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Dear readers,

Let me present the latest issue of the scientific peer-reviewed journal Science & Military 1/2018. Through the articles written by Slovak and foreign experts, the journal aims to initiate an inspiring discussion and, thus, broaden the knowledge relating to military science.

We are pleased to present you with valuable scientific and expert multidisciplinary knowledge, which initiates and enriches the dialogue in the specified areas on a national and international scale.

This issue offers interesting articles that have been successfully reviewed. I am convinced that they will inspire you and make you think about and discuss the presented issues.

The first among the reviewed articles, which was written by Peter Rindzák and titled ***"The Dependence of Information Entropy on the Measurement Error of the Sensor Network Designated to the Target Localization"****, describes the approach to processed signals using information entropy as a parameter for evaluating the quality of information. This article deals with the simulation of sensors dislocation, which is affected by the same measurement error or different error for each individual sensor.*

The authors Tomáš Čižik and Monika Masariková wrote the article titled ***"Cultural Identity as Tool of Russian Information Warfare: Examples from Slovakia"****. The authors´ main aim is to analyse how Russia or, more precisely, Kremlin exploits the concept of cultural identity in shaping its anti-western and pro-Russian narrative. The article begins with context analysis and definition of information warfare and cultural identity and explanation why it is particularly successful in some countries. Then it proceeds to the analysis of particular examples of disinformation campaigns related to Slavic culture and shared Slavic values in Slovakia.*

The article titled ***"Some Aspects of Technogene Safety and Their Impact on Functioning of Public Systems",*** *which was written by Alla Bespalova, Vladimir Lebedev, Yuri Morozov and Inga Uriadnikova, deals with questions of technogenic safety, which are observed at the example of the situation at Ukrainian Donbas. It is shown that dust generated by enterprises refers to the factors that gradually accumulate and then disrupt the human health.*

Another article titled ***"Decompiling Java Bytecode: From Common Java to Newest JDK8 Features, from Obsolete Decompilers to Cutting Edge Technology"*** *was written by Jozef Kostelansky and Lubomir Dedera. In this paper, the authors focused on reverse engineering, which is an elementary part of static analysis. They evaluate current Java bytecode decompilers and the output from current Java bytecode decompilers using test samples and metrics from previous surveys in 2003 and in 2009.*

Among the articles in this issue, you can find the article written by Victor Grechaninov titled ***"The Expediency of Improvement of Armed Forces Management by Automatization of Their Base Functions"****. The article deals with the management process of the team of people that represents a system of certain sequential interrelated activities called management functions. It introduces the general (basic) management functions that are specific for the armed forces. It is disclosed operation of Commander and his staff on the organization preparations for the operation (combat actions). It proves the necessity of automation of basic management functions of the armed forces, as well as modelling of possible actions and processes.*

The series of articles is closed with the paper titled ***"Gender and Leadership in the Military"*** *written by Veronika Marenčinová. This paper has discussed the role of women and the obstacles they face all over the world in their attempts at military leadership. The gender equality issue is still a major challenge in most militaries worldwide. Except for a few developed countries that have opened up their military to women at all levels, most countries still offer female soldiers a traditional role hence they largely remain a supporting arm of the male soldiers. It is going to take inconceivable skills to bring female leadership into most militaries of the world due to factors discussed in this paper.*

In conclusion, I would like to thank you for your continued interest and support, and wish you pleasant, inspiring and interesting reading.

Col. (ret.) Prof. Eng. Marcel HARAKAĽ, PhD.
Chairman of the editorial board

Reviewers

THE DEPENDENCE OF INFORMATION ENTROPY ON THE MEASUREMENT ERROR OF THE SENSOR NETWORK DESIGNATED TO THE TARGET LOCALIZATION

Peter RINDZÁK

Abstract: The Information from the sensors and resources which are available to the commander are important during his decision-making process. An important parameter of this information is their quality. This article describes the approach to processed signals using information entropy as a parameter for evaluating the quality of information. Initial precondition for applying the information entropy model, the individual optimization strategies are used in 2D and 3D space. In the previous work, we dealt with sensors which were capable to scan without measuring error. In this publication, we are dealing with the simulation of sensors dislocation which is affected by the same measurement error or different error for each individual sensor. Lastly, the thesis for possible future studies can be found at the end of this article.

Keywords: NEC, Network enabled capability, UAV, sensors, TDOA, information entropy.

1 INTRODUCTION

In the information age, in addition to the standard equipment which armies require for their combat, additional information and analytical tools are necessary for to increase the level of command and control process effectivity. In particular, this concerns the systems capable of combat situations recognition, sensors and tools for sensors information analyses.

The principal of the TDOA method was described in the paper [1]. This method is vastly used while testing and evaluating the effectivity of the estimation process. The paper [2] was focused on factors which influence sensors dislocation in 2D space and the optimization of their dislocation for the most accurate estimate of target's position. In the article [3] we applied a mathematical model in 3D space and, similarly to the previous article, we were dealing with the optimization accordingly.

The following article describes the relationship between the information and its impact on the battle results in the network-oriented NEC environment. In addition, this model applied in other procedures which describe the relative domination of information as well. While acquiring information from sensors and resources, the commander requires and selects the information which is the most valuable for his decision to be made. Therefore, the processing of signals from sensors and other sources will have substantial impact on the commander's decision. In a network-oriented environment, for to accomplish the information dominance, it is essential to achieve a certain degree of sensors and resources deployment effectivity as a considerable ratio to the quality and the information integrity.

2 MATHEMATICAL MODEL

We assume that our sensors are carried by UAV, they are able to communicate within the network and are capable of moving in the trajectory represented by perimeter of the sphere. Secondly, we assume that all sensors should have the different error deflection and are able to move in the same speed. The target followed by sensors is situated in the middle of the sphere.

During the testing and evaluation of effectiveness of estimate, the Cramer-Rao inequality is used. The main goal is to express a lower bound on the variance of estimators.

Cramer-Rao inequality (CRB) for target vector $\bar{p} \in R^D$ and sensors $\bar{q_i} \in R^D$, where D expresses 2 or 3 dimensional area and M expresses the quantity of sensors, can be defined by [4]:

$$CRB = J^{-1} = (v\sigma)^2(GG^T)^{-1} \qquad (1)$$

where:
$G = [g_{ij\dots}]$, (i,j)∈ I, $\bar{g}_{ij} = \bar{g}_i - \bar{g}_j$, $\bar{g}_i = \frac{\bar{q}_i - \bar{p}}{\|\bar{q}_i - \bar{p}\|}$

where:
J ... is the Fischer information matrix (FIM), (its presence ensure the existence of linear independence of vectors),
$\bar{g}_i$ ... is the vector heading from the target p to sensor *i,*
$\bar{g}_{ij}$ ... is difference between two direction vectors,
σ^2 ... expresses an error variance caused by Gauss noise (reliability factor).

Set I consists of each individual sensor pair (i,j). Matrix G contains all vectors $\bar{g}_{ij}$, where (i,j)∈ I.

