detailed analysis, the expertise begins with the evaluation of a voice, followed by a syllable, a word or a sentence. Basic vocal sound is produced by air passing through the larynx, causing the vibration of vocal cords. The sound is generally perceived by the ear (but also by tactile and kinesthetic perception), which brings us to three basic characteristics of sound: pitch, loudness and quality. As a sound phenomenon, there are four processes of speech production: respiration, phonation, resonation and articulation. All these processes provide individual characteristics to each particular speaker. Speech originates from simultaneous and synchronized action of these processes. It is a group of modifications, blending and segmenting of sound and movement in time (Heđever, 2012). All speech processes are time-related. However, some of these processes "happen in time and others change over time" (Škarić, 1991; 213). If we study speech, in particular its specificities, it is necessary to convey a research of spectral, intensity-related and time-related components of speech. We may assume that the majority of speech specificities are being manifested *inter alia* through specific changes of certain time segments. Sometimes, these changes are visible only in "macro-segments" (prolonged time sequences, in duration of several minutes) and sometimes in "micro-segments" of speech, lasting only for milliseconds. These changes are not always relevant and we sometimes fail to perceive it, but its identification and analysis may contribute to finding the perspective of specificities of the speech inquired. Each speech deposition consists of components related to content (linguistic component) and form (manner of respiration, phonation, resonation and articulation). Both components are present in final realization of speech, while careful and precise acoustic analysis may determine which processes were involved in forming particular segments of speech signal (Jessen, 2008).

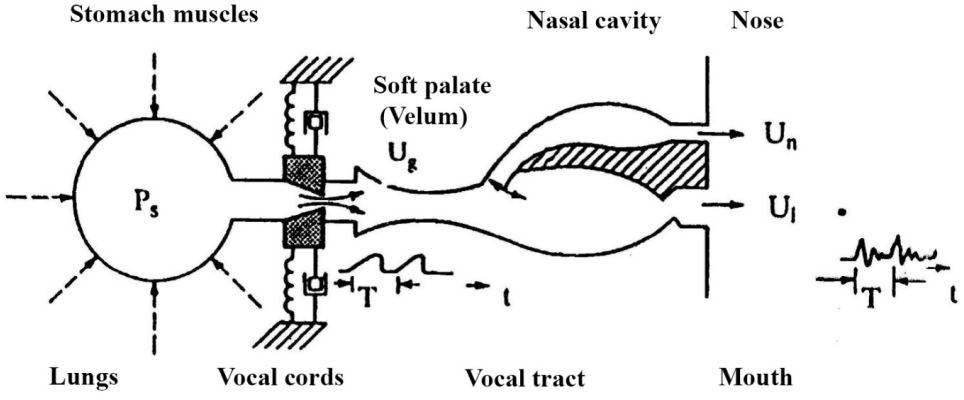


Fig.1. Speech Mechanism Scheme

Theoretical foundation of vocal identification is based on presumption that each individual voice is distinct and different from any other, which can be confirmed by voice analysis. There are two basic factors which make each voice unique during the speech process. First factor is the size, shape and connection of vocal cavities (throat, nose, and mouth) and the length and tension of vocal cords. Cavities of the vocal tract act as resonators (similar to pipe organ's tubes) amplifying certain tones produced by the vocal cords. Thus, typical sounds are created which is being registered as a print in a voice analysis. The other factor which gives unique characteristics of speech process of each individual speaker are the acquisited motor patterns which directly involve articulation organs (lips, teeth, tongue, soft palate, jaws) in speech production. Humans acquisite these motor patterns through process of learning and impersonating other people from their immediate surrounding and they are singular features of each particular individual (Bell-Berti & Hariss, 1982).

FORENSIC SPEAKER RECOGNITION

Speaker identification based on vocal analysis may be defined as a combination of auditive (hearing) and spectrographic (instrumental) comparison between one or more familiar voices with the voice unknown, in order to either identify or eliminate the investigated individual. The onset of voice analysis method was first encountered in America in the late 1940s when it was used for military intelligence purposes. The intense use of voice analysis technique for forensic purposes began in the late 1960s at the time when it was officially introduced by the Police forces in America as one of the identification methods. Forensic speaker recognition comprises comparison of familiar voice of a suspect with the unfamiliar voice with aim to identify or eliminate the suspect as a perpetrator. The specificity of forensic recognition lies in mandatory precondition of conditional cooperativeness of undisputed person and the uncontrolled conditions of acquired recording of a disputed voice. In such recognition procedure, elements of recognition in the form of verification and identification stand out clearly (Jovičić, 2009). From the forensic point of view, the process of individualization of a person swings from general population towards the individual, while the speed of reduction of its characteristics depends on disputable and undisputable features standing at a disposal of a forensic investigator.

Biometric technology is based on analysis of range of human features, such as physiological, biological and behavioral. Voice is characteristic in biometrics as it comprises physiological and behavioral features. Biometric methods of vocal analysis are based on non-linguistic information, i.e. acoustic features of speech being characteristic for each particular speaker and are interpreted and used accordingly. What is characteristic for forensic methods is that they use all available markers which can be registered in a speech signal, as well as linguistic infor-

mation comprised in each voice message (Kašić&Đorđević,2009). Besides, it is utterly important to emphasize that the quality of voice recordings in a forensic recognition depends on many unpredicted and uncontrolled conditions, while the recording cannot be repeated. Text context which is being investigated is also out of control of a forensic investigator (they receive the content to be analyzed and processed). Duration of the voice recording is also an important element for quality identification. One should bear in mind that speech expression is determined by a combination of variables each having its own degree of freedom (Jovičić, 2001). This triggers a problem that speech expression spoken out consecutively by the same speaker is not the same. In general, we can say that variations in speech expression can be recognized as voice variations and speech variations (Coulthard, Johnson & Wright, 2017). So, we can speak of intra-speaker variations based on inherent characteristics of each speaker, being the main marker of individuality, but are subject to changes (hoarseness as a result of age, respiratory infections, and vocal cords' surgery). Intra-speaker variations at the context level (phonetic and linguistic level) also include variations of emotional nature (Jovičić & Kašić, 2009). The essential thing is to discriminate speech characteristics of two speakers and to determine criteria for finding similarities between these two speakers with more or less probability. The essence of forensic speaker recognition is to actually determine intra-speakers variations and intra-speakers distances and reach a decision on similarities between these two voices based on matching zone of the two statistical divisions of the features. This assessment can be given partially for each particular feature. The final estimation is given after considering the complete milieu of observations. At this point, knowledge and experience of forensic investigators stand out, as they are able to integrate all the results of analysis and circumstances involved (Rose, 2002). Reaching final evaluation is performed upon Voice Comparison Standards of the International Association for Identification passed in 1991 and extended in 2000 by the Forensic Science Service, based on needs and experience from practice. Formulated scale of verbal evaluation is applied in most countries in Europe, including Serbia at its Forensic Acoustics and Phonetics Laboratory of the Life Activities Advancement Center as shown in Table 1 (Association of Forensic Sciences Providers, 2009).

Table 1.Vocal Identification Verbal Scale Grades

IAI standards (1991)	Forensic Science Service (2000)	Acoustic Phonetics and Forensics Laboratory Belgrade
Complete identification	Very strong likelihood	Very high degree of likelihood
-	Strong likelihood	High degree of likelihood
Probable identification	Moderately strong likelihood	Significant degree of likelihood
-	Moderate likelihood	Certain degree of likelihood
Possible identification	Limited likelihood	Likelihood exists and person cannot be excluded
Inconclusive case	Inconclusive case	Inconclusive case

Possible elimination	Limited unlikelihood	Unlikelihood exists and person cannot be excluded
-	Moderate unlikelihood	Certain degree of unlikelihood
Probable elimination	Moderately strong unlikelihood	Significant degree of unlikelihood
-	Strong unlikelihood	High degree of unlikelihood
Complete elimination	Very strong unlikelihood	Very high degree of unlikelihood

Types of Forensic Voice Investigation

Nowadays, several voice analysis methods for speaker identification are used. Purpose of each applied method is to maximize the accuracy of identification. Most common methods are: spectrogram analysis, auditive-linguistic analysis and auditive-instrumental analysis (hybrid analysis) which includes use of computer programs.

Spectrography

This method provides a visual image – voiceprint based on acoustic sound analyzers. Visual image is called spectrogram. Spectrography is based on Fourier transform of sound recording, representing the transformation of a sound from time domain into frequency domain. Periodical sound signal is decomposed into its constituent frequencies – accorditions (Author, 2011). Thus, sound may be analyzed based on distribution of constituent frequencies determined by its amplitudes (loudness). This method requires adequate program support (Heđever, 2009).

This method enables detection of inter-speaker differentiations, while inter-speaker variables are not taken into consideration, which seriously compromises the validity of identity identification. These are the prevailing reasons for the standpoint that spectrography may be useful in a wider auditive-instrumental method.

Auditive-linguistic analysis

This method is used for analyzing features in speech expression which indicate speaker's identity in acoustic, linguistic and phonetic domain. The analysis is performed by prolonged listening and hearing speech expressions, resulting in identification of speaker's characteristics. Forensic investigator finds the duration of analyzed voice recording extremely important, as more material provides more diverse feature characteristics of the speaker. This analysis is being conducted depending on disposable voice material which needs to be analyzed. We have a

situation with two voice recordings, one of a perpetrator, the other of a suspect. In this case, forensic investigator can independently perform analysis and reach elements necessary for identification. The other situation is when there is just one voice recording, recording of a suspect. In this identification method, role of a victim or a witness who tries to remember the voice they have heard remains crucial. The identification is being done by voice line-up. Voices of witnesses may be lined-up in two tactical methods: standard, simultaneous method and sequential method, done in sequences. In the first case, witness will hear all the voices and then they will be asked to declare if they have recognized the perpetrator's voice among them. In the second case (sequential voice line-up) the witness will be asked to immediately declare whether the voice belongs to the perpetrator or not, right after hearing the particular voice. In a sequential voice line-up, voices are not being presented simultaneously, but sequentially (Simonović, 1999). The identification of a person by their voice should be selective. Voices line-ups (both suspects' and fillers') should be similar in its characteristics (phonetic, linguistic and acoustic) to the extent that the voice of a suspect does not stand out individually. The sole act of identification is performed in such a manner that the witness, having described the voice of a perpetrator, enters into separate room from which the identification is conducted. There they receive instructions and explanations on the identification procedure (for example, they are explained that the individuals they are about to identify cannot see or hear the witness, instructed not to hurry and, in case they make an identification, they should point at the person and explain the features they recognized the suspect by). This preliminary instructions should be carefully executed, all witness' questions must be answered, due to their high stress level before and during the identification process. After the witness answers affirmatively that they understood the identification procedure, the administrator opens a door to the next room with line-up and asks the witness the following question: "Does among the voices you are about to hear happen to be the voice which you have described earlier or is it not the case?", which is a factual commencement of the identification procedure. When it comes to practical experience, in Serbia and some countries in the region, the witness is usually being presented with a voice of a suspect along with three or four more voices of innocent citizens (Author, 2016).

Although there are opinions that, due to its sensitivity, auditive line-up should rather be considered as indicial evidence, the court practice stands on a point that the result of identification represents the evidence at the trial and serves as a ground for court verdict (Ilić, P.G. et.all., 2013).

Auditive-instrumental analysis and voice analysis programs

This contemporary method is used to increase the power of objective voice identification and suppress the impact of subjective factor as much as possible. Man and computer are two inseparable components, as it is the human factor

that performs selection of parameters and speech segments which are subject to comparison, as well as numeric interpretation and explanation.

PRAAT program enables monitoring of voice features in time and frequency domain, process of synthesis and analysis of voices, as well as speech signal manipulating. The program is able to process downloaded audio signal by filtrating it or distinguishing some specific frequency segments, marking audio recording segments which are parts of sentences, words or syllables. Program is equipped to analyze wave sound by frequency, amplitude, duration, loudness, jitter, etc. It also calculates and graphically shows pitch of voice, intensity of sound, spectrogram, jitter and shimmer.

MDVP Program (Multi Dimensional Voice Program) by KayPENTAX is highly suitable for voice forensic investigation as it has the option to follow-up and calculate significantly larger amount of parameters than the abovementioned PRAAT. Among other things, MDVP can give us the data on respiratory and aerodynamic parameters of a voice through numerical, graphic and image displays. Using Kay Elemetrics Corp. Model 4337, while singing vowel A, out of 34 total voice parameters which can be monitored by this model, 19 were monitored, as shown in Fig. 2 and 3.

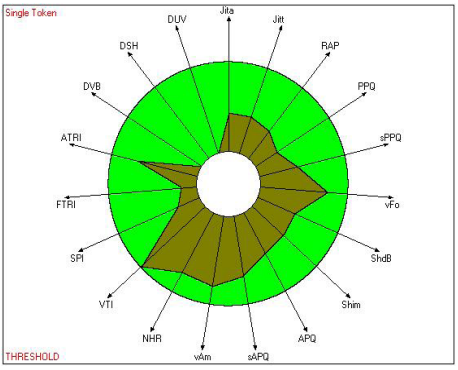


Fig. 2 Male voice singing vowel A

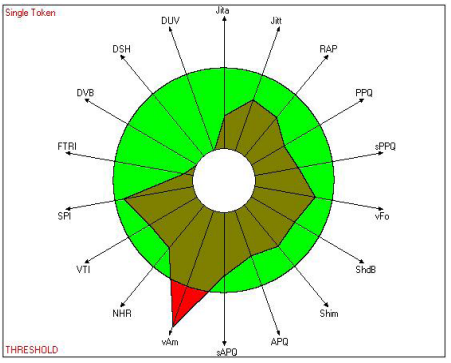


Fig.3 Female voice singing vowel A

CONCLUSION

Voice forensic investigation in identification purposes is important, because in the past there have been many cases in criminalistic and court practice that the voice or speech recording of one or more individuals happened to be the only clue and evidence of the criminal act. Regardless of the court, this forensic discipline became a powerful tool in the hands of police investigations. Recent research studies support the idea of fully automated speech analysis, aiming at future elimination of subjective impression of an investigator performing the analysis and reaches conclusions. Practical experience has shown that, for the time being, this option remains just a theory. The issues of perspective and problems of voice

forensic analysis open new fronts and challenges to voice analysis forensic investigators which needs to be solved in the future, in a manner which will determine the prosperity of their profession.

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ANALYSIS OF MACEDONIAN TRANSLATIONAL EQUIVALENTS OF THE ENGLISH TERMS "PUBLIC POLICING" AND "PRIVATE POLICING"

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Abstract: The paper analyses the semantic aspects of the English terms "public policing" and "private policing" and their Macedonian counterparts. The analysis relies on information retrieved from a survey involving two groups of students from the Faculty of Security in Skopje who were asked to translate these terms from English into Macedonian. The students were divided into two groups. Both groups of students had attended the classes in English language, while one of the groups also attended the classes in System of Private Security. The paper attempts to document the students' understanding of "public policing" and "private policing". It further wishes to map the differences regarding the distribution of acceptable and unacceptable Macedonian equivalents for these terms in both groups. The authors' hypothesis that knowledge of contents in both subjects is linked to better understanding of these two terms related to their prospective profession will be either confirmed or challenged.

Key words: public policing, private policing, translation, English, Macedonian.

INTRODUCTION

Debate over public policing and private policing has oftentimes turned into a debate over the public and the private. Throughout the history of humankind these two aspects of life have interchangeably gained dominance one over the other and they were to a great extent intertwined (Hess, 2009: 65). Considering the very dynamics of society, the public and private distinction has come to historical scene in the so called stratified societies. At the earliest stage of primordial societies, the public dominated over the private owing to the absence of societal stratification. But, as the societies evolved towards the stratified ones, the private has appeared and gradually developed to the point where nowadays we have a real boom of the private over the public. The debate over public and private policing has mostly followed the development of the general public over private de-

bate, but in the area of security. Since the public policing-private policing debate is a security one and fairly tangled, there are very contradictory stances over the questions such as which one of them has appeared first in history, which one is more important and what the future is of the nexus public policing-private policing (Claassen, 2009: 1-7).

Because the generic notion of policing is quite extensive, as it encompasses many security functions carried out by the public security institutions in the nation-states during the era of modern societies, we have to be very careful when using the term policing for determining the security functions within contemporary postmodern and globalized societies. This caution is essentially needed due to the fact that nowadays security has neither been guaranteed anymore nor enabled only by state and public security providers, such as police. With seemingly irreversible process of security privatization, the private security entities have occupied significant part of contemporary security space, with security functions directly derived and transferred from public and state security institutions (Бакрески, Герасимоски и други, 2014: 130). In many democratic countries of the world, these non-state security providers are mostly associated with the term private policing and considering their growth in size, scope and powers, there are many countries, especially from the Western hemisphere, like the U.S.A., Canada or Great Britain, where the distinction between the so called public policing and private policing has been blurred and it is not always apparent where 'public' areas end and 'private' areas begin (Button, 2007: 37; Sarre, 2005: 61).

What is defining and crucial for the distinction between public policing and private policing today is not merely the very size of the private security sector (subsystem) throughout the world in terms of material and human resources, but it is the range of security functions that private security entities exert. In other words, the notion of public policing in many developed countries has been almost entirely consumed by private policing and reached the point of development where it is almost irrelevant who exerts the security functions (police or private security), since there are virtually no or very slight differences between them in terms of security functions they carry out. It can be clearly seen in the private policing in some of the most developed Western countries, where private security entities exert powers in crime and loss prevention, securing public places, developing public-private security partnerships, securing and managing prisons, assisting in detention of persons, routine sharing of security information, critical-infrastructure protection, leading corporate private investigations and so on. As Elizabeth Joh insightfully remarks, the security officers have become very police-like (Joh, 2006: 49).

DISTINCTION BETWEEN PUBLIC POLICING AND PRIVATE POLICING

In order to understand the entire complexity of debate over public and private policing and their conceptual differentiation, it is necessary to define the basic concepts of private and public policing. The key term is the term *policing* (*policiranje* or simply *polising*, roughly translated in Macedonian), which does not have an adequate translational equivalent in the modern Macedonian language and is most often either not translated or when it is done it is translated with the phrase *exertion of police affairs – vršenje policiski raboti* (Мјурej и Мек Ким, 2003: 636). As the great private security connoisseur Les Johnston thinks, the term policing in Ancient Greece was used in a socio-political sense as a whole of organizing and governing functions at the level of the social community, while starting from the mid-18th century, the notion began to receive the current meaning of the unity of regulatory security functions, specifically with the police as an exponent of public security in contemporary civil societies (Johnston, 1992: 4). Policing lies at the heart of any order, comments Clifford Shearing, so it has to be understood only in terms of exerting security functions that maintain the societal order (Shearing, 1992: 426).

The present term *policing* denotes all the functions that the police, as a carrier of public security, carry out in modern states, such as regulation of public order and peace; guaranteeing fundamental human rights and freedoms; protection of life, personal safety and property of the citizens; prevention and fight against crime and so on. In the police and security sciences, there is a distinction between *public policing* and *private policing*, i.e. *javno policiranje* and *privatno policiranje*. The distinction is basically performed according to the criterion of the status of the public in relation to private security in the society and within the security system, as well as in terms of providing resources for their work. Thus, public policing is funded by the state whilst private by non-state (private) sources of funding (van Steden, 2007: 15-16; Bayley & Shearing, 2001: 5). The definition of *policing*, and within that framework, *public* and *private policing*, becomes elusive if we know that it has transcended the borders of states and became transnational, largely differentiated and pluralized in the epoch of the globalized and postmodern society (Sheptycki, 2002: 323; Dempsey, 2011: 27).

The transfer of security functions primarily refers to the relation between public security (police) - private security. In western scientific thought there is a special notion that denotes the police powers that are subject to transfer, and for them, a special term policing has been developed. Policing implies exercising police affairs, i.e. powers originally belonging to public security (the police). What the generic notion private security usually means, especially in earlier phases of its development, like in Macedonia for instance, is that it mainly includes private security activity and private detective activity, both with powers that are not close, let alone equal to the powers of public and state security institutions. That is why

we do not speak in terms of private policing and public policing in Macedonia and in the countries of the Balkans in general, but we mainly use the term private security. To our knowledge, no relevant scholarly paper or legal document ever mentioned the term private policing in Macedonia, as can be seen in the Strategy for development of private security in Republic of Macedonia (Комора на Република Македонија за приватно обезбедување, 2016).

In order to better differentiate the very process of transferring (delegating, outsourcing) the powers from public and state towards private security subsystem (sector), the terms public policing and private policing have been coined (Bayley & Nixon, 2010: 1-6; Bayley & Shearing, 2001; Bayley & Shearing, 1996). According to many seminal researchers of private security and policing, today we have a state of so-called plural policing, that is, powers that were once inherent in the police (public) security only, nowadays are carried out by many other security entities, mostly by the private security entities (Johnston, 1992; van Steden, 2007; Bayley & Shearing, 2001; Sheptycki, 2002; Stenning, 2010; Stenning, 1989; Jones & Newburn, 2006; Blackstone & Hakim, 2009; Kempa, Carrier, Wood & Shearing, 1999; Sarre & Prenzler, 2011; Swol, 1999; Спасески, Аслимоски, Герасимоски, 2017: 27).

RESEARCH METHODOLOGY

Taking into consideration the complexity of the terms *private policing* and *public policing* and their relevance to the field of private security, we decided to assess the familiarity with these two terms of the students from the Faculty of Security in Skopje. We designed a questionnaire that was distributed to 80 students. They were divided into 2 groups, namely, Group A (40 students who have attended only English Language classes), and Group B (40 students who have attended classes in both English Language and System of Private Security). They were given a paragraph in English that contained, inter alia, the terms *public policing* and *private policing*, and its translation into Macedonian where they were asked to insert only the Macedonian translational equivalents for these two terms. The questionnaire was designed in Macedonian, using the Cyrillic script, but in this paper we used the Latin script both for the presentation of the excerpt from the questionnaire and the research results, i.e. the Macedonian lexical solutions offered by the students.

The following is the English paragraph:

PRIVATE POLICING *is quite popular in the USA and in some European countries. This means hiring a* ***PRIVATE DETECTIVE*** *and conducting a private investigation for certain offences. However, this is mainly used for resolving personal or family issues, such as love affairs, embezzlement of family businesses, etc. For serious crimes, such as burglaries or murders, which are of general public concern, the systems of* ***PUBLIC POLICING*** *have to deal with the issue.*

The Macedonian translation with the missing words is given below:

_____ e mošne popularno vo SAD i vo nekoi evropski državi. Toa podrazbira angažiranje _____ i sproveduvanje privatna istraga za odredeni prestapi. Sepak, vakvata praktika glavno se koristi za rešavanje problemi od lična priroda, kako na primer ljubovni aferi, pronevera na pari od semeen biznis itn. Za spravuvanje so seriozni krivični dela od tipot na provalni kražbi ili ubistva, koišto se od javen interes, se zadolženi sistemite za _____.

The goal of our research was twofold. On the one hand, we attempted to assess students' level of familiarity with these two concepts in general, while on the other hand we wanted to see whether the number of subjects whose classes were attended at the Faculty would influence the students' knowledge of the meanings of *private policing* and *public policing*. Our hypothesis was that the students from Group B (those who attended classes in both English Language and System of Private Security) would show better understanding of these terms, and would offer more appropriate Macedonian translational equivalents.

RESEARCH RESULTS AND DISCUSSION

1. Private policing

Regarding the term *private policing*, we obtained the following results:

Table 1: *Distribution of Macedonian lexical equivalents for private policing in both groups of students, and their classification.*

Translational equivalent	Group A	Group B
Acceptable translational equivalent	Total: 7 (17.5%)	Total: 17 (42.5%)
prajvat polising	-	1 (2.5%)
privatna bezbednost	5 (12.5%)	16 (40%)
privatno polisiranje	1 (2.5)	-
privatno policisko rabotenje	1 (2.5%)	-
Translational equivalent acceptable in a broader sense	Total: 24 (60%)	**Total: 15 (37.5%)**
privatna policija	17 (42.5%)	2 (5%)
privatno gonenje/istraga	1 (2.5%)	-
privatno istražuvanje	2 (5%)	-
privatno obezbeduvanje	4 (10%)	13 (32.5%)

Unacceptable translational equivalent	Total: 9 (22.5%)	Total: (15%)
Polising	-	1 (2.5%)
privaten detektiv	1 (2.5%)	-
privatna polisa	3 (7.5%)	1 (2.5%)
privatna služba	2 (5%)	-
privatni agencii	-	1 (2.5%)
privatno obezbeduvanje (bezbednost)	-	1 (2.5%)
privatno osiguruvanje	2 (5%)	1 (2.5%)
tajna policija	1 (2.5%)	1 (2.5%)
No answer	Total: 0 (0%)	Total: 2 (5%)
	-	2 (5%)

The Macedonian lexical repertoire does not have a one-word equivalent for *policing*. Macedonian scientists, experts and practitioners either use the anglicism *policiranje* in the gerund form, or a longer descriptive phrase such as *vršenje policiski raboti* or other synonymous phrases. In the Macedonian Law on Police, the actions of the police officers that cover the notion of the English term *policing* are actually referred to as *policisko rabotenje* and are extensively elaborated in Article 5 (Закон за полиција, 2006). Bearing this in mind, we were not surprised by the diversity of the students' answers. However, we were surprised that none of the students from Group B (i.e. those who have studied both English and System of Private Security) answered with *privatno policiranje/policisko rabotenje*. There was only one student who literally transcribed the term *private policing* as *prajvat polising*. As far as Group A (i.e. the students who have attended only English classes) is concerned, only one student provided the answer *privatno polisiranje* which was counted as accurate translation although *policing* was not adapted to the Macedonian phonetic system, so instead of *policing* the student used the phonetically transcribed form *polising* based on the pronunciation of the original English term. Also, there was only one student who translated *private policing* as *privatno policisko rabotenje*.

12.5% of the students from the "English-only" group and even 40% from the students who attended classes in both subjects chose *privatna bezbednost* as an equivalent for *private policing*. We included this term into the group of acceptable answers, taking into account the fact that *privatna bezbednost* covers the activities that are encompassed by private policing, i.e. private security activities and private detective activities.

However, the term *private policing* can also be translated with other Macedonian lexical equivalents, when perceived in a broader sense. Bearing this in mind,

we extended the group of acceptable translational equivalents for *private policing*, and classified all the obtained answers into four categories.

The extended group of acceptable Macedonian counterparts for *private policing* includes the terms *privatno obezbeduvanje*, *privatno gonenje/istraga* and *privatno istražuvanje*. They correspond to the English terms *private security* and *private investigation*, respectively, and cover specific segments of private policing which means that when used in a specific context addressing those specific segments they can be accepted as its Macedonian translational equivalents. The students may have chosen these equivalents taking into consideration the specific paragraph which provides examples covered by these terms as hyponyms of *private security*.

Another interesting example from this group is the term *privatna policija* which was offered as translation for *private policing* by students in both groups. In this case, the students were not able to distinguish between the nouns *police* and *policing*. If we translate *privatna policija* back to English, we will get the term *private police*, which is a very interesting concept when it comes to its semantic analysis in English and Macedonian. Thus, for instance, in the USA *private police* may be used as a synonym for *private policing*, while in Macedonian context the term *privatna policija* has acquired a negative meaning and is usually linked to the abuse of the police for private goals, i.e. for the benefit of individuals, where policing is viewed as privatized instead of private. Therefore, when translating texts addressing private policing in the US context, *privatna policija* may be accepted as adequate translational equivalent.

Finally, we encountered some answers that we considered totally unacceptable. Thus, for instance, there was a student from the "English only" group who translated *private policing* with *privaten detektiv (private detective)*, in spite of the completely different referents linked to these two notions, namely, *detektiv (detective)* refers to a specific person, i.e. professional carrying out detective work, while *policing* does not have a person as its referent.

Privatna polisa is another interesting example. In this case, the students obviously wrongly associated the root of *policing* with the noun *policy*, and consequently translated *policing* as *polisa*. The Macedonian word *polisa* is the equivalent of the English noun *policy* referring to "contract of insurance"[1] and is specifically used in the context of insurance. Some students went even further, translating *private policing* with *privatno osiguruvanje*, using the gerund *osiguruvanje* as the Macedonian lexical counterpart of the English noun *insurance*.

Some students translated *private policing* as *tajna policija*, which is also a wrong translation of *private policing*. The Macedonian term t*ajna policija* is translated into English as *secret police*. It is mainly used colloquially with reference to the Macedonian Agency for Security and Counterintelligence. The notion it covers in Macedonian is totally unrelated to the notion of the English term *private policing*,

1 Source: https://en.oxforddictionaries.com/definition/policy

since *tajna policija* is a state service, and consequently cannot be modified with *private*.

2. **Public policing**

The answers obtained from the students with regards to the Macedonian translation of the term *public policing* are presented in the table below:

Table 2: *Distribution of Macedonian lexical equivalents for public policing in both groups of students, and their classification.*

Translational equivalent	Group A	Group B
Acceptable translational equivalent	Total: 7 (17.5%)	Total: 23 (57.5%)
javna bezbednost	5 (12.5%)	21 (52.5%)
javna policija/javen bezbednosen potsistem	0	1 (2.5%)
javno polisiranje	1 (2.5%)	0
javno policisko rabotenje	1 (2.5%)	0
pablik polising	0	1 (2.5%)
Translational equivalent acceptable in a broader sense	Total: 20 (50%)	Total: 6 (15%)
javna policija	16 (40%)	4 (10%)
javno obezbeduvanje	4 (10%)	2 (5%)
Unacceptable translational equivalent	Total: 13 (32.5%)	Total: 8 (20%)
gonenje po službena dolžnost	1 (2.5%)	0
državna, javna bezbednost	0	1 (2.5%)
državna (javna) policija, državen bezbednosen system	0	1 (2.5%)
državna policija	1 (2.5%)	0
javen nadzor	1 (2.5%)	0
javna bezbednost (državna) kako MVR i sl.	0	1 (2.5%)
javna polisa	2 (5%)	1 (2.5%)
javna služba	2 (5%)	0
javno istražuvanje	1 (2.5%)	0
javno osiguruvanje	1 (2.5%)	1 (2.5%)
javno pravosudstvo	1 (2.5%)	0
opštestvena polisa	1 (2.5%)	0
otvorena policija	1 (2.5)	0
policisko pravo	0	1 (2.5%)
privatna bezbednost	0	2 (5%)
republička policija	1 (2.5%)	0
NO ANSWER	0	3 (7.5%)
no answer	0	3 (7.5%)

Following the analogy with *private policing*, we can agree that the nearest Macedonian translational equivalents for *public policing* are the ones containing the gerund *policiranje* or other descriptive phrases that denote exertion of police powers. This was the case with *javno polisiranje* (although *polisiranje* was not used in its phonologically adapted form *policiranje*) as well as *javno policisko rabotenje*. Also, the term *pablik polising*, as a literally transcribed form based on the original pronunciation of *public policing* was counted as acceptable answer, reflecting the practice of some Macedonian speakers to phonetically replicate the original English words.

Most of the students from Group B (52.5%) translated *public policing* as *javna bezbednost*, as well as 12.5% of the students from Group A (i.e. the "English-only" group). Literally translated, the English equivalent of *javna bezbednost* is *public security*. In Macedonian context the defining semantic component of *public policing* are the police powers, i.e. the total of all police powers of public security. Consequently, the terms *public policing* and *public security* are often used interchangeably as synonyms. This accounts for counting *javna bezbednost* as an acceptable lexical solution in Macedonian.

We also added *javna policija/javen bezbednosen potsistem* as an acceptable answer, taking into consideration the explanation of the notion *javna policija* as perceived by the student who provided the answer, namely, *javen bezbednosen potsistem* or its English counterpart *public security subsystem* which actually describes what public policing refers to.

However, we extended the number of acceptable answers, taking into consideration the notion of *public security* viewed from a broader perspective. Following the same analogy with the equivalents for *private policing* elaborated above, all the obtained answers for *public policing* were also classified in the categories presented above.

As can be seen from the table, we also classified *javna policija* and *javno obezbeduvanje* as possible translational equivalents for *public policing*, within the broader meaning of the concept. In Macedonian, we do not usually use the term *javna policija*, but when looking up the meaning of *public policing* in English one can observe that in many texts *public policing* is used interchangeably with *public police*. Further research will be necessary to assess the students' motivation for such choice, but one possible assumption might be the influence of the English use of the term *public police.* As far as *javno obezbeduvanje* is concerned, it is a hyponym of *public policing*, i.e. it contains part of the notion covered by this term, and consequently might be considered as its acceptable equivalent.

Also, there was a group of answers that we considered unacceptable for various reasons. We were surprised to learn that in some cases *public policing* was translated as *državna/javna bezbednost (=state/public security)* and *javna bezbednost (državna) kako MVR i sl. (=public (state)security) such as the MoI etc.),* which is an indicator that there are still students who are unable to differentiate between *public security* and *state security* and use them as synonyms, although they are

completely different semantically. In Macedonian context *public security* refers to the security of all citizens, as opposed to *state security* which refers to the security of certain institutions such as, for instance, the President of the country. In other words, they differ in that they protect/safeguard different values, and cannot be used interchangeably.

Gonenje po službena dolznost is another interesting term, but it actually refers to *ex-officio prosecution*, i.e. prosecution carried out by relevant authorities mainly with reference to serious crimes as stipulated by the respective laws.

Finally, the answer *javna služba* denotes a very board concept, literally translated in English as *public service*, and covers a wide range of professions and activities that fall within this category. Therefore, it cannot be accepted as equivalent for *public policing*.

CONCLUSION AND RECOMMENDATIONS

As it can be inferred from the research results, the students who studied both English and System of Private Security showed greater familiarity with the terms *private policing* and *public policing* and provided the answers that may be considered acceptable in a narrower or broader context of the given notions, compared to the students who studied only English. When it comes to their familiarity with these two terms in general, when perceived as a whole, the majority of both groups showed familiarity with the meanings of both *public policing* and *private policing* in a narrower and broader sense.

Based on the research results, we recommend the following:

- The terms *private policing* and *public policing* should be addressed more thoroughly in both subjects, taking into consideration the overall results and the distribution of answers in all categories.

- Taking into account the obvious tendency for interchangeably using the generic terms private/public policing and the specific terms derived from them, we recommend that this distinction should be accentuated in both subjects.

- The distinction between *state security* and *public security* should also be given particular attention, not only in the English classroom and the syllabus of the System of Private Security, but also in the syllabi of other security-related subjects. The failure of some students to distinguish between these fundamental security concepts as opposed to *private policing* and *public policing* as relatively new concepts is an indicator that they have not mastered some basic security terminology which was a surprising fact.

- Further research (based on interview with the students) should be carried out in order to determine the influence of the possible factors on the perception of the given terms and the choice of the adequate translational equivalents.

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VOLUME II

Topic VI

INFORMATICS AND APPLIED MATHEMATICS IN FORENSIC, CYBERCRIME AND SECURITY SCIENCES

CRIMINAL OFFENSES AGAINST SECURITY OF COMPUTER DATA IN THE REPUBLIKA SRPSKA ACCORDING TO THE CRIMINAL LAW OF 2017

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Abstract: In 2003, new criminal legislation came into force in Bosnia and Herzegovina. It is established on the basis of international standards, legal traditions, domestic and foreign legal theory and court practice, but also according to the needs of criminal policy. Of the four criminal laws (Bosnia and Herzegovina, the Federation of Bosnia and Herzegovina, the Brčko District of Bosnia and Herzegovina and the Republika Srpska) with numerous novelties, in 2017, the Republika Srpska passed a completely new Criminal Code. This Code, starting from international obligations, in the first place the Convention on Cyber (computer) Crime from Budapest (2003), establishes a system of criminal offenses against the security of computer data, with a system of criminal responsibility and sanctions for natural and legal parties as perpetrators of these criminal offenses. The concept, elements, characteristics and forms of computer crimes in new legislation of the Republika Srpska are discussed in this paper.

Keywords: computer, abuse, criminal offense, responsibility, punishment.

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INTRODUCTION

In July 2017, the Republika Srpska passed a new Criminal Code[4] (hereinafter: the Code) which had replaced previously valid Criminal Code[5] from 2003 with numerous amendments. After a short period *vacatio legis*, the Code entered into legal force.

On the basis of numerous international standards, this Code, though based on previous legal tradition applicable at a time of existence of Socialist Federal Republic of Yugoslavia, court practice, understandings of domestic and international legal theory, but also the requirements of modern policy of fight against crime, contains numerous new and original solutions in general, and even more in special part (at incriminations of particular criminal offenses, i.e. their forms and kinds).

Therefore, this Code, in Chapter thirty two under title: „Criminal offenses against security of computer data" stipulates several criminal offences of this kind called computer, information or high-tech criminal offenses.

GENERAL CHARACTERISTICS OF CRIMINAL OFFENSES OF COMPUTER ABUSE

The object of protection of these crimes is security of computer (information) data and systems, that is of computer network (Jovašević, Ikanović, 2012: 185-194). Today, it is common that the concept of computer crime includes these criminal offences. Aside from this name for criminal offenses systematized at this place, they can also be called hi-tech crimes. This concept understands commission of criminal offenses which have computers, computer networks, computer data, computer systems, and their products in material or electronic form, as objects or means of commission of criminal offenses.

Computer represents one of the most significant and most revolutionary products of technical and technological development from the end of 20th Century. However, even besides the advantages the computer has and its huge benefit for the humanity, it soon became a means of abuse of unscrupulous individuals or groups. That is how computer crime appeared as special and specific form of modern crime. Thanks to a huge power of computers in memorizing and fast processing of enormous amount of data, automatized information systems became more and more numerous and irreplaceable follower of the entire human and social life of natural and legal persons.

Various forms of application of computers (Jovašević, 2011: 419-421) in all spheres of life, economy and other social activities, have not remained unspot-

4 "Official Gazette of the Republika Srpska", No. 64/2017.
5 „Official Gazette of the Republika Srpska", Nos. 49/2003, 108/2004, 37/2006, 70/2006, 73/2010 and 49/2013.

ted by unscrupulous and malicous individuals or groups who are trying, without choosing means and ways, to obtain illegal material gain for themselves or other, or to cause damage to another person. Thus a computer becomes a means, a tool for execution of criminal offenses. There are various terms used in theory for different forms and kinds of computer abuse, such as: computer abuse, delicts committed with help of computers, information crime, computer crime, cyber crime, techno crime, etc.

The concept of computer crime understands all various forms, kinds and types of illegal behaviors directed against security of computer and information systems, in their entirety or parts of them, in different ways and with different means, with the intention to obtain gain (of pecuniary or non-pecuniary nature) for themselves or others, or to cause damage to another person.

From such determined concept of computer crime are derived its characteristics (Jovašević, 2017: 211-216):

a) object of protection is security of computer data or information system as a whole or part of it (segment),

b) special, specific character and nature of illegal actions of an individual,

c) special knowledge and specialization of a perpetrator of these criminal offenses which excludes the possibility that every, or any person is found in such a role,

d) special way and means of executioin – with the help or by use (abuse) of computer and

e) intention of a perpetrator, as subjective element at a time the action, which reflects in intention to obtain gain for himself or another person or to cause damage to another natural or legal person, was taken.

Computer crime (Jovašević, 2003: 351-361) is characterized with great dynamics and exceptional variety of shapes, types and forms of its manifestation. It is understandable since this is a new technology with great possibilities for application in a wide scope of human, social and economic activities, and, thus, the possibility of computer abuse is growing from day to day. In addition to new forms of its appearance from before, already known criminal offenses which change traditional, classical way and model of appearance under influence of computer abuse, new forms of illegal behavior, which know no boundaries between the states, appear.

Harmful consequences of computer criminal offences are huge and are manifested in the occurrence of material damage to natural or legal persons (sometimes for the whole country), in the loss of business reputation, the loss of confidence in the safety and truthfulness of computer business and computer data in general, the danger of abuse of freedoms and the rights of a man and citizen in various ways, the disclosure of personal, business and other types of secrets and similar.

The perpetrators of these criminal offenses constitute a specific category of persons. These are mostly non-delinquent and socially adaptable, non-violent

persons. They must possess certain special, professional and practical knowledge and skills in the field of information and computer techniques and technologies for commission of criminal offenses by use of computers. In addition, these are the persons whom such technological means are available in a physical sense.

These criminal offenses are concealed, often without visible spatial and temporal close connection between the perpetrator and the injured party (passive subject). In practice, there is a greater or lesser time difference between the action taken and the moment of the occurrence of the consequence.

These offenses are hard to detect, and even more difficult to prove, they remain practically undiscovered for a long time, until the injured party has suffered damage in the domain of information and computer data or systems. It is a crime that quickly and easily changes forms and shapes of manifestation, the borders between the states, and the type of injured party (Jovašević, Mitrović and Ikanović, 2018: 722-733).

As to guilt, these offenses are committed with intent.

Provisions of Articles 407-413 of the Code provide for the following computer criminal offenses. These are:

a) damagining computer data and programmes,
b) computer sabotage,
c) generating and introducing computer viruses,
d) computer fraud,
e) unauthorized access to protected computers, computer networks, telecommunication network and electronic data processing,
f) preventing or restricting access to public computer network,
g) unauthorized use of computer or computer network.

DAMAGING COMPUTER DATA AND PROGRAMMES

Concept and elements of criminal offense

This is the first computer crime stipulated under Article 407 of the Code. It consists of unauthorized deletion, alteration, damage, concealement or otherwise making unusable computer data or programme (Petrović, Jovašević, 2005: 278-285).

Object of protection is security of computer data or computer programme, and object of the attack is: a) computer data, and b) computer programme.

Computer data is any representation of facts, information or concept in a form that is suitable for their processing in a computer system, including an appropriate programme on the basis of which computer system performs its function.

Computer programme is a set of commands that governs the operation of computers, as well as to solve a specific task with a computer.

Execution has multiple alternative determinations. It consists of (Jovašević, Mitrović and Ikanović, 2017: 357-367): a) deletion, b) alteration, c) damage, d)

concealement and f) making unusable a computer data or programme. For the existence of this offence it is important that the action be taken without authorization, and accordingly, by unauthorized persons, in a manner and by action that are not allowed and not stipulated by the law.

Deletion is removal of computer data, entirely or partialy, or computer programme.

Alteration is partial change of existing data or entry of new data by persons in the proceedgins not being prescribed under appropriate provisions or under appropriate procedure.

Damage is provisional, partial or short-term disabling of use of computer data or programme by causing malfunctions or by tearing of some parts, connections or circuits, so that computer data or programme cannot be used during a certain period of time for the purpose they were intended.

Concealement is the transfer of data or programme from a place it was stored or confined and its removal to another, most often, unknown place.

Making computer data or programme unusable in another way is any other disabling for shorter or longer time or disabling its use to a greater or lesser extent.

The consequence of this offense is the violation of protected goods – computer data or programme which belongs to a natural or legal person in sense of its usability, usefulness in general or for a particular time, at a particular place or for a particular purpose.

The perpetrator of the crime may be any person, and the guilt requires intent.

A fine or sentence of imprisonment for up to one year is prescribed for this crime. The perpetrator shall be obligatory imposed a security measure of seizure of equipment and devices used for the commission of the criminal offence.

Aggravated forms of criminal offense

Criminal offense from Article 407 of the Code have two aggravated forms for which more severe punishment of perpetrators are prescribed.

The first aggravated form of this crime, for which a sentence of six months to three years of imprisonment is prescribed, exists if the action taken in the execution of the crime caused damage amounting to over KM 10,000. The amount of caused material damage to another natural or legal person, which is determined according to market conditions at a time of commission of the criminal offense in legally prescribed amount, constitutes qualification circumstance.

The second aggravated form of this crime is qualified by scope and intensity of caused consequence. For this offense a sentence of one to five years of imprisonment is prescribed. This criminal offense exists if the action taken in the execution of the crime caused material damage to another natural or legal person, amounting over KM 50,000, whose amount is also established according to market conditions at the time of commission of the criminal offence in question.

COMPUTER SABOTAGE

Article 408 of the Code stipulates criminal offense called „Computer Sabotage". The offense (Petrović, Jovašević and Fehatović, 2016: 428-438) is committed by whoever enters, destroys, deletes, alters, damages, conceals or otherwise makes unusable computer data or programme or damages or destroys a computer or other device for electronic processing and transfer of data, with intent to prevent or considerably disrupt the procedure of electronic processing and transfer of data important for republic authorities, public services, institutions, economic enterprises or other entities.

The object of protection is determined twofold, as: a) computer data or programme, and b) computer of other device for electronic processing and transfer of data. It is important that these devices and resources belong, i.e. that they are important for republic organ, public service, institution, economic enterprise or other entity.

The action of execution is alternatively determined (Turković et al., 2013: 341-347) as: a) entry, b) destruction, c) deletion, d) alteration, e) damage, f) concealement, and g) otherwise making unusable of computer data or programme, i.e.: a) destruction, and b) damaging of computer or another device for electronic processing and transfer of data.

Entry is input or storing of new, previously unexisting, data or alteration of already existing computer or other data into computer programme.

Destruction is complete or permanent destruction of substance and shape of particular object so it cannot be used for a purpose and intention it was previously used for.

Deletion is removal of computer data or programme most often mechanically or otherwise, in its entirety or partially.

Alteration is partial change of existing data in term of its content, place of its whereabouts or its nature or entering of other false data into computer system.

Damage is termporary, partial or short-term disabling of computer data, programme, computer or other device for the purpose they were intended for.

Concealement is removal of data or objects from a place they were located before, which was known to everyone, and its transfer to another, most often, hidden place, so that another person cannot know about its content at all or for a particular period of time.

Making unusable of computer data or programme constitutes any action affecting the usability of computer data or programme, to a greater or lesser extent.

Depending on the object of attack, which the action of execution of this criminal offense is directed against, two of its forms may be distinguished. These are (Đorđević, 2011: 177-182):

a) destruction or damaging of computer data or programme, and

b) destruction or damaginig of computer or other device for electronis processing and transfer of data.

For the existence of both forms of this criminal offense, it is necessary two more elements are cumulatively fulfilled. These are:

a) that the action of execution is taken in relation to objects that belong to a republic authority, public service, institution, economic enterprise or another entity (legal person with special authorizations). Accordingly, the capacity of the damaged person constitutes an element of criminal offense, and

b) that the perpetrator, at a time of taking the action, has certain intention – to prevent (completely and permanently) or considerably disrupt (makes it more difficult) the procedure of electronic processing and transfer of data. It is not significant whether this intention in the specific case has been achieved, but that it existed at a time the perpetrator took the action of execution.

Consequence of this offense is harm to a computer data, programme, computer or device for automatic transfer or processing of data in term of thier usability and usefulness.

Perpetrator of the offence may be any person, and the guilt requires direct intent characterized by alleged intention.

A sentence of imprisonment for a term of six months to five years is prescribed for this offence.

GENERATING AND INTRODUCING COMPUTER VIRUSES

Article 409 of the Code prescribes a criminal offense which consists of generating a computer virus with intention of its introduction into somebody else's computer, computer or telecommunication network (Babić, Marković, 2007: 206-207).

Object of protection is security of computers, computer or telecommunication network from viruses of different kind and nature, and object of attack is a computer virus. This is a computer programme or other set of orders introduced into a computer or a computer network, which is created to multiply itself and act on other programs or data in a computer or computer network by adding this program or set of orders to one or more computer programmes or data (Kokolj, Jovašević, 2011: 357-369).

This action of execution (Pavišić, Grozdanić and Veić, 2007: 554-562) is generating – making of previously non-existing computer virus which is capable, sufficient or which may cause certain changes or damages in use and usability of computers, computer or telecommunication network in its entirety or part of it.

It is importatnt that the action of execution of this crime is taken with certain intention (as subjective element) – intention to introduce such generated

computer virus into somebody else's computer, computer or telecommunication network. The perpetrator has to have the intention at a time the action was taken, notwithstanding whether the intention has been achieved in a particular case.