The most common strategy is to minimize the trace of CRB [4]:

$$min\, f_{CRB} = tr[J^{-1}] = (v\sigma)^2 tr[(GG^T)^{-1}]\,. \qquad (2)$$

Required conditions for calculation min f_{CRB} are:

1. $\sum_{i=1}^{M} \bar{g_i} = \bar{0}$
2. For matrix $D\, x\, M$ $g = [g_1 \dots g_M]$ must be $gg^T = \frac{M}{D} I$

where:
$\bar{g}_i$ ... is a vector heading from target p to sensor i,
M ... the number of sensors,
D ... area dimension,

I ... expresses matrix, where elements on the main diagonal of the matrix are equal to 1.

If we assume that sensors are deployed equally around the sphere perimeter, then the formula (2) can be replaced as follows [5]:

$$\sum_{i=1}^{M} c_i^2 g_i\, g_i^T = \frac{1}{D}\sum_{i=1}^{M} c_i^2\, I_D \qquad (3)$$

where:
c_i ... is error variance of the sensor *i,*
g_i ... is vector pointing from the target to the sensor *i,*
M ... is the number of sensors,
D ... is dimension,
I_D ... is matrix of which diagonal values are equal to 1.

If previous equality is valid, then we can assume that the sensors are dislocated optimally and the minimum value can be expressed as following:

$$\Delta = \sum_{i=1}^{M} c_i^2 g_i\, g_i^T - \frac{1}{D}\sum_{i=1}^{M} c_i^2\, I_D.$$

3 RELIABILITY FACTOR AS A PARAMETER FOR EVALUATING THE QUALITY OF INFORMATION

In general, parameter c_i represents a reliability factor, or basically, a sensor measurement error. In essence, it represents the sum of probabilities of the sensor which affect its final deviation and thus the whole process of detection and optimal deployment.

The initial probability distribution and therefore the total entropy depends on the specific information available to the commander from each individual sensor. In each step of the optimization process of the sensor matrix dislocation, the probability distribution and overall information entropy evolves.

The probability distribution can be affected by the following factors:

- The amount of both, confirmed and unconfirmed messages from sensors;
- The reliability of sensors;
- Field conditions;
- Time latency between the information gathered;
- Vibration of sensors, etc.

We can express this measurement error in more granularly as following:

$$c_i = \frac{1}{(v\sigma)^2} \qquad (4)$$

where:
v^2 ... expresses an error variance caused by vibrations of sensors,
σ^2 ... expresses an error variance caused by Gauss noise (reliability factor).

We can assume, that we have *i* sensors in operation area and A_1, A_2,...,A_n are independent events, which are considered as a target detections from each sensor and also that all sensors would follow just one target. For the final probability of the target detection stands:

$$P(\cup_{n=1}^{n} A_i) = 1 - P\left(\overline{\cup_{n=1}^{n} A_i}\right) = 1 - P\left(\overline{A_1}\right).P\left(\overline{A_2}\right)\ldots P\left(\overline{A_n}\right) \qquad (5)$$

The reliability factor can be observed from different angles. In essence, the reliability factor represents the reliability of the sensors and the reliability of the information processing. In general, the reliability factor describes the quality of the information and the quality of the information network that allows the transfer of information from the sensors to the commander. In a network where each individual sensor is separated from the information network, the reliability factor expresses the entire quality of the sensor. Essentially, if required, this approach can applied across each individual NEC level.

4 THE DEPENDENCE OF INFORMATION ENTROPY ON THE SENSOR NETWORK MEASUREMENT ERROR

Once the information from all sensors is processed, the commander's level of knowledge changes with each iteration which is reflected in changes in probability distribution.

The current amount of information can be measured by information entropy. Information entropy is the measurement of the average amount of information in the probability distribution. The entropy function achieves the maximum when the value of the information in the probability distribution is the lowest (with the highest uncertainty). In practice, this happens if the commander nor possess the localization equipment, neither dispose prior information about the targets in the battlefield.

In this case, we can express the maximum information entropy as following:

$$H(U) = -\sum_{i=0}^{n} \frac{1}{n+1} ln \frac{1}{n+1} = ln(n+1) \qquad (6)$$

The entropy function has its minimum value at zero. This phenomenon occurs when P(U) = 1 and represents a state of maximum certainty or minimal uncertainty. In our case, the entropy function has a minimum if the sensor matrix is in the optimal position.

To be able to simulate the dependence of the resulting information entropy on the individual sensor error, we had to ensure that the initial sensor configuration was not randomly generated, but that it was constant for all measurements.

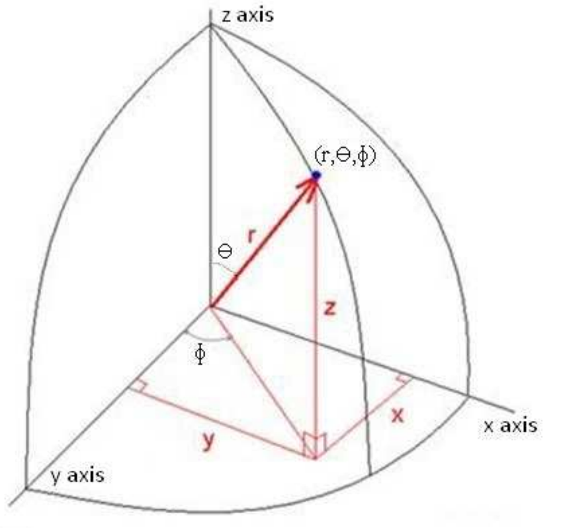

Fig. 1 Converts from Spherical to Cartesian coordinates in 3-dimensions

We know from geometry that there are five different solids whose vertices are located symmetrically around the surface of the sphere. In our case - for simulation purposes, we used the solid called the tetrahedron, which has four vertices. At the beginning of the simulation, four sensors were randomly distributed over the surface of the sphere and are interpreted by blue points.

The coordinates of each individual sensor g_i are expressed by $[x, y, z]^{\mathrm{T}}$(see Fig.1), where:

$$x = r.\cos\phi.\sin\theta$$
$$y = r.\sin\phi.\sin\theta$$
$$z = r.\cos\theta$$

In the first iteration, the uniform array of optimal sensor dislocations, which is shown in green in the figure, was rotated around the center in order to identify the minimum time value necessary for sensors re-dislocation from initial location to the optimal.

In the second step, based on the formula (3) and considering criteria reflecting the minimum necessary time for initial configuration changes to the optimal setting, the sensors were re-dislocated to the optimal locations.

Figure 2 shows a simulation in which four sensors are placed and their measurement was not affected by the measurement error. Information entropy in this case reaches a zero value because the sensor matrix at the optimal position does not generate a measurement error.

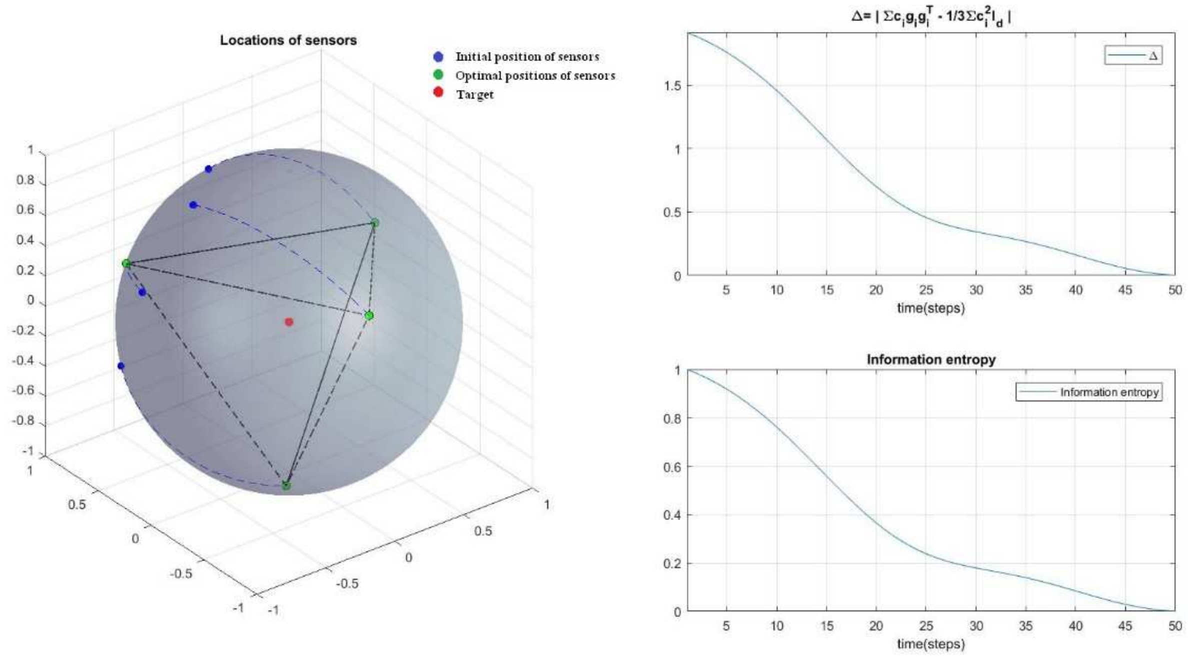

Fig. 2 Dependency of information entropy from measurement error (sensors are not affected by measurement error)

Figures 3 and 4 show the situation where all four sensors are affected by the same measurement error. The error of measurement for the case in Figure 3 was randomly set to 1.05 for all sensors, and for the case in Figure 4, the error was randomly set to 1.20. These values were set to correspond to approximately realistic conditions in practice. The difference between the individual simulations is only in the difference Δ between the actual value $\sum_{i=1}^{M} c_i^2 g_i\, g_i^T$ and its minimum value $\frac{1}{D}\sum_{i=1}^{M} c_i^2\, I_D$ is in each step relatively larger or smaller depending on the level of the measurement error and its orientation. The shape of the continuous variance curve between the optimal and real position of the sensors remained unchanged and therefore the same as in Figure 2. From the graph of the variance between the predicted position and the actual one we derived a graph of information entropy that is directly proportional to the variance. Information entropy in this case does not reach a zero value because the matrix sensor in the optimal position still generates a certain measurement error.

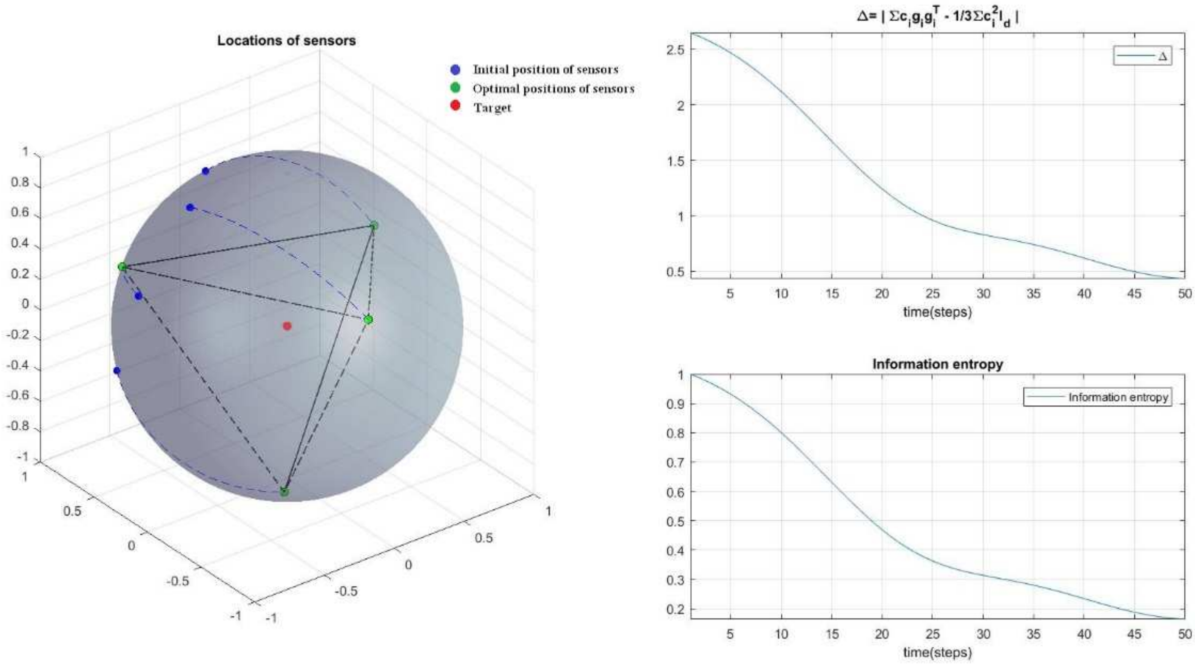

Fig. 3 Dependency of information entropy from measurement error (measurement error for all sensors was 1.05)

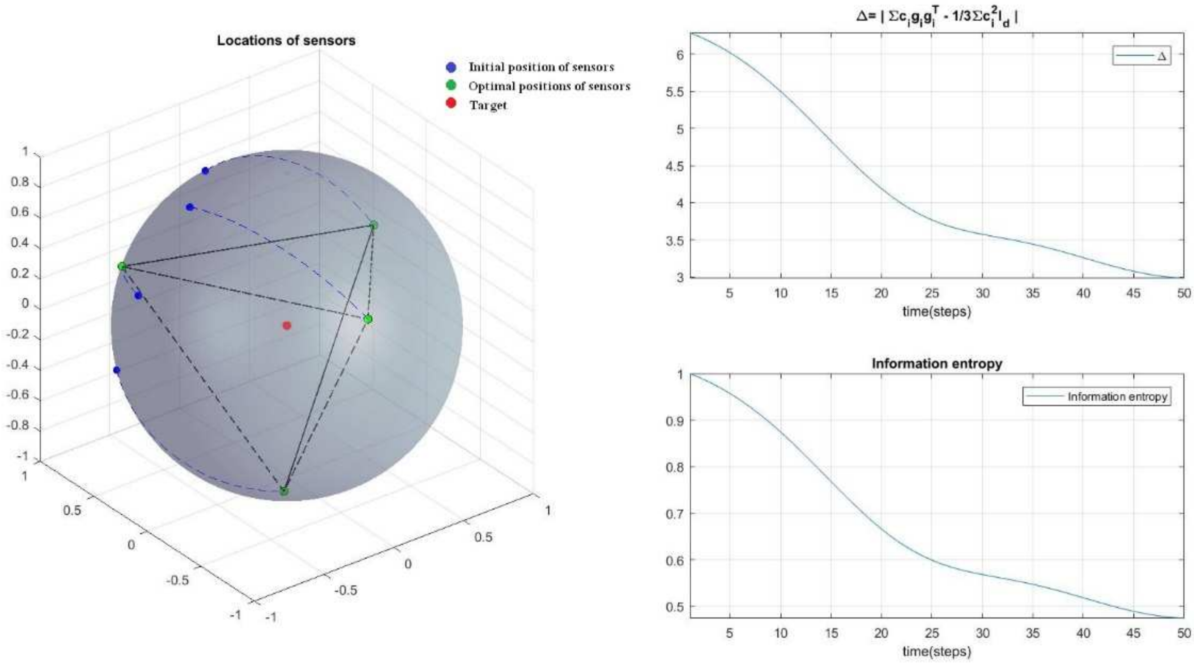

Fig. 4 Dependency of information entropy from measurement error (measurement error for all sensors was 1.20)