Perpetrator of the crime may be any person. As to the guilt, a direct intent characterized by mentioned intention is necessary.

A fine or sentence of imprisonment for a term of up to six months is prescribed for this offense. In addition to the sentence, the perpetrator is obligatory imposed a security measure of seizure of equipment and devices used to commit the crime.

More aggravated form of this crime, for which a fine or sentence of imprisonment for a term of up to two years is prescribed, exists if a computer virus is introduced, indirectly or directly, into somebody else's computer or computer network which, thereby, causes damage (pecuniary or non-pecuniary). Accordingly, the consequence of a criminal offence appears in a form of violation – damage caused to another natural or legal person, and even the whole state.

COMPUTER FRAUD

„Computer fraud" is a criminal offense stipulated under Article 410 of the Code. This offense consists of entering of incorrect data, failure to enter correct data or otherwise concealing or false representation of data, thereby affecting the results of electronic processing and transfer of data with the intent to acquire for themselves or another person unlawful material gain and thus causing peroperty damage to another person (Mrvić Petrović, 2005: 321-325).

Object of protection is security of computer systems from entering incorrect and false data and trust in those systems.

The action of execution consists of two alternatively foreseen activities. These are[6]:

a) concealing, and

b) false representation of computer data.

Concealing is failure to enter a data by a person who is obliged to enter it into a computer or computer network. This may be any kind of data.

False representation of computer data exists when incorrect data is presented, published, entered or used in a computer network (notwithstanding whether it is entirely or partially incorrect).

Both activities have to be taken with respect to the data which is capable of affecting the result (course and procedure) of electronic processing and transfer of data in a computer system, by its significance, nature, character, time of entry or use.

6 The Criminal Code of Monte Negro. Podgorica: Official Gazette of Monte Negro, 2016, pgs. 174-177.

For the existence of this criminal offense it is important that the execution be taken as follows (Đorđević and Đorđević, 2016: 191-194):

1. in a certain manner: a) by entering of incorrect (false) data in its entirety or part of it, b) by failure to enter, non-entering, non-registration of some important data (this means not any data, but only the data that is important for a particular case) or c) otherwise,
2. with certain intent of perpetrator at a time they committed the offense, but this intention does not have to be achieved in a particular case – intent to obtain unlawful material gain for themselves or another natural or legal person, and
3. in such a manner that a consequence of committed offense is violation – causing of material damage to another natural or legal person. This may be any amount of damage having cause-and-effect connection with action of execution, notwithstanding whether a damaged party is owner or user of computer network.

Perpetrator of the crime may be any person, and as to the guilt a direct intent characterized by mentioned intention is necessary. A fine or sentence of imprisonment for a term of up to three years is prescribed for this crime.

Special forms of criminal offense

In addition to its basic form, this criminal offense has two special forms. These are (Lazarević, Vučković and Vučković, 2004: 816-824):

a) less aggravated form, and
b) more aggravated forms.

Less aggravated form of crime, for which a fine or sentence of imprisonment for a term of up to six months is prescribed, exists when a perpetrator committed a crime – concealing or false presentation of data in a computer or computer network in a legally prescribed manner with the intention to cause damage to another person, that is, to cause damage to another natural or legal person.

Malicious intention of the perpetrator to cause material or non-material damage to another person is a privileged circumstance.

This criminal offense also has two more aggravated forms.

The first more aggravated form, for which a sentence of imprisonment for a term of one to eight years is prescribed, exists when material gain (for perpetrator or another person) is acquired by committing this crime in the amount of over BAM 10,000. The amount of acquired material gain is a qualifying circumstance. It has to be in cause-and-effect connection with action taken to committ a crime.

The second form of more aggravated crime, for which a sentence of imprisonment for a term of two to ten years is prescribed, exists if a perpetrator acquired illegal material gain by committing this crime in the amount over BAM 30,000.

UNAUTHORIZED ACCESS TO PROTECTED COMPUTERS, COMPUTER NETWORKS, TELECOMMUNICATION NETWORK AND ELECTRONIC DATA PROCESSING

Concept and elements of criminal offense

The criminal offence set out in Article 411 of the Code consists of access to a computer or computer network without authorization, or access to electronic data processing without authorization by breaching protection measures, or in making, obtaining, sale or giving for use the instructions or devices intended to enter into a computer system (Selinšek, 2007: 424-427).

The object of protection is security of a computer or computer network, or a system of electronic data processing protected by a special technical and other protection measures

The action of execution is multiply determined alternatively (Simić, Trešnjev, 2010: 210-214), as:

a) Unauthorized access to a computer or computer network or electronic data processing. That is entry, penetration, access into protected system of computer data, into the system of electronic processing or transfer of data, as well as into entire computer network or part of it.

It is important that this is a computer, computer system or system of electronic data processing, protected by a special security measures. Therefore, the action of execution is taken in a special legally prescribed manner: a) without authorization, thus, unlawfully, and 2) by breaching security measures (acting contrary to all prescribed measures of some of the measures, by doing or failure to do),

a) making – production of previously non-existing device,

b) obtaining – getting in posession of device in any way,

c) sale – exchange of device for domestic or foreign money, and

d) giving for use – helping, making it easier, enabling someone else to get into possession of the device.

For the existence of this form of criminal offence (Jovašević, 2003: 351-361) it is important that the actions of: making, obtaining, sale or giving for use are taken in relation to introduction or device intended to enter into a computer system.

Perpetrator of the crime may be any person having specific knowledge in the field of protection of computers or computer systems. As to the guilt a direct intent is necessary.

A fine or a sentence of impirsonment for a term of up to six months is prescribed for this crime.

More aggravated forms of criminal offense

This criminal offense has two more aggravated forms for which the Code prescribes more severe punishments.

The first more aggravated form of this crime, for which a fine or a sentence of imprisonment for a term of up to two years is prescribed, exists in case of recording or use of a computer data, obtained by accessing somebody else's computer or computer network, or somebody else's system of electronic data processing without authorization, given that it was done by breaching of protection measures. It is not important for which purpose or intention such obtained (recorded) computer data was used.

The second more aggravated form of this crime, for which a sentence of imprisonment for a term of up to three years is prescribed, exists if accessing somebody else's computer or computer network, or somebody else's system of electronic data processing without authorization by breaching protection measures:

a) results in breach – suspending (disabling) or considerately disrupting (making more difficult) the functioning of electronic processing and transfer of data or network, and

b) results in other serious consequences. What are serious consequences is factual issue which the court resolves in each individual case. These consequences are a result of negligence of a perpetrator and are in cause-and-effect connection with taken action to commit a crime.

PREVENTING AND RESTRICTING ACCESS TO PUBLIC COMPUTER NETWORK

Article 412 of the Code prescribes a specific computer criminal offense consisting of unauthorized prevention or obstruction of access to public computer network (Jovašević, Mitrović and Ikanović, 2018: 722-733).

Object of protection is public computer network and free access to it by individually undefined number of persons. Motive of this incrimination is prevention of monopoly in the use of public computer network.

The action of execution is twofold determined alternatively (Petrović, Jovašević, Ferhatović, 2016: 428-437), as:

a) preventing, and

b) restricting free access to public computer network.

Preventing is completely, permanently or for a particular shorter period of time disabling another person to access public computer network. This may be done by physical prevention, by setting of certain conditions or obstacles, or by requiring the fulfillment of certain assumptions.

Restricting is partial complicating, aggravating, making unavailable, or causing another person to access or use public computer network undisturbedly, freely, and at his discretion.

It is important that this action, in any of mentioned forms, is taken without authorization (by unauthorized person, without complying with requirements and assumptions and out of the proceedings pescribed under the law or other pro-

visions regulating this field) in relation to public computer network (Jovašević, Ikanović, 2012: 185-197).

Perpetrator of the crime may be any person, and as to the guilt a direct intent is necessary.

A fine or sentence of impirsonment for a term of up to one year is prescribed for this crime.

More aggravated form of this crime, for which a fine or sentence of imprisonment for a term of up to three years is prescribed, exists if the crime is committed by:

a) a particular person - an official, and

b) in a specific manner - in discharge of his or her duty.

Capacity of a perpetrator and manner of their actions to commit the crime, constitute qualifying circumstances.

UNAUTHORIZED USE OF COMPUTER OR COMPUTER NETWORK

Article 413 of the Code stipulates the last computer criminal offense. It is called: „Unauthorized use of computer or computer network". The offense consists of the use of a computer services or computer networks without authorization and with intent to acquire unlawful material gain for himself or another person (Jovašević, Mitrović, Ikanović, 2017: 357-367).

The object of protection is legality and conscientiousness in use of computer systems – services or network from all forms of abuse and negligence.

Execution (Jovašević, Mitrović and Ikanović, 2017: 357-367) unauthorized use, accordingly, exploitation, making use of the data obtained or stored in somebody else's computer or computer network with greedy intention - the intention of the perpetrator to obtain in this way unlawful material gain for himself or another natural or legal person.

There has to be intent of a perpetrator at a time they committed the crime, but it does not have to be realized in a particular case.

A perpetrator of crime may be any person, and as to the guilt a direct intent characterized by mentioned intention is necessary.

A fine or sentence of imprisonment for a term of up to six months is prescribed for this crime. Prosecution for this crime is conducted upon a proposal.

CONCLUSION

New Criminal Code of the Republika Srpska recognizes several criminal offences, established on the basis of obligations Bosnia and Herzegovina undertook by signing and ratifying of Budapest Convention on Computer Crime.

These are criminal offences against safety of computer data, and the title itself of Head XXXII of the Code points out to the object of protection of these criminal offences.

As objects of attack various legal goods appear, as well as the execution consists of various actions, such as: deletion, entry, alteration, destruction, damage, making the object of attach unusable, or even generating (producing) of computer virus or its introduction into computer system.

Any person may appear as a perpetrator of these crimes, according to legal provisions, but in the practice these are persons having specific, special knowledge in computers or in the field of information technologies. These criminal offences, as a rule, are committed with intent, and in some cases they are expressed as direct intent – due to existence of a certain intention (greedy or malicious) of the perpetrator at a time the crime was committed.

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HEURISTIC SCANNING AND SANDBOX APPROACH IN MALWARE DETECTION

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Abstract: A heuristic approach in malware detection is similar to the method of detecting anomalies applied to the intrusion detection system (IDS). It speeds up the process of finding sufficiently good solution in situations where the implementation of detailed research is not practical or is very time-consuming - for example, using various general rules, informed speculation, intuition and common sense. Instead of looking for matches (like in static signature-based detection), heuristic intrusion detection looks for behavior that is out of ordinary, with regards to a baseline of the normal network traffic and activity. Heuristic scanning uses rules and/or algorithms to look for commands which may indicate malicious intent without needing a signature. Analysis of static signatures will fail to catch new types of attacks but have usually less false positives. Heuristics might catch more new malware but this usually comes with higher false positive rate. Because of that, most modern and efficient IDS software uses both signature and heuristic-based methods in combination, with the goal of increasing the chance to detect and remove malware. In parallel with the heuristic and signature-based method, sandboxing approach is also used in detection of network anomalies. This is a software management technique that isolates examined applications from critical system resources and other programs. Without sandboxing, an application may have unrestricted access to all system resources and user data on a computer. Similar to heuristics, this method also has its benefits and limitations. The general conclusion is that the best network security can be achieved utilizing more methods simultaneously - by multi-scanning (scanning with multiple anti-malware engines).

Keywords: heuristics, scanning, malware, signature, sandboxing, detection.

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INTRODUCTION

Intrusion detection is an act of identification such activities, which are aimed at compromising confidentiality, integrity and availability (security objectives) of computer resources. The goal of intrusion detection is to identify malicious entities.

Depending on what is being detected (analysis strategy), intrusion detection systems can detect misuses (known attacks and attacks from inside) or anomalies (concentrates on unusual network activity (anomaly) that may indicate the intrusion).

Misuse detection is based on "signatures" (sequences of known attacks) and rules of known attacks. The analysis of static signatures will fail to catch new types of attacks but usually has less false positives. Network anomalies appear in different forms such as:

- protocol anomalies (refers to protocol format and behavior - usually TCP/IP),
- anomalies of the content of application (requires knowledge of application semantics) and
- statistical anomalies (characterization of traffic through statistical measurements - monitoring the behavior of a user or system by measuring statistical variables over a certain period of time).

Applied statistical algorithm must recognize the difference between long-term and short-term changes, to avoid generating false alarms during normal traffic variations. The advantage of statistical anomaly detection is that it can detect attacks that have not been recognized by other detection mechanisms and there is no need for large databases of attack signatures.

Sandboxing is a type of approach in the prevention of a network intrusion where the input code (ActiveX, Java applets and scripts in different languages) is placed in quarantine (sandbox), i.e. restricted area. The system executes the code there and monitors its behavior. If the code violates a predefined policy, it will be stopped and the system will be protected from its further execution and possible attack.

HEURISTIC APPROACH

Heuristics is, in general, a kind of informal decision theory that strives to combine elements of rational (controlled, effortful, slow and often serial, may be abstract, rule-based) and intuitive decision theory (automatic, effortless, rapid and parallel, concrete, associative) because very often the decision should be made quickly, even at the risk of making the wrong decision.

In the context of malware scanning, heuristics can be considered as the opposite of signature-based scanning, which looks for match signatures found in analyzed files with that of a database of known malware. Heuristic scanning uses

rules and/or algorithms to look for commands which may indicate malicious entity. Using this approach, some heuristic scanning methods are able to detect malware without needing a signature.

A lot of modern viruses are only slightly changed versions of conceptions developed years ago. Specific detection methods like signature scanning became very efficient ways of detecting known threats. Finding specific signature in code allows the scanner to recognize every virus whose signature has been stored in the built-in database. Problem occurs when source code of virus is modified by a programmer or mutation program. Signature is being modified due to even minor changes. A virus can behave in an exactly the same way and be undetected due to new signature. The key question is how to recognize a virus with no information about its structure. The answer is in examining its behavior and characteristics.

Heuristic scanning in its basic form incorporates three procedures (called metaheuristics):

- pattern matching (methods of comparison samples)
- automatic learning (self-adjusting system (machine), whose control algorithm changes in accordance with the control results obtained so that with the passing of time the machine improves its characteristics and quality of performance)
- environment emulation (imitation of complete hardware - allows to run software written for another computer or device)

The main idea of heuristic scanning is to examine program sequences and qualify them by their potential destructiveness. If there are sequences behaving suspiciously, the analyzed program can be qualified as a virus.

In anti-virus (AV) software, heuristic scanning is implemented to recognize threats by following built-in rules. Single suspicion is not a sufficient reason to trigger the alarm. But if a program tries to stay resident and contains instructions to search for executable files, it probably is a real virus. AV software very often classifies sequences by their behavior granting them a flag (importance). Every flag has its weight and if total values for one program exceeds a predefined threshold, the scanner regards it as virus.

Heuristic based anti-malware software uses different scanning methods, including[3]:

- File analysis - During this analysis, the scanning software will precisely examine a file to determine its purpose, destination and intent. For example, if the purpose of a file is deletion of some other files, it could be flagged as a virus.
- File emulation - Otherwise called dynamic scanning or sandbox testing, file emulation tests a file in a virtual condition to perceive what occurs. If the file behaves like a virus, it is presumably a virus.
- Generic signature detection - Intended to find different forms of a malware, this method utilizes earlier virus definitions to locate viruses inside the same family.

3 Forcepoint, https://www.forcepoint.com/cyber-edu/heuristic-analysis

This type of scanning has its advantages and disadvantages.

Advantages of heuristic scanning:

- The process of heuristic scanning is significantly quicker than sandboxing because it does not execute the examined file and then wait to record and analyze its behavior (except for some emulation-based techniques).
- The rules in heuristic engines based on the latest threat vectors can be updated without the malicious person finding out the details.
- It does not provide details on how malware is flagged, so malware creators do not know what they have to change so as to avoid detection.
- Heuristic scanning can identify malware that can avoid sandbox detection.

Disadvantages of heuristic scanning:

- As a result of scanning, the information found is generally connected with the name of threat.
- Because the scanning engines are searching for specific parts of code which show a malicious activity, two limitations are possible:
  - If the creator has not implemented the detection for a specific activity, at that point the malware will avoid detection.
  - If the malicious code is camouflaged (for example, inside an encoded file), it will dodge detection.
- Some of the earlier strategies for heuristic-based scanning have a higher tendency for reporting false positives since they are searching for a wide scope of activities that could identify a potentially malicious file. But, newer strategies for heuristic scanning, for example, generic detection, produce false positives less often. Generic detection is based on searching for features or behaviors that are generally observed for known threats.

Multi-layered in-depth detection is a newer and more efficient detection concept which consists of different phases (or layers): reputation matching, heuristic detection, virtualized execution and threat analysis. The structural scheme of this concept is presented in the following figure.

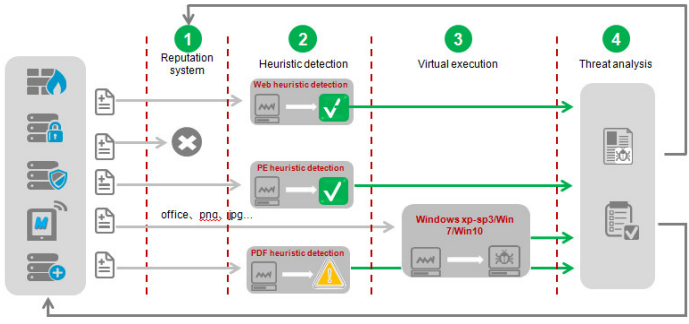


Figure 1: *Layered defense system*[4]

4 Huawei, https://e.huawei.com/en/related-page/products/enterprise-network/security/apt/firehunter6300/brochure/security_firehunter6300_en

The signature scanning methods provide precise scanning by comparing viruses with their signatures. But, these methods fail to detect new and unknown forms of viruses. At the same time the generic techniques can detect new viruses without using signatures. But, these methods are more likely to generate false positives. Based on the above, it can be concluded that there is a positive correlation between the capability to detect new viruses and false positive rate. For example, the heuristic scanning can detect new and unknown viruses but it is more sensitive to false positives.

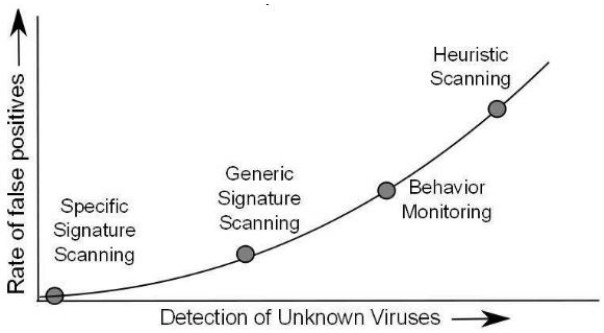


Figure 2: *Correlation between new viruses and false positives*[5]

AV software employs various heuristic techniques to identify previously unknown viruses. Heuristics is about detecting virus-like behavior or attributes rather than looking for a precise virus signature that matches a signature on the virus blacklist. This is a significant progress in finding malicious scripts and programs as it allows the engine to 'predict' the existence of new viruses - even if it is not contained in the actual virus database.

Anti-malware software may have built-in heuristic capabilities. One of the ways to activate it is to adjust the scanning level, within the real-time scanning options. The appropriate behavior settings allow selecting the level of heuristic scanning (Figure 3.):

- Off - Disables heuristic scanning - the software uses only the signature database to determine whether a file is malicious or not.
- Low (often recommended) - Allows lowest sensitivity to detecting unknown threats but will also generate the fewest false positives. This setting combines a high level of security with a low rate of false positives.
- Medium - Detects unknown threats with greater sensitivity than the 'Low' option but with increase of the possibility of false positives.
- High - Highest sensitivity to detecting unknown threats but this also increases the possibility of more false positives.

5 Umakant Mishra: Finding and Solving Contradictions of False Positives in Virus Scanning, Semantic Scholar, https://pdfs.semanticscholar.org/6666/30ad1ec7fdf70d1441c1c883264b3bdee20f.pdf

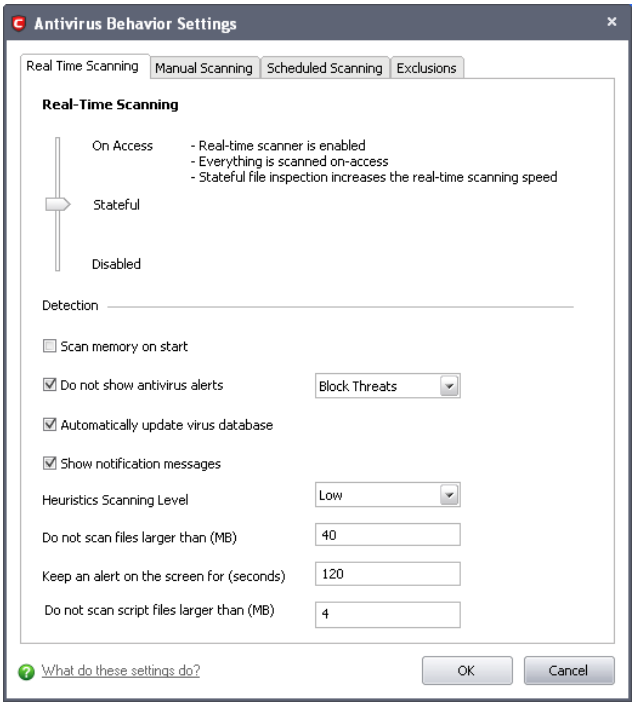


Figure 3: *Heuristics scanning adjustment*[6]

SANDBOXING

Sandbox consists of special built environment, generally virtualized (in some cases physical), where the possibly malicious files are executed and their behavior is recorded. The recorded behavior is then analyzed automatically through a weight system in the sandbox and/or manually by a malware expert. The objective of this analysis is to decide if the file is malicious and if it is, what exactly the file does.

This security mechanism is designed to run untrusted (or exploitable) code, in a manner that prevents the encapsulated code from damaging the rest of the system. The aim of a sandbox is to isolate threats - it provides protection by isolation, not detection.

Sandbox approach in layered configuration can also be successfully used for web and email security as well as for filtering network traffic (figures below).

6 Comodo, https://help.comodo.com/topic-72-1-284-3011-.html

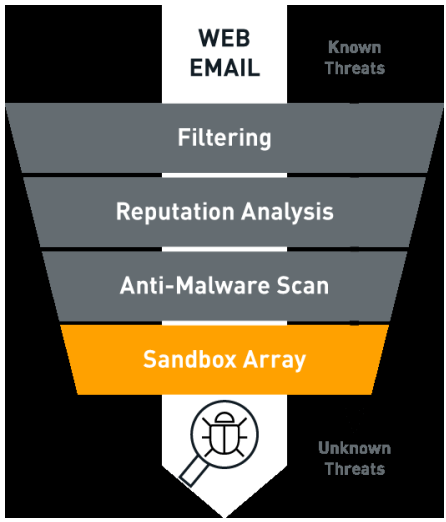


Figure 4: *Web and email security - sandboxing solution*[7]

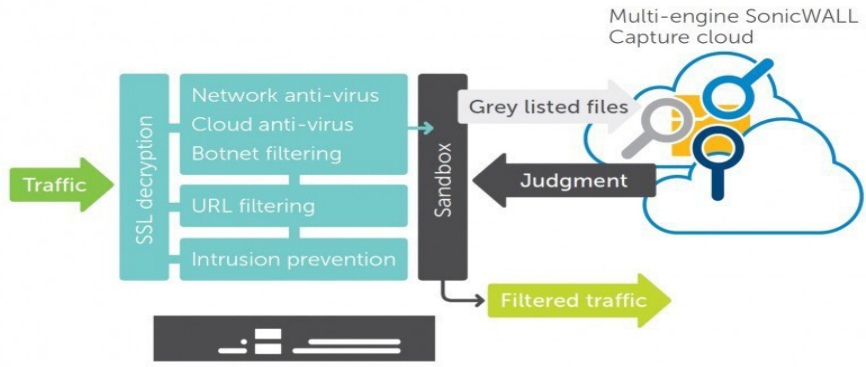


Figure 5: *Traffic filtering using sandbox approach*[8]

Similar to heuristic scanning, sandbox approach also has its benefits and limitations.[9]

Benefits of sandboxing:

- Considering that sandboxing practically opens the file being examined, it can find precisely what that file will do in specific environment.
- Instead of binary form of data and threat name, the great part of sandboxes offers reporting with details on threat behavior. Besides giving additional information on the best way to characterize the file, this technique can be especially helpful in an incident response environment so as to distinguish precisely what the aim of the file has been, in order to explain what the results are.

7 Cyren, https://www.cyren.com/products/cloud-sandboxing

• Many products offer the capacity to provide a very customized actions. For instance, a part of malware that is intended to just completely execute on a concrete client's machine can be replicated.

Limitations of sandboxing:

• Due to the possibility of identifying the applied methodology and customization that is accessible in business sandboxes, malware makers can create adequate practices to avoid detection. This incorporates two classes:

  • Malware intentionally created to be executed in a sandbox and which will act differently so as to not be flagged as malicious. This might be as easy as not running on any virtual machine, or more progressive searching for signs characteristic to a sandbox.

  • Malware makers have made solutions which cannot be detected by the sensors of a specific sandbox.

• It is necessary to provide conditions for sample execution and the time to generate full reports, especially if trying to execute stalled code takes a lot of time and hardware resources to analyze a given sample, causing lower throughput.

• Although the security trend is towards automated sandboxes, a large number of them only provide the raw data on behavior of the malware, so it is necessary to either build a custom application or have an expert to interpret the results.

• Due to the considerable processing time, numerous newer sandboxes are cloud-based, which makes sensitive files hard to use.

The effectiveness of heuristics and sandboxing dominantly depends on the setting of rules. These rules should be forward-looking enough to identify unknown threats and also capable to avoid the appearance of false alarms. One of the possibilities for testing the effectiveness of applied rules is to perceive how well the rules respond to zero-day attacks. Zero-day attacks are malware utilizing unpatched vulnerabilities but with similar exploitation methods. If heuristic rules are well-designed and implemented, they will be able to catch them.

For example, rules developed in the Trend Micro Advanced Threat Scan Engine have been able to detect the following zero-day attacks:[10]

1. CVE (Common Vulnerabilities and Exposures)-2014-0515 in May 2014 was detected by a rule developed in 2014 (HEUR_SWFJIT.B)
2. CVE-2014-1761 in April 2014 was detected by a rule developed in 2012 (HEUR_RTFEXP.A/HEUR_RTFMALFORM)
3. CVE-2014-0496 in February 2014 was detected by a rule developed in 2010 (HEUR_PDFEXP.A)
4. CVE-2013-3346 in November 2013 was detected by a rule developed in 2010 (HEUR_PDFEXP.A).

Testing the performance of a virus scanner has always been a sensitive topic, bearing in mind that small number of testers and organizations are recognized as sufficiently competent by other members of this field. The testing organizations

10 https://blog.trendmicro.com/trendlabs-security-intelligence/heuristic-scanning-and-sandbox-protection-best-of-both-worlds/

generally considered to be competent in this area include: AV Comparatives, AV-Test.org, ICSA Labs, SC Magazine/West Coast Labs, Virus Bulletin, AMTSO (Anti-Malware Testing Standards Organization) and others. Without generally accepted competent reference test set, there is no assurance that scanners are really being tested against actual, working malware. Practically, the majority of the AV vendors provide daily (or more often) adequate updates, so testing a scanner when it is a few months outdated does not say much regarding its present detection abilities.

CONCLUSION

Both heuristic-based scanning and sandboxing present specific advantages and disadvantages and for various situations one scanning technique might be more proper than the other. More reliable security results are achieved by using both methods at the same time in order to minimize the quantity of samples which might probably sidestep detection. Multi-scanning (scanning with multiple engines) is an advantage of the differing heuristic algorithms of many other scan engines.

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CHALLENGES IN ELECTRONIC COMMERCE FROM THE ASPECT OF PROTECTING PERSONAL DATA STORED IN CERTAIN DATABASES AND DIGITAL FORENSICS

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Abstract: It is incomprehensible that the digital era is increasingly developing and applying electronic business. The use of electronic data stored in certain databases, electronic communications and electronic processing of large amounts of data in the performance of business processes of natural and legal persons is evidently increasing, in response to the challenges that electronic business brings, development and harmonization of the normative framework as in the domain of increasing the efficiency of business as well as the challenges that the digital era carries with it especially from the aspect of protection of personal data. The new European Data Protection Regulation (GDPR) has been in place since May 2018, while implementation at the national level begins in the second half of 2019, experience and challenges are the subject of current considerations. The challenges posed by the implementation of the normative framework must also be followed from the forensic aspect in response to potential violations and non-compliance with legal norms, which requires the development and application of new procedures and tools in this area. It is also evident that there is a need to raise the level of knowledge in this field, bearing in mind the specificity of the relation between the normative and technological aspect and the research that is being carried out in this field, both from the aspect of consideration and confidence in the reliability of the application of electronic commerce from the aspect of obtaining and processing information related to forensic aspects in the digital world. The topic of the discussion are precisely these issues that relate to the challenges in electronic commerce both from the aspect of protection of personal data and from the aspect of digital forensics.

Keywords: electronic business, personal data protection, digital forensics, ICT systems, databases

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INTRODUCTION

Together with the increasing digitization of data and the increased application of the ICT System, it is an evident increase in the use of the electronic business. Also, personalization of the services occurs in all domains ranging from the use of services and e-services in certain sectors, such as banking, up to e-Government services, and this leads as well to an increase in the collection and processing of personal data. Personal data can be found in various data records, which are the most often collected, stored and provided for further use even under a much stricter procedure. With the evident increase of the applying and using of new electronic services, the importance of protecting personal data in field covered by electronic business, arise continuously. This result with needs to responding improvement of normative framework at EU level and beyond which was followed by adopting the General Data Protection Regulation is widespread. The General Data Protection Regulation – GDPR (Regulation (EU) 2016/679, Official Journal of the European Union, 2016) was adopted by the European Parliament in April 2016, and has been in effect since May 2018. It has been designed to protect the data of EU citizens and its implementation affects every single organization and business that interacts with an EU resident, regardless of where they may be. It is the most important change in data privacy regulation recently adopted, and fundamentally reshapes the way in which data is handled and has made significant changes in all sectors applying electronic bossiness principle. Furthermore it harmonizes practice regarding personal data processing with ICT systems and services. Especially having in mind that the regulation does not apply only to companies EU-based, but also to companies with headquartered outside the EU that place their products or services in the EU.

The modern digital environment creates new challenges and opportunities for perpetrators of criminal acts, as well as services that influence the illumination of these. So the process of digitization and modernization of business processes is necessary to monitor the development of an adequate response from the aspect of digital forensics. Digital forensics, as one of the branches of forensic science, which aims to gather and document evidence in electronic form, put them in adequate databases and search and explore data using digital forensics and techniques based on information and communication technologies.

Items subject to the Code of Criminal Procedure must be seized or may serve as evidence in criminal proceedings also include automatic data processing devices and devices and equipment on which electronic records are stored or can be stored (Code of Criminal Procedure ("Official Gazette RS, 2011). In the processes of conducting an investigation by digital forensics techniques, collecting, analyzing and presenting digital evidence, it is necessary to ensure that they comply with the normative framework, presented clearly and comprehensively, consistent and acceptable, ensuring the integrity of all types of evidence in digital form.

GDPR SCOPE

The general regulation on the protection of personal data is the response to the increasing representation of new technologies in everyday life, the increasing importance of processing personal data in contemporary economics, national security, scientific research and technological development, as well as reducing confidence in new technologies and their use in the public and private sectors. It relates to the protection of individuals with regard to the processing of personal data and rules related to the free exchange ("movement") of such data within the European Union, as such applies in all Member States, the harmonization of regulations concerning the protection of personal data at the level of the European Union, and beyond, bearing in mind that it does not apply only to EU-based companies, but also to companies headquartered outside the EU that place their products or services in the EU. It applies to the processing of personal data that is fully automated, as well as to non-automated processing of personal data that form part of the recording system or are part of the data recording system.

Primary emphasis is on the scope of application, and no less important is that this regulation does not apply to the processing of personal data: during an activity that is not covered by the legal framework of the European Union, carried out by a natural person during solely personal or household activities and performed by the competent bodies in the purpose of preventing, investigating, detecting or prosecuting criminal offenses or the execution of criminal sanctions, including the protection of public security.

Determination of the concept of personal data has been extended in relation to the previous normative framework (EU 95/46/EC) or a person who can be identified directly or indirectly (name, identification number, location data, network identifier or with the help of one or more characteristics of the inherent for the physical, physiological, genetic, mental, economic, cultural or social identity of a particular person).



Figure 1. *Basic principles of the General Regulation on the protection of personal data*

The principles of personal data processing (Figure 1) relate to a lawful, appropriate and transparent way of processing, right for the data to be collected and processed in accordance with the legally defined purpose, minimizing the use of personal data only to relevant and limited with what is necessary in relation to the purpose according which they are processed, the accuracy and the timeliness of the data, as well as the measures to be taken without delay, in the case of data in relation to the purpose for which they are being processed, are not correct (correction or deletion), limit the retention in accordance with the purpose for which personal data is processed, unless personal data is processed for archival purposes, in the public interest, for the purpose of the scientific or historical research or for statistical purposes, with the application of appropriate safeguards and guarantees of data integrity.

GDPR BRINGS

The new regulation also introduces the concept of pseudonymisation which refers to processing that is done in a manner that prevents the attribution of personal data to a particular person without the use of additional information or data. The application of pseudonymisation to personal data can reduce the risks of violation of data protection obligations. It can be provided in such a way that this additional information for attributing the personal data is kept separately. Furthermore, technical, organizational and personnel measures have to be taken to ensure that personal data cannot be attributed to a particular or specific person. Pseudonymization would mean that data are converted in such a way that the personal data cannot be detected by a reversible process.

The concepts Privacy by Design and Privacy by Default or the concept of integrated privacy protection (Privacy by Design) are being introduced, i.e. that the integration of elements related to the protection of personal data is considered from the design phase of the ICT System and databases development up to the production work and use of developed solutions. In any case, privacy policies should be written in a simple and comprehensible way to the end user. Also, the user should clearly state the consent before access to the use of personally identifiable information, i.e. silence. Pre-marked field or non-response cannot be considered as consent. Consent should be given a clear and affirmative act that expresses the voluntary, independent, informed and unequivocal consent of the person to whom the data relate, in relation to the processing of personal data. The user must be informed about the purpose for which the information and data are collected, stored in specific databases and processed. Moreover, the user has to be informed about the automation of the procedure, as well as about the possibilities of disputing further processing.

It is obligatory to inform users in the event of data breaches occurring in specific databases, without delay or up to the prescribed deadline (Figure 2).

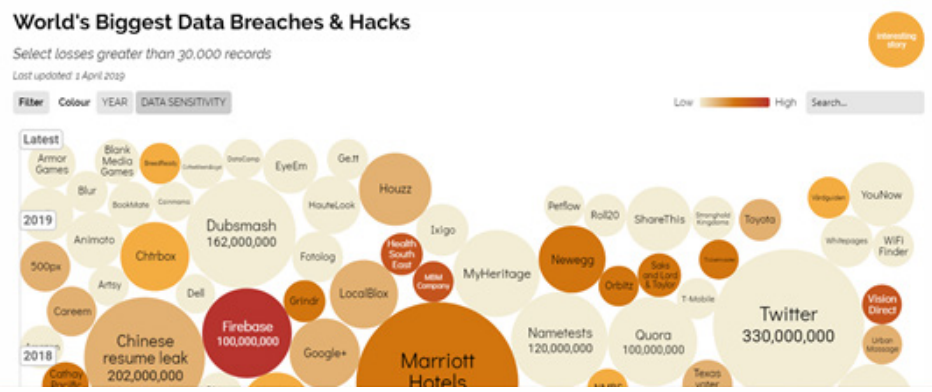


Figure 2. *The biggest cases of violation of records and personal data in the world*[2]

However, there is a general principle for transfer of personal data which are undergoing processing or are intended for processing after transfer to a third country or to an international organization. It provides the possibility of transferring personal data which shall take place only if, subject to the other provisions of the GDPR and means that personal data from one database may be transferred to another using the web service. Also there is a defined principle regarding when the right of access can be used to obtain a copy of the data that is being kept on the person, as well as the right to revoke the consent previously given for the processing of personal data, or delete data from certain databases.

Certain public attention has attracted high penalties that can be imposed by data protection authorities, which are supposed to be up to € 20 million or 4% of annual turnover.

The General Regulation on the Protection of Personal Data provides methodology for the reporting and mechanism how it has to be implemented. The first report and revision will be implemented by 2025, and thereafter periodically every four years. The European Commission, if necessary, submits appropriate proposals with a view to change the GDPR regulation, especially taking into account the dynamics and trends in the development of information and communication technologies, as well as the development of the information society as a whole.

THE YEAR OF THE APPLICATION OF GDPR

The new rules require that any information addressed to the public or to the data subject be concise, easily accessible and easy to understand. Clear and plain language has to be used or additionally, where appropriate, visualisation can be used. Companies have to use simple explanations of the way how the data will be

2 *https://www.informationisbeautiful.net/visualizations/worlds-biggest-data-breaches-hacks/*

managed and handled, mandatory requesting data collection and storage of certain data in databases, ensuring the possibility of copying data to users or deleting them on demand, as well as reporting data security breaches. Many companies already have been harmonized with the GDPR regulations during the first year of implementation, although there have also been those who have been subject to penalty provisions with significantly high penalties. Google is one of the examples. It was penalized with around 50 million euros during this first year of application[3]. In preparation for the implementation of the GDPR regulation, some large companies such as Apple and Facebook have developed new user tools to be able to control and/or delete the collected data.

However, for a year in the implementation of the GDPR, things generally take place well in line with the GDPR regulations. According to the International Association of Privacy Professionals (IAPP[4]), organizations have set up their privacy teams and are making efforts to implement the GDPR regulation in most cases. Since May 2018, more than 95,000 citizen complaints have been registered with the Data Protection Authority (DPA), most of the complaints, it can be said relates to electronic commerce, video surveillance and similar cases[5]. What can be assessed as a major contributor to the implementation of the GDPR Regulation is transparency in terms of data security breaches. In 2018, only 1,700 data security injuries were reported, while estimates that approximately 36,000 data security injuries will be reported in 2019.

According to a study released by law firm DLA Piper[6] from London, around 60,000 data security injuries in the first eight months of the implementation of the GDPR regulation were reported across Europe. According to research conducted in the US by TRUSTe / NCSA, 92% of Internet users expressed concern about privacy in the online environment, 89% avoid companies that do not have a privacy policy, and 60% think privacy in the online environment should be human rights[7] . Trust in e-commerce plays an extremely important role, and is a challenge in the development and use of services and electronic services, as well as the topic of many of the world's research.

According to research conducted in the UK by the International Commissioner's Office - ICO, in June 2018, about a third (34%) of interviewed citizens declared that they had great confidence in companies and organizations that have and use personality data, which represented a significant increase compared to 2017 when this opinion was about 21%. In a survey conducted in March 2019, 64% fully agree or agree with the observation that progress is visible in relation to individual rights in relation to the collection and processing of personal data compared to May 25, 2018, when the application of the GDPR Regulation began.

3 Lineate tech solution company - *https://lineate.com/gdpr-one-year-later/*
4 The International Association of Privacy Professionals - The world's largest global information privacy community
5 *https://www.lexology.com/library/detail.aspx?g=e6416273-7c56-456c-b102-991dcde14991*
6 *https://www.dlapiper.com/en/europe/focus/eu-data-protection-regulation/home/*
7 *https://www.trustarc.com/resources/privacy-research/ncsa-consumer-privacy-index-us/*

GDPR IN SERBIA

The Law on Personal Data Protection[8] was adopted on November 9, 2018, with a delay of nine months for its implementation. Bearing in mind the ongoing process of Euro integration, the preparation of the law took into account compliance with the General Regulation on the Protection of Personal Data and Free Data Flow, Directive 2016/680, and Directive 2016/681. The Law on Personal Data Protection regulates the right to protection of natural persons in relation to the processing of personal data and the free flow of such data, the principles of processing, the rights of the persons to whom the data relate, the obligations of the handlers and processors of personal data, the code of conduct, personalities in other states and international organizations, supervision over the implementation of this law, legal remedies, liability and penalties in case of violation of the rights of natural persons in relation to personal data processing, as well as special cases of processing. This law also regulates the right to protection of natural persons with regard to the processing of personal data by the competent authorities for the purpose of preventing, investigating and detecting criminal offenses, prosecuting offenders or enforcing criminal sanctions, including prevention and protection against threats to public and national security, as well as the free flow of such data.

Personal data protection is provided to any natural person, regardless of nationality and residence, race, age, sex, language, religion, political and other belief, nationality, social status and status, wealth, birth, education, social status or other personal properties. The data must be adequately protected against misuse, destruction, loss, unauthorized changes or access (Law on Personal Data Protection, Official Gazette RS, 97/2008)[9].

Personal data breach can be considered as a security incident in which data that is protected or restricted access, accessed, reviewed, copied, transferred or used by a third party that is not authorized. While an incident can be considered as any event that is not part of the standard functioning of the service and which causes, or can cause, interrupt and decrease the quality of that service.

The rules relating to the protection of individuals with regard to the processing of personal data by the competent authorities for the purpose of preventing, investigating, detecting or prosecuting criminal offenses or the enforcement of criminal sanctions, including protection against threats to public safety and their prevention are defined by Directive (EC) 2016/680[10]. Accordingly, Member States protect the fundamental rights and freedoms of individuals, and in particular

8 *http://www.parlament.gov.rs/upload/archive/files/lat/pdf/zakoni/2018/2959-18-lat.pdf*
9 Law on Personal Data Protection ("Official Gazette of the Republic of Serbia", No. 97/2008, 104/2009 - Dr. Law, 68/2012 - decision US and 107/2012)
10 Directive (EU) 2016/680 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data by competent authorities for the purposes of the prevention, investigation, detection or prosecution of criminal offences or the execution of criminal penalties, and on the free movement of such data, and repealing Council Framework Decision 2008/977/JHA.

their right to the protection of personal data and ensure that the exchange of personal data between competent authorities, where such exchange is required by the law of the EU or the law of a Member State, is not limited to the prohibition in reasons related to the protection of the person regarding the processing of personal data. Also, this Directive sets out the rules relating to the protection of individuals with regard to the processing of personal data by the competent authorities for the purpose of preventing, investigating, detecting or prosecuting criminal offenses or enforcing criminal sanctions, including protection against threats to public safety and their prevention. The obligation to protect the fundamental rights and freedoms of individuals, and in particular their right to the protection of personal data, and to allow the exchange of personal data between competent authorities within the EU, where such exchange is based on EU law or the law of a Member State, reasons related to the protection of individuals in terms of data processing of personal data.

GDPR AND DATA BREACH WARNING

In a very short time it is necessary to find sources of digital evidence. Evidence is collected in a mode of work that corresponds to forensic methods and analyzes data breach on site. The data collected is then analyzed and a safe solution is found to overcome the resulting data breach.

Within a few hours, it is necessary to repair the functionality of the disturbed systems and to enable the return of data and functionality of the systems in which the data are processed. According to the GDPR Regulation, after 72 hours of the occurrence of the data breach, it is necessary to provide information related to the subject of the attack and data breach, how it came about, when and from where the data breach began.

In general, CERT teams, system administrators, forensic teams, legal teams, communication experts, human resources and financial investigations can be involved in responding to an attack on data breach.

If we look at the readiness to respond to incident situations or attempt to violate the integrity of the data, it can also be talked about forensic readiness or readiness to collect and document information related to data breaches. Forensic readiness has a significant role both in terms of incident prevention and in response to incidents.

Bearing in mind the increasing scope of where e-business could be applied in modern life and work, it is necessary to assume that the incident will occur, even if the risk assessment is with low probability, so that capacity development in this domain must also be continuous, because forensic readiness is a measure of the capacity for incidents prevention, as well as information that have to be provided about events that have already occurred in adequate form for further use as evidence in court proceedings.

Developing forensic readiness develops capacities for interactive learning based on systemic approaches to gathering information over time, analyzing and allowing detection of threats, and ensuring adequate response and actions regarding provision of evidence in adequate form, especially in case of data breach.

GDPR AND DIGITAL FORENSICS

Digital Forensics is a science aimed at collecting, storing, finding, analyzing and documenting digital evidence, or data that is stored, processed or transmitted in digital form.

Digital forensics and cyber incident incidents are the basis for obtaining evidence in electronic form, and certainly include the evidence that contains personal data contained in certain databases, which fall within the domain of the GDPR regulation. If digital forensic methods are being implemented or processed in incidents in the European Union or in the business involving the international community, it is necessary to take into account the application of the GDPR regulation.

The forensics, following strictly defined rules, collect digital media and electronic information suspected of being on the evidence they are searching for, provide them with any changes, find any evidence and analyze in order to reconstruct the activities that have been performed on them, and prepare a report to be used to conduct a trial or an internal investigation at an institution in which data was abused or leaked.

Digital forensics has wide application and is not limited to police, court, and military intelligence activities. The banking sector, insurance companies and companies of various profiles have a need and must be extremely cautious with the personal data of the clients they have, as many companies are causing enormous damage due to industrial espionage and general misuse of the IT system.

When it comes to personal data, all processes and activities related to the application of digital forensic methods represent the processing of data from the aspect of the GDPR regulation, with the necessary application of all aspects of information security.

CONCLUSION

It can be concluded that the normative regulation in the domain of personal data protection has been significantly improved (GDPR One-Year Anniversary, 2019) by the adoption of the GDPR regulation, and that after a year of implementation there are still challenges that require an adequate response and certainly a significant improvement in the application and observance of the rules relating to data protection about personality, which are found in certain databases. The challenge is the development of readiness for adequate responses to incidents in

the cyber space as well as the development of the capacities for the application of digital forensic methods in order to provide valid evidence for the prosecution of criminal offenses that take place in the digital sphere or are involved in any way in the committing criminal offenses. It is encouraging that the number of personal data security violations has increased significantly, which also contributes to the development of readiness for responses to incidents in the digital cyber space, as well as forensic readiness to provide adequate support for the methods of digital forensics to the processing of this type of casees.

Developing awareness of the risks which brings the digital age, effective implementation of regulations and development capacity for the application of digital forensic methods contribute to the overall increase in the use of e-business in practice.

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IMPLEMENTATION OF AN ELECTRONIC SERVICE "E-CRIMINAL RECORD" ON PORTAL E-ADMINISTRATION

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Abstract: In order to exchange information more efficiently and faster, transparency in the provision of public services and simpler communication between citizens and the public sector, Web services for obtaining data and information are increasingly being used, which provide easier exchange of information in relation to traditional "paper" systems and therefore significantly accelerate the process and save the time of citizens and legal entities. Bearing in mind the public administration reform in the Republic of Serbia, which is primarily reflected in the utilization of the potentials offered by modern information communication technologies, benefits for citizens, business and the public sector, the Ministry of Internal Affairs (MUP) strives to digitize its administrative processes to contribute to these aspirations. In this paper a new web service "eCriminal record" was presented for obtaining data on punishment and impunity for the needs of State authorities, enterprises, other organizations or entrepreneurs, along with a reasoned request and justified interest based on the law.

Keywords: Criminal Records, ePortal, Web Services, MUP

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INTRODUCTION

In order to understand e-Administration, the development of administration and the reform of the Government and state administration in general must be understood. Re-designing and conceiving the process contributed to the realization that administration represents a dynamic mix of goals, structures and functions. E-Administration initiatives are complex efforts to introduce changes, with the aim of using new technologies to support the transformation of operations, as well as supporting the increased efficiency of reformed Government and state administration. A new challenge for public administration in the 21st century is the creation of e-Administration.

There are several definitions of e-Administration that are used. Some of them place more emphasis on aspects of the functionality of technology in state administration. This is not so problematic if the continuous development of technology, especially the Internet, the application of information and communication technologies would not spread to new aspects of society.