Figures 5 and 6 show a situation where each of the four sensors has a different measurement error. The measurement error for the case in Figure 5 was randomly set to c=[1 2 3 4] for each sensor, and for the case in Figure 6 the error was randomly set to c=[1 3 6 10]. These values are in practice not realistic and have been set as to clearly see the change in the shape of the variance graph and as well as the graph of information entropy. The shape of the continuous variance curve between the optimal and the real position of the sensors is different from the previous simulations and is dependent on the variance of each individual sensor. From the graph of the variance between the predicted position and the actual one we derived a graph of information entropy that is directly proportional to the variance. Information entropy in this case does not reach a zero value because the matrix sensor in the optimal position still generates a certain measurement error.

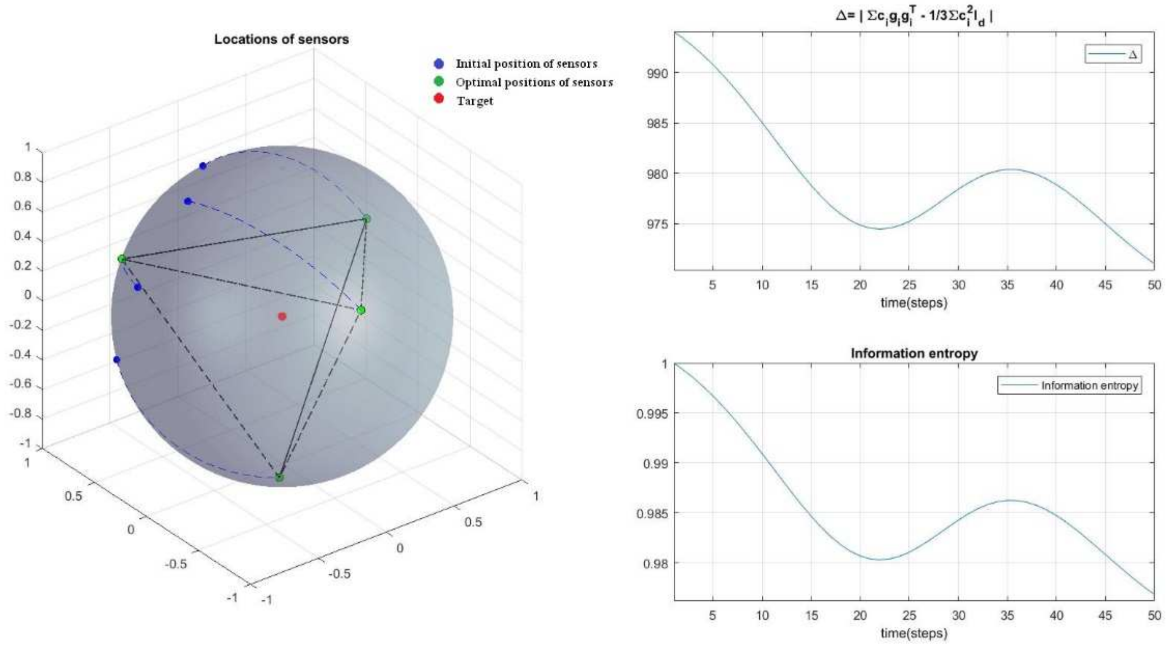

Fig. 5 Dependency of information entropy from measurement error (measurement error for all sensors was set to c=[1 2 3 4])

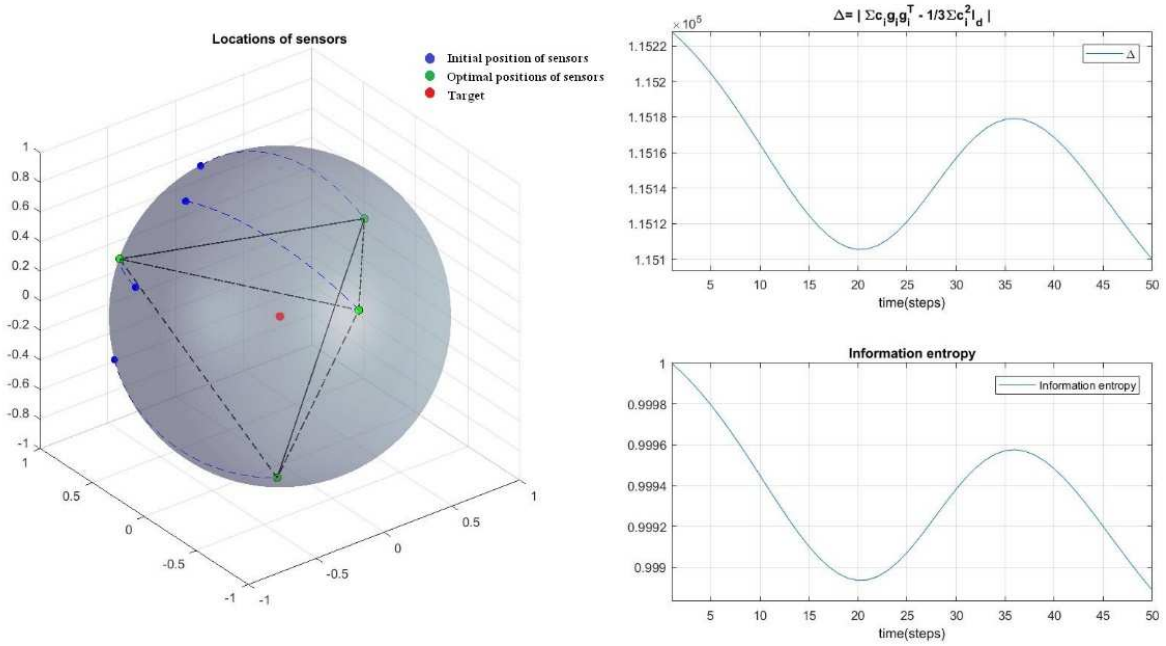

Fig. 6 Dependency of information entropy from measurement error (measurement error for all sensors was set to c=[1 3 6 10])

5 CONCLUSION

During the combat operation, the reconnaissance is as important as the effective use of firepower. The quality of the information depends on its accuracy, completeness and timeliness. The Common Operational Picture (COP) is an awareness of the battlefield situation and therefore represents the understanding of the opponent's intentions and the acceptance of effective actions and the subsequent decision of the commander. During the acquisition of information from sensors and other sources, the commander requests and selects information that has informative value for him. We have described the situation on the battlefield using a mathematical model and a probability model. From the graph of the variance between the predicted position and the actual one we derived a graph of information entropy that is directly proportional to the variance. Based on the change in each individual sensor measurement error, we showed a change in the variance graph between the predicted and the actual position and the corresponding information entropy. If we can predict the number of sensors available to the commander and we know on the basis of sensor properties (probability of detection), field conditions (location of sensors) and experience (weather conditions, sensor vibration) the approximate variance values for individual sensors, we can give the commander a more accurate view of the quality of the information obtained from this group of sensors. This model can also be useful in quantification of information superiority and in creating an optimized model of information superiority, which will be the subject of further modeling and exploration.

References

[1] RINDZÁK, P. *Using unmanned aerial vehicles as a carrier of different sensors in NEC environment.* Tatranské Zruby : Conference VKIT, 2015.

[2] RINDZÁK, P. Optimal sensor dislocation for target localization in 2D and 3D area. In *Science & Military*, 2017, vol. 1. Liptovský Mikuláš : Akadémia ozbrojených síl generála M. R. Štefánika, 2017. ISSN 1336-8885.

[3] RINDZÁK, P. Optimal sensor array and probability of detection in 2D and 3D area. In *Science & Military*, 2017, vol. 2. Liptovský Mikuláš : Akadémia ozbrojených síl generála M. R. Štefánika, 2017.

[4] YANG, B., SCHEUING, J. 2005. Cramer-Rao bound and optimum sensor array for source localization from TDOA. In *IEEE ICASSP*, 2005, vol. 4. p. 961-964.

[5] ZHAO, S., CHEN, B. M., LEE, T. H. 2014. Optimal deployment of mobile sensors for target tracking in 2D and 3D spaces. In *Acta Automatica Sinica*, 2014, 1(1): 50−56.

[6] ISAACS, J. T., KLEIN, D. J., HESPANHA, J. P. Optimal sensor placement for time difference of arrival localization. In *Proceedings of the 48th Conference on Decision and Control.* Shanghai, China : 2009. pp. 7878–7884.

[7] SLOANE, N. J. A., HARDIN, R. H., SMITH, W. D. *Spherical codes.* Available at: http://www.research.att.com/njas/packings/.

[8] YANG, B. Different sensor placement strategies for TDOA based localization. In *Proceedings of the 2007 IEEE International Conference on Acoustics*, *Speech, and Signal Processing,* vol. 2, pp. II–1093–II–1096, Apr. 2007.

[9] OCHODNICKÝ, J. 2007. *Rádiolokácia a navigácia.* Liptovský Mikuláš : Akadémia ozbrojených síl, 2007.

[10] CARTER, G. C. (Ed.) 1981. Special issue on time delay estimation. In *IEEE Trans. Acoust. Speech*, *Signal Processing*, June 1981, vol. 29.

[11] IEEE Trans. Aerospace and Electron. Systems, *"Statistical theory of passive location systems"*, vol. 20, p.183-198.

[12] FARINA, A., STUDER, F. A. 1985. *Radar data processing.* UK : Hertfordshire, 1985.

[13] REN, W., CAO, Y. C. 2011. *Distributed Coordination of Multi-agent Networks*. New York : Springer, 2011.

[14] OUSINGSAWAT, J., CAMPBELL, M. E. 2007. Optimal Cooperative reconnaissance using multiple vehicles. In *Journal of Guidance*, *Control and Dynamics*, 2007. p. 122-132.

[15] HU, J. W., XU, J., XIE, L. H. 2013. *Cooperative search and exploration in robotic networks.* Unmanned systems, 2013. p. 121-142.

[16] CARTER, G. C. (Ed.) 1993. *Coherence and Time Delay Estimation.* IEEE Press, 1993.

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CULTURAL IDENTITY AS TOOL OF RUSSIAN INFORMATION WARFARE: EXAMPLES FROM SLOVAKIA

Tomáš ČIŽIK, Monika MASARIKOVÁ

Abstract: Nowadays, the „information warfare" is becoming more and more common term within the international relations, as an effective tool of combat involving minimal cost. Since March 2014, several European countries have faced massive propaganda and disinformation campaigns originating in the Russian Federation. The Central European countries are no exception. Disinformation portals, which are being visited at least once or twice a week by up to 34 % of Slovaks, use the concept of Pan-Slavism and the idea of Slavic culture and identity. Statistics prove that many people in the V4 countries do not want to be part either of "the East" nor "the West", many people consider Vladimir Putin more sympathetic than Angela Merkel, and many people also think NATO is no longer relevant to European security. In contrary, they believe Russia should become part of the European security structures.

Keywords: information warfare, Russian Federation, Slavs, Pan-Slavism.

1 INTRODUCTION

Main purpose of the article is to analyse how Kremlin uses the concept of cultural identity in its information warfare in the V4 countries[1]. Kremlin in its disinformation campaigns is often arguing that citizens of the Visegrad states share the same cultural identity and language with Russians and therefore they should be part of the Slavic empire or eastern culture. In such disinformation campaigns Slavic culture and common values plays major role. Main argument used by Kremlin is that all Slavic and Baltic countries share common interests and follow common goals, because they share common history, language, culture, habits and heritage. Same rhetoric is also used by extreme right-wing parties, which are using strong nationally oriented and anti-western narrative. It is also used by parties and individuals, who are against membership of the Visegrad countries in the European Union (EU) and North Atlantic Treaty Alliance (NATO). It is clear that concept of common cultural identity plays major role in Russian disinformation campaigns in Visegrad region and without a doubt, it is also attractive and popular among nationalists and extreme right parties.

Therefore, authors´ main aim is to analyse, how Russia or more precisely, Kremlin, exploits the concept of cultural identity in shaping its anti-western and pro-Russian narrative. Article begins with context analysis and definition of information warfare and cultural identity and explanation, why it is particularly successful in some countries. Then it proceeds to the analysis of particular examples of disinformation campaigns related to Slavic culture and shared Slavic values in Slovakia.

2 INFORMATION WARFARE

Information warfare became one of the most common used terms in international relations and foreign and security policy. Many experts consider information warfare to be a very powerful tool in international affairs, which is capable to influence significantly whole nations and alliances without significant efforts or investments. It is caused mainly by its flexible, asymmetric and abstract nature. It can be easily used by any state without even taking borders into consideration. It can take many forms, such as psychological operation, electronic warfare, information operations or cyber operations. Each of these forms has its own pros and cons, and generally it is extremely difficult to counter such actions. The main tools of information warfare are internet and social media, which provide information warfare with whole new battleground. Information warfare is subpart of more complex hybrid warfare, which is composed of 4 main components: information warfare, psychological operations, cyber operations and the use of special forces. Hybrid warfare cannot be considered as a new phenomenon, it was part of conflicts hundreds years ago, but currently, the information era and new technologies creates very specific environment, where hybrid tactics are very useful and effective. Hybrid warfare relies mostly on unconventional tools (soft power) and it is difficult to define it as war between two or more conventional armies[2].

Since March 2014, European countries are facing massive information warfare and disinformation campaigns originating from the Russian Federation. These disinformation campaigns are supposed to undermine the trust of citizens in democratic political system, domestic and European institutions, local political elites and western values. Other goal of Russian disinformation campaigns is to create chaos

[1] For purpose of this article authors define the Visegrad countries as follows – Slovakia, the Czech Republic, Poland and Hungary, which are part of the Central Europe.