For this reason, we mostly use the most common technologically-neutral definition: e-Administration implies the application of information and communication technologies (ICT), and in particular the use of the Internet as a means of achieving good governance.

The reform of the state administration in the Republic of Serbia is based on five basic principles:[5] the principle of decentralization, the principle of depolitization, the principle of professionalization, the principle of rationalization and the principle of modernization. The principle of modernization is justified by ensuring that the traditional form of state administration, as much as possible, is translated into an electronic form using ICT, which leads to the concept of electronic administration, in which the creation and implementation of electronic services is recognized as the most important factor.

DEVELOPMENT OF ELECTRONIC SERVICES

In today's fast-developing applications world, the term distribution has a special meaning. Distributed applications are executed on a number of computers, and they communicate and synchronize each other over the network.

SERVICE ORIENTED APPLICATIONS

Service-oriented applications have been built with respect to the rules of service-oriented architecture, or using a "template" for software development that includes rules, procedures, and proven practices that allow the services to

5 *http://www.mduls.gov.rs/doc/Strategija%20reforme%20javne%20uprave%20u%20Republici%20Srbiji.pdf*

be exposed and consumed efficiently. Such applications do not execute their business logic locally, but using multiple services, where one service is an autonomous system unit and provides support to other system components when accepting a request, and on the basis of it forming an appropriate response (Alonso, 2004).

Unlike traditional, firmly coupled systems, SOA implements a set of coupled services that together produce the desired result. Thus, this architecture is developed around services and messages which interconnect between applications and such services. Exactly one such system is shown in Figure 1.

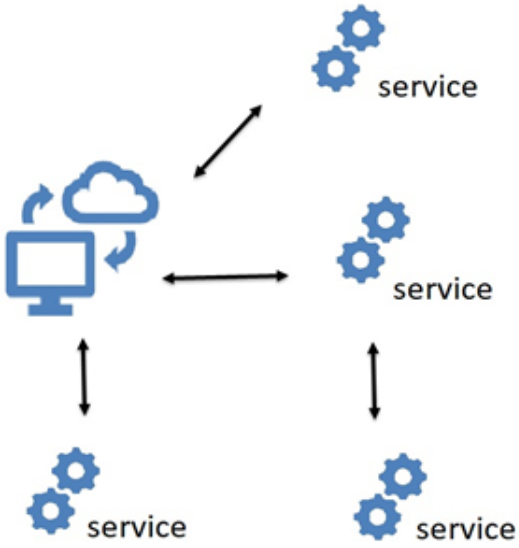


Figure 1. - *Distributed application based on services*

The service executes the business logic of the application by accepting the request and processing it. Service addressing is done on request. The request contains specific formatted data, function parameters, and its name. When a service accepts a request, it processes it by respecting the rules of the protocol, executes functionality and creates an appropriate response. Generated response, the service is packaged again in the form specified by the service protocol and sent back to the client. Regarding the service itself, in the context of program architecture, there are four rules (Steven, 2010):

1. Services have clear limits
2. Services are autonomous
3. Services expose contract and policy, and bot code
4. Service Compatibility is based on policies.

The use of the service implies clear rules, contained in its functions, addresses and security requirements. If these rules are not respected, the service cannot be functional, but it must clearly inform the client that there has been a violation of the rules and thus the improper functioning of the service. The service must be able to express in simple and standardized ways what can be done for the client and how to communicate with it. Therefore, the service must define the area of compatibility and the way interaction is performed.

TYPES OF SERVICES

The basic feature of the service makes it possible to execute some business logic on a remote computer. There are two types of services:

- SOAP, and
- REST.

SOAP (*Simple Object Access Protocol*) is an application communication protocol, but also a format for sending and receiving messages that allows applications to, regardless of the technology they write or the platform on which they are executing, exchange messages with each other using XML (the language for representing data in text format using tags) (Bill, 2007). Figure 2 shows the communication between the service and the client using SOAP.

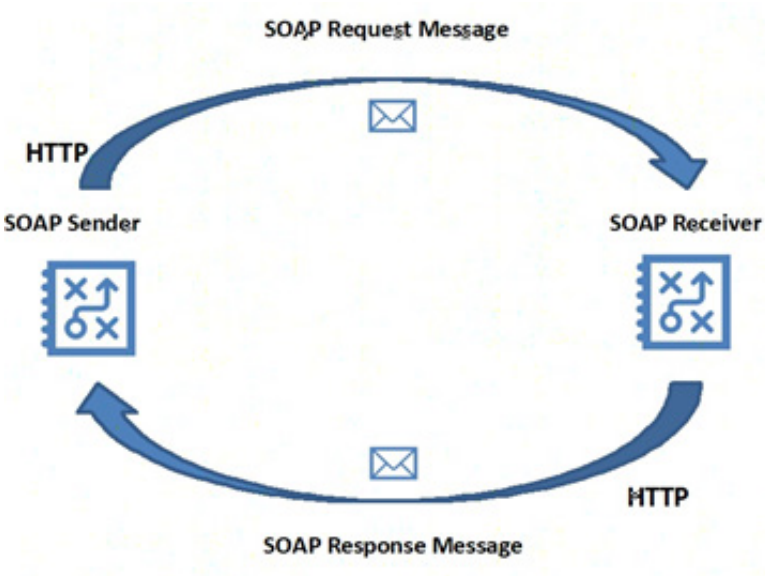


Figure 2 - *Communication between the service and the client using SOAP*

SOAP messages are simple XML documents, which consist of the following elements (Scott, 2006):

- **Envelope** – identifies an XML document as a SOAP message
- **Header** – contains header information
- **Body** – contains request and response information
- **Fault** – contains error and status information.

The XML basis of each SOAP message has the following structure:

```
1   <?xml version="1.0"?>
2   <soap:Envelope
3   xmlns:soap="http://www.w3.org/2003/05/soap-envelope/"
4   soap:encodingStyle="http://www.w3.org/2003/05/soap-encoding">
5   <soap:Header>
6   ...
7   </soap:Header>
8   <soap:Body>
9   ...
10   <soap:Fault>
11  ...
12   </soap:Fault>
13   </soap:Body>
14   </soap:Envelope>
```

Unlike SOAP services, REST (*Representational State Transfer*) services do not use a complicated mechanism for detecting and exchanging messages, but simple HTTP postulates. The basis of REST service are HTTP methods, as can be seen in Figure 3.

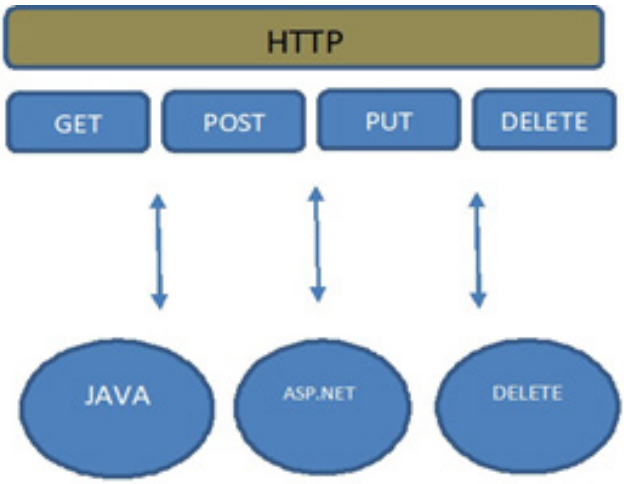


Figure 3 - *REST architecture*

When REST service is addressed using the GET method, it will return one or more data. If POST method is sent to the service, it will create new data. The PUT method tells the service that it is necessary to update the existing data or to create new ones, if the data do not exist. Finally, the DELETE method clears data.

As you can see, there is great freedom in implementing the REST service. In REST, the term contract is terminated, so that messages can be arbitrarily formed. The price of such freedom is that the service must be properly documented in order to be able to use it. Using REST service, sending requests is usually done using HTTP protocol, while the response of the service is delivered to the HTTP response body, most commonly using the XML or JSON format (An open standard for presenting data in a text form in the form of key pairs and values).

E-ADMINISTRATION

E-Administration can be defined as the use of information and communication technologies through an automated system to perform the necessary tasks in order to facilitate the faster and easier transfer of information in order to increase the accessibility and facilitate the functioning of state administrations and public services for the benefit of citizens, legal persons, as well as employees in these institutions (Bonson, 2012). E-Administration can be seen as a way in which the use of the latest ICT technologies, especially web-based Internet services, can provide the citizens and the business sector with a more convenient, faster and easier access to information and quality services of the public sector and state authorities according to the principle anywhere, at any time and in accordance with the requirements of equal access for all.

By using electronic administration, citizens can do their jobs without waiting in line, get timely and accurate information, or do a job for which it is sometimes necessary to spend several days visiting various state institutions. Entities from the business world, above all from the ICT domain, can use the electronic administration in order to open new market areas of work. State institutions can use the electronic administration in order to relieve pressure at counters, increase transparency of their work, lower their services and thereby raise the level of citizen satisfaction. Electronic administration means the use of the Internet or other electronic systems to simplify and facilitate the communication of the economy and citizens with e-Administration services that are available 24 hours a day, 365 days a year. Accordingly, users of electronic administration are: G (*Government*), E (*Employee*), B (*Business partners*) and C (*Citizen*). (Soliman, 2006).

E-Administration represents a continuous optimization of service delivery, management and participation of citizens and the economy, through the transformation of internal and external relations using new technologies, the Internet and newly developed media. This includes -Government relations towards citizens (*Government to Citizen* - G2C), Government to Employee (*Government to Employee* – G2E), Government to the business sector (*Government to Business* -

G2B), as well as mutual relations between Government and state administration (*Government to Government* - G2G) (Petrušić, 2013).

MODALITIES OF COMMUNICATION IN E-ADMINISTRATION

Within the electronic administration, there are the following modalities of communication between the users:

- G2G intranet (Government communication subsystem, information, services)
- G2E intranet (Government officials, "chat room" notice board, learning)
- G2B Internet (supply, information, services)
- B2G Internet (Government communication with business partners)
- G2C Internet (Online Services, Digital Democracy)
- C2G Internet (Governmen*t* communication with citizens).

- **Government to Government - (G2G):** The efficiency of the state administration itself depends on other departments of Government within the state itself. G2G enables the exchange of different information and data, Government resources, and only the improvement of the efficiency of the initiated processes.

- **Government to employee - (G2E):** consists of communication and exchange of information among public sector employees, state administration, various ministries and state agencies. Civil servants, through various forms of communication, education, exchange and use of information and data in a simpler, faster and more efficient manner through cost reduction, improve the efficiency of the state administration.

- **Government to bussiness – (G2B):** It consists of the exchange of electronic data between the administration and the private sector, i.e. legal entities. Online communication with the administration reduces paperwork and simplifies regulatory processes, or helps businesses to become more competitive and more attractive to potential investors.

- **Government to citizen - (G2C):** deals with the relationship between administration and citizens. It allows citizens to access information and administration services, using more available systems.

ADVANTAGES OF E-ADMINISTRATION

High availability of information enables citizens to express free will and political views. This results in the consolidation of democratic principles. Citizens have the opportunity to access information on all legal regulations. They have the opportunity to be directly informed about the law and the by-law in preparation, who wants an amendment, or who of the councillors when and how they vote. Apart from visible advantages for the citizens and the economy of the state, the relief of the e-Administration for the republic authorities has one big advantage which is reflected in the reduced cost.

LEGAL REGULATION OF ELECTRONIC BUSINESS IN THE REPUBLIC OF SERBIA

The strategy for the development of electronic commerce in the Republic of Serbia is contained in the Strategy for the Development of the Information Society in the Republic of Serbia until 2020[6], and in the National Strategy for Sustainable Development and the Strategy for the Development of Electronic Commerce in the Republic of Serbia[7].

The Strategy of the Information Society of the Republic of Serbia until 2020, which provides reform and modernization of public administration based on the widespread use of information and communication technologies, is one of the key elements of the overall transition of the Republic of Serbia into a modern information society. According to the National Strategy for Sustainable Development in the Republic of Serbia, it is necessary to support the increase in the level of digital literacy among citizens and the introduction of quality education in terms of information and communication technologies at primary school level. It should provide conditions for further increase in the number of Internet users and access to ICT for all, natural and legal persons. The legislation of the Republic of Serbia adopted during the 1990s was conditioned by the degree of technological development and the standards in the field of information technologies. The current level of information and communication technology, the development of modern methodologies, tools, and orientation to object-oriented modelling, Web technologies, distributed systems, new operating systems and new generally accepted standards require the redefinition of existing regulations.

In addition to technology, legislation adopted during the 1990s was also outdated from the perspective of current social requirements for the implementation of the concept of e-business from the aspect of harmonization of our legislation with the EU and international standards. The laws of the Republic of Serbia that have passed in the past years and which are in accordance with the European

6 *https://www.paragraf.rs/propisi/strategija_razvoja_informacionog_drustva_u_republici_srbiji.html*
7 *http://www.gs.gov.rs/lat/strategije-vs.html*

Union, especially refer to the Law on Business Registration on Access to Information of Public Importance and the Law on Electronic Signatures and relevant bylaws, consists of the concept of basic elements of e-business, such as the introduction of electronic signatures and digital certificates, the possibility of filing the application of natural and legal persons (users) and electronic provision of customer services via the Internet, communication of users and authorities by e-mail, sanctioning negligent and malicious acts, etc. Among the legal provisions of the Republic of Serbia, the most important is the implementation of the Law on Electronic Signatures[8] (adopted in December 2004). The use of electronic signatures should fulfil the basic legal precondition for moving from paper to electronic processes in all areas of life, in order to achieve one of the basic preconditions for further development of e-business in the Republic of Serbia.

ELECTRONIC SERVICES ON THE PORTAL OF THE ELECTRONIC ADMINISTRATION

The e-Administration portal is the national portal for providing electronic services to citizens, businesses and state authorities in the Republic of Serbia. As such, the Portal offers numerous electronic services of different complexities, some of which are integrated with the information systems of the state administration and local administration authorities, while other requests are downloaded through the e-Administration system envisaged for this purpose.

The e-Administration portal forms a central access point for electronic administration services. The users of the Portal are citizens, legal entities and employees in the state administration and local self-administration. The central point for the exchange of information between the information systems of state administration and local self-administrations is the ESB (*Enterprise service bus*) the solution that is called for its purpose *Government service bus*.

The system e-Payment is a special logical and physical entity intended for paying the envisaged fees. It is used by the e-Administration Portal as an integral component, but it is also used by the state administration and local self-administration authorities that offer their services independently and in this way provide the possibility of paying. E-Payment communicates with the information system of the Treasury Department in order to send announcements for expected arrivals and receive information on arrivals through payment transactions.

Published electronic services should be available to users of e-Administration. Finding a specific service is done according to the already offered modes on the e-Administration portal, i.e. through the appropriate area and situation, from the list of services sorted by alphabetical order or by the authority providing the service or by keyword search. (Marković, 2008). Regardless of the way in which the service occurred, after it has been selected, it is necessary to use the existing de-

8 *http://ca.mup.gov.rs/zakon%20o%20elektronskom%20potpisu.pdf*

scriptive data presentation mechanisms, such as in the case of the existing e-Administration services (Figure 4).



Figure 4. *E-Administration Portal*

For the purpose of simplifying the implementation of electronic services, a mechanism should be provided which will be implemented by the user through the entire administrative procedure, and in accordance with the defined service. This implies showing the user an electronic form, defined with the help of a generator, in which he will input the required information, make inquiries into electronic records of external systems, and send relevant submissions to other authorities. It is necessary to require electronic signing when submitting a request from the system within the e-Administration portal (Nikolić, 2013). External systems return the required information at the same time, while for information based on submitted submissions, it will be necessary to wait for the deadline prescribed by law. Therefore, the solution must provide an opportunity for the user to see that the response (notification) was received by the submitted submission, as well as the content of the response itself (Figure 5). All responses received on the basis of

the submitted submissions must be presented in the form of a list for each authority individually. The user should be able to easily download the document from the response to the submission.

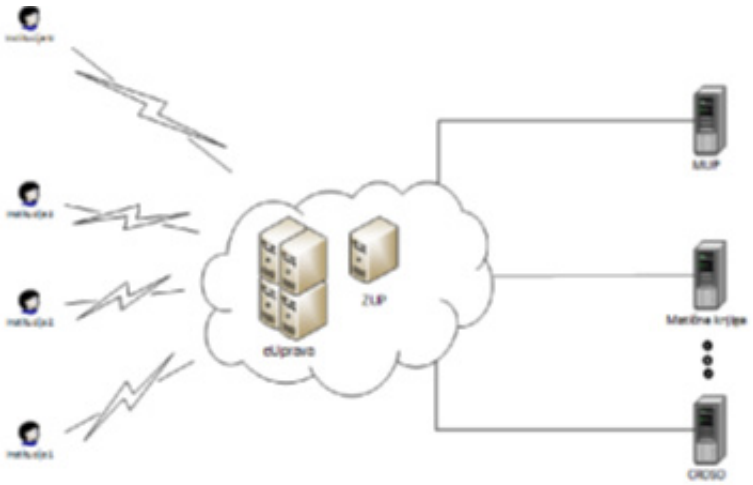


Figure 5. *Communication of citizens with e-Administration*

CRIMINAL RECORDS ON THE E-ADMINISTRATION PORTAL

The architecture of the system for the implementation of e-Services "Submitting a request for conviction of (non) punishment" is presented as a diagram in Figure 6.

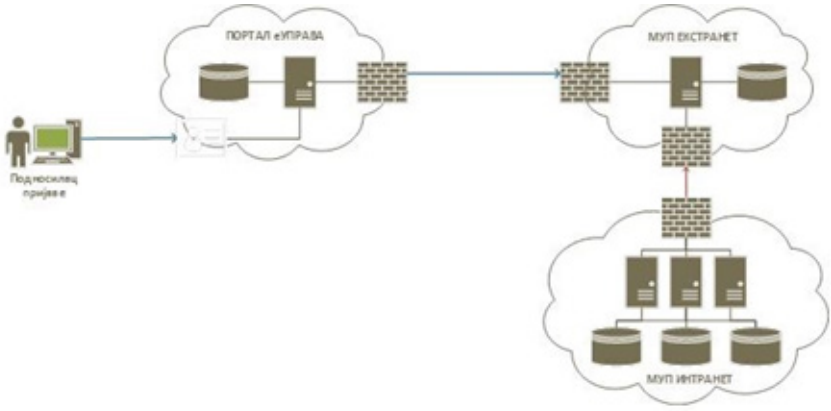


Figure 6: *System architecture*

The Criminal Code of the Republic of Serbia and the Code of Criminal Procedure regulate the content and manner of keeping the penal records, as well as the conditions and manner of providing data from this record. The by-law, i.e. the Rulebook on Criminal Records, has established the jurisdiction of this Ministry for conducting criminal records and providing data from this record.

Criminal records are kept according to the place of birth in the regional police administrations for all adult persons who are citizens of the Republic of Serbia, as well as for foreign citizens and stateless persons born on the territory of the Republic of Serbia, for the citizens of the Republic of Serbia born abroad who have been convicted by a final court verdict domestic court. Criminal records are also kept for foreign nationals who have been legally convicted of crimes committed in the territory of the Republic of Serbia and for the citizens of the Republic of Serbia convicted of criminal offenses by foreign courts.

Criminal records may only be given to the court, the public prosecutor and the police in connection with criminal proceedings against a person previously convicted, a penal enforcement authority and an authority involved in the process of granting amnesty, pardon, rehabilitation or deciding on the cessation of the legal consequences of conviction, as well as the guardianship bodies, when necessary for the performance of duties under their jurisdiction. Data from the criminal record can also be given to other state authorities that are responsible for detecting and preventing the commission of criminal offenses, when this is prescribed by a special law. Citizens may, at their request, be given information about their conviction or non-conviction. Deleted convictions are not given to anyone.

The Criminal Code prescribes Rehabilitation, which deletes the sentence and ceases all its legal consequences, and the convicted person is considered to be non-convicted. Rehabilitation is based on the law itself (legal rehabilitation) or at the request of the convicted person based on a court decision (judicial rehabilitation).

The procedure for legal rehabilitation of convicted persons in relation to rehabilitation has not been convicted or is not considered convicted by law, is initiated and carried out ex officio when, according to the information from the diary, conditions are fulfilled for the adoption of a decision on rehabilitation. During the decision-making process, there must be the necessary verification and collection of data on whether the penalty has been collected, sustained, forgiven or obsolete, whether the rehabilitation period for the second conviction is running, whether a person is undergoing a safety measure that causes an obstacle to rehabilitation and that criminal proceedings are instituted against a person for a new criminal offense committed before the expiry of the period prescribed for legal rehabilitation (obtained from the competent court by the place of residence). Following the procedure, a decision is made on legal rehabilitation based on which the information on conviction is deleted.

The following institutions of the Republic of Serbia are participating in the realization of the electronic service "Submission of a request for conviction on

punishment and impunity": Ministry of Internal Affairs and Office for IT and Electronic Administration of the Government of the Republic of Serbia.

From the aspect of the Office for IT and Electronic Administration, in technical terms, an application form was developed on the e-Administration portal, which is in integration with the Ministry of Internal Affairs web services, in order to enable secure electronic data exchange between the relevant systems.

From the aspect of the Ministry of Internal Affairs in technical terms, the upgrade of the software application "Criminal Records" was performed in order to submit applications submitted on the e-Administration portal's website, which could be processed and recorded in IS Ministry of Internal Affairs (Figure 7).

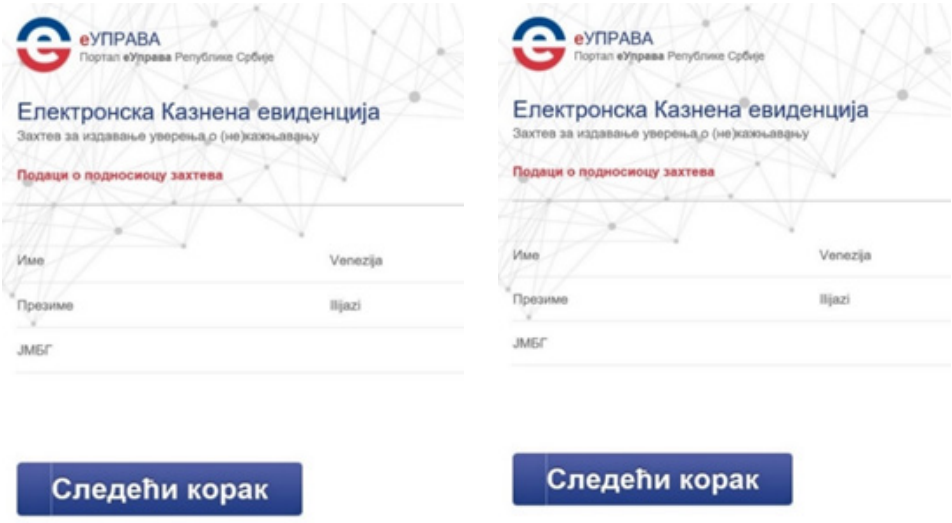


Figure 7. *Request for issuing certificate of (non) Punishment*

The implementation of the web service for filing the Request for obtaining a conviction and impunity certificate should enable the safe submission of data requests from the e-Administration portal, as well as the mechanisms for checking data from the application through the relevant records of the Ministry of the Interior. After processing the application to the applicant, a notification is sent via Portal to the mail or SMS about the processed request and the notice on the acceptance of the Certificate, as shown in Figure 8.

Thanks to the new electronic service, citizens will in the future be able to "proclaim" through the portal e-Administration the Certificate of (non) Punishment to take it to their regional police administrations. The service will be available to citizens residing in the territory of the Republic of Serbia.

The use of this service implies that a citizen is registered and also registered with the e-Administration Portal with his username and password or a qualified electronic certificate.

The electronic service "Request for issuing certificate of (non) Punishment" is intended for adult natural persons who are the citizens of the Republic of Serbia who wish to submit a request for obtaining data on (non) punishment by electronic means. The applicant selects the place where they exercise their right, or whether it is a certificate required for exercising the rights in the country or abroad.

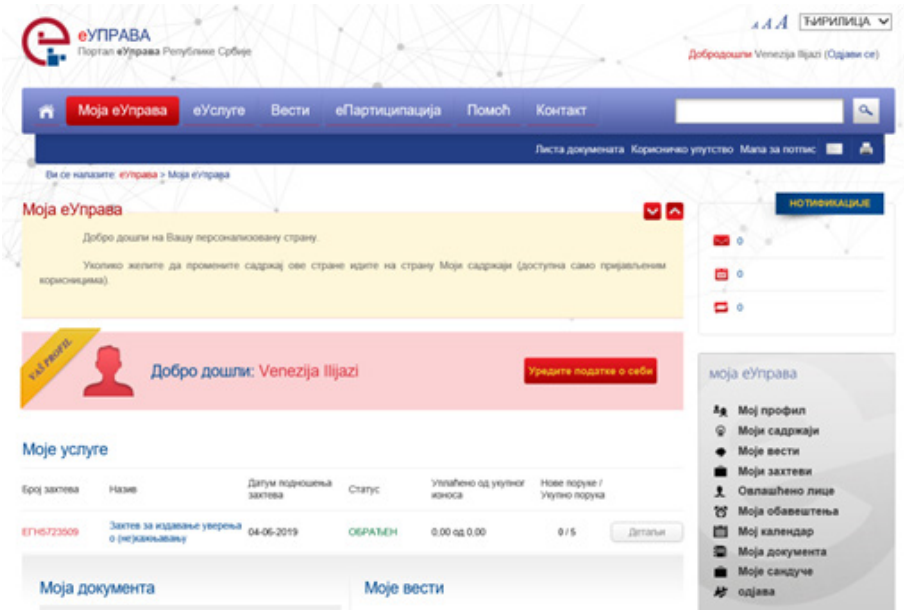


Figure 8: *Monitoring the service of issuing Certificates of (non) Punishment on the e-Portal*

The purpose of this electronic service is to enable the electronic submission of a request by a citizen of the Republic of Serbia to obtain a certificate of (non) Punishment, payment of necessary prescribed fees, fees and expenses, without going to the Regional Police Directorate or the Police Station, but via the Internet, and through e-Administration portal, completing the electronic request form.

The certificate of punishment and impunity shall be taken over by the relevant Police Directorate by the place of residence.

CONCLUSION

The development of new ICT technologies and their distribution largely affect our everyday life. Various electronic services offered to us in the form of electronic banking, e-mail, access to social networks, etc. have made communication, education, business management, information exchange simpler, faster and safer. The use of electronic administration significantly reduces administrative costs, as well as the reduction of corruptive activities, enabling greater transparency and openness.

The need for developing electronic services is becoming more and more diverse. The development of electronic administration through the introduction and use of new electronic services in recent years is in great expansion using the concepts G2C, G2G and G2B. Citizens and business users have been provided with simpler and greater functionality through the availability of various electronic services.

The Ministry of the Interior is the leader in the implementation of new electronic services on the e-Administration portal.

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USEFUL PYTHON LIBRARIES FOR CREATING IDS SOFTWARE

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Abstract: This paper considers contours of the possibilities of applying the selected Python libraries in order to detect intrusion attacks whose purpose is to penetrate secured network or secured computer. This paper elaborates Python libraries that can be used for monitoring network traffic and eventually use them for making IDS software (Intrusion detection system). After preview of libraries with those capabilities, a very simple use case of IDS software solution is going to be presented, so that the readers can see how the mentioned libraries can be used for that kind of software.

Keywords: Python, IDS, Eddie, Pypcap, Scapy, SimpleMonitor

INTRODUCTION

Nowadays, IT industry is facing one of its biggest challenges and that is computer networks security. We are living in a time where DDoS (Distributed Denial of service) attacks are present everyday and they are available for anyone who is willing to pay certain amount of money, since even with some basic computer knowledge one man can do it and make some serious damage to the victim.

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That is the reason why prevention and short time respond to these attacks is crucial, and eventually one of the reasons why this paper is written. IDS systems are playing a big role in detecting those attacks, it does not matter if it is hardware of software system. This paper is focusing on software IDS systems and using existing Python libraries is going to represent how effectively malicious attack can be detected and separated from legitimate network traffic. IDS and Firewall is not the same thing, that is because IDS does not prevent attack, but instead of that IDS alarms user that attack is happening or has already happened. In order to achieve that, we need a few libraries to make them work together, so that the alarm triggers at right time. Libraries that are represented in this paper are Eddie – used for monitoring network and file system, Pypcap – used for recording incoming packages, LinkChecker - used for link checking and detailed website analysis with possibility of creating website map, Scapy – used for recording and decoding network packages, protocols and request that are received and SimpleMonitor library that is used for monitoring hosts and network connections. Using some of the mentioned libraries we are going to make application with purpose to detect attacks and an alarm user about that. Other programming languages are also used for this purpose, for example JAVA (Northcutt & Novak, 2003) and C++ like standards for Web and back-end programming, also Ruby is used because it is allround language just like Python that are discussed in this paper.

LIBRARIES PREVIEW

Tools

As we have said before, Python programming language is used in this paper. We have chosen Python because it is a script language and it is very flexible. A more prevalent version of Python in use is version 3. Developer environment that is chosen is PyCharm (Kroger, 2015) because of its simple IDE interface that is well known and for its numerous options such as, debugging, marking syntax and other errors, simple project structure and lots of other options.

Eddie

Eddie is also called monitoring agent. It can be used as a standalone tool and perform actions, checks and tests that are predefined. Eddie has usage in network monitoring, file system check, HTTP checks, POP3 tests, SNMP queries, RADIUS authentication tests, process tracking, network configuration, ping check, TCP ports check, monitor file changes and scanning file logs (The EDDIE Tool project, 2008). This library is interesting for us because of its network monitoring and gathering data capabilities, for what we usually need several libraries and here it is all in one place. Whole library is developed in 100% Python and it can be started on any computer with running Python environment. Rules of monitoring

are creating in a similar way as Python regular expressions and they can go from the simplest one to the most complicated one, depending on what we need.

Pypcap

This library has wide application in creating tools that are used for network security, precisely in our paper it is very useful for detecting network attacks. This library, beside its other functions, serves for monitoring network traffic, more specific for recording and transfer of network packages, and it can also be used for filtering packages at preprocessor level and for network statistics (Pypcap, 2018).

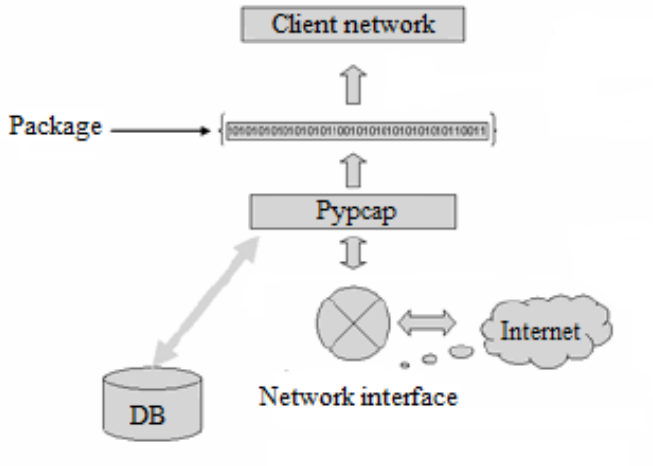


Figure 1. *Storing an incoming package in DB*

The example shown in Figure 1 clearly shows how Pypcap would store a package and package information into the database for further analysis. It is important to say that we do not intercept the package, but only collect information about it, because we are making a software for detecting an intrusion, and not for blocking it. The most important information for us is the number and size of incoming packages in a period of time. Analyzing those data, we can detect DDoS attack that we have mentioned before.

LinkChecker

As its name says, this library is useful for link checking, or in other words for website validation. Links can be checked separately or whole web pages at once (LinkChecker, 2008). This library returns data on web page availability, page name, page response time, page size, page last modification date, and on errors on that page. A few more things can be obtained using this library, such as the

number of images on a specific web page, the number of applications, text content, video, mail addresses etc… those things are not so important as that we have mentioned before, because with those previous we can analyze server pages in details. This library is the most useful for extracting data out of websites because output data can be shown in few structured formats such as HTML, XML, CSV, SQL or simply as a graphic representation of website map. All these structured formats are easy to work with and process them later.

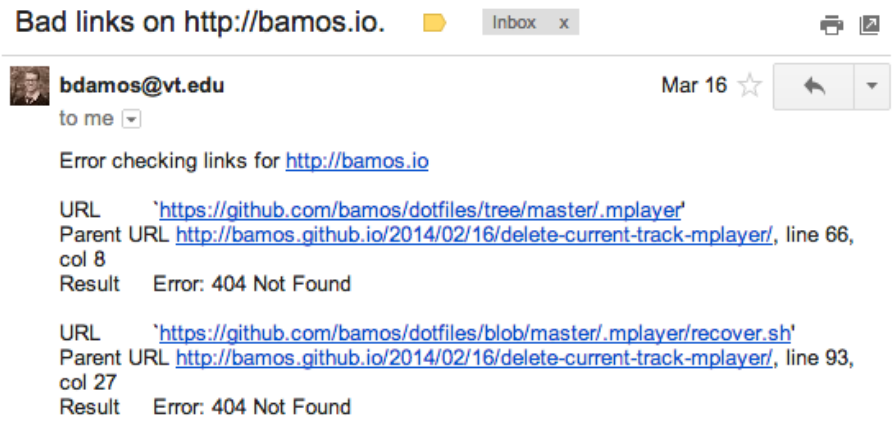


Figure 2. *LinkChecker result*

Figure 2 shows the result of LinkChecker webpage validation, where the result is showing unavailable links on the requested webpage. This library may not have its application in network attacks detection, but it can provide us with useful data that we get after analyzing data of the attack which has previously happened.

Scapy

Scapy library has some possibilities that other libraries do not. It can decode various number of different protocols network packages to send them, store them, make a request and response comparison and a lot more. It is a very flexible library, easy to combine with other tools. Any functionality that is integrated can be used with existing libraries (Scapy project, 2009). As it is, it represents a perfect choice for making a new tool. As we have said before, it can be used for sending packages, which is important part in making IDS software, because by sending packages we can test its functionality and efficiency. The best option of Scapy library is the so-called Traceroute that is tracing a route of a network package. Any package poses a 8 bit TTL field that is decremented every time it passes over some router on its way to destination, the feature that is implemented to prevent infinite package circulation over internet or network. When TTL value hits zero,

the ICMP error comes out, which represents that the package time has expired, that response has been returned to the sender of the package. Scapy uses that fact to find all jumps, basically IP addresses of the router that package passed over on its way. This is very useful feature that can help in finding the attacker.

```
Sample usage:

sudo python traceroute.py www.google.com
[sudo] password for gene:
WARNING: No route found for IPv6 destination :: (no default route?)
1 -> 10.0.0.138
2 -> 172.18.212.13
3 -> 172.18.69.149
4 -> 172.18.241.101
5 -> 203.45.53.237
6 -> 203.50.44.13
7 -> 203.50.11.72
8 -> 203.50.11.95
9 -> 139.130.213.54
10 -> 66.249.95.234
11 -> 72.14.236.181
12 -> 74.125.237.209
```

Figure 3. *All jump to webpage www.google.com*

Figure 3 represents all jumps to the webpage www.google.com. It is easily seen that 12 jumps have been made and IP address of every router over that package travelled to its destination. From the above it is clearly seen why this library is very important from the perspective of network security and finding a source of an attack.

SimpleMonitor

SimpleMonitor is Python script that tracks hosts and network connection. It is made in order to be fast and easy to use, to be more convenient for smaller companies and home application. Instances of this script can send results to one centralized location (Simplemonitor project, 2015).

Some of the functionalities that SimpleMonitor supports are:

- Ping monitoring
- TCP monitoring (scanning is there any open ports on host)

- HTTP monitoring (checks whether we can download URL without error and also if the page content responds to our query)
- DNS monitoring
- Services monitoring
- Windows services, daemontools services
- Hard drive free space monitoring
- File creation time
- and a lots of others…

A lot of options can be added to work together with this script and it is fairy simple for anyone who knows how to code in Python

Options of SimpleMonitor for logging and alarming are:

- Storing all tracking processes state and all other iteration into SQLite database
- Storing current tracking processes state into SQLite database
- Sending warning email when error occurs with tracking process and when it is restored to original state, directly over SMTP or Amazon SES
- Writing into log file all successful and unsuccessful made operations, or only unsuccessful
- Sending SMS messages over BulkSMS service (subscription needed)
- Writing HTML status page
- Writing entries into syslog (all except Windows)
- Sending notifications over Slack, 46elks, Notify My Android, Pushbullet and Pushover
- Execution of commands when error occurs with tracking process and when it is restored to original state

Furthermore, options for logging and alarming can be added easily here by writing some more code in Python.

More options that SimpleMonitor supports:

- Simple configuration of file format: standard is INI file for configuration
- Dependency: SimpleMonitor can be adjusted to depend on status of other processes. If process has failed, processes that depends on it will be skipped until that process becomes successful
- Tolerance: Tracking process can be set to alarm after certain number of failure attempts
- Alarm escalation: Alarms can be set so that after a failure occurs a few time in a row (after tolerance limit excided) before its get triggered, so it can be sent to more addresses
- Urgency: Processes can be set as non-urgent so we do not use some of the alarming options on them such as SMS

- Process by host: Defying process to track only one host and to ignore others, so that configuration file can share between all hosts
- Process intervals: Processes are set in that way for example to make checks every 60 seconds, but also can be set to make checks once a day
- Alarm periods: Alarms can be set to trigger only at certain time of the day or at specific days only
- Alarm snoozing: For example if process fails during the night, we do not want to be disturbed in the middle of the night by SMS, but at 7 o'clock in the morning we are going to receive a SMS that error has occurred on that process
- Distant processes: Processes that are on distant computers can send their results to centralized instance with purpose of logging and alarming

Each of these options that we have mentioned above and which are part of the SimpleMonitor script can be very useful for creating our IDS software. Options as regards alarming are extremely important and flexible, so they have a wide application for us.

USE CASE OF IDS SOFTWARE

In this use case, one SimpleMonitor will be uploaded in one Linux machine to monitor the operation of a web site hosted on one remote Windows-machine, and in case the page becomes inaccessible, it will send an email to a specific address. In order to be able to perform this experiment, one Windows-machine must be set up to host a web site. To accomplish this, we used the Windows 10 machine with the Wampserver version 3.1.4 software package installed in which Apache 2.4.35 is used to host the web site. After installing Wampserver on the partition C: of this Windows-machine, a folder named wamp64 appeared, including, among other things, a folder www. Within this folder, we created a folder called http-test and placed an index.html file in it shown in Figure 4.

```
1  <html>
2      <header><title>http-test</title></header>
3      <body>
4          <h1>
5              Hello world!
6          </h1>
7          <p>
8              Html web page for testing
9              <a href="https://jamesoff.github.io/simplemonitor/">Simplemonitor</a>
10         </p>
11     </body>
12 </html>
```

Figure 4. *Content of index.html*

In addition, we need a remote Linux machine. In our case, the Ubuntu 18.04.2 LTS version was used on which the Python 3.6.7 version was installed. Linux and Windows-machines are within the same network.

Within the Linux machine via a search engine, by typing a link to a web page hosted on the web page, this page is displayed in the browser. Within the Linux machine, a new virtual environment for Python is created. We do this by typing the following commands into the terminal:

```
python3 -m venv env
source ./env/bin/activate
```

The SimpleMonitor is downloaded from the https://jamesoff.github.io/simplemonitor/ website. SimpleMonitor is downloaded as a zipped folder which, when extracted, comes as a string of scripts and configuration files. In order to work with these scripts, it is necessary to bring all the libraries into the new virtual environment we created. This is done by opening the terminal to the folder, where SimpleMonitor is located and running the command:

```
pip install -r requirements.txt
```

The next step is to create configuration files. Within the same folder, two files "monitors.ini" and "monitor.ini" are created. Monitors.ini represents a list of elements that are monitored. In this configuration file, the type of monitoring is defined, as well as the required parameter for this type of monitor, which is a link to a web page. In this case, this file is filled using following settings:

```
[website-http]
type=http
url=http://10.233.209.188/http-test/
```

monitor.ini represents a configuration file for how to monitor and how to react in a particular situation. In our case, the configuration file looks like this

```
[monitor]
interval=10

[reporting]
loggers=logfile
alerters=email

[logfile]
```

```
type=logfile
filename=monitor.log
only_failures=1

[email]
type=email
host=smtp.gmail.com
port=587
from=test1bad1usb@gmail.com
to=test@test.com
username=**********
password=*********
ssl=starttls
```

Here, settings are such that the connection will be refreshed every 10 seconds, that error reports will only be written in log files named moniotr.log and that in case of an event registered as an Alert, an email will be sent to a Gmail address defined by another Gmail address using the Gmail address.

Now that everything is set, we can run the monitor command:

```
python monitor.py
```

The monitor does not display because it successfully communicates with the web page.

If we stop the work of the server, the web page will no longer be available and the monitor will send us the alert that will send the email to the defined address.

At that point, SimpleMonitor realizes that communication with the server is lost and triggers an alert on it.

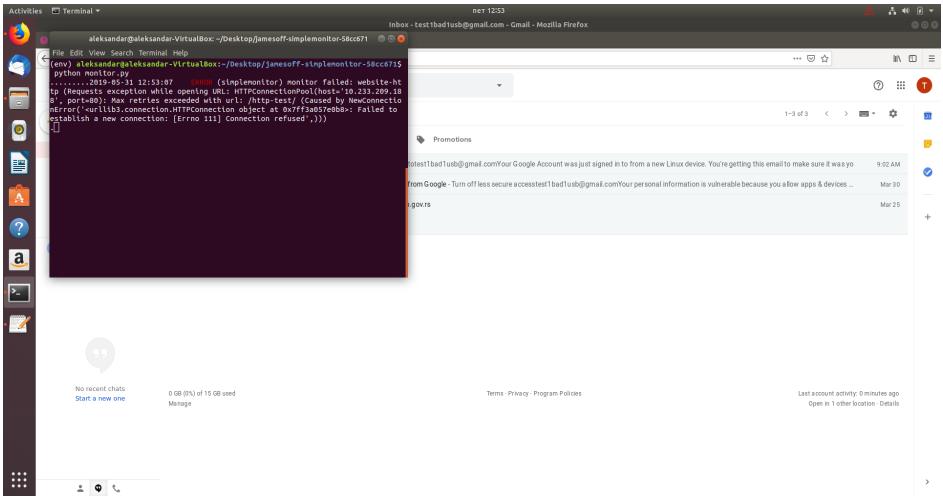


Figure 5. *Monitor raising error*

As soon as the alarm is raised as we can see in Figure 5, a new e-mail error message shown in Figure 6 is sent to the defined e-mail address

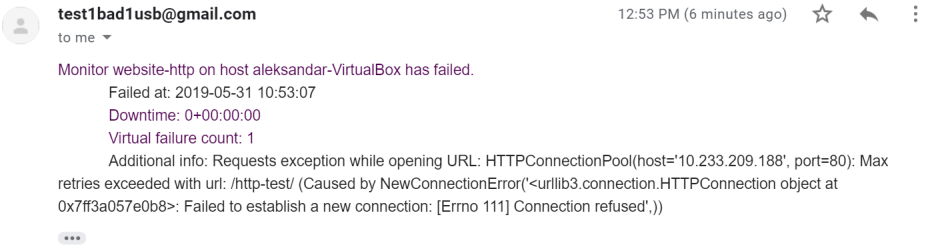


Figure 6. *Received email*

With these settings, the notifications that the server is not available will be sent over and over until the server becomes available again.

In JAVA programming language this solution would be much larger for coding, and more complex itself. For the same thing we would need a few libraries like libraries for packet capturing, data processing, etc. (Ezin, Eugène & Djihountry, Hervé 2011). Additionally, a large number of classes because of the code readability must be separated into smaller parts for easier manipulation, while in case of Python that is not a problem.

CONCLUSION

As we can see, it is fairly easy to start and build a simple IDS software. This is just an example of that, where we can see possibility of alarming through email when webpage becomes unavailable. Even this SimpleMonitor script can help for some basic user needs, such as detecting DDoS attack or server failure, it is really easy to add some features to this for some more information regarding alarming. Furthermore, it is possible to make this work with some other tools that would make it even easier for a user to figure out what is happening and what needs to be done to be protected from an attack, or to fix a problem.

Besides, IDS software can be made in other languages as we have mentioned in the introduction section, like JAVA and C++, but advantages of Python programming language are that Python is a high-level, interpreted and general-purpose dynamic programming language that focuses on code readability. The syntax in Python helps the programmers to do coding in fewer steps as compared to Java or C++. It has large support for libraries, easy integration with other systems, and increased productivity as well. Disadvantages of Python programming language are those that it is weak in mobile computing, difficult for programmers to learn other languages because they are used to extensive libraries and other Python features, it has design restriction and errors that require more testing time than other programming languages, and finally it has primitive database access layer compared with JDBC or ODBC.

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ABUSE OF E-COMMERCE FROM THE ASPECT OF CYBERCRIME

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Abstract: The spirit of modern business life cannot be imagined without the Internet and its networks. Electronic commerce enables easy and fast communication, quick transmission of large amounts of data over long distances, digital delivery of goods and services, money online payments, creation of virtual organizations. The rapid increase in computer crime has led to technical, legal and operational problems. The primary task of legal regulation of eletronic trade is to encourage its development, while at the same time trying to prevent its abuse. It is difficult to estimate the number and type of criminal offenses in the area of computer crime that occur in the course of e-commerce, as well as the economic damage caused by the commission of these crimes. This fact makes this subject legally current and still insufficiently explored in practice.

Keywords: e-commerce, crime, abuse, computer, damage.

INTRODUCTION

The development of science and technology has led to the emergence of the digital age, which has also caused changes in human life, as well as in the way of doing business. In business, the quality of business processes is improved, they are done much faster and thus provide an increase in business volume. With the advent of the digital economy, information technology, which is changing the way of doing business at all levels, both countries, companies and individuals, is especially important. The digital economy directly changes business, trade and organization of the market, through a new way of learning and knowledge exchange, which accelerates the overall economic and social development.

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The term cybercrime refers to a set of criminal offenses where computers, computer networks, computer data, computer systems, as well as their products in material and electronic form, occur as an object of execution and as a means of committing a criminal offense. It should also be noted that digital economy and e-commerce become particularly significant area for organized criminal groups. (Kostić, Konstatinović-Vilić, Nikolić-Ristanović, 2011) The disconnection of electronic commerce in the cyber space carries with it certain specificities, which will be discussed in this paper, both from the criminal-legal and from the economic aspect.

THE TERM E-COMMERCE

Electronic commerce presents a modern form of doing business electronically and encompasses a range of different activities, including electronic trading of goods and services, on-line delivery of digital content, electronic money transfer, electronic trade of securities, invoice billing, public procurement, direct marketing of consumers and post-sale services. Within the European Union, there is no universally accepted definition of e-commerce so far, but it is clear that it involves commercial transactions, via telecommunication networks, using electronic means. The transactional nature of the exchange is a key feature, including an agreement to deliver goods, to perform services or transactions of intellectual property rights.

With a fast-paced environment, e-commerce has created a wide range of innovative businesses, markets - creating new features and new revenue. As far as the very concept of electronic commerce is concerned, there are different definitions in theory and in the legislation. According to Article 4, paragraph 2 of the Law on Electronic Commerce, electronic trade in goods and services is a form of district trade in the sense of the law governing trade. According to Article 3 of the Law on Trade of the Republic of Serbia (Official Gazette of RS no. 53/10 and 10/13) trade is a set of business activities of goods traffic, that is, services aimed at generating profit, as well as another socio-economic goal. As far as the very concept of electronic commerce is concerned, there are different definitions in theory and in legislation. According to Article 4, paragraph 2 of the Law on Electronic Commerce, electronic trade in goods and services is a form of district trade in the sense of the law governing trade. According to Article 3 of the Law on Trade of the Republic of Serbia trade is a set of business activities of goods traffic, that is, services aimed at generating profit, as well as another socio-economic goal.

SOME LEGAL ASPECTS OF E-COMMERCE

Electronic commerce represents the massive use of computers in mutual communication for the purpose of trade. The rapid development of computer technol-

ogy and Internet communications, with its technical capabilities and characteristics, has caused doubts about the legal nature. The United Nations Organization, through its specialized UNCITRAL organization, developed in 1996 UNCITRAL Model Law on Electronic Commerce. The Law regulates the conditions and ways of providing information society services, the obligation to inform the users of services, the electronic commercial message, the rules regarding the conclusion of the contract in electronic form, the responsibility of the provider of information society services, supervision over the implementation of laws and violations.

Our Electronic Commerce Act ("Official Gazette of RS", No. 41/2009) is drafted based on this model. It should be emphasized that this is a special law, but does not exclude the application of other regulations governing commercial messages, certain services, contract conclusion, consumer protection. It excludes its application if this application is more unfavorable to consumers. The Law on pretection of consumers ("Official Gazette of RS", No. 79/2005) also refers to the application of the rules envisaged for the so-called distance selling.

Electronic Commerce first appeared in the United States, using the Internet as a communication channel through which direct communication between sellers and customers was facilitated, thus reducing operating costs and delivery times. E-business was first introduced by the U.S. company IBM dealing with computer technologies, i.e. production of computer software, hardware and having the largest number of inventions in this field. (Petrović, 2018)

In practice, the concepts of e-business and e-commerce are often identified. E-business is a wider and more comprehensive concept of e-commerce, because it involves the purchase and sale of products and services, and also includes providing customer service, cooperating with business partners, applying e-lerning and transactions within business systems. E-commerce is a part of electronic business. The development of information and telecommunication technologies directly affect the continuous development and improvement of electronic commerce. From the moment of moving transactions from real to the Internet space, the development of electronic commerce progresses at a high speed.

Broadly speaking, e-commerce is defined as the sum of business operations, using modern technology. It can be said that e-commerce in the trade encompasses all forms of transactions relating to commercial activities, including organizations and individuals, based on the production and transmission of digital data, containing textual, visual, and sound recordings. (Končar, 2008:147)

Conclusion of the contract in electronic form

The Electronic Document Act, electronic identification and trust services in electronic commerce regulates electronic document, electronic identification and trust services in electronic commerce. ("Official Gazette of RS", No. 94/2017) In the case of a contract concluded with the statement by electronic means, it is not a matter of any new form, but only about the way of expressing the will. The form is a requirement

from the angle of the law, and the form is a way of expressing the content, both in the electronic offer and when accepting the offer. Any possibility of fraud during the conclusion of a contract can always be easily fixed by direct contact.

The Law on Electronic Signature ("Official Gazette of RS", No. 135/2004) proclaims that the validity of the contract cannot be challenged solely because it is concluded in electronic form. When the contract is allowed in the oral form, it can be concluded in electronic form. If a written form is required, it is also necessary to use an electronic signature during electronic communication. Exceptionally, certain statements of will, including some contracts, cannot be completed electronically. The obligation to provide certain data before the conclusion of the contract in electronic form is also established. The contract is considered concluded when the bidder receives a response containing the acceptance of the offer.

COST-BENEFIT ANALYSIS OF E-BUSINESS

Electronic commerce offers many advantages over performing traditional commercial transactions. These benefits are numerous, both for vendors and for customers. Greater use of e-commerce provides a number of benefits, and thus grow their character, and the possibility of abuse of the same. While traditional business is based on the use of paper documents in communication between participants, e-commerce provides an opportunity to all transactions carried out by Video Digital and control information system of the enterprise. Most companies combine segment of e-commerce with traditional performance activities and such organizations are called composite organizations (Rainer& Turban, 2009).

The benefits of e-business are:

1. offers companies the possibility of expanding the national and international markets with minimal investment;

2. lowers the cost of communication services, because the Internet is more favorable;

3. companies using the Internet to communicate with customers and get information about their needs;

4. cost digital promo-materials are significantly lower than the cost of printing and mailing paper catalogs;

5. electronic commerce allows companies to offer their products or services to a larger number of potential customers;

6. use of marketing distribution channels is drastically reduced, making the product cheaper and higher profits for the seller;

7. e- commerce reduces stockpiling, telecommunication costs, reduces the time between payment and receipt of goods, etc.

The main benefits that customers have from e-business are:

1. reduce the cost of your purchase, because there are no costs of performing the purchase (go to the store, transportation costs, etc.);
2. the possibility of finding a cheaper product or service;
3. possibility of electronic auctions;
4. electronic commerce often provides customers cheaper products and services allowing them to buy in many places, and to implement quick comparison of price environment;
5. customers can buy or carry out other transactions throughout the year;
6. electronic commerce allows customers to communicate with other buyers and sellers in the electronic community. (Panić, 2015)

Lack of e-commerce is the lack of live contact with the seller, which means many customers. A large number of customers are convinced by sellers that a particular product is right for them. Furthermore, a classic store allows a customer to come into physical contact with a product. Testing the product on the site is an important factor for a potential customer to decide to purchase. Electronic commerce is increasingly reminiscent of the market, where a catalog offers everything that a classic trade cannot sell. Payment by installments is just one of the tricks of the marketing of e-commerce. Often, the customer gets the product to his/ her home, which is of lower quality than the one he / she ordered, so that the costs of returning products is often higher than the price of the product itself.

Development of the developed world economy is based on information. Realizing the importance of e-business and the possibility of abuse of the same, the developed countries have regulated this question within adequate legal framework. Misuse of e-business results in a phenomenon of cyber crime. The Republic of Serbia is a liitle late with the regulations in this area, but in recent years this activity has intensified, thus creating the legal framework and specific institutions whose task is to fight against cyber crime.

THE IMPACT OF ELECTRONIC COMMERCE ON TRADE FLOWS OF THE REPUBLIC OF SERBIA

On the territory of the Republic of Serbia, the use of e-business and e-commerce is still at the beginning, because the adopted legislation encompasses the traditional way of doing business. Limits of use complete e-business is the lack of infrastructure to facilitate the execution of business transactions.

In relation to the public sector, private companies in the Republic of Serbia have replaced the traditional way of doing business electronically, via the Internet. Prospects for the development of electronic business in the Republic of Serbia is indicated by the fact that an increasing number of citizens are traded via the Internet. E-commerce allows quick finding the desired items, easier price comparison and payment transactions without visiting the bank.

Based on the research carried out in 2017, approximately 41.4% of enterprises ordered products and services through the Internet, and 23.8% of enterprises received orders via the Internet. Social networks are increasingly present in business. Around 40% of companies use a social network for their business. In addition, 9.3% of companies paid cloud services. In Serbia, 99.7% of companies have Internet Web, sat owns 80.4% of the company (Petrovic, 2018).

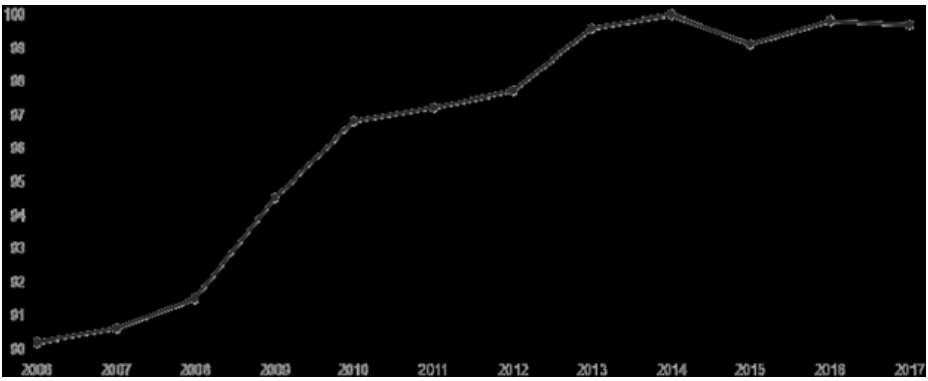


Chart 1: *Use of the Internet in enterprises in Serbia*
Source: National Bureau of Statistics, the use of information and communication technologies in the Republic of Serbia, 2017

Graphic shows a tendency to increase the number of companies using the Internet, which indicates the increase in the use of e-business and e-commerce.

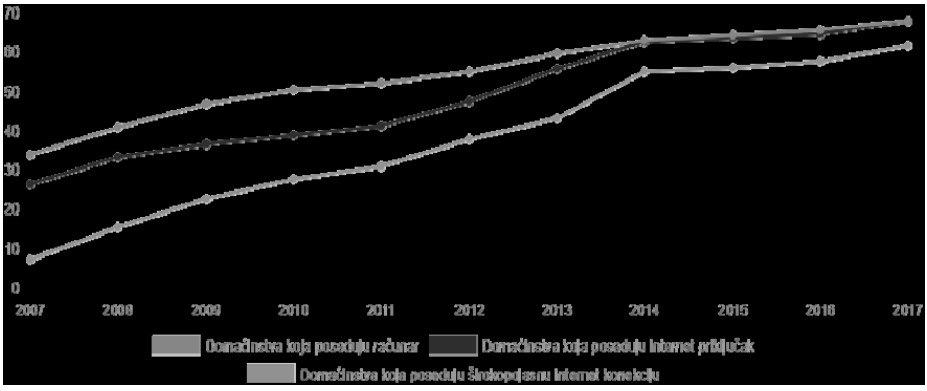


Chart 2: *Households with Internet connection, a computer and Internet connection*
Source: National Bureau of Statistics, the use of information and communication technologies in the Republic of Serbia, 2017

Nearly 70% of households in the Republic of Serbia have Internet connections. The highest prevalence of the Internet in the area of the capital with more than 75%, in Vojvodina it amounts to about 70%, while in central Serbia slightly above

60%. Over 90% of households have a mobile phone with Internet access, 43.7% have computers and 61.9% have a broadband Internet connection as shown in the graph No. 2. (Republic Institute for Statistics of RS, 2017)

Based on the previous data obtained from the Republic Institute for Statistics, it can be concluded that as far as households are concerned, they are expected to further increase the trend of computer users and Internet users, which is a good indicator of the development of electronic commerce in the Republic of Serbia. As for the companies and the use of communication technologies, the fact is that they have not exploited all the possibilities and opportunities offered by electronic commerce, but it is expected that it will change in the future.

E-business in commerce aims to create a successful and long-term market position. Market positioning provides long-term achievement of the objectives of business for companies. The primary objectives of enterprises in electronic commerce are to meet the needs of customers and realize good level of profit. A successful market position is an important target for trade. The chances of a successful business are far greater if the positioning is anticipated and planned, and it is one of the reasons why e-commerce is important for positioning in the market.

CYBERCRIME

Technology and the Internet have contributed to rising crime. The anonymity provided by the Internet technology enables perpetrators to make a false online applications for bank loans, credit card bills, insurance, brokerage accounts, health care, etc. (National Fraud Centar, 2000). The emergence of computer crime dates back to the 70s of XX century to the 80s and 90s when many economies realized the danger of this type of crime. Computer crime is a special kind of crime directed against computer systems as a whole, or partially, in different ways and by different means in order to gain profit for oneself or others, or to cause damage. (Parker, 1983).

Computer security is a human problem that cannot be independently solved by means of technology. Security is an issue of management. The fact is that policy managers are critical to the success of the security program. Many companies do not pay enough attention to computer security. Many managers do not understand the problem and they do not think they are at risk. What is important is that managers understand the practical, ethical and legal issues of security, and inform their employees about the importance of security issues and security risks (Milosavljević, Veinović & Grubor, 2009).

With the development of electronic commerce, economic crime gets a new shape and a new environment. Computer technology has become the source of transnational crime, eliminating the differences between the countries. Computer crime is a form of criminal behavior in which the use of computer technology and information systems are manifested as a crime scene, or the computer is used as

an agent or as a target of the crime, which results in a consequence in legal terms. Cybercrime is also against legal violations of property in which the computer data are changed (computer manipulation), destroyed (computer sabotage), or used with hardware (stealing time) (Stojanović, 2011). An important feature of a computer crime is a rapid pace of development. Numerous forms and manifestations of cyber crime are constantly increasing, and the main cause of this is the continuous development of technology. Computer technology is used in all spheres of life, resulting in a significantly more dangerous forms of criminal behavior which have not previously be known in the criminal and judicial practice. Cybercrime knows no borders between countries and continents. This is a consequence of the spread of the Internet use in the world.

The most common method of carrying out scams on the Internet involves creating fake Web addresses where lower cost electronic products are sold. Buyers are attracted by the low prices of the products and a significant discount. A characteristic of these cases is the lack of ability to pay by card, even if there is, it is very expensively charged. After the advance payment, online retailers disappear, leaving customers with neither money nor products.

Almost all forms of crime include various forms of "laundering" money, tax evasion, abuse of various businesses, investment scams and the like. Fraud in accounting lead to the presentation of false information about the financial condition, performance and net assets of the entity, and therefore cause false and falsified financial statements. Fraud in business often has support in accounting, which on one hand is the instrument of their execution and concealment, but on the other hand can be an instrument of detection of a criminal activity (Cvetković & Kesetović, 2018).

Challenges as regards detecting computer fraud are an open question whether a criminal investigation is the appropriate instrument for criminal acts. Computer fraud is the sphere of organized crime, so it is necessary to intensify the proactive work of the police and the judicial (public prosecution), to reduce the percentage of commission of computer frauds. To achieve this goal, it is necessary to intensify cooperation between state organs that have relevant information concerning crime prevention.

In the domain of domestic regulations, the most prominent is the Law on Organization and Jurisdiction of State Authorities for Combating High-Tech Crime ("Official Gazette of RS", No. 61/2006 and 104/2009) In the area of inter-state law, this legal topic relates to the United Nations Convention against Transnational Organized Crime (Official Gazette of the FRY- International Treaties, No. 6/2001), which was adopted in 2000 in Palermo and the Council of Europe Convention on Cyber Crime, which was adopted in Budapest in 2001. Cybercrime is "the commission of offenses for which its subject and object have the Internet as a global computer network and a computer that makes the trained persons in order to cause harmful effects or obtaining illegal material benefit". (Stamenković, 2014)

CRIMINAL ACTS AGAINST THE SECURITY OF COMPUTER DATA

Criminal offenses against the security of computer data enters the so-called high technology or computers crime, or, cybercrime. (Martin&Martin, 2001) The Criminal Code (Official Gazette, 85/2005…94/2016) provides for criminal offenses against the security of computer data. Criminal law protects the use of information technology for permitted purposes, and the concepts of "computer systems" and "computers" are introduced into criminal law. The Criminal Code prescribes a total of eight criminal offenses against the security of computer data. The object of protection of these crimes is the security of computer data and systems, or, computer networks. (Vodinelić, 1990)

In the case of a criminal offense Damage to computer data and programs, the act of committing a criminal offense is the deletion, alteration, damage, concealment or otherwise the use of unusable computer data or a computer program. The consequence of a criminal offense is to prevent computer programs and data serving their purpose, and the specified execution actions must be taken unauthorized. The object of execution actions is computer data or a computer program. As far as the subjective character is concerned, an intent is needed, and the perpetrator of this criminal offense may be any person. If another offense was committed by the act of committing this criminal offense, as a rule, there will be only that other criminal offense.

In the case of a computer-sabotage offense, the act of committing a crime is the filing, destruction, erasure, alteration, concealment, or otherwise making unusable computer data or programs. The second act of execution is destruction and damage to the computer or other device used for electronic processing and data transfer. For the existence of a work, a computer-focused action should be important for state authorities, public services, institutions, or businesses.

When it comes to Making and Involving Computer Viruses, the act of committing this form of criminal offense is the creation of a computer virus that has the ability to cause the computer to operate incorrectly and cause damage. When a computer program is created, the job is completed and it exists only if a computer virus is created in order to be entered into another computer. There is another form of commission of this crime that consists in entering a computer virus into another computer and a computer network.

A particular form of fraud is reflected in the act of committing a criminal offense by entering inaccurate data, failing to enter the correct data or concealing another way of accurate data or false display of data. The goal of computer fraud is to achieve an altered result of electronic data processing, with the intent to acquire unlawful material gain, thus causing damage to the other. It is interesting that for a complete criminal act, it is not necessary that this intention and the achieved, hardest and most difficult form is determined in accordance with the amount of property gain obtained, while the privileged circumstance makes the

intention to damage only the other person, without the intention of obtaining unlawful material gain and necessity left intentions.

Unauthorized inclusion in a computer, a computer network, or unauthorized access to electronic data processing constitutes an act of execution of the basic form of a criminal offense with an irrelevant intent of execution. In a more severe form, we recognize the use of data that results from the offense.

The other heavier forms of criminal offense exist in the case with the consequences of a more severe degree, with the existence of an intent.

Preventing and restricting access to the public computer network except the security of computer data aims to protect certain freedoms and rights of citizens. The act of a criminal offense is the prevention or obstruction of access to the public computer network unauthorized. A severe form exists if an official appears as an executioner in the performance of a service.

In the case of Unauthorized use of computers and a computer network, the execution is an unauthorized use of computer services and a computer network. Users of Internet Service Providers and Providers are affected. It is necessary to have an intent and intention to acquire unlawful material gain for oneself or others, although it is not necessary that the intention be achieved. It is interesting that mostly the perpetrator performs this unlawful act repeatedly, and there is only one criminal offense. In this part, it is interesting that criminal prosecution is undertaken solely by a private lawsuit.

Article 304a of the Criminal Code determines as a criminal offense the Creation, acquisition and giving of other means for the commission of criminal offenses against the security of computer data. In the legal text, this work is among the latest in the group of criminal offenses against the security of computer data.

CONCLUSION

The rapid increase in computer crime has led to a number of problems: technical, legal and operational. Regarding procedural items, the main problem is in finding and collecting evidence. In the case of criminal offenses committed by computer, evidence is in electronic form. The cyber space does not recognize the territorial and state boundaries. Many acts cannot be localized. The issue of jurisdiction is a problem when it comes to the fight against computer crime, and it is necessary to consult one of the states that pretend to be competent in order to determine under which jurisdiction the procedure would be most effective. Special police training, prosecutors and judges are needed, so that the state apparatus can put a stop to this type of crime.

The use of e-commerce has taken on huge borders today, so in practice there are inevitable encounters of various types of criminal offenses against the security of computer data in commercial traffic. It is difficult to estimate the number and type of these crimes, as well as the economic damage. The methods of committing

crimes are very diverse. Criminals are distinguished where computers appear as a means of committing a criminal offense and as objects of execution, as well as criminal offenses in which the elements of the illegal use of the Internet appear. In one group there are new offenses such as the spread of computer viruses, the destruction of files or software, and the like, or the offenses in which the computer is the means of attack. The second group is a classical offense, such as scams, copyright infringement, and the like, in which the computer is used as a means of execution and which, in turn, gets a new form of cyber space in which electronic commerce takes place on a daily basis.

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CENTRALIZED DIGITAL FORENSIC ANALYTICAL SYSTEM: RATIONALIZATION USING OPEN-SOURCE SOFTWARE OF GENERAL PURPOSES

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Abstract: Digital forensics is a part of everyday work of law enforcement agencies and corporate security and has numerous challenges. Forensic investigators need to make a continual investment in new tools and methods of extracting data from a large number of different devices. They can save financial resources in the second critical phase of the digital forensics process, which is an analysis and search for evidence. This paper discusses the possibilities of development of a forensic analytical system which primarily enables cross-search through data and collaboration of investigators by using general purpose open-source tools. The main feature of the open-source tool is that they are mostly free of charge and free to use, which provides a significant saving. Bash scripts that organize tools and commands execution on the specific task allow a forensic investigator to create custom tools that meet their needs and increase job efficiency.

Keywords: digital forensics, open-source tools, NoSQL database, Bash script.

INTRODUCTION

Digital forensics has made progress in the last few decades of its development from "obscure tradecraft to an important part of many investigations" (Garfinkel, 2010: 64), and today digital forensic tools are in everyday use. Forensic investigation is a complicated and time-consuming process that requires researchers skills from multiple fields, such as information security, penetration testing, reverse engineering, programming and behaviour profiling in order to reach the ultimate goal, which is to create a clear picture of the crime committed using a computer (Koen, 2009).

The two main areas in which digital forensics is applied most intensively are law enforcement agencies and corporate security, with each having a different approach (Bassett, Bass & O'Brien, 2006). In brief, corporate security focuses on adequate response and damage assessment (Cohen, Bilby & Caronni, 2011), while

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law enforcement agencies seek to find traces of the crime, computer programs or data that can indicate the link between the offence and the perpetrator or victim in a large amount of data. With respect to both these areas, digital forensics can be defined as a process in which scientific principles are applied in order to analyse electronically stored information (artifacts) on one or more digital devices, in order to determine the sequence of events that led to a particular incident, as well as the understanding and reconstructing events that must have transpired in generating the said artifacts (Raghavan, 2013).

Modern digital forensics faces numerous obstacles, even without the use of anti-forensic techniques. The necessary picture of what happened in a particular case is most often challenging to create due to inconsistencies and a lack of incriminating evidence (Koen, 2009). We could divide the forensic investigation process into two phases, Acquisition Phase and Analysis Phase (Brian Carrier, 2002), each with its challenges.

The process of data acquisition is hampered by a large number of various devices from which it is necessary to collect digital evidence; different methods of protecting devices from unauthorized access; data is no longer on devices but on different virtual storage (cloud technology). A particular frustration for the forensic community is generated by mobile phones since the beginning of their proliferation. As mobile phones develop faster than other technologies, a significant problem is the development of the tool that would be considered as an industry standard (Yates, 2010). The paradigm of "internet of things" and the development of even more devices that contain forensic artifacts will further complicate the acquisition process. Also, the evidence needs to be collected from several technological zones, from the devices themselves, the Network zone, and the Cloud zone (Miljković, Čabarkapa, Prokin & Budimir, 2018). Another issue is the protection of modern devices that does not require a specific user activity and advanced technical knowledge because various authentication mechanisms (passwords, fingerprint scanning, or face recognition) are already present by default. Encryption of data storage is already a constant problem for forensic investigators, and with further hardware development, it becomes more a rule rather than an exception. In order to overcome all problems, forensic investigators must continuously invest in new data collection tools and techniques, so any kind of rationalization in this phase of the process is impossible.

The data analysis phase consists of searching for evidence among the collected data. We want to confirm the hypothesis of some event or find arguments to refute the hypothesis, or at least show that a particular system has altered in order to conceal evidence (Brian Carrier, 2002). The point is, however, in challenges that arise in order to reach this evidence like data diversity, a large amount of data, struggle with storage space, and bottlenecks affecting performance (Wang & Alexander, 2015). Even considering those challenges, the analysis phase is where forensic investigators can make rationalization of financial resources. The purpose of this paper is to demonstrate that it is possible to create a centralized forensic

analytical system using open-source technology, with the emphasis on the use of tools that are not forensic, but for general purposes. Linking the functionality of particular tools was done by using a Bash script that requires knowledge of programming basics (variables without too much consideration about the type, conditional statements, and control flow). Application of the different tools and the Bash scripts allows the forensic investigator to build the system according to his needs or the needs of a particular case. Investigators can always improve their scripts by merely adding new tools with a necessary set of options.

Researches on the subject of free software in digital forensics analyse solutions that are more oriented to specific forensic tasks such as OpenLV (Vidas, Kaplan & Geiger, 2014), a forensic email analysis tool using dynamic visualization (Stadlinger & Dewald, 2017), or tool for forensic acquisition and analysis of the VMware virtual hard drive (Hirwani, Pan, Stackpole & Johnson, 2012), without any possibility for investigators to collaborate with each other. In recent papers, there is no analysis of the possibility of using shell scripts and open-source tools in order to create an analytical system. The forensic utility *fiwalk* is somewhat applicable to the concept and represents a batch forensic tool, a solution that uses the Python script, relies on an open-source forensic tool, but under the collaboration implies the exchange of XML files (Garfinkel, 2009).

The rest of the paper is organized as follows: the second section presents technologies and commands used to build a system and the way how this can be achieved; the third section shows the results of the work through demonstration of functionalities required for such system and relation of applied technologies to requirements are discussed; a brief conclusion also contains guidelines for further work; the last section is providing a list of used references.

BUILDING A SYSTEM

Data that digital forensic investigators collect and analyse are related to the file, such as its path to the original medium, name, size, type, and other information obtained from the file system. There are metadata which also represent file parameters (for example, a mark and the model of the camera which took the photo, if GPS is on we can find the spatial references) but they are part of the file content, not the file system. Then, investigators search the content of the file itself.

Data collection

Applications that are usually built-in as part of operating systems distributions based on the Linux kernel could provide the needed information. For example, with the *stat* command, we can learn the size and the last file modification time, the *baseman* can extract the file name from the absolute path, a *file* can obtain file type information. By installing packages for forensic purposes, the commands of

these packages can be used to get all the available details mainly found in file systems such as NTFS (like a file creation time) and other non-Linux environments.

After the mounting source of digital evidence, which can be a forensic copy, storage medium from the case (with the usage of write blocker) or any other media that contains data for analysis, it is necessary to go through all the folders and find all the files. The *find* command can be used for this purpose, as it returns a list of absolute paths of all files. With *read* command, we can go through each absolute file path using them as the input parameter for other tools and commands. Besides, the full path information itself is a forensic artifact. An example of using the commands mentioned above for extracting file information data is shown in Figure 1.

```
#!/bin/Bash
find "$(pwd)"  -type f | while read -r f_path;
      do
      case_name="$1"
      device_description="$2"
      f_name=$(basename -- "$f_path")
      f_parent_path=$(dirname "$f_path")
      f_ext=$(echo "${f_name##*.}" | tr '[:lower:]' '[:upper:]')
      f_type=$(file -b "$f_path")
      f_mime=$(file --mime "$f_path")
      f_mod_time=$(stat -c '%y' "$f_path")
      f_size=$(stat --printf="%s" "$f_path")
      f_sum=$(md5sum "$f_path" | awk '{ print $1 }')
…
done
```

Figure 1: *Collecting file information from the file system*

In addition to file information that various tools already collected from a file system, the next tool named *exiftool* extracts a various set of metadata depending on the file type as shown in Figure 2.

```
#!/bin/Bash
find "$(pwd)"  -type f | while read -r f_path;
      do
      …
      temp_dir="/home/eve/forensics/temp_dir/"
      case $f_ext in
            JPEG | JPG | PNG | PSD)
                  fmd_make=$(exiftool -s -s -s -make "$f_path")
                  fmd_model=$(exiftool -s -s -s -model "$f_path")
                  fmd_software=$(exiftool -s -s -s -software "$f_path")
                  fmd_lat=$(exiftool -s -s -s -gpslongitude "$f_path")
                  fmd_long=$(exiftool -s -s -s -gpslatitude "$f_path")
                  fmd_w=$(exiftool -s -s -s -imagewidth "$f_path")
                  fmd_h=$(exiftool -s -s -s -imageheight "$f_path")
                  fmd_mdate=$(exiftool -s -s -s -filemodifydate "$f_path")
                  f_md="metadata: [{make:'$fmd_make',
model:'$fmd_model',software:'$fmd_software',lat:'$fmd_lat',long:'$fmd_long',
w:'$fmd_w',h:'$fmd_h',mdate:'$fmd_mdate'}],"
                  ;;
            …
      esac
…
done
```

Figure 2: *Collecting metadata with exiftool command*

Each tool tries to display a more transparent list of results, which is also true for *exiftool*. To provide only the necessary data (image size, processing software

and other), we need to execute *exiftool* command repeatedly several times with the different options (repeating the option -s tree times separates the value from a result, for example, image height).

The most important information for the forensic investigation is within the contents of the file. Unlike the tools that collect data from the file system and metadata, in order to extract as much information from the contents of the file one open source tool is not enough, for each type of file or set of files with a similar purpose we need different ones. For example, the LibreOffice open-source package offers the ability to read the contents of the file it creates, as well as several other proprietaries file types like Microsoft Office files (Word, Excel, PowerPoint).

We usually use LibreOffice application over a graphical user interface, but it also could be executed from the command line interface. What we should keep in mind is how to read the file to obtain the expected results. When it comes to the LibreOffice application, it needs to provide an absolute path to the file and directory where we save the output, that is, the text file with the LibreOffice file content. The output directory in the script shown in Figure 3 is for temporarily storing content until its further processing. The same principle applies to the *pdftotext* command, which converts PDF file to text file based on the absolute path of the PDF file. What is different is that for pdftotext tool the user defines the output file name of a temporary text file with the content of the PDF file, but in the case of the *libreoffice* command we need to extend the script for two more lines in order to get the name of a temporary file. The name of the temporary files is required later during script execution to read the text content and to delete the temporary file.

```
#!/bin/Bash
find "$(pwd)"  -type f | while read -r f_path;
      do
      …
      temp_dir="/home/eve/forensics/temp_dir/"
      case $f_ext in
            …
            DOC | DOCX | ODT)
                  libreoffice --convert-to txt --outdir $temp_dir
"$f_path" &> /dev/null
                  f_ext_len=$(expr length $f_ext)
                  subs=$(echo ${f_name:0:-f_ext_len})
                  tempfile=$temp_dir$subs"txt"
                  ;;
            PDF)
                  pdftotext -q "$f_path" $temp_dir"temp.txt"
                  tempfile=$temp_dir"temp.txt"
                  ;;
            …
      esac
…
done
```

Figure 3: *Conversion of Office and PDF file contents into a text*

Open-source applications and tools allow us to convert files into more accessible formats, for which it would otherwise be necessary to have original proprietary applications, for example, Adobe Photoshop or Corel Draw. Inkscape is a profes-

sional open-source vector graphics editor, and its natural working environment is a graphical interface, but with the *inkscape* command, it is possible to convert various formats used in graphic design within a script as shown in Figure 4 into a PNG format readable with any image preview application or Internet browser.

```
#!/bin/Bash
find "$(pwd)"  -type f | while read -r f_path;
      do
      …
      temp_dir="/home/eve/forensics/temp_dir/"
      case $f_ext in
            …
            CDR | SVG | EPS | AI)
                  img_rep_path="$img_repository""$case_name"-$f_sum.png
                  inkscape "$f_path" --export-png="$img_rep_path"
                  img_rep_path=",'img_rep_path':'"$img_rep_path"'"
                  ;;
      …
      esac
…
done
```

Figure 4: *Converting files with vector graphics into a raster-graphic file format*

Microsoft Windows operating system, for example, uses extensions of file names to determine which type of file it is, but forensic investigators cannot rely on extensions. They can be deliberately replaced by users, making it harder to find specific types of files, or applications that could exclude extensions entirely (Firefox Mozilla puts the SQLite file name extension, while Google Chrome does not). In Figure 5, we can see how to identify file type by using the *file* command.

Applications often use SQLite as a database manager, so Figure 5 shows how the *sqlite3* extracts tables and their contents stored in the SQLite file found in the case. Unlike most other files, the *sqlite3* application cannot access the SQLite file from the write-protected medium. Therefore, we copy the SQLite file to the temporary directory in order to access it, read content from all tables, and save it as a text for further processing.

```
      …
      temp_dir="/home/eve/forensics/temp_dir/"
      case $f_ext in
            …
            *)
               sqlite=$(echo $f_type | grep 'SQLite' | wc -l)
               if [ $sqlite -gt 0 ]
               then
                  temp_sqlite=$temp_dir"sqlite"
                  cp $f_path $temp_sqlite
                  echo ".tables" | sqlite3 "$temp_sqlite" | while read -r
table; do
                  for word in $table
                        do
                        echo "naziv tabele: "$word >> $tempfile
                        sqlite3 -csv $temp_sqlite "select * from '"$word"';"
>> $tempfile
                        done
                  done
                  rm "$temp_sqlite"
                  tempfile=$temp_dir"temp"
                  fi
      …
      esac
```

Figure 5: *Extraction of SQLite tables content into a text file*

Using the --mime option of a command *file*, it is possible to determine whether it is a binary file. If this is not the case, the contents of the file are textual and can be read instantly, while in the case of a binary file, we can extract a group of printable characters with *strings* command as shown in Figure 6.

```
…
temp_dir="/home/eve/forensics/temp_dir/"
case $f_ext in
      …
      *)
         charset=$(echo $f_mime | grep 'binary' | wc -l)
         sqlite=$(echo $f_type | grep 'SQLite' | wc -l)
         if [ $sqlite -gt 0 ]
         then
         …
         elif [ $charset -eq 0 ]
         then
            f_content=$(cat "$f_path")
            f_content=$(echo $f_content | tr -cd '[:alnum:].,/: ')
         else
            strings -10 "$f_path" > $temp_dir"temp"
            tempfile=$temp_dir"temp"
         fi
esac
…
```

Figure 6: *Reading text files and printable characters from binary files*

Differences in results of using *strings* command and the application that can read the contents of a particular binary format are shown in Figure 7. The text that represents the contents of the file on the right side of Figure 7 we cannot find in a text composed of printable characters on the left side of the figure, meaning that strings command does not provide complete information about the content.

dzigi@dzigi-Lenovo-Z50-75: ~/Desktop

```
<< /AcroForm 4 0 R /LastModified (D:20090624150438) /
MarkInfo << /LetterspaceFlags 0 /Marked true >> /Meta
data 5 0 R /OCProperties << /D << /AS [ << /Category
[ /View ] /Event /View /OCGs [ 6 0 R ] >> << /Categor
y [ /Print ] /Event /Print /OCGs [ 6 0 R ] >> << /Cat
egory [ /Export ] /Event /Export /OCGs [ 6 0 R ] >> <
< /Category [ /View ] /Event /View /OCGs [ 7 0 R ] >>
 << /Category [ /Print ] /Event /Print /OCGs [ 7 0 R
] >> << /Category [ /Export ] /Event /Export /OCGs [
7 0 R ] >> ] /OFF [ ] /ON [ 6 0 R ] /Order [ ] /RBGro
ups [ ] >> /OCGs [ 9 0 R 6 0 R 18 0 R 7 0 R ] >> /Pag
eLayout /OneColumn /Pages 20 0 R /PieceInfo << /Marke
dPDF << /LastModified (D:20090624150438) >> >> /Struc
tTreeRoot 40 0 R /Type /Catalog >>
<< /Type /ObjStm /Length 211 /Filter /FlateDecode /N
1 /First 4 >>
<< /DA (/Helv 0 Tf 0 g ) /DR << /Encoding << /PDFDocE
ncoding 140 0 R >> /Font << /Helv 145 0 R /ZaDb 146 0
 R >> >> /Fields [ ] >>
<< /Subtype /XML /Type /Metadata /Length 4017 >>
<?xpacket begin="
```

dzigi@dzigi-Lenovo-Z50-75: ~/Desktop

```
l crime. This unfortunate
situation may potentially allow computer criminals to
 commit crimes using
technologies for which no proper forensic investigati
ve technique currently exists.
Such a scenario would ultimately allow criminals to g
o free due to the lack of
evidence to prove their guilt.
A solution to this problem would be for law enforceme
nt agencies and
governments to invest in the research and development
 of forensic technologies
in an attempt to keep pace with the development of di
gital technologies. Such an
investment could potentially allow new forensic techn
iques to be developed and
released more frequently, thus matching the appearanc
e of new computing
devices on the market.
A key element in improving the situation is to produc
e more research
```

Figure 7: *Comparison of the results of the strings command and pdftotext command working on the same file*

Data import

Figure 8 shows how the script can import all the collected information into the MongoDB NoSQL open-source database. From temporary files where the script stored textual content of a subject file, the script read data, and then along with other information collected from the file system and metadata, they are entered as a document within a database collection. The *mongoimport* command imports data into a database that script previously saved in a file as a JSON matrix.

```
#!/bin/Bash
find "$(pwd)"  -type f | while read -r f_path;
      do
      …
      temp_dir="/home/eve/forensics/temp_dir/"
      …
      if [ ${#tempfile} -gt 0 ]
      then
            f_content=$(cat "$tempfile")
            f_content=$(echo $f_content | tr -cd '[:alnum:].,/: ')
      fi
      echo "[{'case_name':'$case_name',
'device_description':'$device_description',' f_name':'$f_name',
'f_parent_path':'$f_parent_path', 'f_ext':'$f_ext', 'f_mime':'$f_mime',
'f_type':'$f_type', 'f_path':'$f_path', 'f_mod_time':'$f_mod_time',
'f_size':'$f_size', 'f_sum':'$f_sum',
"$f_md"'f_content':'$f_content'"$img_rep_path"}]" | iconv -f latin1 -t utf8
-c > $temp_dir"temp.json"
      mongoimport --quiet --db forensics --collection files --type json --
jsonArray --file $temp_dir"temp.json"
      …
done
```

Figure 8: *Importing collected data into a NoSQL database*

Analysis and Reporting

Bash scripts and various commands can be used to search over imported data and create reports in a context that the forensic investigator needs or chooses. The script is obtaining database search results in the JSON format after that command *jq* parses data into an array. The report function saves the data in a text file with name extension HTML that can be opened later in the Internet browser. One of the ways to search the database and create a report is shown in Figure 9.

```
report() { while read line; do echo $line>> report.html; done; }
echo "db.files.aggregate([
      {\$project:{_id:0,f_path:1,f_ext:1,img_rep_path:1,f_sum:1,f_content:1,
length:{\$strLenCP:'\$f_content'}}},
      {\$match:{f_ext:{\$in:['PDF','AI']}}}]).forEach(printjson);" >
$temp_dir"q.js"
mongo --quiet forensics '/home/eve/forensics/temp_dir/q.js' | jq -r
'(.f_path)+"\t<img src=\""+(.img_rep_path)+"\
width=\"300\"">\t"+(.length|tostring)' | while read -r row;
#+"\t"+(.length|tostring)'
do
      IFS=$'\t' read -r -a items <<< "$row"
      echo "<tr>" | report
      for item in "${items[@]}"
      do
            echo "<td bgcolor=\"#F5D0A9\">" | report
            echo $item | report
            echo "</td>" | report
      done;
      echo "</tr>" | report
done
```

Figure 9: *Database search and report creation*

RESULTS AND DISCUSSION

Digital forensic cases often include several suspects, and each of them has few devices which need storage for large amounts of data. For the sake of efficiency in such cases, it is necessary to simultaneously engage the investigational forensic team, which is why one of the requirements is the development of new forensic techniques, procedures, and tools, namely collaboration (Garfinkel, 2010). The tool must provide the possibility of real-time collaboration, in asynchronous way, and remote access to achieve the most optimal conditions, as well as the effects of team work (Garfinkel, 2010; Hibshi, Vidas & Cranor, 2011).

One of the prerequisites for collaboration is the parallel import of data that allows the team of investigators to import data from multiple devices from the same case or several different cases at the same time. Launching, for example, one script with various instances of the Terminal program in Linux can concurrently import data from one computer or multiple computers in the network (Figure 10).



Figure 10: *The five instances of the Terminal program use the same script and at the same time import data into the database*

Figures 11 and 12 show the simultaneous import of data by recording two different states of the importing system, a change in the number of documents in the database and the size of the log files.

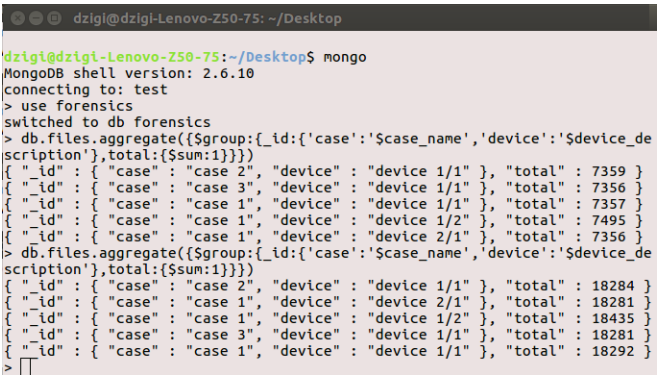


Figure 11: *Change of the number of documents in the database during import*

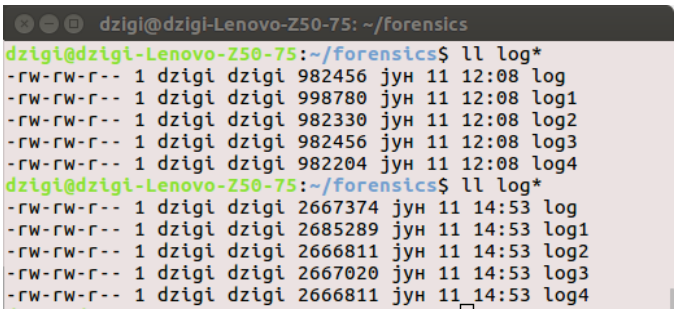


Figure 12: *Change of the log file size during the data import*

Open-source tools that can meet the requirements are database managers, and we distinguish two types by the databases they manage: Relational and NoSQL (Could be Non-SQL or Not only SQL).

The use of NoSQL databases for forensic purposes is suitable even though they do not provide the implementation of ACID (Atomicity, Consistency, Isolation, Durability) properties of a database transaction that should provide validity even in the event of errors, system failures for various reasons as relational managers do (Roussev, 2011). After the initial import of data, forensic investigators access data only by reading, and not changing or deleting them, so consistency issues of the database are not expected (Federici, 2013).

The advantage of using NoSQL databases is that the concept of a document is much closer to file properties which ultimately differentiates by type, quantity, and content of its metadata and other parameters. In Figure 13, there are two MongoDB collection files, the first document contains data about a file that does not have metadata, and the other includes metadata, without the need to explicitly change the structure as it would be the case with relational databases. NoSQL databases solve this problem by offering the ability to store objects and matrices in one field (Boicea, Radulescu & Agapin, 2012).



Figure 13: *An example of two documents from the same database collection with a difference in the structure*

Scalability is another important feature of the NoSQL database manager. The amount of new information entering into forensic analytical systems is significant, and it is difficult to anticipate what resources are sufficient to meet the needs of the job. The ability to expand storage capacity without disturbing the functioning of the working database gives priority to NoSQL systems relative to relational managers (Boicea et al., 2012).

In addition to storage space and collaboration requirements, the basis for each forensic analytical tool is the ability to search to find information or digital evidence (Koen, 2009). In Figure 14 there are two examples of search queries that use regular expressions for finding IP addresses, as well as searching multiple terms at the same time and displaying only the data from the corresponding fields (in this case it is an absolute path).

```
db.files.aggregate([
      {$match:{f_content:{$regex:'\b((25[0-5]|2[0-4][0-9]|[01]?[0-
9]?)(\.|$)){4}\b'}}}
      ])

db.files.aggregate(
      {$match:{"f_content":{$in:[/<search term>/,/<search term>/,...]}}},
      {$project:{"_id":0,"f_path":1}}
      )
```

Figure 14: *MongoDB queries enable different searches for forensic artifacts*

NoSQL databases are more efficient than relational when it comes to response rates. The same applies to open-source relational database managers (Gyorodi, Gyorodi, Pecherle & Olah, 2015), as to the proprietary database managers, even for those which are considered an industry standard (Boicea at al., 2012; Wu, Huang & Lee, 2015). That is why NoSQL databases are a recommended solution for intensive enrolment applications and queries against massive amounts of data (Gyorodi et al., 2015). Creating indexes for fields containing texts further accelerates the search.

In order for a forensic tool to be considered reliable, it is necessary to meet conditions such as the accuracy of the information particular system produces; that there are no errors; data must always be available for analysis, and that there is adequate support in order to eliminate the detected errors (Koen, 2009). The last reference opponents of open-source software often use to criticize, because of support and work on specific projects based on enthusiasm. In this research, scripts consist of open-source tools and commands whose primary purpose is not digital forensics, but as an everyday application in different areas of human work. The number of users of such applications exceeds the size of the forensic community gathered around a particular tool, which allows errors to be detected and repaired more efficiently.

The main reason why forensic investigator needs to create a tool for himself lies precisely in the fact that most of the current forensic tools, whether they are

free or proprietary, are designed in "evidence-oriented" fashion (Hibshi et al., 2011: 82), or "for finding evidence where the possession of evidence is the crime itself" (Garfinkel, 2010: 68). Also, manufacturers of a forensic software are always balancing between demand and profit, and even though comprehensive, their tools and systems do not need to respond to every request by a forensic investigator or a specific case (Horsman, 2019). Customization of a forensic analytical system by selecting only specific tools related to a particular context, in order to improve efficiency and effectiveness of the script, lead to another condition that a forensic tool should satisfy which is usability (Hibshi et al., 2011). Most forensic investigators are not programmers, but even if they are, they are not willing to write a code from the beginning (Hibshi et al., 2011). By using commands and Bash script, they already have all the functionality they need to complete the task.

Forensic tools and systems, regardless of their efficiency supported by high-performance hardware, are often not sufficient to finish a task on time, so investigators are using triage. It represents a way to shorten the time of analysing all the collected evidence by focusing on specific directories or file types instead of doing the keyword search of all files (Cohen et al., 2011). Importing only data about the file that the script collects from the file system is a process that takes a relatively short time. After that, a query on a database can help with the triage showing the locations of searched file types sorted by their quantity in the specific location as shown in Figure 15.

```
db.files.aggregate(
      {$match:{f_ext:{$in:['DOCX','DOC','PDF']}}},
      {$group:{_id:'$f_parent_path', total:{$sum:1}}},{$sort:{total: -1}}
      )
```

Figure 15: *An example of a query that helps during triage*

Using the script shown in Figure 9 after we searched for information about files, we could also create a report in HTML format which is convenient for submitting reports since all operating systems in use today contain Internet browsers. Creating a report is the end of the forensic investigator's work on the case.

Forensic investigators are inclined to rely on commercial solutions, especially those dealing with criminal digital forensics, believing that specific tools have been accepted by courts (Meyers & Rogers, 2005). The problem with commonly accepted commercial tools is that forensic investigators can hardly testify in court on reliability of the tool and the procedures because manufacturers tend to hide everything (Meyers & Rogers, 2005). The essence of the trial is in the forensics investigators themselves and their knowledge about the methods and tools they use, and not what tool it is. Open-source is a more convenient solution because investigators can get a clearer insight into what a particular tool does and how, and the methods discussed in this paper allows automation of testing itself using the same principles creating a script with various commands and options.

CONCLUSION

The open-source concept speaks of freedom, such as using the software for any suitable purpose; freedom to study an application's source code; free redistribution of the applications, and for the improvement of the software for a particular purpose (Koen, 2009), but the fact is that such software is in most cases free of charge. Ubiquitous computing increase volume and variety of data available for digital forensic analysis (Popović, Kuk & Kovačević, 2018), however, this paper shows that by using open-source tools in the matter of digital forensics, we can achieve more than "something for nothing" (Goode, 2005: 669). Free tools developed under various open-source licenses provide great possibilities of applying in the field of digital forensics, and building of an efficient costumed centralized analytical system is more of a question of specific needs of a forensic investigator or forensic teams.

The advantage of using different open-source tools for collecting information using Bash scripts is that the system can be developed gradually as the forensic user finds and masters a new tool. Any new tool alone or combined with other tools can upgrade the script or could be used to create a new one.

Working with Bash scripts looks like programming, but in fact, it is much closer to organizing the running of various tools while choosing their options is a condition for gaining the expected results. It is important to emphasize that the relation of what one could achieve comparing with a length of the script itself is inversely proportional, while the syntax is more straightforward than in programming languages.

Systematization of various file types the content of which can be converted to text and imported into a database, as well as the investigation of the ability of script to work with compound files, such as ZIP and other archive formats, will be subject to the future work.

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ANALYSIS OF ATTACK ON THE WIRELESS COMPUTER NETWORK

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Abstract: In the recent years, things have turned more towards the concept of "Internet of Things", which represents networking, mostly wireless different types of objects that are in mutual communication. This may include various physical objects, vehicles, buildings and other things with built-in electronic devices, software, sensors and networks that enable sharing information between the connected devices that can be remotely monitored and controlled. While it brings many benefits, it also brings to the focus the question of security. It is considered as one of the most importance, especially having in mind that most of the above-mentioned systems are used for critical infrastructure, where the system is expected to work towards perfection, and where any kind of influence on the network may be fatal for their performance. Since wireless networks become dominant compared to wired ones, their security evaluation is widely researched. There are different tools avaliable for security evaluation of local wireless computer networks. In this paper, we are focusing on tools that can be found within Kali Linux OS. For evaluation purpose, we were launching a set of different attacks on wireless networks, and afterwards we made a comparison of their performance. Our experiment has shown that wifi is prone to attacks, that they can easilly be performed by using avaliable free platforms and that Kali Linux provides tools for that which are efficient.