[2] ČIŽIK, T. 2017. Baltic States – How to React to "New Warfare" in the Context of the Article V?

in the minds of citizens and create the situation, when nobody knows, which information is false and which is correct. Information warfare itself cannot be considered as a new phenomenon in the armed conflicts, however in today's information era, the Internet and the social media have provide information warfare with a new battleground, where the main target groups are not militaries, but the minds of civilians.

Information warfare can be considered as a very powerful geopolitical tool, which can negatively influence any European state without direct use of military or hard power. Russian information warfare and propaganda have a clear geopolitical context. Disinformation campaigns are carefully prepared by experts and tailor-made for each state, not only in the close neighborhood of Russia such as Ukraine and Georgia, but also for NATO and the EU member states[3].

In Russian disinformation campaigns, the strong emphasis is given on so called – Pan-Slavism, Russian culture and common values. According to Encyclopaedia Britannica (n.d.), Pan-Slavism is *19th-century movement that recognized a common ethnic backround among the various Slav peoples of eastern and east central Europe and sought to unite those peoples for the achievement of common cultural and political goals.* Slavic culture and Slavic identity is often being used as a central concept in various disinformation media.

Such - according to them - "alternative" websites, can be found in any of the Visegrad state. Their main purpose is to share as much false information as possible and to create chaos in the minds of its citizens. Since 2014, there are traceable massive investments of the Russian Federation in media. A case in point, the budget for the RT agency (formerly Russia Today) in the period 2007-2015 was approximately 120 million USD, peaking in 2013-2014 with 400 million USD. Sputnik News in conjunction with Ria Novosti have a combined operating budget of 200 million USD per year, not to mention the local media involved in the spreading of propaganda[4]. Without any doubts, Russia's investments into development of tools of information warfare are not coincidence. In Russian Military doctrine from December 2014, information is treated as cheap and universal weapon, which is easily accessible and permeated all states borders without restrictions[5]. According to the Military Doctrine[6], one of the main internal military risks for the Russian Federation are "*subversive information activities against the population, especially young citizens of the State, aimed at undermining historical, spiritual ad patriotic traditions related to the defense of the Motherland".* Based on previous quotation, it can be assumed that Russia is clearly aware of the power of information.

3 CULTURAL IDENTITY

According to Ibrahim and Heuer[7] *"the concept of cultural identity refers to familial and cultural dimensions of a person's identity, and how other perceive him or her, i.e., factors that are salient to a person's identity both as perceived by the individual and how others perceive the person's identity".* According to Ennaji[8], *"cultural identity is the identity or feeling of belonging to a group. It is part of a person's self-conception and self-perception and is related to nationality, ethnicity, religion, social class, generation, locality or any kind of social group that has its own distinct culture".* It is no surprise that Kremlin is playing cultural identity card in Visegrad region to its advantage.

"The entire Central Europe region has suffered, in the last 100 years at least, from much turmoil, which has resulted in a degree of instability of political and economic institutions. The region has also been fairly isolated from mainstream of world politics". The Central European countries share same history, culture, language[9], habits and symbols. In the 19th century, majority of the Central European states was part of the Habsburg Empire and in the second half of 20th century they were under the Soviet dominance[10]. They were part of the Soviet Union for almost 45 years. Therefore, it is logical that citizens of the Central European countries consider themselves, to some extent, as a part of the East. However, it is necessary to mention that there is a difference between young generation and older people, who feel nostalgic about the Soviet Union.

In case of the Central Europe, Russian disinformation campaigns are using mainly alternative and social media platforms to spread as much false information as possible. However, Kremlin also exploits the fact that Baltic states has sizeable Russian minority. *"Due to Soviet Russification policies, Latvia and Estonia are the most exposed, as 26.9 percent of 2-million strong Latvia's populations are ethnic Russians and 24,8 % of 1,3 million of Estonians, while Lithuania has*

[3] ČIŽIK, T. 2017a. *Russian Information Warfare in Central Europe*.

[4] DELFI. 2015. Kremlin's millions: How Russia funds NGOs in Baltics (3).

[5] ČIŽIK, T. 2017b. Information Warfare as a Geopolitical Tool.

[6] *Theatrum Belli.* 2015. The Military Doctrine of the Russian Federation.

[7] IBRAHIM, F.A., HEUER, J. R. 2016. *Cultural and Social Justice Counseling.* p.15.

[8] ENNAJI, M. 2005. *Multilingualism, Cultural Identity and Education in Morocco*. p.19-20.

[9] Except Hungary.

[10] PEHE, J. 2002. "Central European Identity in Politics". *Conference on Central European Identity.*

5,8 percent Russian population our of 2,9 million"[11] In addition, most of the Central European countries are considered as Slavic countries (except Hungary and Baltic states), and therefore Kremlin is extensively using Slavic culture and common Russian culture as a main topic in its disinformation campaigns, as it will be discussed later.

However, not only Russian-speaking minorities, but also ethnic Estonians, Latvians and Lithuanians are exposed to Russian language propaganda. According to surveys, 39 percent of those Estonians, who prefer viewing news in multiple languages, watch Russian TV channels[12]. In Latvia, the weekly reach of Russian TV channels is 48 percent[13] and 13 percent of Lithuanians watch news via Russian TV channels at least once a day[14].

As it was mentioned above, Kremlin uses alternative websites to spread disinformation to specific groups of people. The most recent researches show that this tactics is very successful. Research[15] done by Globsec Policy Institute in September 2017 points out that 33 percent of Czechs, 39 percent of Hungarians, 45 percent of Poles and 21 percent of Slovaks would like to be part of the West. On the other side, 5 percent of Czechs, 5 percent of Hungarians, 3 percent of Poles and 9 percent of Slovaks would like to be part of the East. However, there are huge number of citizens of these countries, who would like to be "somewhere between" the West and East – 41 percent of Czechs and Hungarians, 35 percent of Poles and 42 percents of Slovaks. Such numbers show that half of the citizens of Czech Republic, Hungary and Slovakia do not want to be part neither of the West nor the East.

In addition, Globsec's research showed that in three out of four of the Visegrad countries, the public is more sympathetic to Vladimir Putin than to Angela Merkel[16]. In Slovakia, 41 percent of the population finds Vladimir Putin sympathetic, however, only 19 percent said the same for Merkel. In Hungary, 44 percent of the population considers Putin sympathetic. In Czech Republic, it is 32 percent. However, in Poland, only 10 percent of Poles finds Putin sympathetic and 59 percent of Poles find Angela Merkel sympathetic. It is necessary to mention that during last years, due to their historical experiences with Russians, Poles have often warned other European countries of Russian aggressive actions. It comes as a no surprise that from the Central European countries, Putin is the least sympathetic foreign leader in Poland.

As it was argued in previous part, majority of the citizens of V4 countries does not want be part neither of the West nor the East, but on the other side, they like Vladimir Putin more than other foreign leaders. This suggests, to some extent, that Kremlin's tactics of using pan-Slavism yields relevant results and definitely can influence public opinion in different countries.