Keywords: cybersecurity, cybercrime, security, wireless network

INTRODUCTION

Modern society is embracing the emerging concept of "Internet of Things" (IoT) representing '*a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction*'.[2] Although the traditional form of wired network connection is still in use, wireless connection is the technology that provides the wide utilization of IoT.

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2 https://internetofthingsagenda.techtarget.com/definition/Internet-of-Things-IoT

There are several advantages and disadvantages of wireless standards 802.11 utilization. Advantages include the mobility, usability and flexibility, and disadvantages are related to limited bandwidth in comparison to wired networks and security issues. Security issues are particulary important because anyone who is within signal transmission radius might be able to record (listen) and analyze network traffic. There exist different ways how WEP and WPA/WPA2 authentication can be bypassed. For example, WEP is susceptible to FMS (Fluhrer, Mantin and Shamir) attacks, including Korek and PTW variations and ChopChop attacks, while WPA and WPA2 are susceptible to dictionary attacks and Bruteforce (Kanawat S. D., Parihar P. S., 2011).

There are different tools avaliable for security evaluation of local wireless computer networks. One of them includes penetration testing, where a simulation of attack is performed in order to find vulnerabilities and provide protection for them. One of the most popular and most advanced Penetration Testing Distribution is Kali Linux.[3]

Kali[4] represents a version of Linux operating system, with built in tools and framework, which does testing on the network, system, penetrative tests and such. Like other versions of Linux operating systems, it is free with a large support from the community. The possibility exists of booting the OS in Live mode, directly from the USB or some other device. It can also be used in forensic mode, preventing any interaction with the hard disk, which can be verified through unchanged hash value of hard disk image.

It is possible to control the path of graphic and command interface, however it is more effective to use the command in terminal mode due to its stability, which responds to optimization of hardware resource usage needed for the display of graphical elements (Beggs R., 2014).

In our experiment, we were testing different tools avaliable within Kali framework. The aim was to compare their performance in order to evaluate both: the security of wireless networks as well as the ability of used tools to simulate real attack and find vulnerabilities.

The tools in Kali that we used for simulation of attack on WiFI are:

- Crunch
- Aircrack
- Evil twin
- Cowppaty

In order to perform this kind of attack the wireless adapter should be working in the monitor mode, in order to be able to view and capture the network packages. For our experiment we used "*TP Link WN722N*" *version* 1.0 which has this ability.

The rest of the paper is organized as follows. In the first section, we gave the brief description of two popular attacks that we are going to use in our simulation

3 https://www.kali.org/
4 more on https://www.offensive-security.com/kali-linux-vmware-virtualbox-image-download/

of attack. In section 2 we gave the results of our simulation of attack. The paper is closed with the conclusion section and list of used references.

ATTACKS ON WIFI NETWORKS
tcp handshaking flood

enabling communications takes place where a user who requires communications, through TCP protocol by sending the SYN packet (initiating communications), after receiving, the other side sends back SYN and ACK, where the user sends ACK again and the enabling communications starts. The first step the attacker performs is to repeatedly send SYN packets at the other side (server), using falsified IP addresses (spoofing), to which the server responds with ACK packets. The communication is not established since the server is waiting for the response (which never arives). Since the table of the avaliable connections is filled, when it comes to legitimate users they are kicked out of the establishing communication (Figure 2). Nowdays, this kind of attack is very efficient due to the fact that our devices (cellphones, laptops, sensors, etc.) are set to constantly receive the network traffic and if they find themselves on the receiving end, then networks enable the exchange of credentials in the established communication (Beggs R., 2014).

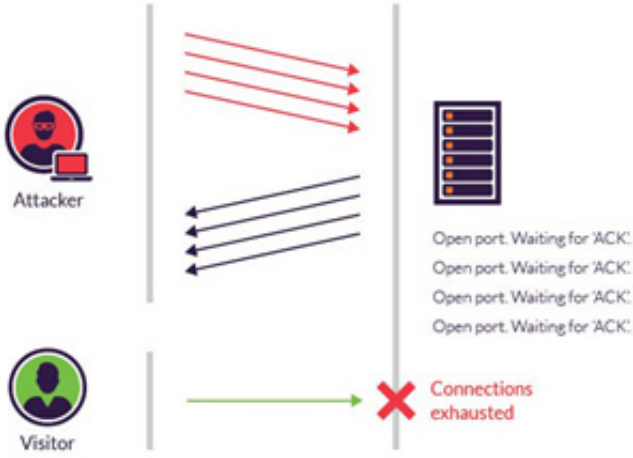


Figure 1. *TCP Hanshaking Flood attack*[5]

5 adapted from https://www.google.com/url?sa=i&source=images&cd=&ved=2ahUKEwj-l6TF-MriAhVE_aQKHQa8CHgQjRx6BAgBEAU&url=https%3A%2F%2Fwww.imperva.com%2Flearn%2Fapplication-security%2Fsyn-flood%2F&psig=AOvVaw3KFfimucO68gyjb9U38DQF&ust=1559569841643159

EVIL TWIN

This technique is very compelling for use because it can give a desired result in short term. It must use more tools for an attack, as it is important to fabricate an IP address (spoofing), disconnect users, and then take the packet with credentials. In some ways, it is a hybrid type of an attack, because it covers the method of social engineering, where the main target is the end user (Beggs R., 2014).

The same attack can be initiated systematically (step by step), through the use of special kinds of tools, but there exist more types of solutions which integrate more kinds of tools, so that it can ease up the end user's initiation of the attack. Integration of these tools requires minimal interaction between users and the system. The breach into the network is done firstly by committing the deauthentication of the user then the valid device tries to establish a connection. It relies on a stronger signal of the chosen station, which sends a request for connection with a fake station, after that the user is expected to input their password. This option is done through a specially generated station, so that the user has an impression of communication with the geniune device, with consequences that password is sent to the hacker who then immediately use it (Figure 2).

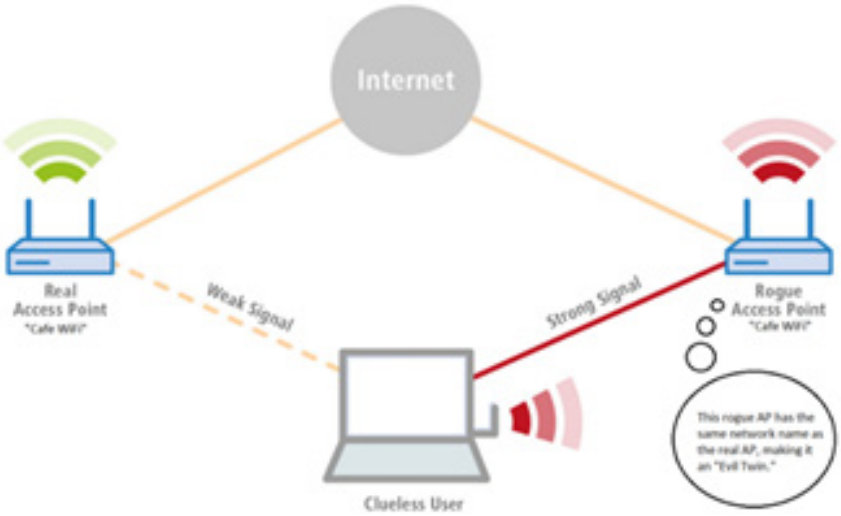


Figure 2. *A graph of an Evil Twin attack*[6]

SIMULATION OF ATTACK ON WIFI NETWORK

Before the beginning of the simulation the router that is to be used for an attack is set. The safety parameters in WPA2 are set (Figure 3), and the chosen password is put in under the guide of the most widely-used factory settings - the last few keys are the serial number of the device.

6 adapted from: https://thecybersecuritymancom.files.wordpress.com/2018/08/evil-twin.png?w=925

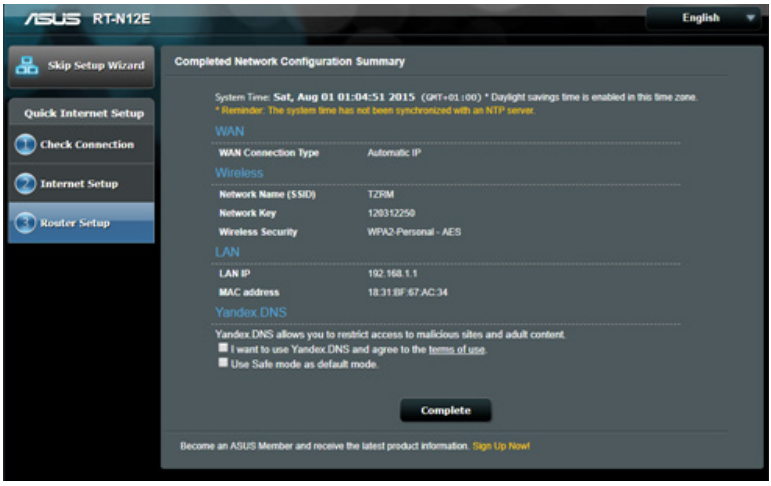


Figure 3. *The safety parameters of the router*

After the successful setting of the router, we are performing the scaning of the network, which gives us the list of available signals of different networks with a detailed description of devices they emit (MAC address, type of protection, SSID, etc.).

Then we perform the command: airodump-ng wlan0 where the result is shown in Figure 4.

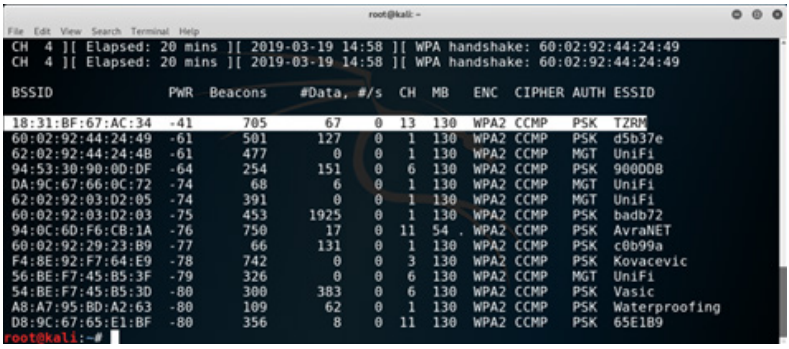


Figure 4. *The display of online signals in the network*

We perform this function by entering the number of channels we want to listen to, the file in which we place the packets, which we later "catch", the MAC address of the device, as well as the interface through which we go online.

By reviewing the list of devices and their communication in the network, we choose a potential target, focusing on the device which we want to follow. We do this by inputting the number of the channel which we want to listen (eavesdrop), we dedicate the file in which we will save network traffic packets we were able to

capture, the device's MAC address and the interface through which we go into the network.

Then we perform command: airodump-ng –c (number of channels) –w fajl –bssid (MAC devices) wlan0

Figure 5 shows the process of following (listening) the seleceted device.

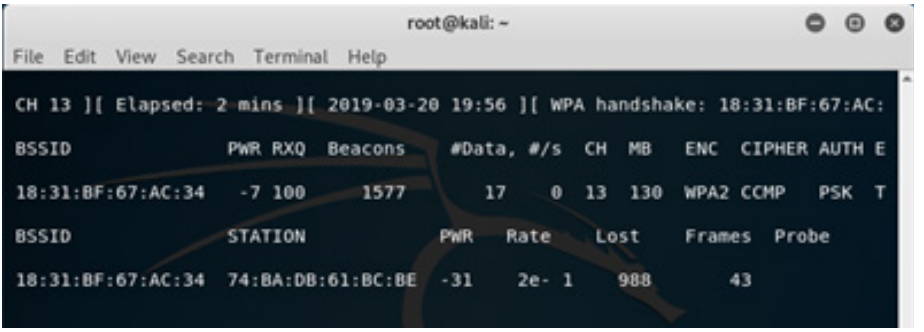


Figure 5. *Showing the following of the selected device*

After listening to the network traffic (eavesdropping), we initiate "TCP Handshaking Flood", where we send frequent requests to the device in order to drop other networks out of communication. With tool aireplay, we initiate connection, a function which will lead to kicking out every legitimate user of the device, then we input the MAC address of the device and one client, as well as an interface which we use to connect to the network.

The result of performing the command: aireplay-ng -0 5 –a (MAC device) –c (MAC client) wlan0 is shown in Figure 6.

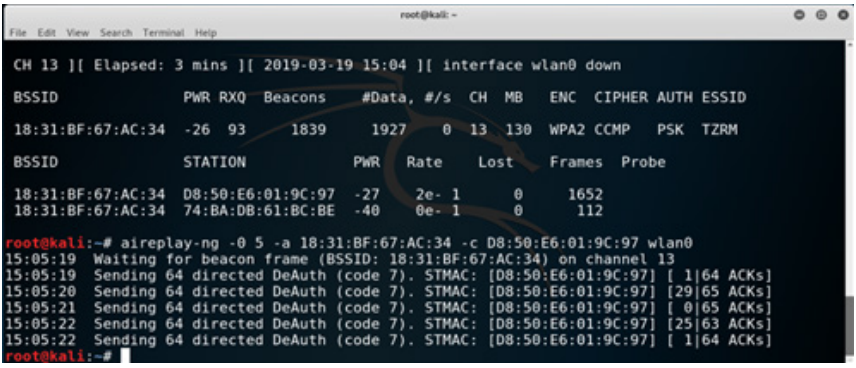


Figure 6. *Showing the already sent requests for communication by which the kicking of every legitimate user is done*

After the user is dropped out of the network (disconnected) the attacker is waiting for the new attempt of the device to reconnect to the network. At that point, packets with secure credentials (authentication) can be captured and saved

in the dedicated file and the crunch tool in combination with aircrack can be applied. By doing so, a brute force attack is initiated, where every possible combination of characters is tried. This is made possible through the crunch tool that tries out every combination, and as additional parameters, we can input how many characters the password may contain as well as the specific group to which they belong. Every listed value is then compared with the content of the file containing the captured network traffic packets of the targeted device. For that puprose, we use the aircrack tool (Figure 7). The command we have performed is: crunch 9 9 1234567890 | aircrack -w- fajl.cap –bssid (MAC device)

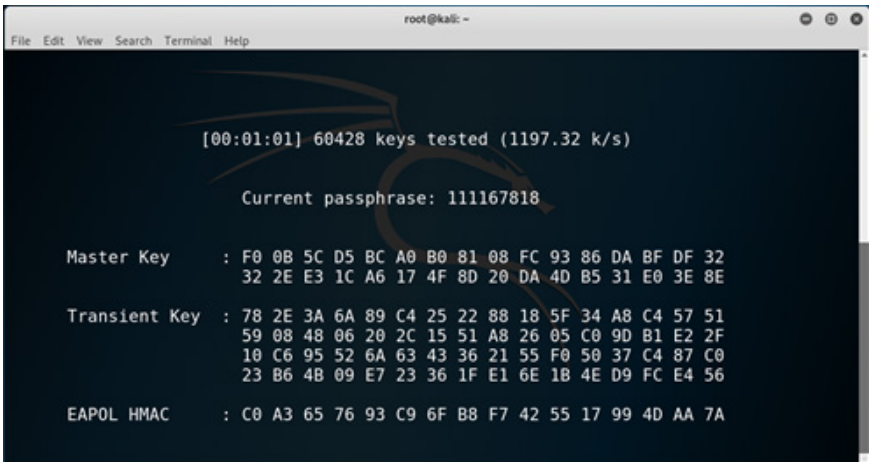


Figure 7. *Listing and trying to codebreak the passwords*

After the process is finished, the user's password is shown in the ASCII code, understandable to a human, that is, the end user.

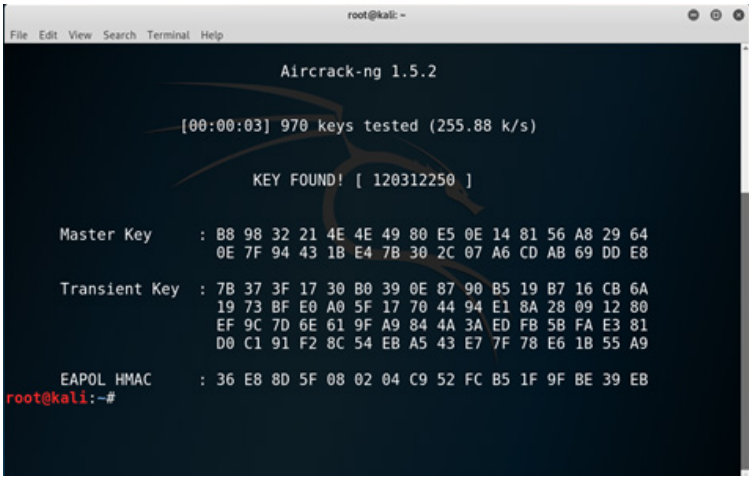


Figure 8. *Final result of the broken password*

The attack was successfully completed, regardless of the type of protection, but with used parameters (the lenght of the password), the process lasted for approximately 1 hour and 43 minutes. This method of attack represents the combination of many types of individual tools, having their own roles in completing the process. Additional integrated solutions provided by other vendors alow the hackers to simply initiate the selected types of attacks. These tools are available in Github (a platform for development and sharing of software applications) where simple downloading makes it possible to use it as well as to make the additional changes and developments. All tools provide similar hacking methods, since the most popular techniques are "TCP Handshaking Flood" and "Evil Twin" (Smet D., Pritchett W., 2013).

The first integrated solution we considered is "Fluxion".[7] It is freely available containing several tools that can be used for simulation of attack at wireless computer networks (Figure 9).

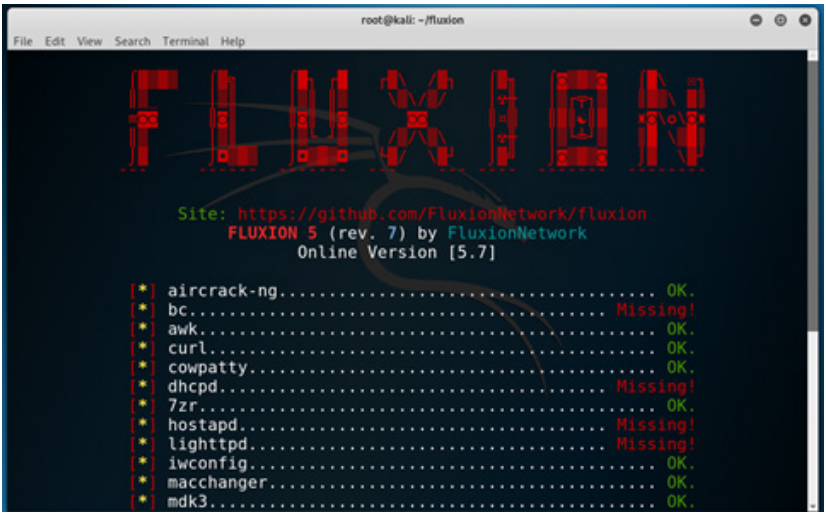


Figure 9. *"Fluxion" tools*

During the initialization of the tool, a loading of the existing tools is done, since this collection of tools uses the ones that are already installed. In the case that a specific solution does not exist, it is possible to initiate downloading of the missing tools. Built-in funtions that are available include (as shown in Figure 10) creation of a virtual Access Point, as a malicious duplicate of the geniune one, which will receive the packet with the password in the form of open text. Another one is "TCP Handshaking Flood", a function that was already covered in the previous part of this section.

7 https://github.com/FluxionNetwork/fluxion

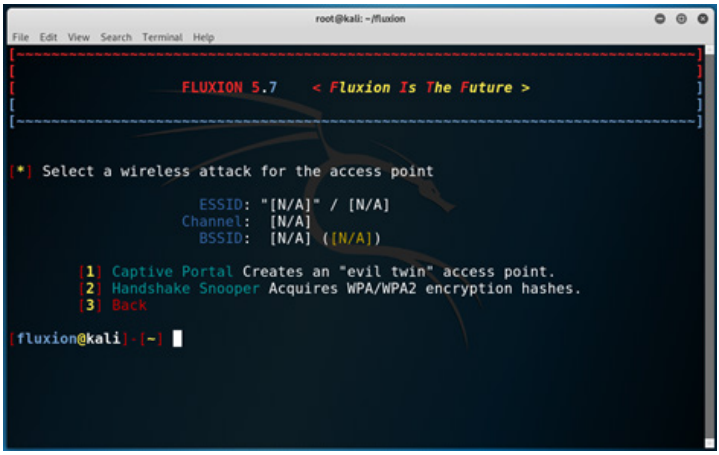


Figure 10. *A window showing a choice for an attack*

By scanning the network, the analysis of the available nearby networks prone to attack is performed. This automated method is done by itself, where the user is simply expected to provide a choice of targeted network.

TCP HANDSHAKING FLOOD

As stated in the earlier part of the presentation, the process of viewing the network traffic is done when the network adapter is in "monitor" mode. The second and third types, shown in Figure 11, are about active way of shutting other devices from the network, which is done through constant sending of SYN packets.

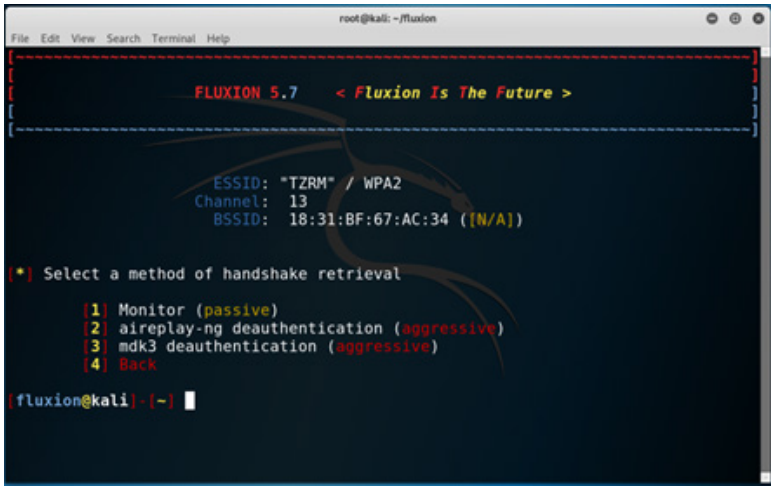


Figure 11. *The choice of methods for deauthentication of the user*

The method of deciphering of packets with credentials is possible, along with the previously used tool "aircrack", by using tools "mdk3" and "cowpatty".

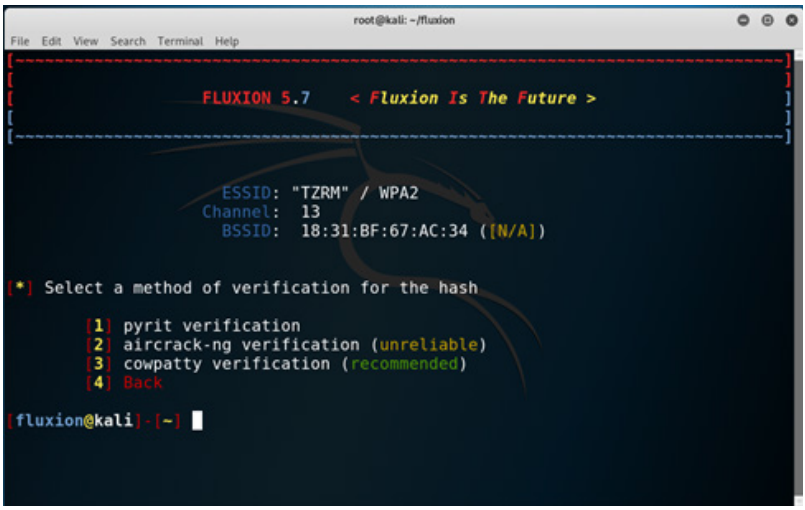


Figure 12. *Types of tools for deciphering*

After selecting the right tool, the automated process for listening (eavesdropping) of the targeted network and its traffic packets, the attack is initiated (Figure 13). Its goal is to deactivate devices from the network in order to force them to reconnect (log back in) when their credentials will be captured and afterwards decrypted.

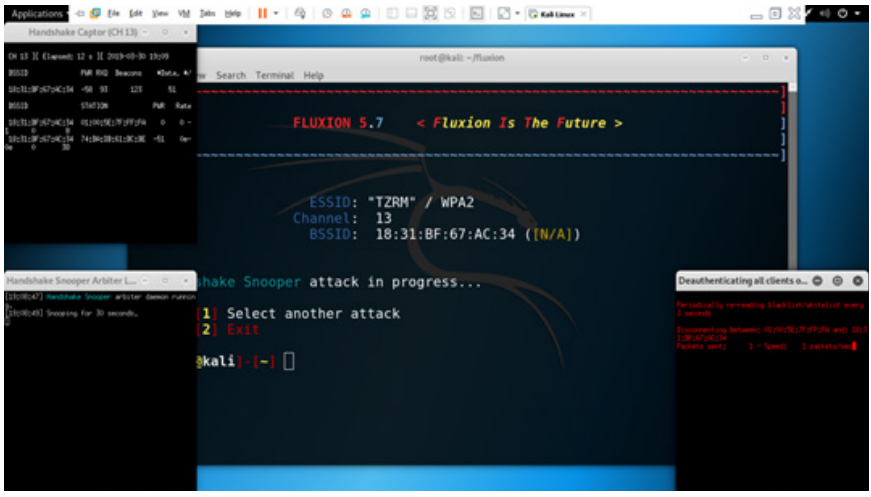


Figure 13. *Iniating an attack*

EVIL TWIN

This type of attack clones the existing station, in which a fake MAC address and name is generated, so that it can fool a user to connect to a fake network and input credentials. This method to a larger extent depends on the user, as it is important for the user to provide log-in credentials to a particular generated station. This method is suitable for use in public locations, where it is necessary to register to the network in order to have internet access.

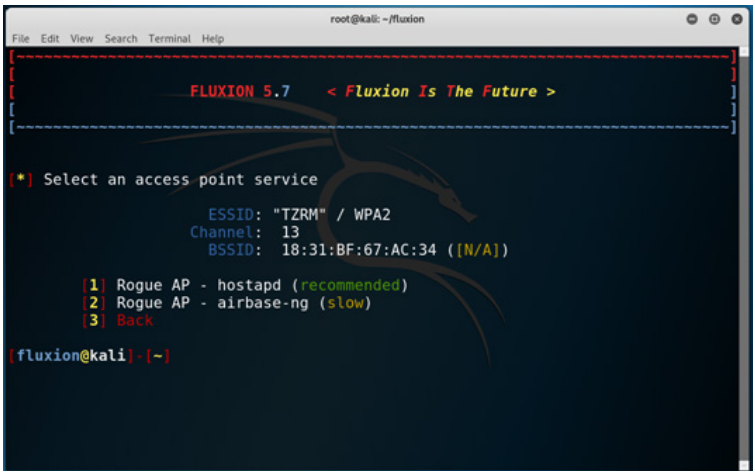


Figure 14. *The choices for a type of generating fake wireless network device*

Access to a page is done through "http" protocol, but the possibility of showing "SSL" certificate exists in order to ensure the user that he is in the mode of safe (encrypted) communication (as shown in Figure 15).

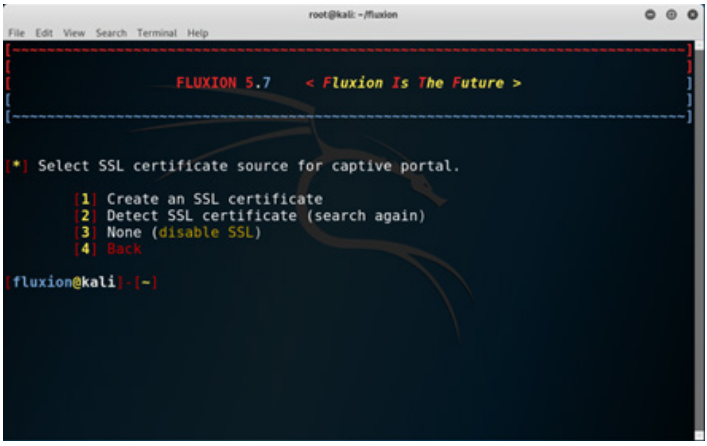


Figure 15. *A selection of creating a digital certificate*

By selecting an option for creating a digital certificate, the user is given an opportunity to choose a type of web page, i.e a type of a generic station where the user will leave their own access credentials (password). In our experiment, a generic page in Serbian is selected (Figure 16).

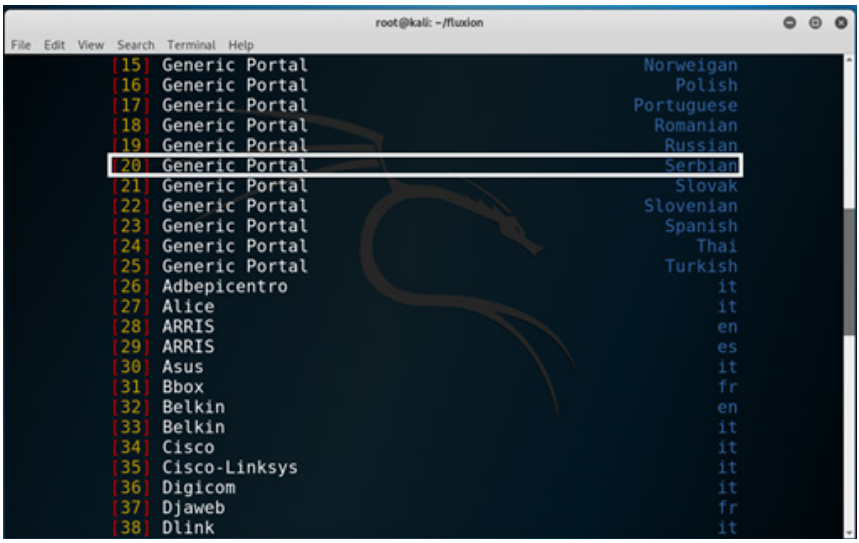


Figure 16. *Possible choices for a generic station*

After this step we enter to the production phase, where SYN packets are frequently sent in order to deactivate (disconnect) valid users. The expected result is that users are going to try to reconnect (log to the network) where they will be forwarded to the (fake) page for validation with the expectation that users will give their credentials to that fake router. This whole process is monitored as shown in Figure 17.

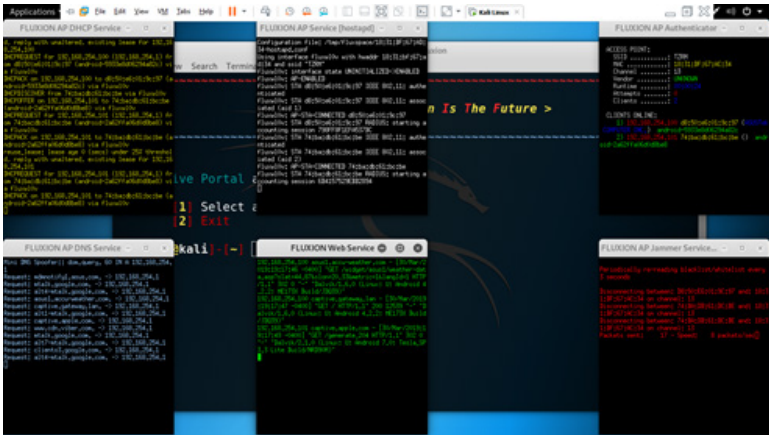


Figure 17. *Monitoring the state of fake routers*

Page display is available in many different languages and it is possible to choose different pages, which are identical to the factory-set pages of service providers, as shown in Figure 18.



Figure 18. *Log-in page*

After logging with credentials, the packet is immediately sent to the attacker where it is stored in a separate file in a form of open (readable) text (Figure 19).

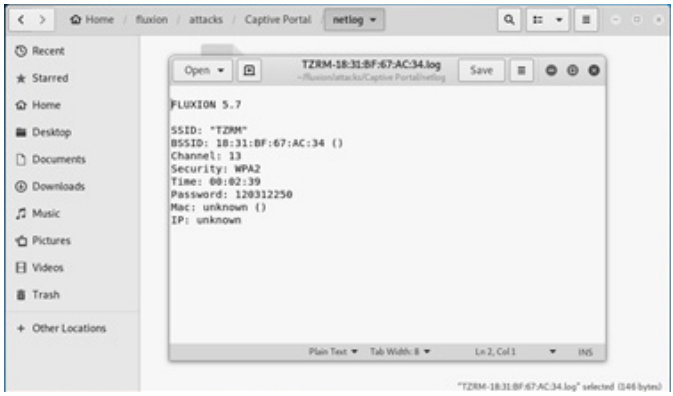


Figure 19. *Text file with parameters for network access*

The attack (hacking) process alone takes approximately 3 minutes, which at first glance seems like a good result. However, the main disadvantage of this approach is that it relies on the user attempt to reconnect, sending the access credentials over the network, which in some situations will not be the case. Sometimes the user will understand that something is wrong and will refuse to attempt to reconnect. Nevertheless, many users, especially in public areas using free wifi spots, will try to reconnect exposing themselves to this kind of attack. Once the attacker is in position to have someone's network access credentials, he can use them in order to perform more attaks with the aim to have access to all data (including private and sensitive) of the targeted user.

CONCLUSION

In this paper we presented two methods recognized as most widely used for attacking the security of wireless computer networks. In every system, the weakest point is the human, who is commonly the main target of the attack. In the first type of attack we performed, human interaction is not needed to a large extent, but the device must already be in possession of network access credentials. It requires more time since the captured packets containing password must be decrypted. The other type of attack we demonstrated requires a greater human interaction, otherwise this attack is useless. The process of disabling (disconnecting) the device from the network and reconnecting does not differ much from the first approach, but what comes afterwards is different. This method forces user to connect to the network with the strongest signal strenght, redirecting him to the login page where he will provide access credentials, meaning that the attacker will be able to get them (in a form of open text) and have immediate access to the network. Since there is a plenty of avalibale integrated tools for attack, requiring little or no knowledge at all, along with software that can be downloaded from "Github" platform, we can confirm that the security of wifi networks is questionable. Therefore, the appropriate measures must be taken in order to minimize their vulnerability. As one of very helpful measures that does not require financing or technical skills is raising the awereness of end-users to this kind of attack in order to be able to protect themselves when using public/open wifi spots.

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VOLUME II

Topic VII

INNOVATIVE TECHNIQUES AND EQUIPMENT IN FORENSIC ENGINEERING

AN INVESTIGATIVE APPROACH FOR INCIDENTS INVOLVING CHEMICAL WARFARE AGENTS (CWAs)

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Abstract: During the last decades, the need for more awareness and adapted practices regarding the forensic investigation of incidents involving chemical warfare agents (and more globally the CBRN incidents) has been highlighted. The lack of a global approach and specific investigation strategies for these events has been mentioned in numerous publications, which have also underlined the need of capabilities development in this field. Since 2016 The Organisation for the Prohibition of Chemical Weapons (OPCW) has launched a Temporary Working Group on Investigative Science and Technology with the focus to increase forensic capabilities. One of the reasons why the investigative approach is not yet a matter of course may be that the first attempts of forensic investigations were based on a direct implementation of forensic methodology within the standard operating procedures in place to manage the CBRN incidents. However, this may not have been the best strategy as the priorities, actors involved and scene dynamic are different between incidents involving chemical warfare agents and what may be considered as a more "traditional" crime scene. Therefore, the investigative approach of incidents involving chemical warfare agents need to be adapted and specific capabilities need to be developed (e.g. to work with a PPE or to handle contaminated evidence). These capabilities are multiple and the investigative methods have to be adapted since the start of the investigation at the scene itself up to the analysis that may be done in the laboratory.

Keywords: CBRN, Chemical Warfare Agents (CWAs), Investigative Approach, OPCW

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INTRODUCTION

Chemical warfare agents are often mentioned in relation to Biological, Radiological and Nuclear (CBRN) threats. The CBRN threats are different from hazmat situations by the fact that a CBRN threat implies an intentional attack with a malicious motivation and the intent to harm a large numbers of people. Therefore, the CBRN threats are equally referred to as Weapons of Mass destructions (WMD) (Prockop, 2006; Ganesan, Raza, & Vijayaraghavan, 2010). These weapons are considered as unconventional due to the great destructive power, the psychological impact and the lasting traces they leave on touched areas and peoples.

HISTORICAL REVIEW

Since the dawn of time, humans used toxic materials to get rid of their enemies or to harm opponents. The CBRN threats emerged at the beginning of the 20th century after the industrial revolution (Tucker, 2006; Spector, 2017). The great advancement in technologies and the numerous discoveries in science in the 1850s gave humans a better understanding of physical and chemical properties These new knowledge helped to have great improvement in living conditions and to optimize production processes but it also accelerated the development of mortal and heavily destructive means such as chemical and biological weapons.

World War I (WWI) was the first milestone in the ill-fated development of chemical weapons. As the trench war was setting a static frontline, the German scientist Fritz Faber proposed to use toxic chemical to breach the enemy lines and achieve a breakthrough in war (Mangerich & Esser, 2014). The first chemical attacks occurred in Belgium in 1915 where chlorine gas was released on the French troops. However, the chemical used rapidly became more and more potent as researches were done and at the end of WWI, the most common Chemical Warfare Agent (CWA) was mustard gas (Tucker, 2006; Pita, 2009; Spector, 2017).

After the events of WWI, the international community understood the necessity to prohibit chemical and biological weapons that not only had disastrous outcome for contaminated people but also impacted psychologically every person that witnessed chemical attacks. The Geneva protocols in 1925 helped to set some limitations and to define the first pieces for war laws (International Committee of the Red Cross, 2016). In the Geneva protocol, state parties agreed on the prohibition of use of toxic and asphyxiating gas in war (Tucker, 2006; OPCW, 2017b).

However, the use of chemicals as weapons was reiterated in World War II (WWII). This time chemicals were not used on the battlefield against enemy troops but to kill thousands of innocent people in the sadly famous death camps in Germany and Western Europe. These events, along with the atomic bombings of Hiroshima and Nagasaki in August 1945, changed the dimension and the perception of warfare (Tucker, 2006). The images and outcome of these events deeply affected human minds and will probably stay in the collective memory.

However after WWII, the CBRN agents where not directly banished as one might imagine. The race for armament only began and large sums of money were invested by Russia and the United States of America, as well as by other European countries, to further research, develop and produce the CBRN weapons (Tucker, 2006; Spector, 2017). The deterrent power of such weapons being considered as high enough to prevent enemies attack, the CBRN agents are not only material but also psychological weapons (Gouweloos, Dückers, te Brake, Kleber, & Drogendijk, 2014; Krieger, Amlôt, & Brooke Rogers, 2014).

The psychological damage may also be an interesting mean for non-state actors to disrupt societies. Several terrorist organization tried over the years to acquire knowledge and materials to synthesize CWA (Zanders, 1999; Tucker, 2000; Meulenbelt & Nieuwenhuizen, 2015). The major event that involved the use of chemical warfare agents by a non-state actor organization is certainly the sarin attack in the Tokyo subway in 1995 by the Aum Shinrikyo Cult (Tucker, 2000, 2006).

In 1997, the Chemical Weapons Convention (CWC), ratified by almost all state parties, entered in force. For its implementation, the Organization for the Prohibition of Chemical Weapons (OPCW) has been created the same year (OPCW, 1993, 2017b). Despite this treaty, several incidents involving CWA have been observed in recent years, not only during the Syrian war since 2013 but also for example in the death of Kim Jon-Nam in Malaysia in 2017 (OPCW, 2017a). Recent and past events showed the international community and the OPCW the need to extend their capabilities and the need not only to be able to identify CWA but also to attribute attacks to its perpetrators (Tucker, 2010; Zanders & Balci, 2013; Smallwood, Trapp, Mathews, Schmidt, & Sydnes, 2013; Borrett, Timperley, Forman, & Tang, 2018).

FORENSIC IMPLEMENTATION

Chemical threats are not always intentional and great efforts have been made to assess and mitigate chemical risk in various situations. The handling of a chemical threat is primary based on the mitigation of the risk and the reduction of damages. Well-documented risk management strategies have been widely developed and are *de facto* available (Linney, Kernohan, & Higginson, 2011; George Calder & Bland, 2015;). But because the awareness of implicating the forensic science in the investigative process has been achieved only recently, the forensic capabilities are still lacking in the field of the CBRN and not yet well integrated in the risk management strategies (OPCW, 2016; Borrett et al., 2018; Forman et al., 2018;).

First strategies proposed were based on the idea of a direct implementation of forensic science methods in the already existing CBRN intervention protocols (Murch & Tech, 2012; Peña-Fernández, Wyke, Brooke, & Duarte-Davidson, 2014). However, due to some major differences in between these two domains, such approach suffers from some limitations. The aim of the first responders and

forensic scientists, as much as their priorities and the way of handling the same situations, are fundamentally different (Calder & Bland, 2015). The investigation of the CBRN events is complicated for forensic scientists as their work is impeded by contaminations and safety issues. Currently, the first responders are to intervene before forensic scientists to ensure safety and this without regard for potential evidence that may be destroyed by their actions. It seems therefore essential to rethink the intervention on incidents involving chemicals agents to integrate forensic teams since the early stage of the intervention. The global approach need to be adapted and standard operating procedures need to be implemented. Even though the CBRN events are highly unpredictable, having procedures that involve forensics from the beginning could help to preserve evidence without stopping the first responder to do their tasks (Linney et al., 2011). In a CBRN intervention, it is crucial to identify accurately and as soon as possible, the agents employed in order to respond effectively to the incident. From a forensic point of view, it is required to develop systematic processes for the assessment, collection, preservation and interpretation of material collected on the CBRN crime scenes.

Based on the existing CBRN and forensic processes, both fields could learn from one another to develop performant forensic investigations of the CBRN incidents.

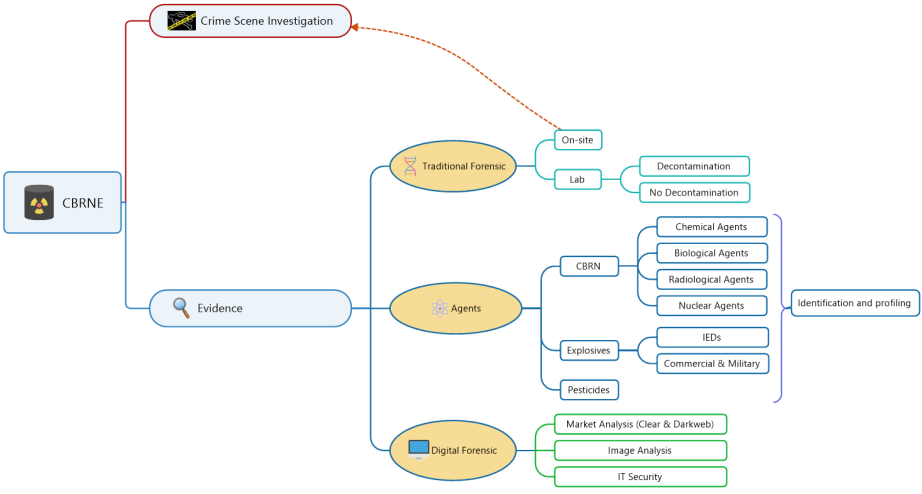


Figure 1: *Field where forensic procedures could be develop and research efforts need to be undertaken.*

So far, little attention has been given to the possible use of traditional forensic evidence from the CBRN incidents. The collection and treatment of seized specimens is challenging due to the fact that they are contaminated by highly dangerous substances. Further researches need to be undertaken in order to evaluate the best ways to proceed. As an example, finger marks detection or DNA recovery

may be more or less influenced by the chemical decontamination mean used. Briefly, the seized specimens could either be directly analysed on-site, which requires that the forensic scientist wears personal protective equipment (e.g. respiratory protective device and body surface protective equipment), or transferred to a CBRN laboratory that may handle the contaminated items. For the forensic investigation of specimens in laboratory, two solutions may be foreseen; the analysis in the CBRN facilities or the decontamination prior to the transfer toward forensic institutes (Borrett et al., 2018; Kummer, Augustyns, Van Rompaey, & De Meulenaere, 2019; OPCW, 2018). Lacking concrete research on the detection and analysis of traditional forensic exhibits collected from a CBRN crime scene, there is yet no methodology nor procedure to collect, handle and harness the potential of traditional forensics in such cases.

The analysis of the chemical agent itself is essential to determine the threat, but may also provide additional information. One research aspect is the source inference based on the chemical impurity profiling of the CWAs. Since 2010, several research projects (Hoggard, Wahl, Synovec, Mong, & Fraga, 2010; Fraga, Bronk, Dockendorff, & Heredia-Langner, 2016; Fraga, 2018) have investigated the possibility to cluster together products to precursor batches through the impurity profiles. However, these studies have mainly been realised in laboratory condition. To estimate the utility of these techniques in real case scenarios, it is necessary to evaluate the impact of contextual factors on the impurity profiling of CWA.

One other emerging area in forensic science is the digital field. Although, cybersecurity is a growing concern, the digital environment equally offers new investigative opportunities. The use of image analysis, to better understand ground movement for example, could help prevent some attack or detect at earlier stage a possible CWA incident. Additionally, open source intelligence, combined with image analysis and the current monitoring of the chemicals, could help gather information to help prevent proliferation of CWA (Minas, 2010).

In short, it is visible that at all stages of the CBRN forensic investigation (Fig. 1), new methods and capabilities need to be develop. In addition, it seems essential to define an investigative approach to react to the CWA incidents and to elaborate an appropriate framework with adapted vocabulary. By targeted research on all the above-mentioned aspects, capabilities and readiness of all involved parties will be increased.

CONCLUSION

Since its beginning, chemical warfare has been considered as brutal and inhuman. Recent incidents with chemicals weapons have shown that CBRN threats are still topicality. The events in Syria, England and Malaysia have highlighted the need to attribute and understand chemical attacks. Forensic science has tools that could help to answer these questions if involved in the investigation process since its starts. To expand their forensic capabilities and to develop new combined ap-

proach to be able to exert their deterrent power, the OPCW has created a temporary working group, which aims to evaluate the possibilities of forensic science in the field of CWA. It seems now necessary that the CBRN experts and forensic scientists work together to fill these gaps and strengthen the chemical weapons convention for a world free of chemical weapons.

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FIGHT AGAINST CHEMICAL WATER POLLUTION: SETTING UP A MONITORING SYSTEM IN RIVERS OF THE LAKE GENEVA BASIN TO SUPPORT AUTHORITIES IN DECISION-MAKING

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Abstract: Water pollution by chemicals (e.g. persistent organic pollutants) impacts biodiversity as well as human health, economy and life quality. With the increase of population and human activities, it has become an urgent security issue. By introducing the water pollution-related traces into an intelligence process, we are convinced that forensic science can support authorities in decision-making to tackle this security issue. By taking the example of the Lake Geneva basin, this study identifies the limitations of current approaches to monitor chemical pollutants (hardly comparable data, insufficient sensitivity and low temporal representativeness). To overcome these limitations, a passive sampling-based acquisition process was elaborated. Relevant features were extracted (concentrations, loads and 'chemical signatures' of pollutants) and enabled pattern detection. The analysis of these patterns in combination with alternative information (e.g. field knowledge from environmental agencies) resulted in intelligence products that can support authorities in preventing current chemical releases from being repeated (or continued) or similar releases from being committed.