International Republican Institute (IRI) also conducted research[17] on public opinion in V4 countries, which included questions about citizen's sources of political news, trust in political system, opinions on the national and regional context and issues of identity. When asked about the Vladimir Putin´s Russia defending Christendom and traditional European values, 18 percent of Hungarians, 14 percent of Poles, 27 percent of Czechs and 41 percent of Slovaks agreed that *"Russia has taken the side of traditional European values",* according to this research. Moreover, 24 percent of Hungarians, 21 percent of Poles, 38 percent of Czechs and 37 percent of Slovaks think that „*Russia and Putin can be allies against the EU that is pushing us to abandon our values"*.

IRI's research showed also alarming phenomena, negative attitude of V4 citizens towards NATO, with 41 percent of Hungarians, 35 percent of Poles, 50 percent of Czechs and 53 percent of Slovaks thinking that NATO is no longer important for European security and the approach to security should be rethought. Also 54 percent of Hungarians, 35 percent of Poles, 59 percent of Czechs and 75 percent of Slovaks thinks that *"Russia should be considered a partner in European security and brought into European security structures"*. Also, 41 percent of Hungarians, 27 percent of Poles, 44 percent of Czechs and 60 percent of Slovaks thinks that *"the United States should not play a role in European security, and in the fact its presence in Europe increases tensions and insecurity"*.

While Kremlin is exploiting situation to spread as much disinformation as possible through social media and disinformation websites (in which Russia is being portrayed as a victim of the West and NATO aggressive policy), large audiences are using social media as their main source of information every days. According to IRI's research, it is 40 percent of Slovaks, 47 percent of Czechs, 34 percent of Poles and 41 percent of Hungarians are using social media everyday as their main source of information. According to ongoing research of Centre for

[11] ŠUKYTÉ, D. 2017. *Russian Information Warfare in the Baltic States and Possibilities to Resist.* p. 122.

[12] SAAR POLL OÜ. 2014. *Current Events and Different Sources of Information*. p. 13-14.

[13] BALTIC COURSE. 2016. *Non-Latvians youngsters do not watch Latvian public television.*

[14] ŠUKYTÉ, D. 2017. *Russian Information Warfare in the Baltic States and Possibilities to Resist.* p. 122.

[15] GLOBSEC POLICY INSTITUTE. 2017. *Globsec Trends 2017: Mixed Messages and Signs of Hope from Central & Eastern Europe*.

[16] KREKÓ, P. 2017. Merkel's Next Challenge: Defeating Putin in Central Eastern Europe. *Atlantic Council.*

[17] INTERNATIONAL REPUBLICAN INSTITUTE. 2017. *Public opinion in Hungary, Poland, Czech Republic and Slovakia*.

European and North Atlantic Affairs[18] (CENAA), this number is even larger when it comes to younger generation. Research has shown that almost 70 percent of young people[19] in Slovakia are using social media (Facebook) as their main source of political information.

Moreover, according to the same research, 27 percent of Poles and 24 percent of Slovaks, Czechs and Hungarians think that *"major media is not concerned with factual and correct reporting of a story, but instead is focused on propagating a narrative that serves a particular interest"*. Even though the majority of people think that major media is (or at least is trying to be) professional and unbiased, on average one out of four persons think it is biased.

IRI´s research[20] also revealed that 15 percent of Hungarians, 12 percent of Czechs and 10 percent of Slovaks and Poles read these outlets because *"major media outlets are biased and refuse to acknowledge simple truths. Alternative sources are willing to tell the truth"*. At least once or twice a week those sources are visited by 36 percent of Hungarians, 34 percent of Czechs and Slovaks and 21 percent of Poles.

According to ongoing research of (CENAA), 23 percent of young people are using mainly disinformation media, such as Hlavné správy, Slobodný vysielač, Zem a Vek, as their main source of information.

4 EXAMPLES FROM SLOVAKIA

What particular examples of disinformation campaigns related to cultural identity can be found on disinformation websites, which portray themselves as alternative media offering different point of view or revealing the truth?

To begin with the concept of the Slavic culture that is popular on disinformation websites. Little research on website Hlavné správy, Zem a Vek or Slobodný vysielač, has revealed, that keyword of "Slavic", "Slavs" or "Pan-Slavism" appears is tens of articles.

These articles spread conspiracy theories stressing that Slavic culture is much older than it is officially presented. They claim that history of Slavic culture was artificially changed. Hlavné správy´s article "Traces of Slavs and making-up of a history"[21], which claims that *"history of many nations was intentionally made-up, classified and manipulated by historians"*, can be used as an example. It claims that history of Slavs can be traced back to Egyptian Pharaohs, or even Mesopotamia. As another article *"*Chairman of NGO Slavica Miloš Zverina: ´No one remembers golden ages of Slavs, when they lived as a one nation, stretching from the Atlantic Ocean to Alaska´."[22] suggests, there should have been times in the past, where Slavs were living in larger areas, yet there are *"creators of the official history"*, who prevent us from knowing the truth.

Very same example can be found in another Slovak "alternative" source of information called *Zem a Vek*, where in article "Slavs are second-class for the West, the future lies is Slavic union"[23] it is claimed that it is *"necessary to create an international organization, which will consist of ethic Slavs – the most numerous group in Europe"*. Main purpose of this international organization, according to author, will be the preservation of national identity of Slavic countries. The very same article with same wording appears in all major disinformation websites – Zem a Vek, Slobodný vysielač, Hlavné správy, Na palete. In total, this article in four media has more than 4.7k shares on social media, including Facebook, Twitter, LinkedIn, Pinterest. This article, particularly on website Na palete (with 2.8k shares), is also the most shared article on social media, which contains word "Slavs", in the last year, in whole Slovakia.

Article "Slovaks – ethnic authenticity record holders?"[24] focuses also on the ethnic origins. Nevertheless, this time it discusses origins of Slovaks. It says that according to the genetic research of Dr. Ferák, almost 85 % of Slovaks has genes, which appeared in our area 8 000 years ago, stressing that we are the ones who lived under the High Tatras even back then. Moreover, according to the article we are *"the oldest ethnic group in Europe. Our genes appeared in Europe already 20-50 thousand years ago"*.

Other messages in these disinformation media, centre on the primacy of the Slavic culture, which is supposed to be better than other cultures, with Slavs serving as an example to other nations. This idea appears for example in the article at Hlavné správy "Annual Slavic meeting: Slavs should be lighthouse in the sea of multicultural and political chaos"[25]. As the title suggests, authors claims that Slavs are the ones who can navigate others in difficult times.

Similar idea appears in yet another article from Zem a Vek "Slavs do not need life advices from

[18] Research outcomes will be available in November 2017.

[19] Young people – high-school students between the age of 15 and 21.

[20] INTERNATIONAL REPUBLICAN INSTITUTE. 2017. *Public opinion in Hungary, Poland, Czech Republic and Slovakia*.

[21] *Hlavné správy.* 2016. Stopy Slovanov a prekrúcanie histórie.

[22] *Hlavné správy.* 2017b. Predseda OZ Slavica Miloš Zverina: „Zlaté časy Slovanov, keď žili ako jeden veľký národ od brehov Atlantického oceánu po Aljašku, si už nikto nepamätá".

[23] *Zem a Vek.* 2017. Pre Západ sú Slovania druhotriedni, budúcnosť je slovanská únia

[24] *Hlavné správy.* 2016 b. Slováci – rekordérmi etnickej authenticity?