Keywords: pollution sources, passive sampling, pattern detection, intelligence, decision-making

INTRODUCTION

Water security has become an urgent issue because water resources are affected by population increase, economic development, climate change and other global to local drivers (Bakker, 2012; Sandford, 2012; Pahl-Wostl et al., 2016; Estoppey et al., 2019a; Wheater, 2019). Water pollution is one of the main stress-

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ors (Vörösmarty et al., 2010). In a regulatory context, it can be defined as 'the introduction of anthropogenic contaminants into water at a level that produces adverse effects to the receiving environment' (Tarazona, 2014). In this paper, we tackle the issue of 'chemical pollution', which is as worrisome as 'pathogen pollution' because of unknown long-term effects on aquatic life and on human health. Hundreds of millions of tons of industrial chemical (e.g. additives, lubricants, flame retardants) and consumer products (e.g. pharmaceuticals, cosmetics, detergents) are annually used worldwide and partially find their way into natural waters. Although most of these chemicals are found at very low concentrations (micropollutants), some are of concern because of their high toxicity (Schwarzenbach et al., 2006). During the last decades, international and national legislations have been developed to protect water, setting thresholds and penalties, among others (Kurukulasuriya and Robinson, 2006).

Similar to crimes against person or property, when water pollution cases occur (e.g. pollutant concentration in fishes exceeding legal thresholds), forensic science can support investigations and/or provide expert opinion in court decisions (Estoppey, 2017). However, forensic science can go beyond such a case-by-case approach (Ribaux et al., 2013) by introducing 'pollution traces'[2] in a solving problem process to acquire a better understanding of the security issue caused by water pollution. We hypothesize that setting up a monitoring system as described by Ribaux (2014) (acquisition of comparable data, extraction of relevant features, pattern detection, pattern analysis) can provide intelligence products. Those may support authorities in decision-making to prevent water pollution offences from being committed or repeated.

By taking the example of the Lake Geneva basin, the aim of this study is to identify the limitations of current approaches to monitor micropollutants and to assess a passive sampling-based acquisition process to provide comparable data, enabling the detection of most problematic sites and helping authorities to prioritize security actions.

LIMITATIONS OF CURRENT APPROACHES TO MONITOR MICROPOLLUTANTS

Lake Geneva is shared by two countries (France and Switzerland) and four regions (the French department of Haute-Savoie and the Swiss cantons of Vaud, Valais and Geneva). Pollution of the lake and the rivers of its basin implies a wide range of agencies, all of which have their own practices. The International

2 In a strictly legal-procedural approach, only traces related to pollution cases (exceedances of legal thresholds) should be introduced in the process. However, environmental law is unique in that a specified amount of harmful activity is permitted (Gibbs and Boratto, 2017). In our opinion, understanding "water pollution" problems also requires exploiting information conveyed by anthropogenic contaminants that are not legally classified as pollutants at the measured concentrations.

Commission for the Protection of the Water of Lake Geneva (CIPEL) performs an extensive coordination role. Three main limitations of current approaches to monitor micropollutants in the lake basin have been identified (Estoppey et al., 2019b):

1. Difficulty in obtaining comparable data. A homogeneous global view of micropollutant levels in the Lake Geneva basin is complicated because sampling methods and frequencies as well as target substances differ across regions and agencies.

2. Difficulty in achieving sufficient sensitivity. Some of the micropollutants, such as hydrophobic compounds, are present at particularly low concentrations in water (ng/L or even pg/L) and are difficult to measure with usual methods based on (grab or automatic) active sampling.

3. Difficulty in acquiring a temporal representativeness. In many rivers of the lake basin, only grab samples are collected, thus providing only a snapshot of the concentration at the moment of the sampling.

These limitations make the understanding of the problem of pollution by micropollutants in the Lake Geneva basin difficult. The prioritization of actions in space (e.g. at the most polluted rivers) and in time (e.g. at key times of year) by authorities is thus largely compromised.

AQUIRING RELIABLE DATA THROUGH A COMMON SAMPLING PROTOCOL

Traces related to chemical pollutions of water (i.e. the remnants of the chemical releases) are often latent[3]. The acquisition of these traces requires a method that can be systematically and regularly applied; as the possibility to subsequently detect spatiotemporal patterns depends on it. Those patterns may help to understand past and present water pollutions and prevent future pollutions (Ratcliffe, 2011; Morelato et al., 2014). The acquisition method should be simple and cost-effective enough to be used at large-scale, but at the same time needs to be sensitive and representative enough to overcome the limitations highlighted in the previous section. Passive sampling – which is based on the free flow of contaminants from water to a polymer (Vrana et al., 2005) – has shown to possess the essential traits for local and global monitoring of nonpolar organic compounds in water (Lohmann et al., 2012; Lohmann et al., 2017), therefore overcoming the limitations described in the previous section:

The comparability of provided data offers a global view of micropollutant levels. Samplers can indeed be deployed at large scale at low cost, enabling a

3 In certain cases of chemical pollutions (oil spills, release of oxygen demanders,…), traces are however visible with the naked eyes (oil sheens, dead fishes,…). For such cases, a higher number of stakeholders (including for example fishermen's associations or even the population in general) could contribute to the detection of new pollution events.

sequestration of pollutants in a same matrix (polymer) followed by a centralized chemical analysis (Lohmann et al., 2017).

The pollutant accumulation in samplers allows achieving low limits of quantification. For nonpolar compounds, sampling rates (R_S) of several dozen of liters per day are achieved, enabling to reach high sensitivity over a typical sampling period (t) of 4 to 6 weeks (Smedes and Booij, 2012; Jacquet et al., 2014).

The integrative sampling provides time-weighted average (TWA) concentrations. When samplers operate in the linear phase of the uptake, they sequester pollutants from episodic pollution, improving the representativeness of results (Vrana et al., 2005).

In a first instance, a monitoring system was set up for three classes of nonpolar compounds (PCBs, PBDEs, and PAHs). For these compounds, exchanges between water and (absorption-based) passive samplers are well understood (Mills et al., 2014) and the two required compound-specific parameters - i.e. the sampler-water partition coefficient (K_{SW}) and the sampling rate (R_S) - have been determined/modeled (Booij et al., 2007; Smedes et al., 2009; Rusina et al., 2010; Smedes, 2019). In addition, performance reference compounds (PRCs) can be used to correct the impact of exposure conditions (typically water flow rate) on R_S (Booij and Smedes, 2010; Lohmann et al., 2012; Smedes and Booij, 2012). Proficiency tests are regularly organized (Booij et al., 2017) for the often-used single-phase silicone rubber (SR) samplers. The latter offer high robustness (resistance in river conditions) and a linear phase of uptake (integrative window) for most of the studied compounds (Estoppey, 2017).

Even though it is not a prerequisite (see section below), the chances of success of a systematic monitoring by passive sampling are maximized, in our opinion, when lab and field tasks are distributed as presented in Figure 1. In this process, a central laboratory (with expertise in passive sampling) manages the preparation of samplers (step 1 on *Figure 1*), loading PRCs on cleaned samplers and distributing them into jars. The ready-to-use samplers are supplied (ideally by mail) to partners around the lake (mainly environmental protection agencies) who manage the installation (step 2) and the retrieval (step 3) by following a common protocol. During the first campaign, partners have been trained by our care (in the field) to ensure that key manipulations (e.g. exposition of procedural blank to air) are done correctly. Exposed samplers are then transmitted back to the central laboratory, which carries out a Soxhlet extraction and quantifies the amount of pollutant in samplers (N_S) by gas chromatography coupled with mass spectrometry in tandem (step 4). TWA concentrations of pollutants can then be determined from N_S, R_S, K_{SW} and t.

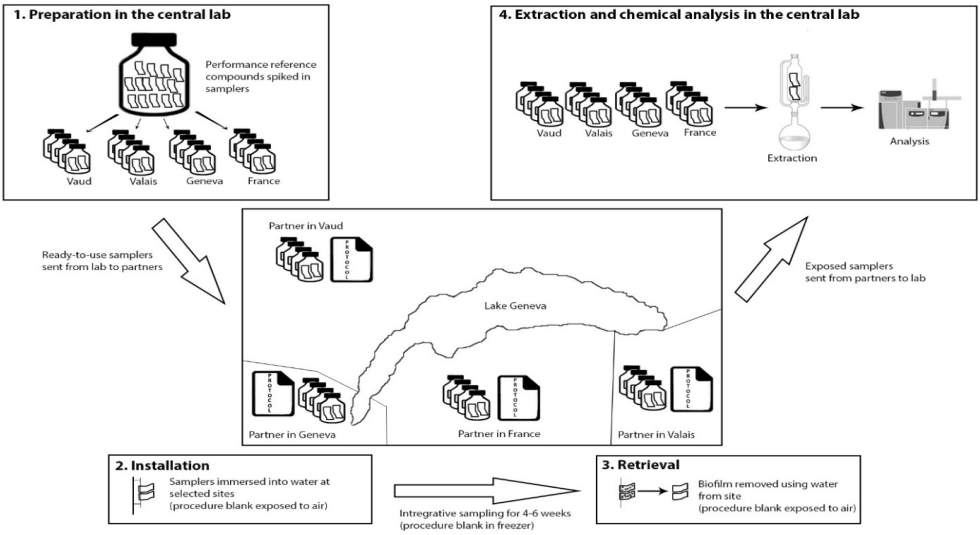


Figure 1: *Passive sampling-based monitoring of nonpolar contaminants in rivers of Lake Geneva basin.*

SELECTION OF FEATURES AND PATTERN DETECTION

As underlined by Lohmann et al. (2017), a global monitoring does not ultimately require analysis of all samplers by a single laboratory, as long as the implied laboratories provide comparable results (testable through proficiency tests). It is however essential that a selection of features is systematically measured/reported to enable subsequent comparisons among sampling sites and among sampling periods. This selection of features (often referred as 'profile' in forensic literature) should be relevant to the intelligence process objectives (Morelato et al., 2014). In this project, three features have been considered as relevant:

Aqueous concentration of pollutants (C_W), i.e. the amount of pollutants per volume of water (e.g. in pg/L). Comparing this feature among sampling sites enables the identification of the rivers with the highest risks for organisms and humans (regarding the exposure to studied pollutants). *Figure 2* shows C_W of PCBs obtained in the first campaign. The highest concentrations were measured in relatively small rivers (< 1 m^3/s during the sampling period). The same rivers are of concern for PBDEs, whereas the rivers presenting the highest C_W of PAHs are the two biggest studied rivers (> 25 m^3/s).

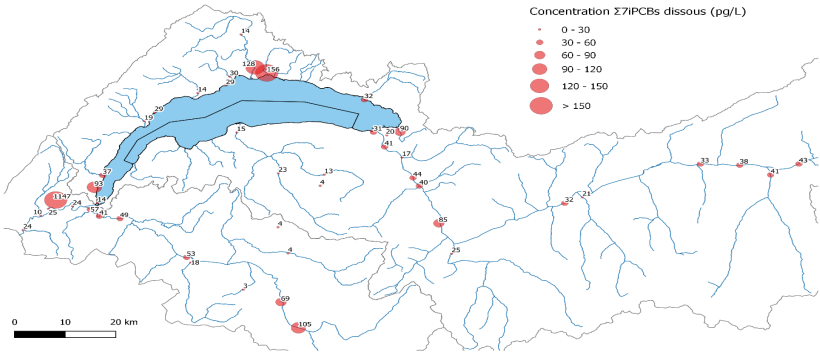


Figure 2: *Aqueous concentration of the sum of the studied PCBs (dissolved fraction) at the different studied sites (pg/L) (adapted from Estoppey et al., 2019b).*

Load of pollutants, i.e. the amount of pollutants per period of time (e.g. in mg/day). Measuring this feature requires to multiply C_W by the volumetric flow rate (e.g. in m^3/day) at each sampling site (obtained from hydrological stations or estimated from on-site measurements). Comparing this feature among lake tributaries reveals the main contributors to pollutants in the lake, whereas comparing loads among sampling sites along a single river may reveal increases due to the presence of pollution sources. *Figure 3* shows PCB loads obtained in the first campaign; the Rhône river (about 165 m^3/s at the sampling period) is the main contributor to PCBs in the lake (among studied tributaries), as it is also for PBDEs and PAHs.

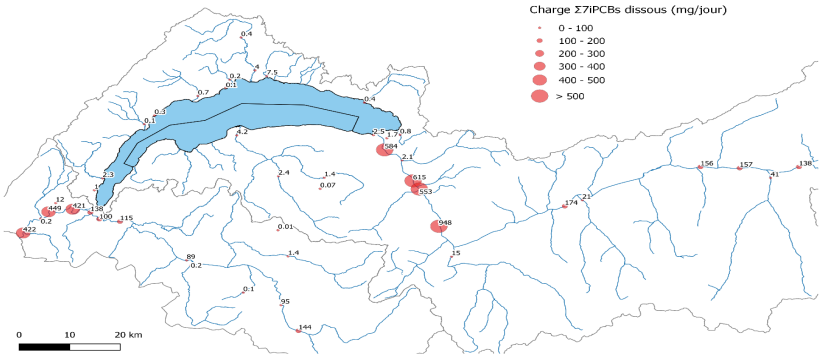


Figure 3: *Loads of the sum of the studied PCBs (dissolved fraction) at the different studied sites (adapted from Estoppey et al., 2019b).*

'Chemical signature', i.e. the proportion of compounds within a class of pollutants (e.g. in %). This feature may provide information on the kind of pollution sources affecting the rivers. *Figure 4* illustrates a few examples of PCB 'chemical signatures' observed in the first campaign. Some signatures are dominated by less hydrophobic congeners (e.g. PCBs 28 and 52 in the Venoge and Chamberonne rivers) whereas other signatures are dominated by much more hydrophobic ones (e.g. PCBs 138 and 153 in the Arve river).

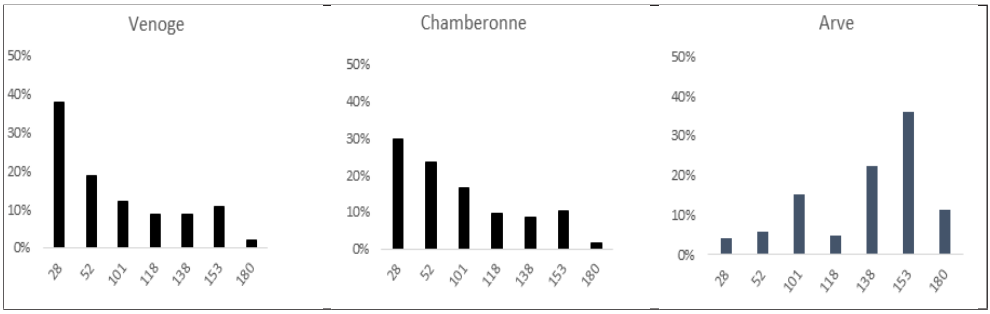


Figure 4: *Loads of the sum of the stdied PCBs (dissolved fraction) at the different studied sites (pg/L) (adapted from Estoppey et al., 2019b).*

UNDERSTANDING THE PROBLEM TO SUPPORT DECISION-MAKING

Analyzing the detected patterns leads to hypothesis generation that often requires alternative information (e.g. knowledge of partners about 'history' of the rivers and potential pollution sources or pollutant proprieties affecting their fate in the environment). Based on data provided by environmental agencies, it has been shown that a high number of industries and contaminated sites (landfills/backfills) were present along the rivers with the highest C_W and loads of pollutants. The information about past and present construction/maintenance works as well as remediation processes (occurring near some of these rivers) was provided by partners and also brought to the analysis. In addition, based on literature and information from previous investigations, the extracted 'chemical signature' was used to infer on the type of pollution sources which could mainly contribute to the pollution of certain rivers. For example, the signature obtained in the Chamberonne river was dominated by low-chlorinated PCBs and could suggest that the river is affected by releases from wastewater treatment plants or contaminated industrial sites (pollutants washed by rain). Those results are similar to the Venoge river, which also present this atypical signature (Schmid et al., 2010; Estoppey, 2017). The signature obtained in the Arve river on the other hand is dominated by more highly chlorinated PCBs, which could reflect the presence of combustion processes (Van Caneghem et al., 2014).

The resulting intelligence product should then be rapidly communicated to authorities in order to support their decision-making process (Morelato et al., 2014). It can for example help to:

- Prioritize reactive actions to prevent the highest pollutant releases to be continued/repeated. To effectively decrease the risks to which organisms and humans are exposed in rivers of the Lake Geneva basin, authorities should primarily investigate the rivers presenting the highest $C_{W,}$ based on a list of potential sources that can be provided. To reduce the inputs into the lakes, actions should be taken in the tributaries presenting the highest loads.
- Take proactive actions to prevent similar pollution types from being committed. Maintenance and constructions works are suspected to releases some of the studied pollutants into certain rivers. To prevent future pollution during such kinds of works, authorities can request more protective measures from companies. Raising industry awareness to cover potential contaminated sites can prevent pollutants to be washed by rain.

CONCLUSION

The first monitoring campaign described in this paper acts as a proof of concept. Comparable data obtained through the passive sampling-based acquisition process enables trends to be detected by using relevant extracted features. The analysis of those trends provides intelligence that can be rapidly transmitted to authorities to support them in decision-making (e.g. prioritization of reactive actions to prevent pollution to be continued/repeated or possibility to take proactive actions to prevent similar pollution types from being committed). This intelligence process is cyclical and thus subject to continuous development. The critical point is to organize all the acquired knowledge in a structured *'memory'*. Only in this way, newly integrated data can be efficiently compared to former data and allow the detection of new trends. Data provided by future campaigns are for example expected to make the detection of temporal trends which can be linked to natural (e.g. precipitations or temperature) or anthropogenic (e.g. constructions or maintenance works) parameters possible. The cycle-process thus leads to a better understanding of the water pollution problem. In addition, using a '*memory*' helps to improve the different steps of the process. In the acquisition step for example, the deployment strategy in rivers presenting high flow rates or strongly fluctuating water-levels has been improved after the first campaign.

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HOW DO I SMELL? THE POTENTIAL OF BODY ODOR IN HUMAN PERSONAL IDENTIFICATION

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Abstract: The ability of canines to discriminate among individuals lead scientists to believe, a long time ago, that every human has a unique scent. Development of physicochemical analytical techniques enabled testing and further researching these expectations. Sensitive and reliable SPME-GC/MS method allows detection and identification of volatile organic compounds comprising individual scent, whose presence in odor is constant and can, therefore, be used for personal authentication. Ongoing studies further demonstrate the efficiency of chemical sensors, such as the E-nose, in real-time personal recognition. In this paper, factors defining human scent, as well as the possibility of utilizing body odor as a novel biometric identifier, were presented. The advantages and limitations of mentioned techniques, as well as future directions for experimental studies, were also considered. Finally, the possibility of utilizing body odor in police work for locating human remains and sniffing out the wrongdoers was given.

Keywords: human scent, volatile organic compounds, SPME-GC/MS

INTRODUCTION

In practical police work dogs are used for scent detection since the beginning of the twentieth century. Beside the possibility to train dogs to find substances like explosives or narcotics, canines are being used to follow the trail of missing humans or even to find buried human remains. Today canines are used in police stations around the world to connect the smell from an object found on criminal site with one of the scented objects from the row for identification in scent line-up technique (Prada, Curran & Furton, 2015). High rates of successful canine identifications lead scientists to wonder what it is in human odor that a

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canine detects in order to match two samples of odor left by the same individual. The possibility of using the existing techniques to differentiate humans based on their odor signatures, which could then be regarded as a biometric characteristic, was therefore considered (Rodriguez-Lujan, Bailador, Sanchez-Avila, Herrero & Vidal-de-Miguel, 2013).

The first step in ascertaining the possibility of human scent as a biometric characteristic is determining the frequency of occurrence of compounds from scent across a population and possibility of acquiring human scent profiles that vary among individuals. Technology development in the last few decades brought several methods that can be utilized for this task. A solid-phase microextraction followed by gas chromatography-mass spectrometry analysis (SPME-GC/MS) proved to be adequate technique for characterization of human smell compounds. The aim of this paper is to present feasibility of this method and results obtained over the years, as well to introduce new approaches based on the electronic nose (E-nose).

BODY ODOR AND FACTORS THAT DEFINE IT

There are numerous sources that contribute to a person's odor signature. Volatile organic compounds (VOCs) released from the body result from individual's genetics, gender and age, but also skin microbiota, together with various environmental factors. All these aspects combined define the ultimate odorant mixture characteristic of an individual (Prada et al., 2015).

Human skin and scent transfer

Skin is a protective barrier of a human body responsible for its thermal regulation. It is equipped with secretion glands that aid in this function. These glands govern the production of volatile organic compounds of scent; therefore distinct odors are emitted from different body parts depending on the gland types present, as well as their concentration on the skin surface (Dormont, Bessière & Cohuet, 2013).

Eccrine sweat glands have long, thin ducts that open directly onto the skin surface. They excrete perspiration responsible for reducing the body temperature and are widely distributed over the body, but are especially concentrated in the palms of the hands, the soles of the feet and forehead. There are approximately 3-4 million eccrine glands in one person's skin which can excrete up to 3 liters of sweat per hour. Composition of eccrine sweat depends on the body region. It is a clear, acidic fluid containing up to 99% water, while remaining components include electrolytes, glycoproteins, lactic acid, sugars and amino acids.

Apocrine sweat glands have ducts that exit towards the surface via hair follicles. They are, hence, restricted to hairy body areas (mostly pubic area, armpits

and breast areola) and their activity starts at puberty. They too excrete colorless, slightly acidic fluid, which consist of water and higher concentrations of fatty acids, triglycerides, ammonia and sugars.

Sebaceous glands can primarily be found on the face and scalp but are distributed all over the skin surface, and excrete sebum via hair follicles. Sebum is a complex, yellowish, viscous fluid that contains fatty acids, triglycerides, wax esters and free sterols. Its excretion is a slow process, as approximately 0.3 mg of sebum is excreted per 10 cm^3 per hour (Rodriguez-Lujan at al., 2013; Prada et al., 2015).

Secretions of sweat and sebum glands are odorless, however metabolic activity of skin bacteria transforms them into odorous components. Human skin is inhabited by a diverse bacterial flora, including but not limited to *Corynebacterium*, *Staphylococcus*, *Propionibacterium*, *Streptococcus*, *Pseudomonas*, *Brevibacterium*, *Acinetobacter*, *Bacillus* and *Micrococcus* species (Wood & Kelly, 2010). Type and density of present bacteria are determined by numerous factors, such as anatomic location, sweat production, host's hormonal status and environmental conditions. Bacterial degradation of sweat components leads to the production of many VOCs present in human smell. For example, sulphur compounds present in human scent are metabolic products of several bacterial species, such as *Corynebacterium tuberculostearicum*, *Corynebacterium minutissimum*, *Staphylococcus epidermidis*, *Bacillus licheniformis* and *Staphylococcus haemolyticus* (Fredricks, 2001); many fatty acids, aldehydes and alcohols result from sebaceous triglycerides decomposition by the lipases produced by *Staphylococcus capitis*, *Propionibacterium*, *Corynebacterium* and other *Staphylococcus* species (Chiller, Selkin & Murakawa, 2001).

There are approximately two billion cells which make the outer layer of skin, more than 600 of which are shed per second into the environment during the natural process called desquamation. These rafts of dead skin contain one or more dead epithelial cells, skin microflora and body secretions, which all contribute to the individual's odor. Rafts are approximately 14 μm in size with mass of 0.07 μg.

Since the air around the skin is usually of lower temperature than that of a human body, thermal convection process constantly transfers body heat to the surrounding area, carrying with it the skin rafts. Lighter rafts then drift away while the heavier ones fall close to the person, leaving scent in their wake. Once transmitted into the environment, stability of human scent is dependent of various environmental conditions, such as temperature, moisture or wind (Li, 2009; Prada et al., 2015).

Body odors can be classified into three categories. Primary odor is a result of the components that are stable over time regardless of external factors. Secondary odor contains components that are present in a scent due to diet, drugs, diseases, mood swings and other internal factors. Tertiary odor is comprised of external components, such as the ones resulting from the use of perfumes and other cosmetic products (Rodriguez-Lujan at al., 2013; Prada et al., 2015).

Clearly, detection and analysis of primary odor components has been the focus of research attempting to utilize odor signature as a unique human identifier.

METHODS OF SCENT COLLECTION AND CHARACTERIZATION

For investigative purposes, human scent can be collected either directly or indirectly. Direct methods include collecting the object that has been in contact with a person whose smell is being analysed, or collecting the sample from an individual with a collecting medium such as gauze pads. Indirect methods include the use of absorber placed in contact with or in the vicinity of an object from which the scent is collected (Curran, Prada, Schoon, Almirall & Furton, 2005).

Nowadays, methods for collecting smell usually imply passive collection, or headspace absorption. One such method, designed specifically for human scent collection, utilizes the Scent Transfer Unit device (STU-100), a portable vacuum instrument which draws the air through the sterile pads, which than traps VOCs from scent. This method allows noncontact collection without contamination of the object of interest (Prada et al., 2015).

SPME-GC/MS

SPME-GC/MS is a method that has been successfully used for the extraction and characterization of volatile compounds of explosives and drugs and has, therefore, been proposed for use in the human scent VOCs analysis (Curran et al., 2005a). SPME is a simple, sensitive, solvent-free technique which allows extraction and pre-concentration of analytes from headspace of samples on adsorbent-coated fibres (Curran, Ramirez, Schoon & Furton, 2007), as well as their desorption directly into GC injectors. GC is used for separating components of the sample, while MS is used as a detector for individual analytes (Li, 2009). Many studies employed this technique over the years.

Most commonly tested body parts were armpits (Curran et al., 2005a; Curran, Rabin, Prada & Furton, 2005; Penn et al., 2007) and hands (Curran et al., 2005b, 2007; Curran, Prada & Furton, 2010), but smell had been sampled from the upper back and forearms as well (Gallagher et al., 2008). In order to minimize the presence of tertiary odor components in scent samples, various skin treatment procedures were implemented prior to the odor collection in different studies. Some protocols required participants to discontinue the use of deodorants and perfumes (Curran et al., 2005a, 2005b; Penn et al., 2007; Gallagher et al., 2008), while others urged them to use fragrance-free liquid soaps (Penn et al., 2007; Gallagher et al., 2008) several days before the odor sampling. In cases when washing of the sampling area occurred, it was done with olive oil (Curran et al., 2005b, 2007, 2010) or glycerine-based (Curran et al., 2005a) soaps and air-dried. Vol-

unteers were sometimes asked to do some exercise in order to accumulate larger amounts of sweat (Curran et al., 2005a, 2005b; Gallagher et al., 2008).

Odor samples were collected on adsorbent materials, such as cotton swabs (Kusano, 2011) or gauze pads (Curran et al., 2005a, 2005b, 2007, 2010) and stored in controlled environmental conditions before the extraction; alternatively, SPME was used to collect the VOCs directly from the headspace above the participants' skin (Gallagher et al., 2008).

Obtained profiles were analysed, present compounds identified by spectral library and their quantitative presence in samples estimated. Close to one hundred chemical compounds were detected in scent samples, including only a few families of compounds, namely carboxylic acids and derivative esters, but also aldehydes, alkanes, alcohols and ketones. Table 1 shows fifteen most often reported compounds in these studies.

Table 1: *Most often reported VOCs of human smell with references*

Compound	Reference
phenol	Curran et al., 2005a, 2005b, 2007, 2010; Penn et al., 2007; Gallagher et al., 2008; Kusano, 2011
nonanal	Curran et al., 2005a, 2005b, 2007, 2010; Gallagher et al., 2008; Kusano, 2011
decanal	Curran et al., 2005a, 2005b, 2007, 2010; Gallagher et al., 2008; Kusano, 2011
undecanal	Curran et al., 2005a, 2005b, 2007, 2010; Penn et al., 2007;
dodecane	Curran et al., 2005a, 2005b, 2007, 2010; Kusano, 2011
tetradecane	Curran et al., 2005a, 2005b, 2007, 2010; Kusano, 2011
2-furancarboxaldehyde	Curran et al., 2005a, 2005b, 2007, 2010
2-furanmethanol	Curran et al., 2005a, 2005b, 2007, 2010
hexanedioic acid, dimethyl ester	Curran et al., 2005a, 2005b, 2007, 2010
propanedioic acid, dimethyl ester	Curran et al., 2005a, 2005b, 2007, 2010
octanoic acid, methyl ester	Curran et al., 2005a, 2005b, 2007, 2010
6,10-dimethyl-5,9-undecadiene-2-one	Curran et al., 2005a, 2005b, 2007, 2010

benzyl alcohol	Curran et al., 2005a, 2007, 2010; Kusano, 2011
toluene	Curran et al., 2005a, 2005b, 2007; Kusano, 2011
octanal	Curran et al., 2005a, 2007; Gallagher et al., 2008

Obtained profiles of VOCs differ significantly among individuals. Although some studies reported a lack of significant differences in compounds detected in male and female samples (Gallagher et al., 2008), others reported the presence of 'gender-specific' signatures (Penn et al., 2007). Specifically, even though unique individual markers to discriminate the sexes were not discovered, multivariate distribution of several marker compounds was used to successfully predict volunteer's gender. Further, specific compounds were found to be present only in particular age groups (Gallagher et al., 2008).

Despite variations in smell composition on different body parts due to the presence of distinct gland types, two samples from the same individual share a considerable number of compounds and their ratio pattern is constant for one person and varies significantly from other tested subjects (Curran et al, 2005a; Gallagher et al., 2008).

Reproducibility of the results was also tested. It was noted that samples taken on different occasions show differences in component concentrations, but similarities in ratio patterns of the peaks remain constant (Curran et al, 2005b).

Only those compounds found in all scent samples of one individual are considered their primary odor components. Curran et al. (2010) tested 10 subjects, where three samples were collected from each individual during a 12 hour period. The analysis resulted in 24 compounds deemed to constitute primary odor. When correlation tests were used to determine relationships between acquired samples, individuals were correctly discriminated and identified in over 99.5% of the cases, even using high correlation threshold.

The possibility of matching person's odor profiles from a human scent database library was evaluated. Successful identification rates were inconsistent and unsatisfying even with low correlation threshold, which implies that 24 compounds determined to be primary odor components were not sufficient markers for identification when larger population was considered. This further implies that determination of human odor baseline on an individual basis is critical in determining which VOCs are significant for determining identity.

Even though SPME-GC/MS proved to be a sensitive and reliable method for detecting sweat compounds present even in small concentrations, the exact origin of individual VOCs from human odor is still unknown. Current studies were unable to determine whether discriminating potential of scent compounds lies in the relative ratio of VOCs between individuals, the presence of highly variable VOCs, or whether the coherence of both factors is required.

Therefore, the use of human scent for personal identification in large populations is currently impossible, however it demonstrates satisfying results for authentication purposes.

E-nose

Even though conventional instruments such as GC and MS allow identification of all VOCs present in smell samples, those analytical procedures are time consuming and too expensive for routine identifications (Li, 2009). The goal is, thus, to develop technology which allows their real-time efficient automated detection and classification. One such system is E-nose, a combination of sensing and classification units, which is already being successfully used for quality control of food and beverages, as well as the detection of air pollutants (Wongchoosuk, Lutz & Kerdcharoen, 2009). Since such instrument does not provide information about types of VOCs present in the sample, but a system generates data based on the change of sensors' signals when they come in contact with any volatile, it was considered as a biometric technique that could recognize odor signature for personal authentication (Iskandarani, 2010).

A number of various E-noses have been developed, some of them shown in Figure 1.



Figure 1. E-nose systems: HERACLES Neo (Alpha MOS)[2] and Cyranose (Sensigent)[3]

The sensing system represents an array of chemical sensors whose role is to acquire odor components, where each detected odorant produces a signature of characteristic pattern. Odor molecules are being detected based on their reaction with the target sensing materials on the sensor surface (Li, 2009). A number of chemical sensors have been developed, and based on their detection mechanisms, they can be classified into several categories. Most commonly used are conductivity, piezoelectric, optical fibre and spectrometry-based sensors; clearly,

2 Taken from www.alpha-mos.com
3 Taken from www.sensigent.com

each sensor type has its advantages and flaws (Korotkaya, 2003; Oyeleye, Fagbola, Babatunde & Adigun, 2012).

Pattern recognition system is designed to classify detected odorants through automated identification. It includes several approaches, statistical techniques for reducing amount of analysed data and pattern classifying algorithms such as Principal Component Analysis (PCA) or Artificial Neural Networks, which performs clustering of the acquired data into groups based on measured attributes (Korotkaya, 2003; Oyeleye et al., 2012).

Considering it is a device designed to analyze volatile components, E-nose is a gas sensor that is, like most gas sensors, sensitive to humidity. That means that if two odor samples from one person are analyzed in different humidity conditions, obtained results could differ significantly. Correction of humidity effect is therefore crucial for ensuring that sensor responds only to odor components. In their studies, Wongchoosuk at al. (2009) proposed and simultaneously used two methods for this task. The first solution was a hardware-based approach where the carrier gas was directed through water container immersed in a heath bath with controlled temperature, ensuring the constant humidity background. The second was a software-based method, where a mathematical model describing the resistance of every used gas sensor at different humidity level was developed. Model calibration ensured that humidity signal could be subtracted from the total signal.

In this study commercially available gas sensors of varying detection ranges for different types of gases were used. Utilized sensors were fabricated by deposition of a metal oxide semiconductive material on device electrodes. Catalytic reaction between gas molecules and metal oxide surface resulted in a change of resistance between the electrodes, which was then measured and converted into a signal.

Since the armpit is a body part known to have large number of glands where skin bacteria produce strong odor, it was chosen as a region of interest. Samples were taken from two male subjects twice a day for five consecutive days. During this period volunteers were forbidden to consume alcohol and engage in sexual activities, as to lessen the effects of secondary odor in scent samples. In order to test the impact of hygiene products on scent signature, subjects were instructed to use deodorant after showering on one arm only. Cotton pads were used for collecting the samples, which were then presented to E-nose for analysis.

PCA was used for pattern analysis of the smell samples, and the results showed that even though obtained signals varied among samples taken from an individual, PCA was able to successfully group the data of each volunteer regardless of the deodorant use. It was, therefore, demonstrated that each person had distinguishable odor pattern that could be used for their authentication.

A subsequent study (Wongchoosuk et al., 2011) broadened this research by testing four volunteers, without controlling their everyday activities. The applied

system was able to successfully differentiate the odor signals of individuals with 95% accuracy.

Initial studies demonstrated that E-nose represents a promising approach for authentication of individuals based on their scent. However, they were performed on a negligible number of subjects and experiments on extensive population need to be conducted.

POSSIBLE APPLICATIONS OF HUMAN IDENTIFICATION BASED ON BODY ODOR

Human scent is a trait whose composition is dependent on many factors, such as diet, medical conditions and the use of personal hygiene products. Despite challenges, scientists continue attempting to determine primary odor constituents given their promising potential in practical work. Given that presence of those components is dictated by genetic factors, as a well as accompanying microbiota that are highly diverse between individuals (Gao, Tseng, Pei & Blaser, 2007), odor profile is an individual trait that could be exploited for unambiguous personal identification. Thus, underlying factors defining body odor make intentional change of scent signature virtually impossible. Biometric sensors, such as E-nose, that could be built for discrimination among individuals based on their scent are, therefore, less likely to be circumvented, which is crucial for real-life applications.

Canines have been used for locating missing persons and identifying suspects based on their scent for decades. They are also utilized for locating human remains in various stages of decay. It is therefore only logical to assume that decomposing human body releases characteristic VOCs in the environment, and many experiments were conducted to discover them. DeGreeff and Furton (2011) collected samples from the headspace of human and animal remains, as well as from the headspace of living humans and animals with the STU-100. Utilizing the SPME-GC/MS, they detected 13 VOCs present only in human remains samples. Despite some shared compounds, complete odor profiles of living humans and human remains samples differed significantly. VOCs detected in animal and human samples differed even more. This demonstrates the promising potential of the technique for differentiation between living and deceased humans scent trails left on crime scenes, as well as for uncovering the origin of indistinguishable body parts and tissues.

For the last several years there has been a great interest in olfactory sensors development, which could be used for smelling potential threat at a distance. The idea is based on the detection of fear pheromones in human body odor. It is speculated that bodies of stressed individuals release unique compounds in the environment (Randerson, The Guardian; 2008, December 3). The identification and detection of these components could be used for devising the sensors that would

be able to sniff out the wrongdoers at the distance based on their scent alone. That could lead to the detection of people with bad intentions, terrorists, drug dealers and fugitives at strategic locations, such as control gates on airports and customs at state borders, leading to their arrest before they have a chance to act on their intentions or leave the country.

CONCLUSION

An increasing body of work in recent years has attempted to ascertain whether human scent is a sufficiently distinguishing characteristic among people and whether it can be used as a biometric characteristic for individual authentication. Analytical methods, such as SPME-GC/MS, proved to be effective tools for obtaining characteristic odor profiles, but, at the same time, too expensive and time-consuming for routine authentications. On the other hand, E-noses have shown great potential as uncostly, real-time biometric sensors, but their proficiency has yet to be demonstrated in experiments conducted on larger populations.

In order to investigate the utilization of scent as a biometric trait, the feasibility of human identification must be examined. Extensive research needs to be conducted, in order to determine the primary odor components and identify specific compounds responsible for the unique scent signatures. That would include long-term sampling of large population groups, where influence of secondary factors such as diet, medicament consummation and health conditions would need to be excluded. In addition, strict protocols would need to be developed in order to minimize the effects of varying experimental conditions.

Other than personal identification in civil applications, human body odor is an emerging biometric characteristic with respect to forensic evidence. With the use of functional detectors, scent trails left on crime scenes could be used for identifying criminals, as it is being done with fingerprints and DNA traces. Knowing which components to seek, selective E-noses could be designed to help find buried human remains. That could lead to the exclusion of dogs on site and the use of reliable devices. Finally, advances in detection of alert signals from human scent at the distance would contribute to efforts in preventing terrorist attacks worldwide.

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THE APPLICATION OF CHITOSAN-BASED MICROPOWDERS IN DEVELOPMENT OF LATENT FINGERMARKS

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Abstract: Latent fingermarks are common type of traces found at the crime scene. Therefore, their visualization and enhancement are widely used techniques in identification of offenders and accomplices by law enforcement agencies worldwide. Chemical and physical methods seemed to be reliable for that purpose and have now been used for years. Therefore, researchers focus their work in order to discover new methods for detection and visualization of latent fingermarks. In this regard, the usage of polymeric materials, especially biopolymers, has not yet been sufficiently tested, and scientific public is almost unaware of the potential of these materials in forensic science. In this paper, conjugates based on chitosan were obtained by the precipitating method and their application in detection and visualization of latent fingermarks was examined. The results demonstrated that this bio-based powder system could be potentially used as substitutes for commercially used powders in detecting and visualizing of latent fingermarks.

Keywords: Detection and Visualization of Latent Fingerprints, (Bio)polymers, Chitosan, Forensics

INTRODUCTION

Humans first spotted the presence of papillary lines several thousand years ago. The cave art was discovered in New Scotland and France with fingerprints and footprints dating as far as 15,000 years BC. **(Mozayani, Noziglia, 2006)**. During the rule of Hammurabi in the Babylon, fingermarks were used as cachet, that indicates their significance. Marcello Malpighi explained their occurance and classified them in 3 categories:

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Whorl Ridge Patterns consists of almost concentric circles. Whorl patterns have been observed to most likely possess two deltas. These patterns account for 25% of all fingerprints. Loop Ridge patterns consists of ridges which will flow in one side, re-curve (loop-around), touch or pass through an imaginary line drawn from the delta to the core, and exits the pattern on the same side from which it entered. Loop pattern shape been observed to possess only one delta. These patterns account for 70% of all fingerprints. Arch Ridge Patterns consists of ridges flowing in one site and flowing out the opposite side of the print pattern. These patterns have been observed to possess no deltas. These patterns account for 5% of all fingerprints (Maltoni, Maio, Jain, Salil, 2009).

The pioneer in person identification using fingermarks was Ivan Vučetić, together with Francis Galton, in 1891. He introduced the practice of taking all ten fingerprints, and recording and classifying criminals based on the fingerprints of the left and right hand, as well as the special classification labels for each form of papillary line form, thus forming the first dactyloscopy collection. Soon, such a method, now known as dactyloscopy, has become very important for the reliable identification of persons in the daily work of the police and judiciary (Radmilović, 2008).

FINGERMARK ANATOMY

The skin is the largest human body organ that consists of three basic layers: epidermis, a protective layer consisting mainly of dead cells; dermis, an inner layer composed of living cells: sweat (eccrine and apocrine) and sebaceous glands, root of hair, collagen and elastic fibers, with blood vessels and nerves network (Choi, McDonagh, Maynard, & Roux, 2008); and hypoderm, a subcutaneous layer and consists mainly of fatty tissue (Champod, Lennard, Margot, & Stoilovic, 2004; Page, 2017; Sato, Kang, Saga, & Sato, 1989).

The papillary lines are found in the dermal layer and they increase the exchange of oxygen, nutrients and waste materials between the dermis and the epidermis. They are formed during embryonic development, and are genetically hereditary, but also depend on external factors of the environment. Their creation actually is a stochastic process, which depends on the position of the fetus at a given moment, the composition and density of the amniotic fluid, etc. (Champod, Lennard, Margot, & Stoilovic, 2004; Fingerprint, 2019; Weyermann, Roux, & Champod, 2011).

The papillary line prints today are one of the most important evidence in the forensic practice, because these fingerprints/impressions can often be found at the crime scene. The four essential properties of the papillary lines are: immutability, individuality, classification (according to basic forms) and portability (Dactyloscopy, 2019).

However, to distinguish the prints, the most significant features are minutiae points, such are ending of papillary line, dot, island, lake, bridge, bifurcation, trifurcation, etc., representing interruptions of papillary lines, contain the information necessary for reliable identification. (Champod, Lennard, Margot, & Stoilovic, 2004; Јојић, Бабић, & Ђуровић, 2014). In general, traces in the criminalistics, and thus fingerprint marks, may be visible and latent (invisible). Visible fingermark traces are divided into positive, negative and embossed (three-dimensional). These traces are easier to work with compared to latent, especially because it misses two, maybe the most difficult steps – locating and visualizing the trace. Conventional methods daily used by law enforcement worldwide can be categorized in 3 groups-Optical, Physical and Chemical methods.

Chemical methods are based on chemical reactions between chemical compound and a fingerprint trace on various porous, semiporous and non-porous surfaces. Physical methods include physical interactions, the physical binding of certain (usually powdered) substances to certain components from the latent trace, and are generally applied to non-porous and rarely semiporous surfaces (Bumbrah, Sharma, & Jasu, 2016; Champod, Lennard, Margot, Stoilovic, 2004; Knowles, 2001; Milašinović & Koturević, 2016). Depending on the physical interaction, humidity, background contrast, various powders are used in the practical applications. The powder is applied to a latent trace sample or subject using a brush (ordinary or magnetic, depending on the type of powder used), whereby the powder particles are physically attached to the components of the sweat deposited from the fingermark, which results in the visualization (appearance) of the entire image of the left trace. Afterwards, traces of papillary lines can be fixed, excluded and analyzed in the laboratory (Bumbrah, Sharma, & Jasu, 2016; Champod, Lennard, Margot, Stoilovic, 2004; Milašinović & Koturević, 2016; Sodhi & Kaur, 2001).

Ordinary (classical) powder substances consist of polymeric resin (adhesive agent) and colored substance (contributes to the contrast). Adhesive system binds to the sweat and oily components present in the fingermark. The use of metal powders is widespread, and their basic advantage over organic powders is a longer lifetime. A large number of powdered substances contain natural or synthetic organic derivatives that show fluorescence or phosphorescence when exposed to UV or laser light. The advantage of these powders is the application on multicolored surfaces, where the problem is the contrast, and can also be used for poorly visible traces (Horswell, 2004; Pounds, Grigg, & Mongkolaussavaratana, 1990).

In addition to the fact that powder substances are very often used in everyday forensic work, they also have certain disadvantages. It often happens that, due to improper handling of the brush, irreversible destruction of the trace occurs; powder can sometimes "overfill" the prints and thus make the identification and analysis of minutiae impossible; many commercial powders are harmful and toxic, and inhalation can affect the health of the applicant/user. In order to overcome the last-mentioned disadvantage, researchers are developing new systems for the

visualization of latent traces based on the application of (bio)polymeric materials (Milašinović N., 2016).

POLYMER MATERIALS: CLASSIFICATION, FEATURES AND UTILIZATION

Polymers are organic or inorganic compounds consisting of molecules with large molecular masses (macromolecules), and by multiple repetition of constituent units (basic motifs) in the molecular chain, which are interconnected (most often) with covalent bonds. Polymers with a small number of basic motifs in which the degree of polymerization is between 2 and 20 are called oligomers (Jovanović & Đonlagić, 2004; Plavšić, 1996). According to the source they come from, polymers are divided into three groups: natural, synthetic and semi-synthetic polymers (Jovanović & Đonlagić, 2004).

Natural polymers or biopolymers produced by living organisms are divided into three basic groups: polynucleotides (DNA, RNA, etc.), polypeptides (collagen, gelatin, etc.) and polysaccharides (chitosan, alginate, dextran, xanthan gum). In addition, biopolymers are produced from renewable sources, and their most important properties are biodegradability and non-toxicity, allowing them easy decomposition by various microorganisms, while, when in contact with the human organism, show no harmful effects (Van de Velde & Kiekens, 2002). Biopolymers have various applications in the industry, but their utilization in the forensic science, more specifically in detection of latent fingermarks, has not been sufficiently explored yet. In this paper, chitosan-based conjugates were synthetized and characterized in order to achieve fine powder structure and applied in detection and visualization of latent fingermarks.

Chitosan (Ch) is a cationic heteropolysaccharide, consisting of β-(1→4)-linked units of deacetylated D-glucosamine (deacetyl units) and N-acetyl-D-glucosamine (acetylated units), and its chemical structure is shown in Figure 1 (left). It is obtained by partial deacetylation of chitin obtained from crab or shrimp shells using alkaline substances. The ratio of free amino groups, or degree of deacetylation, in commercially available chitosans is generally over 60%. According to the molecular weight, expressed in units of daltons (Da), it is divided into chitosan with small (<150 kDa), medium (150-700 kDa) and large molecular weights (700-1000 kDa) (Čalija, Milić , Krajisnik, & Racic, 2013). From a criminal-forensic aspect, the fact that chitosans of large molecular weights are not dissolved in water (Budinski-Simendić, and others, 2014) is a very important fact, since fingerprints consist of sweat, containing over 98% water. Chitosan can potentially bind (usually with the addition of some components) to the residues present in the print, such as salts, fats, organic acids, etc.

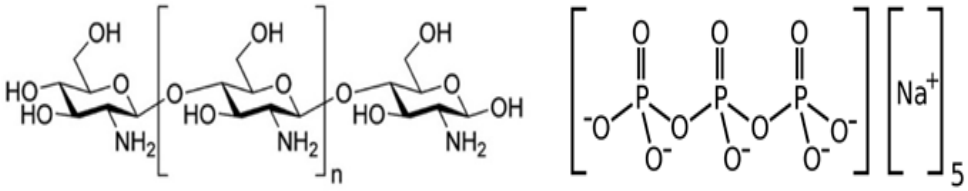


***Figure 1**. Chemical structure of Chitosan (left) and chemical structure of TPP (right)*

Sources: *Mahapatro & Singh, 2011, Sodium triphosphate, 2018*

Bearing in mind all of the above-mentioned chitosan characteristics and the ability of systems based on chitosan to bind to the sweat fingerprint residues using electrostatic and lipophilic interactions, in this paper the chitosan with medium molecular weight was used for synthesis of the conjugate. The pH value of the dissolving solution was adjusted to allow protonation of amino groups present in chitosan and to enable the potential interaction with negatively charged portions of sodium salt of the polyphosphate penta-anion (Sodium Tripolyphosphate (TPP), Figure 1 (right), but also with lipid residues present in sweat (Hejjaji, Smith, Morris, 2017 (b); Il Dueik & Morris, 2013; Il'ina & Varlamov, 2005; Morris, Castile, Smith, Adams, & Harding, 2011). In addition, the viscosity, zeta potential, size and swelling properties of the prepared conjugates may have an impact on the mucoadhesion/bioadhesion of the chitosan-TPP microparticles to a specific surface, and therefore, affect their application in the detection and development of latent fingerprints (Hejjaji, Smith, & Morris, 2017 (b); Il Dueik & Morris, 2013).

In this paper, chitosan-based conjugates were prepared by the precipitation method, using TPP as a crosslinking agent. Synthetized conjugates have shown satisfactory binding ability to the sweat and/or lipid residues present in latent fingermarks.

MATERIALS AND METHODS

Materials

Chitosan medium molecular weight (M~243kDa) was obtained from Sigma-Aldrich (Germany), and TPP from Across Organics (USA). Viscosity measurements were monitored using a Brookfield DV-E viscometer with a S00 spindle at a speed of 60 rpm. For the preparation of buffer solutions, distilled water was used. Acetate buffers of a specific pH values were prepared by dissolving sodium acetate and acetic acid in distilled water. Buffer solutions were then used to dissolve chitosan flakes and TPP powder. All components were used without any purification or treatment.

SYNTHESIS OF THE CHITOSAN-BASED CONJUGATE

In order to optimize the various parameters for conjugate synthesis, the following parameters were varied: the mass and concentration of the constituents, and the pH of the initial solutions. In brief, chitosan solutions were prepared by dissolving 0.2000 g of chitosan flakes in 100 cm^3 of acetate buffer (pH adjusted to 4.32 allowing the protonation of its amino groups (Hejjaji, Smith, & Morris, 2017 (b) which approximately corresponds to the pH of the sweat (~ 4.5)) in order to obtain 0.20 % of chitosan solution. . TPP solutions were obtained by dissolving 0.0840 g of TPP powder in 100 cm^3 of acetate buffer. In order to obtain the appropriate volume of the final solution, the experimental procedures according to the Hejjaji et al. (Hejjaji, Smith, & Morris, 2017 (b)) was modified, and the chitosan solution was added to the solution of TPP in different volume ratios: 6/1, 4/1, 1/1, 1/4 and 1/6 (first and second number correspond to the amount of Ch and TPP used). During the synthesis of the conjugates, the samples were mixed at low speeds and at room temperature using a magnetic stirrer, and the microparticles were spontaneously formed due to ionic cross-linkage of chitosan by TPP. Prepared microparticle suspensions were left in the incubator at 37 °C until complete evaporation of the solvent, and then the synthesized conjugates were powdered using pestle and mortar. The resulting powders of the conjugate were then tested on different surfaces, such as: glass (non-porous), rubber (semi-porous) and paper (porous) surface.

CHARACTERIZATION OF PREPARED CONJUGATES

UV-Vis spectrophotometry

Molar concentration of the initial chitosan and TPP solutions, as well as the concentration of the sample solution (prior to precipitation, and in different phases), were determined using the UV/Vis spectrophotometer Shimadzu UV-1800. Samples were scanned at full wavelength range (190-1100 nm) to determine absorbance and maximum absorption (λ_{max}), using acetate buffer (pH 4.32) as the initial probe solution.

FT-IR analysis

The samples of conjugate powder, in solid state, were recorded using the Bomem MB 100 FT-IR spectrophotometer. Samples of 1.5 mg were mixed and ground with 75 mg of potassium bromide and then compressed into discs at pressure of 11 t for one minute using the Graseby Specac model: 15.011. The spectra were obtained in the wavelength range from 4000 to 400 cm^{-1}, at 25 °C and with a spectral resolution of 4 cm^{-1}.

Optical microscopy

The powder samples were recorded using the Leica FS C Comparison Macroscope optical microscope, equipped with the Leica IM Matrox Meteor II modulation software. Samples were tested in dry condition, with and without backlighting. Before imaging under the microscope, latent fingerprint left on microscopic slides were enhanced using prepared sample conjugates.

DETECTION AND VISUALIZATION OF FINGERMARKS

In order to determine the functionality and possibilities of realistic, everyday use of the prepared powders, fingerprints of three donors were deposited on glass (non-porous), rubber (semi-porous) and paper (porous) surface. Following the guidelines proposed by the International Fingerprint Research Group (IFRG), "natural", oily fingerprints were deposited on the tested surfaces using a technical scale in order to simulate real conditions and to determine the pressure level on the substrate (force accommodated to 100-150 g), and the prints were then left in laboratory (humid) conditions for a period of approximately 24 hours. This period allowed the traces to dry and reduce the amount of residues until the latent fingerprints were enhanced using powder samples.

RESULTS AND DISCUSSION

The Ch/TPP conjugate formation mechanism was tested using UV/Vis spectrophotometry and FT-IR analysis, while the morphology of the particles was characterized by SEM analysis and optical microscopy. The synthesized powders are labeled as S(Ch/TPP), where "Ch" refers to the chitosan concentration, and "TPP" to the concentration of tripolyphosphate (relative to chitosan) used to prepare the desired conjugate.

The powders were tested on paper, rubber and glass surfaces. Powders were applied on deposited fingerprints over 20 times on each of the surfaces, in order to determine the possibility of their application, or the ability to achieve desired visualization results. The best results are achieved with the "oily" fingermarks, using the powder S(6/1), left on the glass and rubber surface. On a white paper surface, due to yellowish powder appearance, it was not possible to achieve a satisfactory contrast between the fingermark and the background.

Figure 2 shows fingerprints (two different donors) on the rubber (semi-porous) surface, developed with S(6/1) powder. The basic forms of papillary lines (circular) are clearly visible, a solid contrast between the papilloma trail and the intermediate space, with slightly less visible minutiae. Furthermore, there is evident powder "overfilling" of the prints, which can be a consequence of the characteristics of the surface itself (folds, protrusions and depressions). Figure 2 also

shows good adhesion of the powder to the surface, due to the fine particles appearance.



Figure 2: *Fingermarks developed on rubber surface with S(6/1)*

Figure 3 shows "oily" fingermark on glass surface developed with S(6/1). In comparison to fingermark developed on the rubber surface, it showed noticeably higher quality, and basic form of papillary lines are clearly visible (the right loop). The great contrast was achieved between papillary lines and background, and minutiae are even more obvious.



Figure 3. *Fingermarks developed on glass surface with S(6/1). Right image shows the same marks but with slightly higher magnifications*

Moreover, due to the smooth structure of the glass surface, the powders showed a very good interaction with the papillary lines, without the print "overfilling", which was observed on the fingermarks in Figure 2. The powdered sample

showed good adhesion, and therefore continuity of papilla traces compared to rubber surface.

The development of fingermarks on the paper (porous) surface did not show satisfactory results, due to which these results were not shown. Also, despite the solid results achieved by enhancing the prints on the rubber surface, the best results were achieved on a glass surface, where all the essential (identification and individual) characteristics of the prints are clearly visible.

UV/VIS SPECTROPHOTOMETRY SOLUTION ANALYSIS BEFORE AND AFTER CROSSLINKING

UV analysis was carried out in order to determine the concentration of initial chitosan and TPP solutions, as well as solutions obtained after chitosan was crosslinked by TPP. Samples labeled P1 and P2 refer to the initial chitosan and TPP solutions, while those labeled P3 and P4 refer to synthetic conjugates, i.e. samples S(1/1) and S(6/1), respectively. All samples were analyzed in triplicate and the mean values of their spectra are shown in Figure 4.

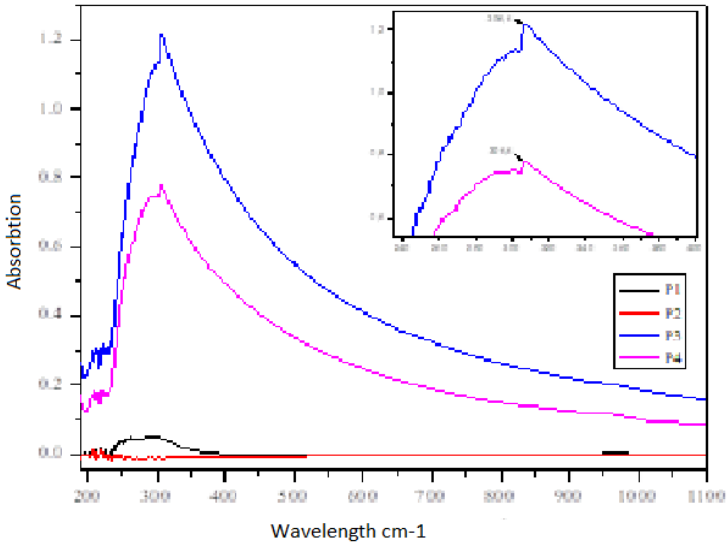


Figure 4: *UV spectra of solution samples: P1- initial solution of chitosan; P2- initial solution of TPP; P3- solution of S(1/1) and P4- solution of S(6/1)*

Samples P3 and P4 coincide at a peak position of 306.6 cm^{-1}, which may refer to chitosan crosslinked by TPP and derivation of the conjugate. At the same peak value (306.6 cm^{-1}), a decrease in the absorbance value from 1.221 (P3) to 0.778 (P4) may be the result of a larger chitosan crosslinking in the sample S(6/1) (P4). S(1/1) was used as the reference sample.

FT-IR ANALYSIS

The FT-IR analysis was carried out with the aim at confirming the formation of the conjugate, in the course of ionotropic gelation. Figure 5shows the spectra of pure TPP and samples S(1/1) and S(6/1). In the spectrum of a pure TPP (Figure 5, spectrum 1), characteristic peak at 1215 cm^{-1} is observed, indicating the stretching of P=O bonds (Dudhani & Kosaraju, 2010). The peak at 1145 cm^{-1} could be due to the symmetric and asymmetric stretching of the PO_2 group, while the peak at 1093 cm^{-1} could indicate the symmetric and asymmetric stretching of PO_3 groups. Peak at 903 cm^{-1}, may be associated with asymmetric stretching of P-O-P bonds (Hejjaji, Smith, & Morris, 2017 (a)).

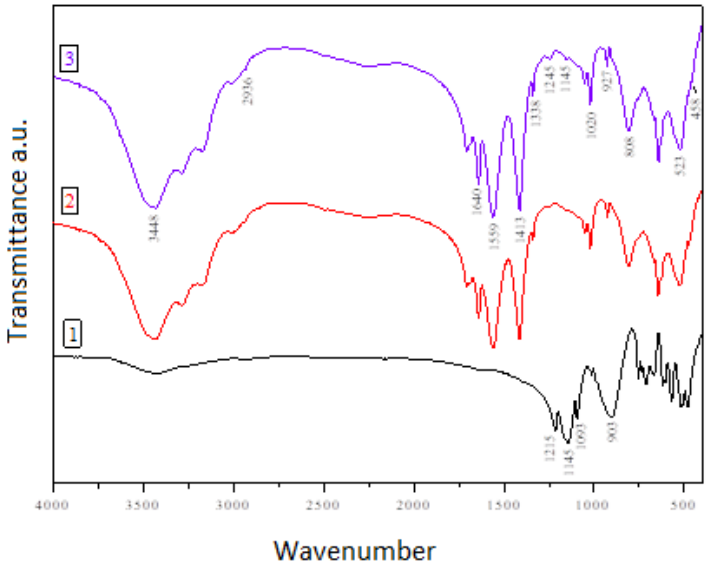


Figure 5: *FT-IR spectrum 1) pure TPP; 2) U (1/1); 3) U (6/1)*

On both spectra samples (Figure 5, spectra 2 and 3), a characteristic strong and wide absorption peak at 3448 cm^{-1} might indicate the overlapping stretching and bending of -OH and $-NH_2$ groups (Milašinović, Čalija, Vidović, Crevar Sakač, Vujić & Knežević-Jugović, 2016). The appearance of the peak at 1640 cm^{-1} could be the result of antisymmetric deformation vibrations of the NH_3^+ group of chitosan (Žalnėravičius, Paškevičius, Mažeika, & Jagminas, 2018), while the peak at 1559 cm^{-1} indicates the deformation of the N-H bond (amide band II in chitosan) (Hejjaji, Smith, & Morris, 2017 (a)). The peak at 1338 cm^{-1} could be associated with deformation of the O-H bond at -CH-OH (Wang & Liu, 2014), while the appearance of the absorption peak at 1145 cm^{-1} could be due to the swinging of NH_3^+ (Roddick- Lanzilotta, Connor, McQuillan, 1998).

OPTICAL MICROSCOPY

The structure of powdered samples

Figure 8 shows the images of prepared powdered samples, taken by Leica IM1000 microscope, equipped with the Matrox Meteor II modulation software, using magnification ×75 and various contrast techniques (backlighting). Since the best results were achieved on a non-porous (glass) surface, the same was used for further research. Powdered samples were deposited on microscopic slides in the form of a gossamer (thinner) and coarse (thicker) layer, in order to compare the uniformity of the particles. By comparing the thin layers of the powdered samples (Figure 6, labels I and II), it is evident that the sample S(6/1) possesses uniform and small diameter particles which were easy to apply and do not stick to the microscope slides (dry and clean), while at the same time were more easily triturated during the preparation. In the case of the powdered samples deposited in the thick layer, the above characteristics are even more apparent (Figures 6, III and IV). The dark-field and bright-field techniques were used to achieve the best possible contrast between samples and backgrounds, which empowered the most small-scaled particles to be spotted.

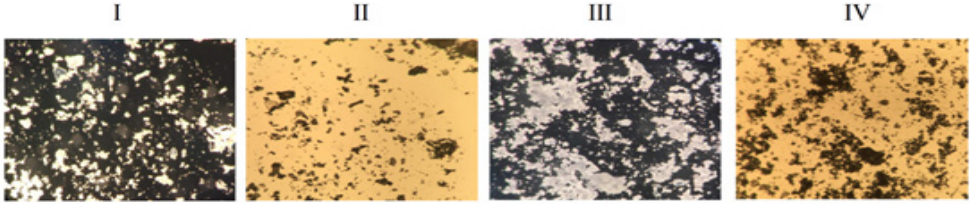


Figure 6: *Microscopic images of powdered samples applied on microscopic slides (magnification ×75); I and III represent images taken in dark-field technique; II and IV represent images taken in bright-field technique contrast.*

TESTING OF THE POWDERED SAMPLES

In order to determine the possibility of application and usability of synthetized powder, following the procedures proposed by the International Fingerprint Research Group, fingerprints were deposited on microscopic slides using a technical scale (force applied to accommodate 100-150 g) and left for a few minutes. After this period, the fingermarks were separated into halves using a thin glass barrier, and then two different powdered samples were used for their visualization, the sample S(6/1) was applied on the left and S(1/1) on the right barrier side, as a reference sample. Then, fingermarks were taken using an optical microscope, with dark-field technique (Figure 7, a)) and light-field (Figure 7, b)), with the ×15 magnification. For practical reasons only selected results were shown.

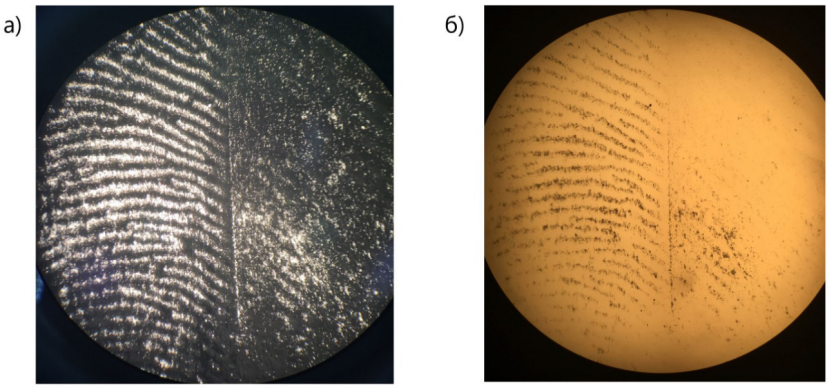


Figure 7: *Fingermarks visualized with S(6/1) (left side of both images) and S(1/1) (the right side of both images), recorded using optical microscope (magnification ×15) with dark-field (a)) and bright-field (b)) techniques.*

It is evident that the powder sample S(6/1) showed better adhesion to the fingerprint residues, making visible papillary lines (and minutiae), with excellent contrast between the papilla and the background (Figure 7, a)). On the other hand, with the application of the powdered sample S(1/1) it was evident that no good interaction with of the powder to the fingerprint residues was achieved.

CONCLUSION

In this paper work, chitosan-based conjugates obtained by the precipitating methods and further ionotropic crosslinking using sodium tripolyphosphate as the crosslinking agent were prepared and characterized, and the possibility of these conjugates' application for the detection and enhancement of latent fingerprint traces was examined. Based on the achieved results prepared samples were small and uniform in size, possess good adhesion properties to the sweat residues left on non-porous and semi-porous surfaces, were easy to handle and had good potential to be applied as substitutes for commercially used powders in forensic science fingerprint enhancement applications.

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BRAY-LIEBHAFSKY OSCILLATORY REACTION AS AN EASY AVAILABLE ANALYTICAL TECHNIQUE FOR DETERMINATION OF RESORCINOL CONCENTRATION

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Abstract: The Bray-Liebhafsky (BL) reaction is the oldest known oscillatory reaction. It consists only of three reactants: potassium iodate (KIO_3), sulfuric acid (H_2SO_4) and hydrogen-peroxide (H_2O_2) which provides its easy available chemical system. In this work, the resorcinol (1,3-benzenediol) effects on BL reaction dynamics, as well as its unknown concentration determination is investigated. The addition of different resorcinol concentration after fifth oscillation affects the appearance of the sixth oscillation. Consequently, the time between fifth and sixth oscillations vs. resorcinol concentration can be successfully used for analytical curve construction, and further unknown resorcinol concentration determination. This work is an attempt to introduced oscillatory BL reaction for the analytical purpose; so far another oscillatory reaction known as Briggs-Rauscher reaction has been successfully used for these purposes. Regarding very small quantity and resorcinol concentration ($6.634 - 10^{-5}$ mol/dm^3) which could be detected in BL oscillatory reaction, results obtained can play important role in the forensic analysis (especially for gunshot residual or illegal drugs analysis).

Keywords: Bray-Liebhafsky reaction, oscillatory reaction, resorcinol, analytical technique, gunshot residue, illegal drugs

INTRODUCTION

Resorcinol is a white organic crystal with a characteristic aromatic odor. Its structure consists of an aromatic ring with two hydroxyl groups in meta-position (Fig. 1). Because of the position of two hydroxyl groups, resorcinol has high reactivity which is responsible for its wide application.

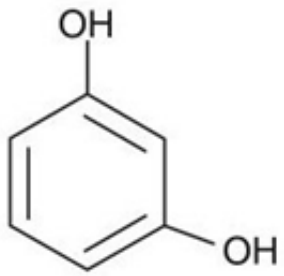


Figure 1. *Structure of resorcinol*

Resorcinol is primarily used by the rubber industry (Krishan, Venkatesan & Adhinarayanan 2004), as well as in high-quality wood bonding (Gardner 2008). It is also used as an effective chemical intermediate in the production of organic compounds, dyes, in pharmaceutical formulations and as UV absorber in resins (Durairaj 2005). Resorcinol has an important role for medical purposes as an antiseptic and in the treatments of various skin disease (Hampil 1928). The resorcinol with the role of stabilizer is the leading component of Gunshot Residue (GSR) (Benito, Abrego, Sanchez, Unceta, Goicolea & Barrio 2015). GSR analysis answers the bunch of questions on was the weapon used in the criminal act, providing some of the crucial evidence. Additionally, the resorcinol can be an active ingredient (or derivate) some of the most commonly used illegal drugs. (Thorton & Nakamura 1972) It is also established that cannabidiol, an active ingredient in cannabis (one of the commonly used illegal drugs), is resorcinol derivate (Thorton & Nakamura 1972). The concentration of resorcinol and its compounds varies depending on the application, therefore techniques for accurate concentration determination is of great significance.

Bray-Liebhafsky (BL) oscillatory reaction is hydrogen peroxide decomposition reaction catalyzed by iodate and iodine in acidic solutions (Bray & Liebhafsky 1931) in which hydrogen peroxide decomposes on oxygen and water (1). During Bray-Liebhafsky oscillatory reaction, the concentration of reactants and products change stepwise, whereas intermediates experience oscillations of concentration in time. Even though BL reaction is one of the oldest known oscillatory reaction, its detailed mechanism is still unknown. Hydrogen peroxide can reduce iodate to iodine in reaction (2) and oxidize iodine to iodate in reaction (3).

$$2H_2O_2 \xrightarrow{[H^+, IO^{3-}]} 2H_2O + O_2 \quad (1)$$

$$2IO_3^- + 2H^+ + 5H_2O_2 \rightarrow I_2 + 5O_2 + 6H_2O_2 \quad (2)$$

$$I_2 + 5H_2O_2 \rightarrow 2IO_3^- + 2H^+ + 4H_2O \quad (3)$$

Bray-Liebhafsky reaction, similar to Briggs-Rauscher oscillatory reactions (Briggs & Rauscher 1973), is very sensitive to the concentration of added additives (Pejić, Anić & Kolar-Anić 2012). Since Briggs-Rauscher reaction is already studied as a test for analytical measurements of resorcinol (1,3-dihydroxybenzene) concentration (Cervellati, Höner, Furrow, Neddens & Costa 2001), the possibility of BL system for determination of resorcinol concentration is the main topic of this work. Regarding resorcinol widespread presence especially in GSR and illegal drugs, this work could have significant importance in forensic science analysis in general.

MAIN PART

Experimental part

The dynamic states of the BL reaction were recorder potentiometrically, using Pt electrode as a working electrode, and a double junction Ag/AgCl electrode, as a reference. The reaction was carried out in a closed well-stirred system, with a magnetic stirrer at the stirring speed of 900 rpm. The system was thermostated at 62.0 °C and the circulating water bath was used to maintain the temperature of the reaction. The experimental setup is represented in Fig. 2

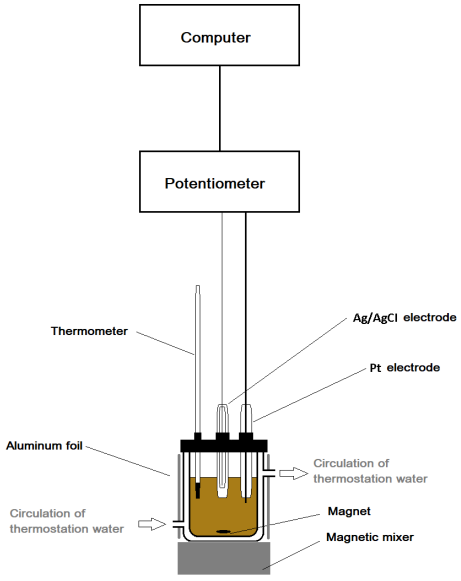


Figure 2. *Scheme of the experimental setup*

The total volume of the reaction cell was 25 ml. The reagents of the BL reaction (sulfuric acid, potassium iodate, and hydrogen peroxide) were prepared using de-

ionized water. Initial concentrations of the solutions were $[H_2SO_4]_0$= 0.048 mol/dm^3, $[KIO_3]_0$= 0.072 mol/dm^3 and $[H_2O_2]_0$= 0.460 mol/dm^3. The hydrogen-peroxide was injected last in the system after temperature and Pt-potential were stabilized. This moment is taken as the beginning of the BL reaction and labeled as the zero point of the *x*-axis. Resorcinol was added after the fifth oscillation, and the following concentrations were tested 0.0159 mol/dm^3, 0.0478 mol/dm^3, 0.0796 mol/dm^3 and 0.1592 mol/dm^3. The injected volume of tested substance was the same in every experiment (100 μl).

Results and discussion

Experimentally obtained effects of the different resorcinol concentrations on the oscillatory evolution of the BL reaction, along with the basic oscillogram to compare, are shown in Fig. 3.

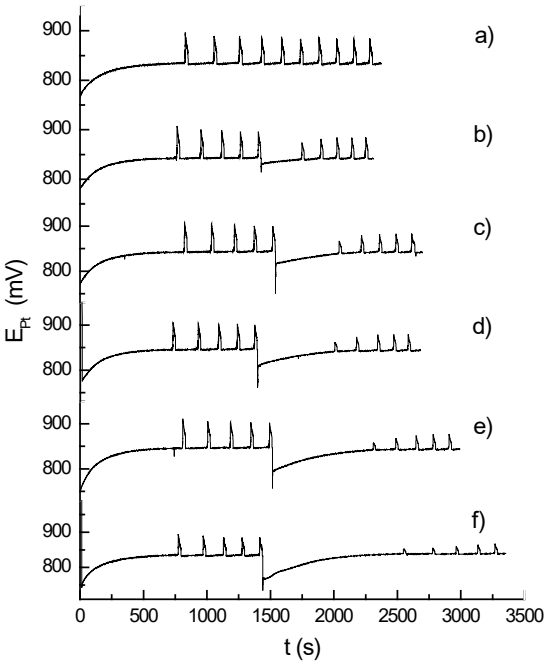


Figure 3. *BL oscillograms obtained by the Pt electrode: a) basic BL oscillogram without the addition of resorcinol; oscillograms obtained with the addition of resorcinol: b) 0.0159 mol/dm^3; c) 0.0478 mol/dm^3 ; d) 0.0796 mol/dm^3 ; e) 0.1114 mol/dm^3 ; f) 0.1592 mol/dm^3*

In all experiments only first ten oscillations were recorded, in order to compare BL oscillograms before and after the addition of resorcinol. It can be seen from Fig. 3 that all of six particular experiments had the same induction period (750 s), in the range of error (± 120 s). Different concentrations of resorcinol were added at the root of the fifth oscillation observed by the initial decline of the Pt-potential. As evidenced on Fig. 3, even the addition of small concentration of resorcinol (100 μl of 0.0159 mol/dm^3 added in 25 ml reaction system) caused the widening of the inter-oscillatory period between the fifth and sixth oscillation ($\tau_{\_5.6}$) and decrease of the first amplitude after the resorcinol addition (sixth amplitude). By increasing the concentration of added resorcinol, the gap between fifth and sixth oscillation becomes wider. The duration of the inter-oscillatory period between the fifth and sixth oscillation shows a linear dependence of the added concentration of resorcinol (Fig. 4). Therefore, the obtained linear dependence ($\tau\_5.6=5500\cdot c_{\_resorcinol}+250$) can be used to determinate the unknown concentration of resorcinol.

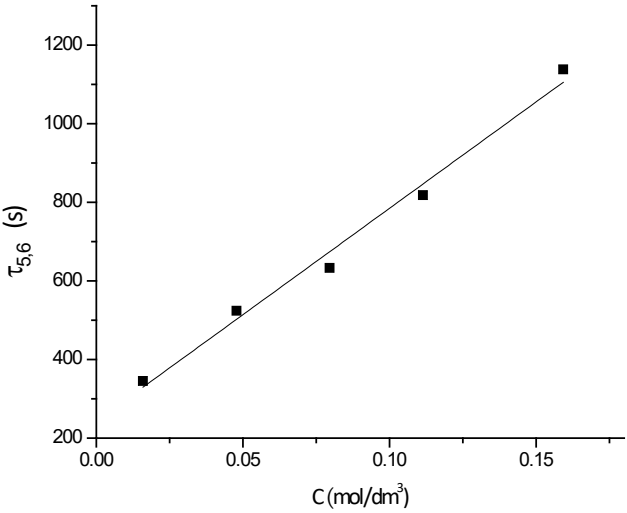


Figure 4. *Dependence of an inter-oscillatory period between the fifth and sixth oscillation on the added concentration of resorcinol*

Regarding very small quantity and resorcinol concentration (100 μl of 0.0159 mol/dm^3) which could be detected in BL oscillatory reaction, results obtained can play important role in the forensic analysis (especially for previously mentioned GSR or illegal drugs analysis). Namely, the addition of 100 μl aliquot of 0.0159 mol/dm^3 resorcinol means the resorcinol concentration of 6.634×10^{-5} mol/dm^3 in 25 ml reaction system. It is evident that such small resorcinol concentration does not affect the concentration of reactants (order of magnitude 10^{-2} mol/dm^3

or higher) in direct resorcinol-reactant chemical reactions and on that way effect BL oscillatory dynamics. Thus, obtained effects of resorcinol addition in BL reaction can only be a consequence of:

i) resorcinol reaction (or reactions) with some key intermediate in BL reaction

ii) resorcinol reaction(s) with reactant(s) producing further BL "active" organic compound(s).

iii) both i) and ii)

Thus, the presumed mechanism of resorcinol effects on the oscillating BL reaction is primarily due to the oxidation of benzene hydroxyl groups (Fig. 5) or iodination of the benzene ring (Fig. 6). The oxidation process of phenols starts with two releases of protons from the hydroxyl group leading to the formation of semiquinone radical anion (Vollhardt & Schore 2003). This mechanism is presented in Fig.5.

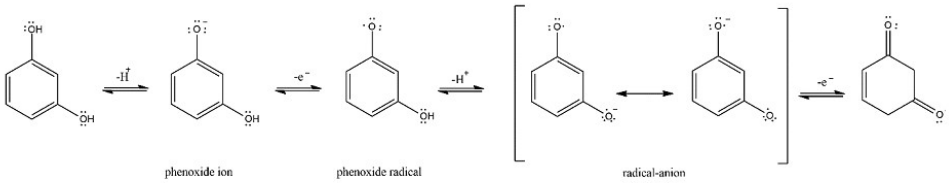


Figure 5. *Mechanism of the oxidation process of phenols*

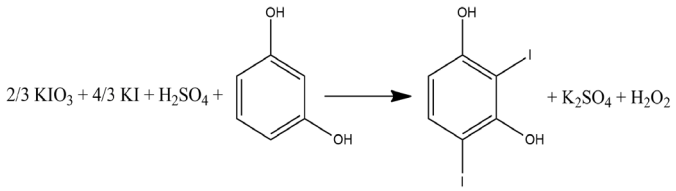


Figure 6. *The iodination reaction of the benzene ring*

As previously known, semiquinones are very unstable and highly reactive substances, especially with oxygen molecular forms. (Munday 2004). As it is assumed, an oxidative form of resorcinol can react with intermediate(s) formed in BL reaction and accordingly be responsible for obtained behavior. On the other hand, it is well-known the application of the $KIO_3/KI/H^+$ system for iodination of the resorcinol (Frederick 1976), producing in rapid reactions two products,

2,4-diiodoresorcinol (Fig. 6) and 2,4,6-triiodoresorcinol. These organic products can be further active and react with BL intermediates generating obtained effects in BL system.

With this acknowledgment and in line with what's stated above, it can be presumed that cannabis (active component cannabidiol) and other organic derivates of resorcinol would potentially have a similar mechanism of reaction in BL system as the pure resorcinol. In support of this assumption is that one of the usually used tests for detection of cannabis - Duquenois-Levin test (Kelly, Addanki & Bagasra 2012) gives false-positive results in the presence of resorcinol due to the similar mechanism of resorcinol and cannabidiol action. Consequently, here proposed BL technique could also be potentially used for the determination of cannabidiol concentration, as an active ingredient of cannabis. To investigate the usage of the proposed technique for the determination of cannabis requires further examinations and it will be conducted in the future.

CONCLUSION

In this work, the Bray-Liebhafsky oscillatory reaction, as an easily available analytical system is used for determination of resorcinol concentration. The different resorcinol concentrations were added after the fifth oscillations and the time between fifth and sixth oscillation were measured. The duration of the inter-oscillatory period shows a linear dependence of the added concentration of resorcinol and the obtained linear dependence can be satisfactorily used for determination of unknown resorcinol concentration. This linear dependence could potentially indicate the new, certain and easy technique for organic GSR analysis for resorcinol as a common stabilizer and possibly other organic compounds that can be found in smokeless powders. The potential mechanisms of resorcinol acting in BL system were also proposed. The similar structure of resorcinol and cannabidiol, and thus their oxidation process, leads to the belief that these two compounds have a similar mechanism of action in the BL system. The proposed BL technique could also be potentially used in the determination of cannabidiol concentration, as an active ingredient of illegal drug - cannabis. To investigate the usage of the proposed technique for determination of cannabis requires further examinations and will be conducted in the future. However, results obtained in this work indicate that Bray-Liebhafsky oscillatory reaction as an easy available chemical system for detection of resorcinol could have significant importance in forensic science analysis in general.

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VISUALIZATIONAND RISK ESTIMATION OF HARMFUL SUBSTANCES LEAKAGE BASED ON ALOHA CODE

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Abstract: Air pollution caused by leakage of dangerous chemicals is a serious threat to the living world and the environment. Predicting the consequences of pollution by mathematical simulation of leakage has become an important method in the field of environmental protection. In this study, two registered accidents of leakage of chemicals on the territory of the Republic of Serbia were analysed, the leakage of hydrochloric acid and the leakage of ammonia. The areal location of hazardous atmospheres (ALOHA) model was selected together with accurate data on geographic location and meteorological conditions for simulation and evaluation of the effects of harmful evaporation on the environment, Additional analyzes of the same accidents were performed for different meteorological conditions and a comparison of the results was done.The simulation confirmed that the extent of the pollution largely depended on the type of chemical pollutantsand then on their release in given meteorological and geographical conditions.

Keywords: Chemical accidents, ALOHA, Risk analysis, Health risk, Serbia

INTRODUCTION

Industrial development of a country implies the construction of factories and facilities, modernization and introduction of new technological processes, transportation and storage of chemicals for the needs of various industrial branches. During all these processes, various chemical accidents often occur, and then the living world becomes the victim of the release of dangerous substances into the environment. Some of the most important goals of the sustainable development

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concept are to prevent or reduce the release of toxic chemicals into the atmosphere, to quickly anticipate and remedy the consequences of an accident.

The air quality assessment by determining the concentration of harmful substances plays an important role in environmental protection. Various methods are used for this purpose such as direct measuring using fixed or mobile measuring stationsor air pollution mathematical modeling based on dispersion models or usage of biomonitoring for pollution determination in particular part of an area.

The significance of mathematical modeling is to help predict and reduce threats and consequences from possible hazards and provide time for preparatory activities before rescue. Assessing the consequences of risks such as the release of hazardous chemicals into the environment is one of the most important activities for increasing the level of safety at the design stage or activity of industries (Beheshti et al., 2018).

The Areal Locations of Hazardous Atmospheres model (ALOHA software, 2016) was selected to simulate two real cases of leakage of toxic chemical, ammonia and hydrochloric acid. Simulation results by ALOHA code are widely used for modeling dispersion of air pollution (Jacimovski et al., 2018). They can also be the basic for relevant effects analysis and pollution risk assessments (Tseng et al., 2012, Salam, 2013).

Ammonia and hydrochloric acid are chemical compounds that are often used in technological processes of various industries. A large amount of ammonia produced is spent on the production of artificial fertilizers, ammonium nitrate and nitric acid. Other quantities are used in the chemical and textile industry, as well as in food industry for food freezing. A lot of hydrochloric acid is used for cleaning, polishing and etching of metals, in the chemical industry for obtaining different inorganic and organic chloride compounds, in the paint and food industry or for the production of aluminum oxide by acidic process (Harvey, 2003).

At ordinary temperatures, ammonia is a colorless gas of a sharp, characteristic odor that is the first warning sign of possible exposure to this gas. Liquid ammonia is a 10-33% solution of ammonia gas. The risks and consequences of exposure to ammonia depending on concentrations are as follows:

400 ppm (278 mg / m^3) = instant throat irritation; 700 ppm (487 mg / m^3) = eye irritation; 1700 ppm (1182 mg / m^3) = coughing,2500-6500 ppm (1738-4519 mg / m^3) = life-threatening after 30 minutes and 5000-10000 ppm (3476-6953 mg / m^3) = death ("HIP-AZOTARA"d.o.o. Pančevo, Safety Data Sheet – Ammonia, 2016).

Diluted hydrochloric acid (mass fraction up to about 25%) is classified as an irritant. Concentrated acids to a theoretical maximum of ~ 40 % are classified as a corrosive substance. The severity of the damage depends on the acid concentration in the solution and duration of exposure. Vapor or dispersed concentrated acid liquid can cause irritation of the nasal cavity, throat pain, choking, coughing and difficulty in breathing (50-100 ppm). Exposure to high concentrations (e.g., 1000-2000 ppm), in duration of even just a few minutes, can cause lung water accumulation (edema of the lungs). Symptoms of edema of the lungs, such as

breathlessness, may last for several hours after exposure (RollingCo, Safety Data Sheet – Hydrochloric acid 31-33%, 2015).

PREDICTION OF THE DISPERSION

An air dispersion model (ALOHA software, 2016) was developed by the Environmental Protection Agency (EPA). The ALOHA model was built upon the Gaussian dispersion model of continuous air pollution flumes to predict how gases that are about as buoyant as air will disperse in the atmosphere (Thoman et al., 2006; Tseng et al., 2012). This program code is suitable for dispersion simulation for over 900 chemicals and especially suitable for the simulation of accidental release of hazardous substances.

The basic form of the Gaussian plume model (Hanna et al., 1982) is given as Eq.1:

$$C = \frac{Q}{2\pi\sigma_y\sigma_z u} e^{-\frac{y^2}{2\sigma_y{}^2}} \left[e^{\frac{-(z-h)^2}{2\sigma_z{}^2}} + e^{\frac{-(z+h)^2}{2\sigma_z{}^2}} \right] \quad (1)$$

where C is atmospheric concentration (mg/m^3) for chemical releases, Q is the source release rate (usually expressed in mg/s for chemicals), h is the effective release height (relative to the ground, in m), y is crosswind distance relative to plume centerline, in m), z is vertical axis distance relative to the ground, in m), u is the average wind speed and $ó_y$, $ó_z$ are horizontal and vertical dispersion coefficients representing the standard deviations of the pollutants concentration distribution in the crosswind axis direction and in the vertical axis direction (in m), respectively. According to the classification scheme developed by Pasquill and Gifford, each $ó_y$ or $ó_z$ curve represents a different atmospheric stability condition. Different classes of atmospheric stability range from very unstable conditions (A) to very stable conditions (F) and they are shown, along with the parameters for the $ó_y$ and $ó_z$ calculation, in Table 1 (Zannetti, 1990, Thoman et al., 2006, Lazaridis, 2011, Lazareviж, 2012, Salam, 2013).

Table1 *Parameters for óy and óz determination*

		A	a	B	b
Highly unstable	A	0.527	0.865	0.28	0.90
Unstable	B	0.371	0.866	0.23	0.85
Mildly unstable	C	0.209	0.897	0.22	0.80
		A	a	B	b
Neutral	D	0.128	0.905	0.20	0.76
Stable	E	0.098	0.902	0.15	0.73
Highly stable	F	0.065	0.902	0.15	0.67

In order for the ALOHA model to be applied, it was necessary to determine the following parameters: the location of the emission source (latitude, longitude and elevation), the atmospheric conditions (ambient air temperature, relative humidity, wind speed and direction and cloudiness of the sky) and the source parameters description (the source height, emmisions flow rate and temperature).

RESULTS AND DISCUSSION

Two cases of hazardous chemical leakage documented in the records of the Ministry of Internal Affairs of the Republic of Serbia, have been chosen for analysis. Simulation was performed using the ALOHA model to obtain the threat zones of toxic materials dispersion.

The first case analyzed pertains to hydrochloric acid leak in January 2009 in Belgrade. The second case occurred in August 2010 in PadinskaSkela, when a large amount of ammonia was released.

In addition to the analysis of cases in the real environment conditions in which they occurred, the effects of pollution in completely opposite weather conditions were simulated and analyzed.The aim was to determine the conditions under which the worst-case scenario would occur.

The threat zones will be shown in diagrams as a result of the simulation in the ALOHA software and will vary in color depending on the degree of threat to the environment.

All zones marked in red represent areas where the population may have serious health consequences due to pollution. The zones marked in orange are potentially highly hazardous to the lives of those people belonging to sensitive categories, such as children, elderly people, patients with chronic pulmonary disease, pregnant women, etc. The population inside the yellow zone would likely not have had serious consequences on health.

Analysis of leakage of hydrochloric acid (Case 1) Case 1, Scenario 1

On January 28, 2009 around 3 p.m., on the premises of BIP (*Belgrade Industry of Beer*), there was a leakage of an overhead tank in which there was about 25 tons of hydrochloric acid (HCl). The exact location where this happened is 44°47'46" of northern latitude and 20°27'07" of eastern longitude. Belgrade is at 132 m of altitude.

The weather data required for the simulation were obtained from the annual report of the Republic Hydrometeorological Service of Serbia for the year 2009 and given in Table 2 (RHMZ, 2009).

Table 2 *Configurations of the release scenario*

Parameters	Winter conditions
Temperature	3.6°C (2 p.m.)
Wind direction	west-northwest
Wind speed	4.4 m/s
Humidity	50%
Cloudiness	10/10
Atmospheric stability level	D

According to the possibilities offered by the software, the source of pollution was chosen to be represented by the puddle of liquid.The mass and diameter of the puddle were 25t and 40 m respectively. The total amount of released pollutants in the atmosphere (hydrogen chloride, in this case) was 217 kg.The maximum average evaporation rate of the hazardous gas in these meteorological conditions was 4.07 kg / min. The release time of the pollutant is limited to 60 minutes.

The source strength slowly declines with time as can be seen in Fig.1.

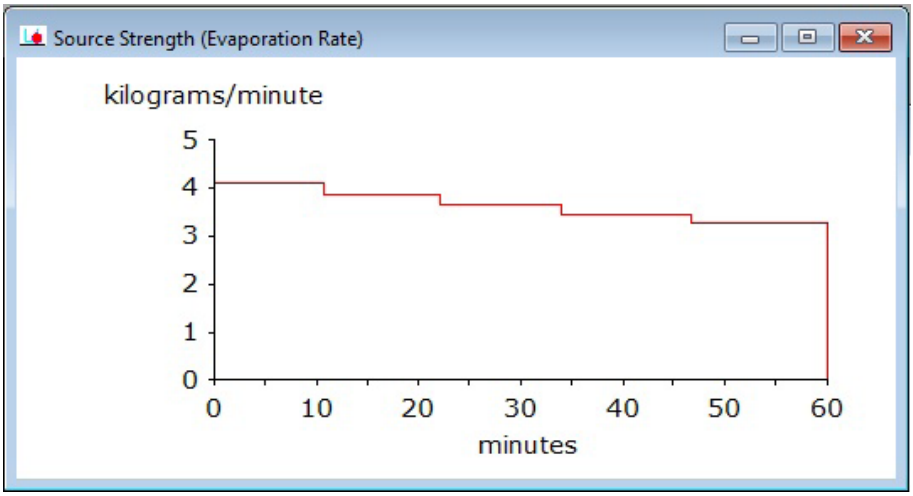


Figure 1. *Source strength in time function (case 1, scenario 1)*

According to the results of the simulation, it can be said that the concentration of the pollutant was relatively low. Maximal value of pollutants concentration in given conditions was 4.412 ppm or 0.44%. Based on the specified pollution threshold values of 100 ppm (0.01%) for the red zone, 22 ppm (0.0022%) for the orange and 1.8 ppm (0.00018%) for the yellow zone, it was calculated that the red zone (zone of the highest risk) covers 23 m from the source, the orange zone covers 53 m, while the furthest point of the yellow zone is 384 m from the source (Fig. 2).

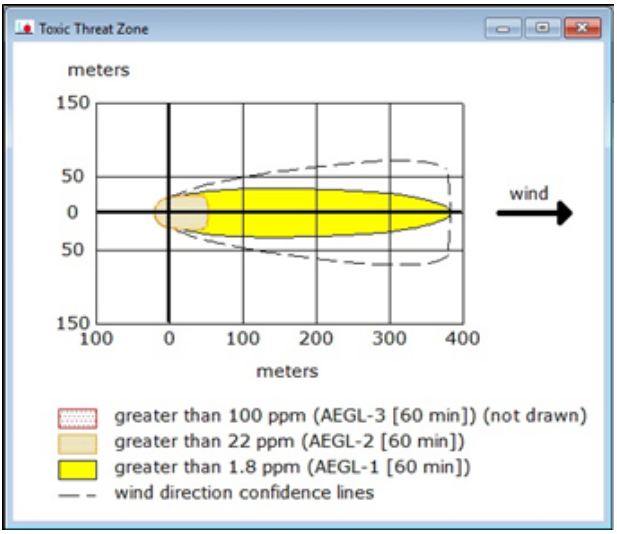


Figure 2. *Diagram of threat population (case 1, scenario 1)*

The red zone is not shown in this diagram, since the Gauss model does not provide reliable results of dispersion for such a short distance. Significant concentrations of pollutants are recorded at distances up to 400 m in the direction of the wind and the width of the accident zone is slightly greater than 50 m. Therefore, the danger zone is about 0.02 km^2 (2000 m^2), which is an area that is barely larger than the area covered by the puddle. In Fig.3 the geographical location of the threat zone with the limits of the orange and yellow zones is shown.



Figure 3. *Image of geographical location of the threat zone (case 1, scenario 1)*

Case 1, Scenario 2

An imagined scenario of the same chemical accident (leakage of 25 t of hydrochloric acid) in summer weather conditions on July 23, 2009 at 2 p.m. would have the parameters given in Table 3. The meteorological data required for the simulation was provided by the Republic Hydrometeorological Service of Serbia (RHMZ).

Table 3 *Configurations of the release scenario*

Parameters	Summer conditions
temperature	36°C (2 p.m.)
wind direction	south-southwest
wind speed	2.4 m/s
humidity	30%
cloudiness	0/10
atmospheric stability level	B

For the same input characteristics of the pollution source (a puddle whose mass was 25 t with a diameter of 40 m), the following output values were obtained: total amount of released hydrogen chloride was 923 kg and the highest average speed was 21.2 kg/min.

According to the simulation results for this scenario, the rate of evaporation is significantly higher, i.e. the strength of the source declines significantly over a time interval of 60 min (Fig.4).

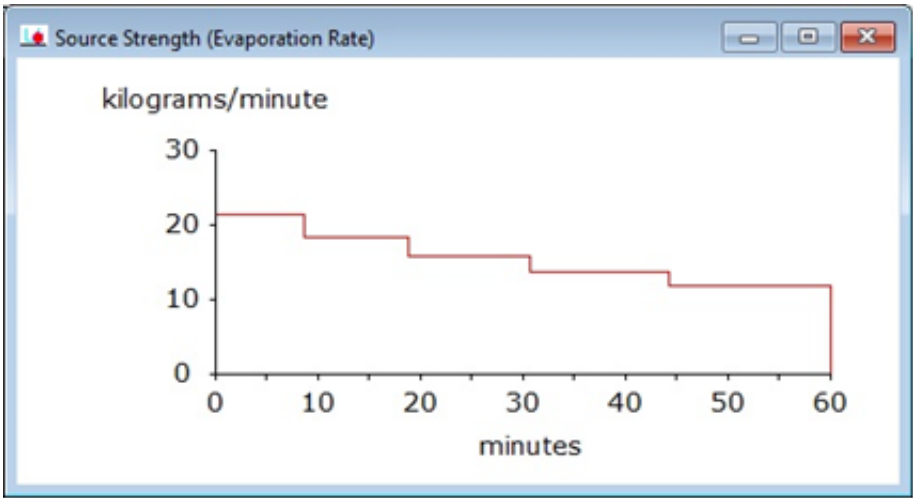


Figure 4. *Reducing the strength of the source with time(case 1, scenario 2)*

The maximum concentration of pollutants in summer weather conditions was significantly higher compared to winter conditions and amounted to 40.789 ppm (4.08 %). The threshold values in zones remained identical (100 ppmfor the red zone, 22 ppm for orange and 1.8 ppm for the yellow zone) and are shown in Fig.5.

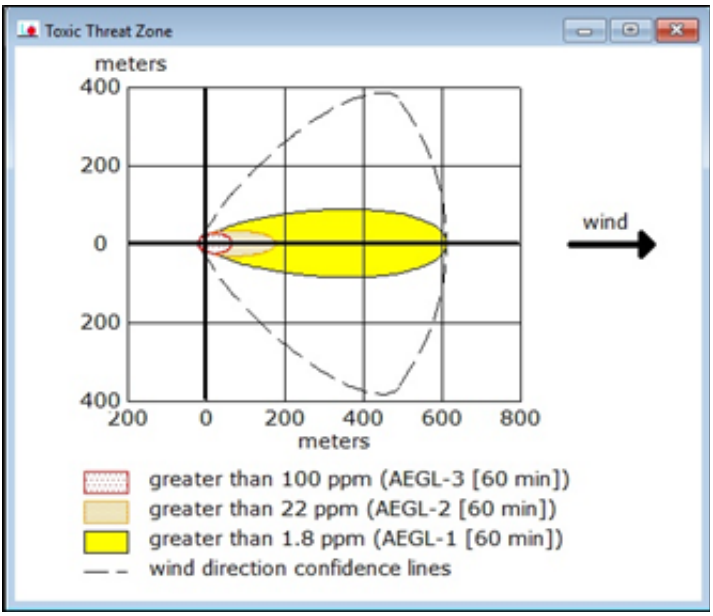


Figure 5. *Diagram of threat population (case 1, scenario 2)*

The results of the simulation show that in this scenario the red zone extends at a distance of 65 m from the source, the orange zone is at a distance of 179 m from the source, while the range of the yellow zone is estimated at 616 m from the source, all in the wind direction.The width of the zone under the influence of pollution was 400 m (Fig.5). Potential threat zone was around 0.24 km^2 or 240,000 m^2, which is a far greater area than in the first scenario, i.e. conversan area that is 190 times larger than the surface of the pollution source.

Based on the geographical location of the accident (Fig.6), it can be concluded that much wider area has been affected by the pollution. This is especially important when observing the red and orange zone concentration of pollutants.



Figure 6. *Geographical location of population threat zones (case 1, scenario 2)*

The simulation results defined the zones of threat under different weather conditions.The pollutant emissions expressed through the distance downstream the source are given in Table 4.

Table 4. *Summary of the simulation results of the pollutant emission downstream the source*

Range of zones with defined concentrations	winter weather conditions (case 1)	summer weather conditions (case 2)
red zone (100 ppm)	23 m	65 m
orange zone (22 ppm)	53 m	179 m
yellow zone (1.8 ppm)	384 m	616 m
potential threat zone	0.02 km^2	0.24 km^2

It can be seen from Table 4 that in case 2 (the hydrochloric acid was released in unstable summer weather conditions), the area that includes the wind direction confidence lines and the area of potential threat will be much larger (0.24 km^2). This means that this would be a worse scenario that would have a greater impact on people and the environment.

Analysis of leakage of ammonia (Case 2) Case 2, Scenario 1

On August 13, 2010 (3.25 p.m.) at a site called PadinskaSkela in the municipality of Palilula (44°56'28" of northern longitude, 20°25'45" of eastern latitude,

the altitude is 132 m), an overhead tank burst and around 20 t of ammonia (NH_3) were released.

The meteorological data required for the simulation were provided by the Republic Hydrometeorological Service of Serbia (RHMZ) and were given in Table 5.

Table 5. *Configurations of the release scenario*

Parameters	Summer conditions
temperature	34°C (3.25 p.m.)
wind direction	south-southeast
wind speed	2.4 m/s
humidity	50%
cloudiness	0/10
atmospheric stability level	B

For simulation purposes, the characteristics of the source of pollution are as follows: it was an overhead tank of horizontal cylindrical shape, 5 m long and with 3 m base diameter, filled with ammonia to the top. The chemicals leakage occurred through an opening of a rectangular shape of 30 cm long and 5 cm at a height of 25 cm from the bottom of the tank.

For given parameters, the following results were obtained: total amount of released ammonia is 20.506 kg, maximal average speed of exposure is 19.800 kg/min and the estimated leakage time is about 2 minutes (Fig.7).

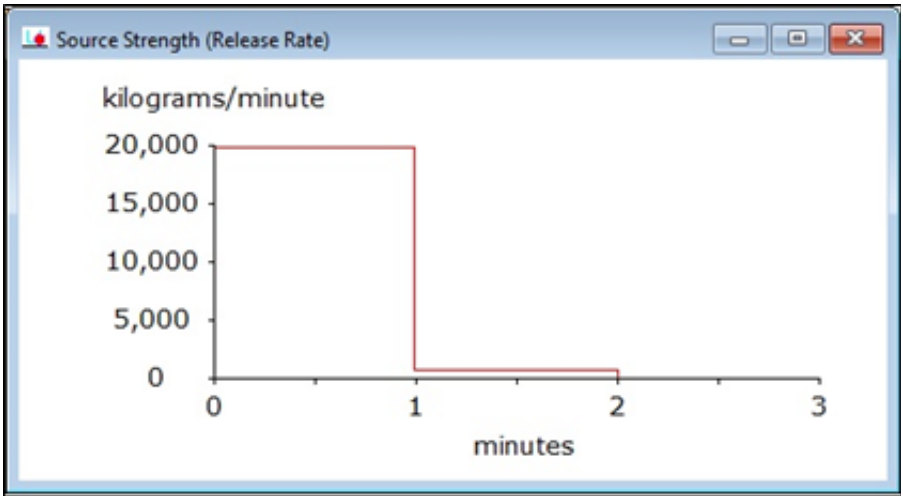


Figure 7. *Source strength depending on time (case 2, scenario 1)*

The source strength in this scenario rapidly declines with time and the tank is almost empty in a minute. Pollutants concentration is high.The definition of the threat-to-concentration zone is as follows: red zone – concentration is greater

than 1.100 ppm, orange zone – 160 ppm, and yellow zone – 30 ppm. In this scenario, the red zone spreads in the area up to 900 m from the source, the orange zone is in the area up to 1.6 km, and the end border of the yellow zone spreads at the distance of more than 2.5 km from the source (Fig. 8).

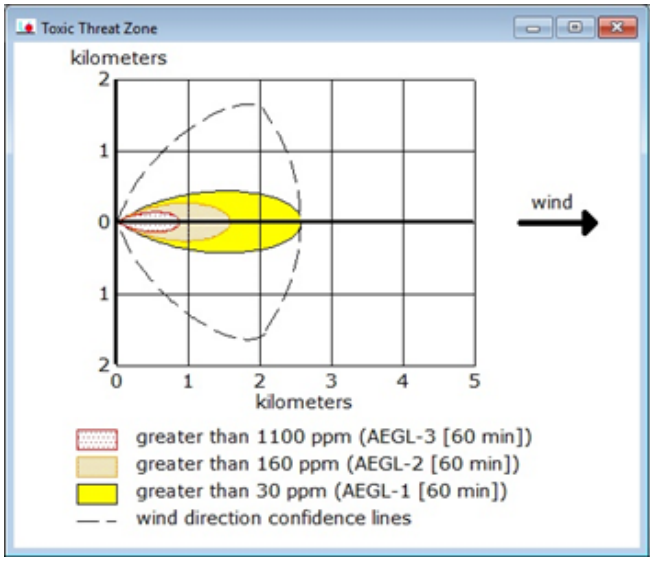


Figure 8. *Threat zone for the case 2, scenario 1*

The zone under the influence of the pollutants extended at a distance of 3 km from the source.

The width of accidental range was 2 km. According to the data, the threat zone about 6 km^2 is shown on Fig. 9.

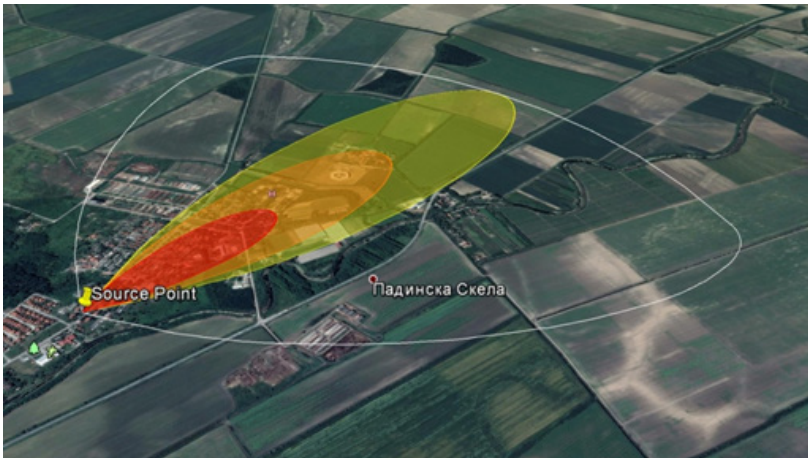


Figure 9. *Geographic image of population threat zones (case 2, scenario 1)*

Case 2, Scenario 2

An imagined scenario of the same chemical accident (leakage of ammonia) in Padinska Skela in winter weather conditions at 2 p.m. on January 28, 2010 would have the parameters given in Table 6.

Table 6. *Configurations of parameters*

Parameters	Winter conditions
temperature	-5°C (2 p.m.)
wind direction	west-southwest
wind speed	2.4 m/s
humidity	75%
cloudiness	10/10
atmospheric stability level	D

In order to compare the results of the simulation of the same chemical incident under different weather conditions, the input parameters for defining the source remained the same.The intention was to keep the concentration of pollutants constant in order to analyze the effects of pollution.

Obtained output data of the source is: substance amount that leaked is 20.587 kg, maximal average exposure speed is 10.100 kg/min, and total leakage time is 3 minutes.

According to this scenario, the strength of the source decreases rapidly over time, so it took about 2 minutes to release most of the liquid from the reservoir (Fig.10). Pollutants concentration is high.

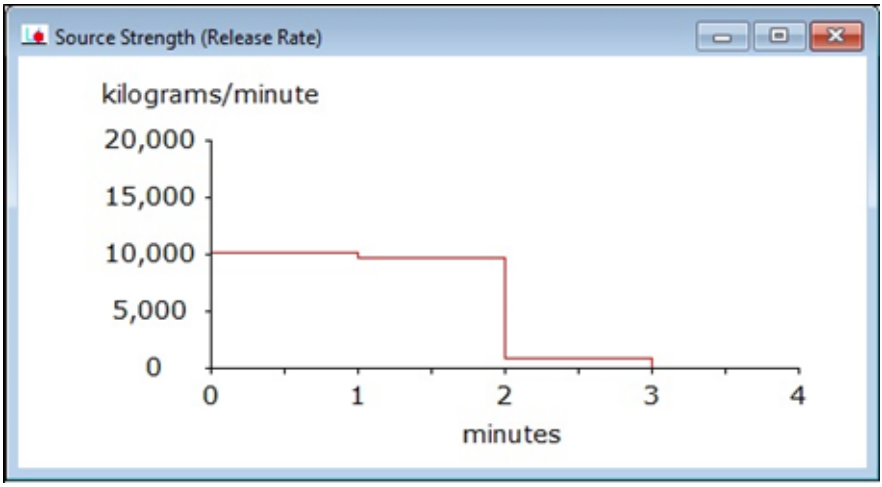


Figure10. *Release rate of the pollutants with the time (case 2, scenario 2)*

The results of the simulation show that, according to this scenario, the red zone extends to 1.4 km from the source, the orange zone covers up to 2.8 km and the final border of the yellow zone spreads at the distance more than 5 km from the source (Fig.11).

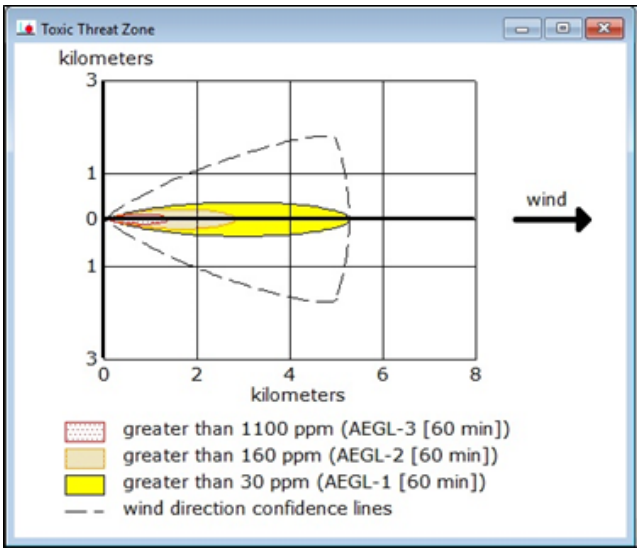


Figure 11. *Threat zones (case 2, scenario 2)*

Concentrations of pollutants are present at a normal distance of more than 5 km and at a width of 3 km. According to these data, the zone of threat is about 15 km^2 (Fig.12).

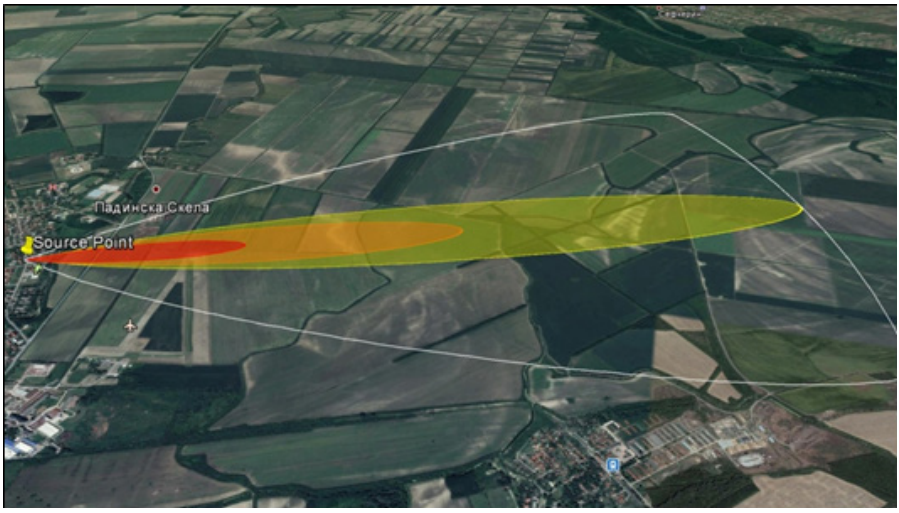


Figure 12. *Geographic image of threat zones (case 2, scenario 2)*

The range of zones with defined concentrations of pollutants expressed through the distance downstream the source are given in Table 7.

Table 7 *Summary of the simulation results of the pollutant emmision downstream the source*

Range of zones with defined concentrations	summer weather conditions (case 1)	winter weather conditions (case 2)
red zone (1100 ppm)	900 m	1400 m
orange zone (160 ppm)	1600 m	2800 m
yellow zone (30 ppm)	2500 m	5000 m
potential threat zone	6 km^2	15 km^2

Based on the results of the simulation from the Table 5, it can be concluded that the worse scenario is the case 2, where the zone of pollution with the ammonia covers an area of 15 km^2.

CONCLUSION

All accidents, regardless of their features and how they occured, are dangerous for the environment and humans. However, chemical accidents are exceptional. Given the fact that there is a need to use chemical substances in great quantities, as well as to store and transport them, it is obvious why chemical accidents are the most frequent ones.

For all of this, monitoring of tanks containing dangerous chemicals must be at a high level, and timely reactions involving the eventual evacuation of people and rehabilitation of the endangered areas due to hazard are mandatory.

The significance of applying mathematical software for the simulation of the pollution processes (ALOHA software) has been shown on the examples of two accidents that really happened. The first accident was the leakage of 25 t of the hydrochloric acid, and the second was the leakage of 20 t of ammonia. In order to analyse the worst possible cases, the imaginary scenarios with completely opposite meteorogical conditions were included in simulation.

From the results obtained by simulation of the leakage case of the hydrochloric acid on the premises of BIP (*Belgrade Industry of Beer*), it can be concluded that the evacuation was unnecessary in the first scenario. There was also no need to block the traffic. The danger zone covered an area of 0.02 km^2 and this indicates that only workers in the mentioned factory and rescue and firefighting service present in the source vicinity were at risk. On the other hand, the results of the simulation of the imagined leakage of acid scenario in summer meteorological conditions are significantly different from the first scenario results. The threat zone would cover an area of 0.24 km^2. The orange zone (concentrations greater than 22 ppm) would have covered a nearby traffic interchange, and even the red

zone would have been of significant size. Obviously, for the second scenario of the first analyzed case, traffic would have to be stopped and that the rescue and fire fighting units would have to act extremely carefully, with warnings to the workers and the population in the affected area.

In the second analyzed case, i.e. the case of ammonia leakage from the tank, the situation was much more serious. Both scenarios of the second case point to a large red and orange zone (concentrations greater than 160 ppm).The first scenario required an evacuation because 50% of the settlements were covered by the zone of threat. Only due to the circumstances in the second scenario (geographical position, the width of accidental region, wind direction and intensity), it would be not necessary to evacuate the population of a nearby settlement. In the second scenario, it would likely be necessary to stop all the flights from a nearby military airport.

The analysis of two real and two imaginary scenarios of chemical accidents has shown that each accident is specific. The consequences of chemical accidents depend mostly on the type of pollutant (chemical substance), the location of the accident and meteorological conditions (mostly on temperature and wind speed and direction).

The application of mathematical models of dispersions, included in software packages for simulation of accidents, in the cases described above proved to be extremely important, either to predict possible consequences or to mitigate them.

ACKNOWLEDGEMENT

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VOLUME II

Topic VIII

EFFECTS OF PHYSICAL ACTIVITY ON ANTHROPOLOGICAL STATUS IN SECURITY AGENCY PERSONNEL

GENDER DIFFERENCES AND CLASSIFICATION OF POLICE UNIVERSITY STUDENTS RELATING TO JOINT TISSUE FLEXIBILITY

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Abstract: Flexibility influences the amplitude of body parts movement and consequently the efficiency of physical activities which are an integral part of police officers training and professional duties. The aim of this study was to determine the level of flexibility in students of the University of Criminal Investigation and Police Studies (UCIPS), as well as the differences between genders and to establish the criteria for evaluation. The sample consisted of 121 participants, 51 female (age 20.2 ± 1.2 years) and 70 male students (age 20.3 ± 0.9 years). All participants were the second year students. A battery of tests for flexibility assessment included: Sideways Leg Splits (SsLS), Sideward Leg Splits right (SdLS right), Sideward Leg Splits left (SdLS_left), Single-Legged Knee Bend right (SLKB_right), Single-Legged Knee Bend left (SLKB_left), Lengthwise Leg Splits right (LLS_right), Lengthwise Leg Splits left (LLS_left), Sit and Reach (SR), and Shoulder Flexibility (SF). The existence of the differences between groups was determined by ANOVA, at the significance level of $p < 0.05$. The differences were found in tests SsLS ($F = 11.459$, $p = 0.001$), SdLS_right ($F = 8.440$, $p = 0.004$), SdLS_left ($F = 5.502$, $p = 0.021$), SLKB_left ($F = 5.545$, $p = 0.025$), LLS_right ($F = 11.481$, $p = 0.001$), LLS_left ($F = 18.008$, $p = 0.000$), SR ($F = 7.886$, $p = 0.006$) and SF ($F = 25.447$, $p = 0.000$). The obtained results indicated different flexibility levels between male and female students. In relation to martial arts and other athletes the UCIPS students had lower levels of flexibility. The applied percentage distribution results, including six different groups, could be used as a scale for assessment of the achieved level of flexibility in police university students.

Key words: flexibility, gender, students, police

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INTRODUCTION

Physical fitness became a very important factor for police officers (Kukic & Dopsaj, 2017) because some of the tasks can involve running, grappling, wrestling, fighting and carrying loads (Strating, Bakker, Dijkstra, Lemmink & Groothoff, 2010). Based on the nature and requirements of these tasks, police officers need to be physically prepared to perform duties sufficiently and effectively, but with a reduced risk of injuries (Guffey, Larson & Lasley, 2015). Method of operation and the responsibility police officers have require optimum level of physical abilities, which is one of the factors influencing efficient performance (Sorensen, Smolander, Louhevaara, Korhonen & Oja, 2000). In contrast, inadequate levels of physical ability may be a limiting factor in the performance of professional duties and could lead to poor productivity, injuries and long-term disability, which results in the loss of human resources and economic costs (Lonsway, 2003; Lockie at al., 2019). Overall, for successful performance of police work and fulfilling professional obligations of police officers, it is necessary to be of adequate health (Sorensen et al., 2000), morphological characteristics (Dopsaj, Milosevic, Vuckovic, Blagojevic & Mudric, 2005; Malavolti et al., 2008) as well as basic and specific physical abilities (Copay & Charles, 1998; Jankovic et al., 2015).

Professional engagement of police officers requires a necessary level of work qualifications and skills, among which are theoretical and practical knowledge in the field of Specialized Physical Education (SPE). As a result of education, the future police officers must be physically capable of performing all occupational requirements successfully, in a way which is safe and secure for all those concerned (Anderson, Plecas & Segger 2001). The students of the University of Criminal Investigation and Police Studies (UCIPS), i.e. the future police officers, are obliged to fulfil certain criteria on an annual basis, which simultaneously indicate the level of their adjustment to applied training loads during SPE courses (Dopsaj & Vuckovic, 2006; Dimitrijevic, Koropanovski, Dopsaj, Vuckovic & Jankovic, 2014). More precisely, the students have to achieve adequate level in muscle force, muscle power and aerobic endurance. In opposite, join tissue flexibility is not a part of basic motor ability assessment at the course of the SPE.

Flexibility is considered as one of the independent components of physical ability, and it is used to describe the amplitude of movement of either one or more joints (Alter, 1996). In other words, it is the ability of expressing muscular and tendon properties throughout the biggest possible joint amplitude (Zaciorski, 1975; Alvar, Sell & Deuster, 2017). The higher level of flexibility provides the more efficient training process (Stefanovic, Jakovljevic & Jankovic, 2010). In that regard, flexibility represents one of many important factors necessary for the successful performance of movement activities. Flexibility is essential for higher amplitudes of movement performance. Having in mind that police work requires the knowledge of a great number of martial arts techniques, greater joint flexibility enables a more efficient and easier performance of the techniques. The performance of techniques at greater distances which provide greater security of police officers

in critical situations is facilitated by the flexibility of muscles. Furthermore, flexibility is important for performing more efficient movement as the individuals with higher levels of flexibility perform movements more efficiently, or quickly, because it enables muscular activity at a longer distance, and consequently at a higher speed. The requirements regarding muscular strength are lower, as it takes less strength to stretch the antagonist muscles which stop the movement. This is important for the fact that police officers are expected to resolve critical situations as efficiently as possible and using minimum level of force. Finally, higher level of flexibility is directly related to reducing the risk of injury due to higher reserve flexibility (Stefanovic et al., 2010). The reduction of medical costs, sick leaves, and reduced work capacity are only some of the factors indicating that the level of flexibility should be developed and kept at a necessary level.

Flexibility could be observed through the functional, reserve and maximal on the one hand, as well as static and dynamic on the other. Functional flexibility is defined as movements with low amplitudes and is manifested in everyday activities (e.g. walking). Reserve flexibility is an addition to functional flexibility and enables movements of higher amplitudes, such as martial art techniques. Maximum flexibility is characterised by extreme joint flexion or extension, abduction, and it is most often performed during physical abilities testing. Static flexibility is manifested in static conditions, and dynamic in the conditions of body movement through space (Stefanovic et al., 2010).

In the last few decades, women have become employed in police workforce more often than before. The dimorphism between male and female human body composition is evident from an early age (Wells, 2007), which particularly manifests in traditionally men's professions (Boyce, Jones, Lloyd & Boone, 2008; Dawes et al., 2017). Recruitment standards for female police officers were set and re-evaluated in order to avoid gender discrimination but also to facilitate the recruitment of women who will be able to perform the job safely (Hauschild et al., 2017; Wells, 2007). However, there are no defined standards for flexibility for both genders.

All of the above mentioned indicate flexibility importance in motoric tasks which security agency personnel realize on their duty. The issue with this research is determining the level of flexibility of the second year students of the UCIPS using standardized flexibility assessment tests intended for upper and lower parts of the body. The aim of this research is to determine the level of the UCIPS students' flexibility, as well as the differences between male and female gender of the tested individuals and to establish the criteria for evaluation of flexibility level.

METHODS

Participants

The testing was performed on 121 students of the second year of the UCIPS. Out of that number, 70 examinees were of male gender (Age = 20.31 ± 0.96), and 51 of female gender (Age = 20.20 ± 1.17). All examinees were informed about the course and the procedure of testing. None of the participants reported any injury or problem which could influence the testing results.

Procedure

The testing included anthropometrical measurements of body height (BH) and body mass (BM), which provided the data for body mass index (BMI) calculation. BH and BM were measured to the nearest 0.5 cm and 100 g, respectively. Thereafter, the body mass index was assessed ($BMI = BM/BH^2$) and expressed in units of kg/m^2. Anthropometric measurements were taken by the same experimenter according to standard procedures (Dimitrijevic et al., 2014).

Flexibility assessment was performed by using the tests already validated by previous research papers as field tests and they are practically applied in various sports (Rosch et al., 2000; Bozic, Pazin, Berjan, Planic & Cuk, 2010), especially where flexibility is one of dominant motor abilities such as martial arts. The testing of flexibility performance was preceded by a standard 10-min warm-up and 10-min active stretching, following a detailed explanation and qualified demonstration of each test.

Single-Legged Knee Bend - This test predominantly assesses the flexibility of the hip flexors muscles. The participant kneels on the right leg, with the left leg extended forward, but the lower leg is kept vertically. From this starting position, the participant slides the knee back as far as possible while supporting himself with his left hand holding the chair and the right hand being supported by the experimenter. The trunk remains in the upright position (i.e., aligned with a vertical line on the wall), no rotation of the hips is allowed, while the lower part of the front leg remains vertical. A kinanthropometer is used for measurement of the height of the symphysis (h), whereas a ruler (fixed on the ground) is used for measurement of the horizontal distance between the back knee and the vertical projection of symphysis (a). The hip extension angle of the back leg is obtained from trigonometric calculation (a = arctan*(a/h)).

Sideward Leg Splits - The test predominantly assesses the flexibility of the hamstring muscles of the front leg and the adductor muscles of the back leg. The participant stands on a smooth board and supports himself with the left hand holding the chair and the right hand being supported by the experimenter. His back (i.e., right) foot is turned out and forms an angle of 90° with the forward (i.e., left) foot. Thereafter, he slowly slides both feet apart. The trunk remains upright (vertical line on the wall) and no hip rotation is allowed. A kinanthropometer is used for measurement of the distance between the symphysis and the ground (h),

whereas a ruler (fixed on the ground) for measurement of the distance between the heel of the back leg and point of the vertical projection of symphysis on the ground (a) and the distance between the heel of the front leg and point of the vertical projection of symphysis on the ground (b). The angle formed by the legs is assessed by means of a trigonometric formula (a = arctan*(a/h) + arctan*(b/h)).

Sideways Leg Splits - This test mainly allows the assessment of flexibility of the adductor muscles (Rosch et al., 2000). The participant stands on a smooth board and supports himself with the left hand holding the chair and the right hand being supported by the experimenter. The feet are placed parallel. Thereafter, he slides both of his feet slowly apart while the trunk remains in the upright position aligned with a vertical line depicted on the wall. A kinanthropometer is used for measurement of the distance between the symphysis and the ground (h), whereas a ruler (fixed on the ground) is used for measurement of the distance between the heels and the point of the vertical projection of symphysis on the ground (a, b). A trigonometric calculation (a = arctan*(a/h) + arc- tan*(b/h)) is used to calculate the angle formed by the legs.

Lengthwise Leg Splits - This test allows the assessment of flexibility of the hamstring and quadriceps muscle (Rosch et al. 2000). The participant kneels on the right leg, with the left leg stretched out forward while supporting oneself with the left hand holding the chair and the right hand being supported by the experimenter. Thereafter, he slides the extended leg forward, while the other knee remains at the floor and the upper leg remains vertical. No hip rotation is allowed. A kinanthropometer is used for measurement of the distance between the symphysis and the ground (h), while a ruler (fixed on the ground) is used for measurement of the distance between the back knee and the point of the vertical projection of symphysis on the ground (a), and the distance between the front heel and the vertical projection of symphysis (b). A trigonometric calculation (a = arctan*(a/h) + arctan*(b/h)) is used to calculate the angle formed by 2 legs.

Sit and Reach - This test mainly allows the assessment of flexibility of the hamstring and the spine muscles (Jackson & Langford, 1989). A box which has a scale marked out on the upper side ("0" marks of the ruler are 10 cm toward the hips) is placed against the wall. The participant sits on the floor with his fully extended legs and feet placed together next to the box. The participant's hands are on top of each other (tips of the middle fingers aligned) and palms down. The participant reaches slowly forward and touches the front of the box with both hands as far as possible. The examiner measures the point where the tip of the middle fingers touches the scale. The precision of the measurement is 0.5 cm.

Shoulder flexibility (twist with the stick) - This test assesses the flexibility of arms and shoulder region. The participant holds a stick in his hands extended forward and his right hand holds the end of the stick, and his left hand holds the stick right next to measurement scale. From the initial position, holding the hands extended forward, the participant slowly raises the stick and parts his hands by sliding his right hand (his left hand remains fixed to the end of the stick). The task requires

that the participant performs a twist above his head holding the stick with hands extended forward, thereby trying to keep as little distance between the inner sides of his hands as possible.

Statistics

The descriptive statistic was conducted in Microsoft Excel (Microsoft software package, Office 365), while univariate analysis of variance (ANOVA) was conducted using Statistical Package for Social Sciences (IBM, SPSS Statistics 20). The significance level was set at $p < 0.05$. The percentile distribution procedure was conducted in order to establish the levels of flexibility.

RESULTS

Table 1 shows the results of median value and standard deviations of morphological characteristics of the participants, as well as the difference in results between the male and female participants.

Table 1: *Demographic and anthropometric profiles of the university academy students*

	Male (N=70)		Female (N=51)		
	Mean	SD	Mean	SD	p-value
Body Height (cm)	182.58	5.18	170.05	4.23	0.00*
Body Mass (kg)	82.24	11.13	64.96	7.76	0.00*
BMI (kg/m^2)	24.62	2.63	22.45	2.39	0.00*

* - *significant difference between groups*

Based on the data from Table 1, a statistically important difference in BH and BM is noticeable between the male and female students. Also, statistically significant differences were obtained regarding BMI.

Table 2 shows the results of median values, standard deviations, as well as the difference in results in indicators between the male and female participants.

Table 2: *Flexibility measures of the university academy students*

	Male (N=70)		Female (N=51)		
	Mean	SD	Mean	SD	p-value
SsLS (°)	118.35	1.77	127.37	1.95	0.001*
SdLS_right (°)	122.04	1.47	128.80	1.84	0.004*
SdLS_left (°)	124.90	1.53	130.71	2.00	0.021*

SLKB_right (°)	47.94	0.72	52.04	1.01	0.001*
SLKB_left (°)	49.11	0.71	53.41	0.69	0.000*
LLS_right (°)	119.70	1.31	130.69	1.52	0.000*
LLS_left (°)	120.51	1.23	132.50	1.70	0.000*
SR (cm)	10.41	0.79	13.67	0.82	0.006*
SF (cm)	94.38	1.61	82.04	1.83	0.000*

SsLS - Sideways Leg Splits; SdLS - Sideward Leg Splits;
SLKB - Single-Legged Knee Bend; LLS - Lengthwise Leg Splits;
SR- Sit and Reach; SF- Shoulder flexibility; ° - degrees.
** - significant difference between groups*

Table 2 shows the statistically significant difference for all variables of flexibility which is noticeable between the male and female students.

Table 3 shows the results of percentile distribution of flexibility in the male and female participants.

Table 3: *Percentile distributions of the flexibility measures of the police university students*

		SsLS (°)	SdLS_right (°)	SdLS_left (°)	SLKB_right (°)	SLKB_left (°)	LLS_right (°)	LLS_left (°)	SR (cm)	SF (cm)
Percentiles Female	10	112.66	114.70	116.82	47.78	48.74	116.46	118.50	6.20	65.00
	25	117.63	120.47	121.48	50.60	50.53	122.01	124.33	10.00	73.00
	50	126.04	127.68	126.57	53.13	53.39	131.90	129.71	14.00	82.00
	75	132.95	134.14	138.28	55.62	57.34	137.06	139.08	18.00	94.00
	90	141.80	142.70	146.39	57.25	59.04	144.79	149.13	21.80	98.80
Percentiles Male	10	102.68	106.46	108.59	39.84	42.75	104.70	106.81	0.55	76.40
	25	110.38	112.32	116.03	44.11	46.32	114.72	113.03	5.38	85.75
	50	119.21	121.39	124.52	48.73	49.98	120.15	120.29	11.00	95.00
	75	126.58	129.54	133.10	52.66	52.86	124.94	126.77	15.00	101.75
	90	135.93	140.92	141.88	54.46	55.09	133.56	135.91	17.90	112.00

On the basis of the results shown in Table 3, the students classification in joint tissue flexibility could be expressed as excellent (over 90 percentile), exceptionally good (between 75-89.99 percentile), very good (between 50-74.99 percentile), good (between 25-49.99 percentile), sufficient (between 10-24.99 percentile) and insufficient (below 9.99 percentile).

DISCUSSION

The aim of this research was to determine the level of flexibility in the second year UCIPS students, the differences between the male and female students, as well as to establish the criteria of flexibility level evaluation. The ANOVA results

showed a statistically significant difference between the male and female students in all flexibility related variables. The female students demonstrated a higher level of flexibility in all tests when compared to the male students. The tests which showed statistically significant differences were SsLS (F = 11.459; p = 0.001), SdLS_right (F = 8.440; p = 0.004), SdLS_left (F = 5.502; p = 0.021), SLKB_right (F = 11.481; p = 0.001), SLKB_left (F = 18.008; p = 0.000), LLS_right (F= 29.837; p = 0.000), LLS_left (F = 34.361; p = 0.000), SR (F = 7.886; p = 0.006) and SF (F = 25.477; p = 0.000). Similar results were also obtained in previous studies with distance runners and karatekas, where the female participants achieved better results in comparison with the male participants in flexibility related tests (Tamra & Robert, 2009; Timotijevic, Aleksic, Jovanovic & Suzovic, 2015). Also, our results strongly agree with the findings of the other study, in which Timitojevic and Koropanovski (2017) investigated the initial level of flexibility on the same population.

In regard to anthropometric parameters, the male students were statistically significantly higher (F = 200.855; p = 0.00) and heavier (F = 90.655; p = 0.00) than the female students. Also, statistically significant difference was found for variable BMI (F = 21.619; p = 0.00), which was higher in male students. Both the males and females belonged to standard weight class in accordance with the World Health Organization's standards, whereby the male students' results were very close to the upper bound. Average morphological parameters in the male students (TV = 182.58 cm, TM = 82.24 kg, BMI = 24.62 kg/m^2) were very similar with the data in Dimitrijevic et al. (2014) research on the Academy of Criminalistc and Police Studies (ACPS) students (Generation 1995: BH = 182.01 cm, BM = 80.95 kg, BMI = 24.38 kg/m^2; Generation 2005: BH = 182.25 cm, BM = 80.63 kg, BMI = 24.23 kg/m^2; Generation 2010: BH = 182.62 cm, BM = 78.89 kg, BMI = 23.61 kg/m^2). The average morphological parameters in the female students (BH = 170.05 cm, BM = 64.96 kg, BMI = 22.45 kg/m^2) were similar to the data in Dopsaj and Vuckovic (2006) research on the ACPS students (BH = 169.5 cm, BM = 62.5 kg, BMI = 21.7 kg/m^2).

Due to the specific nature of police work, hip flexibility is necessary for kicks and punches as well as throwing techniques. Biomechanical requirements for performing kicks include a certain level of flexibility of front and back hamstrings, as well as inner part of upper legs. Efficient rotations in hips which add to previous movements of other body parts, apart from circular punch, are also characteristic of punches and some throwing techniques, and largely depend on the flexibility of this joint. With the fact that the techniques taught in SPE lessons are taken over from martial arts and are adjusted to the requirements of police work, the athletes in relevant disciplines can be considered as a representative sample. In comparison between karate athletes and the UCISP students, karate athletes achieved better results in all tests (Timotijevic et al., 2015).

Sit and reach is the tests for the assessment of hamstrings flexibility, where this kind of ability is of great importance for throwing and foot techniques. The

advantage of this test is simple application, and the disadvantage is the fact that the test does not precisely assess the flexibility in each participant individually. Because of that the participants with longer limbs have the advantage in achieving good results over those participants with shorter limbs. Also, the result of this test depends on the flexibility of spine and shoulder regions. When the results in sit and reach tests were compared, the UCIPS students achieved lower test results than distance runners, judokas (Tamra & Robert, 2009), karatekas (Nikookheslat, Faraji, Fatollahi & Alizadeh, 2016), basketball players, handball players, soccer players, volleyball players (Jaric, Ugarkovic & Kukolj, 2001) and better results than football players (Katralli, Goudar & Itagi, 2015). These differences might be attributed to the influence of training process of the athletes of the categories mentioned above. In comparison with the results of Timotijevic and Koropanovski research (2017), it is noticeable that the male students of the second year of the UCIPS had similar level of lower body flexibility and better results in upper body flexibility than the novices. In contrast, the level of flexibility in female students seems to have decreased from the enrolment.

Shoulder is one of the most flexible joints in human body, and is therefore often prone to injuries. Insufficient level of shoulder muscles flexibility may adversely influence the performance of certain techniques (punches, blocks, throwing and holds), and finally lead to injuries. According to shoulder flexibility, the male UCIPS students achieved similar results to handball players (Grujic, Ohnjec & Vuleta, 2011), whereas the female tennis players achieved better results than the female UCIPS students (Filipcic & Filipcic, 2005). These differences might be attributed to the influence of training process in which the athletes were involved.

The determination of minimum level of flexibility for successful performance of motor tasks would be of particular importance for the improvement of professional work and training process control. This research provides classification of flexibility level for both genders (Table 3). In that regard, police student's flexibility level should be ranged as insufficient, sufficient, good, very good, exceptionally good or excellent. Additionally, the given rank matches the existing marks classification (i.e. 5-10). Finally, the future research should give scientifically valid answers about the importance of flexibility in relevant space, as well as the type of flexibility of importance to the efficient performance of work by security services officers.

CONCLUSION

The main aim of this research represents the establishment of the level of the second year UCIPS students' flexibility. The female students expectedly achieved better results in flexibility tests than the male students. The level of student flexibility was lower in comparison with athletes. In comparison with novices, the second year UCIPS students' posses lower level of flexibility. The classification of

police students' flexibility level given in this research could be involved in evaluation process.

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THE LIFE HABITS, COGNITIVE CAPACITY AND EFFICIENCY OF STUDY

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Abstract: In this paper we have tried to find out whether, and if so, how much, the success of studying, contributed to certain life habits, as well as the cognitive abilities of students of the University of criminal investigation and police studies in Belgrade. Life habits are defined by displaying habits in eating, using leisure time, physical activities as well as relationships with the use of cigarettes and alcohol, and cognitive abilities through the display of the coefficient of intolerance. The sample of students was 89 students of the final year of academic studies. The effectiveness of studying is calculated from the available information on the average grade, the total number of points actually achieved and the duration of the study up to the moment of computation of performance. Adequate statistical procedures have not shown a significant contribution to the monitoring of space, the effectiveness of studying students of the Criminal Police Academy.

Keywords: students, life habits, study success

INTRODUCTION

Investing in higher education is an investment in the future. In the Republic of Serbia, about 11% of the population gained this level of education. Acceptance of European standards in the field of studying resulted in the Republic of Serbia with shortening the completion time of the studies (Savic et al., 2016). At the same time, there are no valid results that would indicate the state of the level of acquired competencies of graduated students.

Professional areas, such as military and police, are very popular in this region for studying. This is indicated by the results of the research of attitudes of high school students in Republic of Serbia. In the mentioned population, there is a considerable interest in the University of Criminal Investigation and Police Studies (CIPS)[1] as a representative higher education institution, and therefore also for

1 By the fulfillment of the necessary conditions, by the Decision of the Commercial Court in

police work (Koropanovski et al., 2016; Jankovic & Koropanovski, 2017; Janković et al. 2018).

As a basis of interest, students have indicated their desire to acquire knowledge from selected fields. In addition to the desire to acquire knowledge, it is assumed and supposedly easier employment after the completion of studies, as well as the expectations of the family (Lažetić et al., 2014).

The organization of accredited study programs at the Criminal Investigation and Police Studies, but also the location itself, imposes the need for student residence in Belgrade, and therefore a real change in the previous way of life. Most of the students at the University of Criminal Investigation and Police Studies are not from the territory of the city of Belgrade, therefore, they are not able to live with their parents (During the schooling, CIPS students, in most cases, lead an internal way of life, independently feed themselves and independently decide on the content of their free time. The transition from the secondary school system (shift and life relative perennial period) to the faculty system (in most cases changing the place of residence, moving to a large urban environment, separation from the family, variable and extensive teaching, a greater number of obligations) can lead to disturbance of the previous life habit (Dimitrijević, 2016). It is to be assumed that such significant changes in lifestyle also affect previously acquired life habits both for female and male students.

In Serbia, about 52.5% of students live with their parents during the study, and more than 90% are financially dependent on them (Savić et al., 2015). The problem of the presence of healthy lifestyles in young people, and in this context, and the ever more intense affirmation of the active lifestyle, is today one of the most frequently asked questions when examining their living and working conditions.

Research shows that there is a trend of an increase number of young people, especially among the student population, dominated by life habits characterized as unhealthy (Nešić et al., 2016).

The efficiency of study[2] means completion of studies within the deadline. The preceding characteristics are generally expressed through the average grade during the studies and the duration of the studies. This way of calculating the average grade of a student during a study does not give a true picture of the students' performance and expertise in the given profession studied. By adjusting the Bologna process and introducing points for each subject, calculating the average grade for studying can be even more specific for each profession (Isljamovic et al., 2012). Recognizing the existence of the points mentioned for each subject

Belgrade, 24.12.2018. In the same year, the registration of a change in the form of organization from the Criminal Police Academy to the University Criminal Investigation and Police Studies was carried out with the Departments of Criminalistics, Informatics and Computing and the Department of Forensic Engineering

2The socio-economic as well as demographic characteristics of the students certainly have a significant impact on the efficiency of studying, but they were not the topic of this paper. The same applies to possible differences in the level of quality of life habits of students at the beginning and end of study or as a possible subject of other research.

in the calculation of the average grade would make it clearer to demonstrate the students' expertise and training for the given profession studied and the insight into his knowledge from the given faculty (Kovačević et al, 2009).

The aim of studying, among other things, is acquiring general and specific competences for the chosen field of study.

METHODOLOGY

In order to understand the contribution of the quality of life habits and cognitive abilities to the efficiency of studying by students of the CIPS, part of the available information (student service of the CIPS) was used, as well as direct collection, using appropriate procedures (life habits of students and their cognitive abilities).

Sample

The sample of respondents in the research consisted of 89 students of the final year of basic academic studies at the CPIS in Belgrade. Subsample was represented 37 (41.6%) male and 52 female students (58.4%) The budget of the Republic of Serbia, as a source of funding the studies, was used by 40 (45%) students, while the self-financed were 49 (55%). There were only 7 (7.8%) students from the city of Belgrade.

Life habits

A survey, conducted by authors Turkony and his associates (2003) was used to determine life habits (LifeH). The questionnaire is structured in three parts, the first being to determine eating habits (NUTR), the other, the area of physical activity (PA), and the third relation to the use of cigarettes (CIG) and alcohol (ALC).

Cognitive capacity

For the assessment of cognitive (intellectual) abilities, a cybernetic battery of intelligence tests with selected tests was used to enable the evaluation of the efficiency of the functioning of the most important cognitive processors (Wolf et al., 1998). This battery contains three tests for assessing the effectiveness of perceptual functions: the parallel processor function and the serial processor functions. They enable the effective manifestation of perceptual, verbal and non-verbal intellectual abilities. By combining the results obtained on these tests, a reliable assessment of general intelligence is obtained. The battery is recommended by the

makers for use as a whole, and the ability to use each of the three tests separately. For the purposes of this paper, the authors used the battery in their entirety, with the aim of determining the IQ, that is, the efficiency of the CIPS as a variable for this area.

Efficiency of study

The performance of CIPS students was evaluated through the achieved average grade during the course of study. The average grade is counted as the product of a collection of all grades and the number of passed exams and was used in paper as variable (EFC).

Statistical evaluation

Data processing was carried out using the statistical program SPSS version 20.0 using adequate procedures for determining descriptive indicators for all observed variables, as well as for determining the significance of correlations as indicators of the predictive value of predictor variables compared to the success of study as a criterion variable.

RESEARCH RESULTS

Table 1 shows the basic descriptive indicators for the total sample and all the variables in the survey. In the last three rows of the same table, the values for two predictor fires (life habits as a total expressed score (LifeH), and the ratio of intelligence (IQ)) and the criterion variable (the success of the study (EFC)- expressed through the average grade) are indicated.

Table 1. *Descriptive indicators for the total sample*

Variables	average value	SD	MIN	MAX
NUTR	25.3	4.608	15	37
PA	11.11	2.34	5	15
CIG	1.7	0.681	0	2
ALC	1.51	0.503	1	2
LifeH	39.62	6.284	26	53
IQ	110.3	6.54	94	122
EFC	7.69	0.62	6.6	9.68

The values, shown for the nutritional quality of students in the study, show that there are no maximal possible values (42), which is the state of life habits when viewed in total (diet, physical activity, smoking and alcohol) (63).

Values for IQ show that students are in high levels of intelligence (according to the division: 90 to 109 = average, 110 to 119 = high, 120 + = above average).

Table 2. *Important indicators Linear regression analysis of variables Successful study*

variables	r	rpart	Beta	t	p
NUTR	-.058	-.058	-.066	-.531	.597
PA	-.179	-.167	-.177	-1.540	.127
CIG	.117	.152	.161	1.404	.164
ALC	.052	.057	.057	.522	.603
LifeH	-.092	-.092	-.092	-.864	.390
IQ	.099	.117	.115	1.073	.286

R = .262 R2 = .069 F = 1.222 P =.306

The low value of the multiple correlation coefficient of 0.306 indicates that the applied predictor system nutrition, physical activity, smoking, alcohol, and life habits overall value is not significantly related to the criterion variable (the success of a study expressed by an average grade).

DISCUSSION AND CONCLUSION

A great interest in studying in the last decade in the world as well as in Serbia, brought a great need in researching the aspect of the students themselves as well as their student life. Efficiency of studying is defined as the academic performance of a student and could be influenced by many factors.

There are a quite number of papers in the area of students' characteristics and their students' habits as well as their relations to the efficiency of studying. Güllü and Güllü (2019) were conducting a research looking for the relations between anthropometric characteristics and lifestyle of secondary school students. Irazusta and the associates (2006) were conducting their research on the first year of female nursing students. More similar research to this paper was made by author Trockel and his associates (2000) where they were interested in the connection between some health-related variables and academic performance. The emphasis of the paper was on the sleep behavior. As for the new papers on the similar topic, Masoomi and the colleagues (2019) were looking for some correlations between breakfast, snack foods, cognitive and academic performance and physical activity levels.

In this paper, however, on the sample of 89 students of the final year of basic academic studies at the Criminal Investigation and Police Studies in Belgrade, we tried to find out whether there is a significant connection between the students'

life habits and their cognitive abilities with the study's success. After analyzing the results, no significant association was found (p = 0.306) among the selected predictors of the total observed (life habits, which were studied in the study through student attitudes towards nutrition, physical activities smoking and alcohol, and cognitive abilities expressed by the ratio of intelligence - IQ) and the criterion variable the success of the study was also evident (expressed by the average grade). The success in studying, individually and in total, is influenced by some other factors that were not included in this research. Study motivation and study skills, that were not tested in this research exhibit the strongest relationships with both grade point average and grades in individual classes (Credé & Kunce, 2008).

The quality of the survey's results in this research was also influenced by the quality of the sample of the respondents and the quality of defining individual variables. Nevertheless, new information about the work of the population of the students of the Criminal Investigation and Police Studies were obtained and the possibilities of other and different research are still open.

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