[25] *Hlavné správy.* 2017. Jubilejný Všeslovanský zjazd: Slovania by mali byť majákom v mori multikultúrneho a politického chaosu.

Germans or Americans"[26]. Author of this article refers to the books of Czech psychologist Jiřina Prekopová, which should prove that the situation in the West is much worse than in the Czech Republic or Slovakia and that there is decadence in Germany, with many spoiled children and people divorce. Author believes there is our *"5000 years old Slavic rightness, which the world is jealous about"* and that we are *"giving away our rightness in the times, when other European nations are lost in their being"*. Article became very popular, scoring 1.5k shares on social media. This article is also the second-most shared article on social media, which contains word "Slavs", in the last year, in whole Slovakia.

5 CONCLUSION

As it has been argued in previous parts of this article, Russia throughout disinformation websites is clearly using cultural identity of the Central European states to achieve its strategic objective – to influence and manipulate minds of citizens and to undermine their trust into existing political system, domestic and European institutions and democracy as such and so to reverse their pro-Western orientation.

According to the most recent researches, it is also clear that this tactic is very successful not only among young generation, but also among general public. From a long-term perspective, such actions have potential to significantly influence the core values of citizens of the Central European countries, as can be currently seen in Hungary, where its government is in the clash with the European Union.

"Tailor-made" disinformation campaigns represent the most imminent and dangerous threat for European security architecture. In fact, European countries are still not able to properly address this threat, mainly due to complexity of information warfare and therefore it will be difficult to improve security of the citizens of the Central European countries without massive investments into education and development of critical thinking, improving knowledge of young generation about history and historical development of international affairs in last 70 years and without cooperation of all state and non-state actors.

References

[1] BALTIC COURSE. 2016. *Non-Latvians youngsters do not watch Latvian public television.* Available at: <http://www.baltic-course.com/eng/baltic_news/?doc=16816> Accessed: September 28, 2017.

[2] ČIŽIK, T. 2017a. Russian Information Warfare in Central Europe. In Tomáš Čižik (ed.). *Information Warfare – New Security Challenge for Europe.* Bratislava : Centre for European and North Atlantic Affairs, pp. 8-34.

[3] ČIŽIK, T. 2017. Baltic States – How to React to "New Warfare" in the Context of the Article V? In *Slovak Journal of Political Sciences.* 2017, Vol 17/2. ISSN 1338-3140.

[4] ČIŽIK, T. 2017b. *Information Warfare as a Geopolitical Tool.* CENAA Analysis. Centre for European and North Atlantic Affairs. ISSN 1339-7168.

[5] DELFI. 2015. "Kremlin's millions: How Russia funds NGOs in Baltics" (3). Available at: <http://en.delfi.lt/nordic-baltic/kremlins-millions-how-russia-funds-ngos-in-baltics.d?id= 68908408>. Accessed: September 4, 2016.

[6] Encyclopaedia Britannica. (n.d.). *Pan-Slavism.* Available at: <https://www.britannica.com/event/Pan-Slavism>

[7] ENNAJI, M. 2005. *Multilingualism, Cultural Identity and Education in Morocco*. Springer Science & Business Media, pp. 19-20.

[8] GLOBSEC POLICY INSTITUTE. 2017. *Globsec Trends 2017: Mixed Messages and Signs of Hope from Central & Eastern Europe*. Available at: <https://www.scribd.com/document/349306275/Globsec-Trends-2017-Final-Preview3#> Accessed: October 6, 2017.

[9] *Hlavné správy.* 2016. Stopy Slovanov a prekrúcanie histórie. Available at: <http://www.hlavnespravy.sk/stopy-slovanov-a-prekrucanie-historie/741328> Accessed: September 24, 2017.

[10] *Hlavné správy.* 2016 b. Slováci – rekordérmi etnickej authenticity? Available at <http://www.hlavnespravy.sk/slovaci-rekordermi-etnickej-autenticity/769022>Accessed: September 24, 2017.

[11] *Hlavné správy.* 2017. Jubilejný Všeslovanský zjazd: Slovania by mali byť majákom v mori multikultúrneho a politického chaosu. Available at: <http://www.hlavnespravy.sk/jubilejny-vseslovansky-zjazd-slovania-mali-byt-majakom-v-mori-multikulturneho-politickeho-chaosu/1019108>Accessed: September 24, 2017.

[12] *Hlavné správy.* 2017b. Predseda OZ Slavica Miloš Zverina: „Zlaté časy Slovanov, keď žili ako jeden veľký národ od brehov Atlantického oceánu po Aljašku, si už nikto nepamätá". Available at: <http://www.hlavnespravy.sk/predseda-oz-slavica-milos-zverina-zlate-casy-slovanov-ked-zili-ako-jeden-velky-narod-od-brehov-atlantickeho-oceanu-po-aljasku-si-uz-

[26] *Zem a Vek.* 2017b. Slovania nepotrebujú recepty na život od Nemcov či Američanov.

nikto-nepamata/1011832> Accessed: September 24, 2017.

[13] IBRAHIM, F. A., HEUER, J. R. 2016. *Cultural and Social Justice Counseling.* International and Cultural Psychology. Springer International Publishing Switzerland. pp. 15.

[14] INTERNATIONAL REPUBLICAN INSTITUTE. 2017. *Public opinion in Hungary, Poland, Czech Republic and Slovakia*. Available at: <http://www.iri.org /sites/default/files/four_country_full_presentation_may_24_2017.pdf> Accessed: October 7, 2017.

[15] KREKÓ, P. 2017. Merkel's Next Challenge: Defeating Putin in Central Eastern Europe. *Atlantic Council.* Available at: <http://www.atlanticcouncil.org/blogs/ukrainealert/merkel-s-next-challenge-defeating-putin-in-central-eastern-europe> Accessed: October 6, 2017.

[16] PEHE, J. 2002. "Central European Identity in Politics". *Conference on Central European Identity.,* Bratislava : November 6-7, 2002. Available at: <http://www.pehe.cz/prednasky/2002/central-european-identity-in-politics> Accessed: September 28, 2017.

[17] SAAR POLL OÜ. 2014. *Current Events and Different Sources of Information.* Tallinn. Available at: <https://oef.org.ee/fileadmin/media/valjaanded/uuringud/Current_events_and_different_sources_of_information__2_.pdf> Accessed: September 28, 2017.

[18] ŠUKYTÉ, D. 2017. Russian Information Warfare in the Baltic States and Possibilities to Resist. In Tomáš Čižik (ed.). *Information Warfare – New Security Challenge for Europe.* Bratislava : Centre for European and North Atlantic Affairs, pp. 116-135.

[19] *Theatrum Belli.* 2015. "The Military Doctrine of the Russian Federation". Available at: <http://www.theatrum-belli.com/the-military-doctrine-of-the-russian-federation/> Accessed: January 30, 2017.

[20] *Zem a Vek.* 2017. Pre Západ sú Slovania druhotriedni, budúcnosť je slovanská únia. Available at: <http://zemavek.sk/pre-zapad-su-slovania-druhotriedni-buducnost-je-slovanska-unia/> Accessed: September 24, 2017.

[21] *Zem a Vek.* 2017b. Slovania nepotrebujú recepty na život od Nemcov či Američanov. Available at: <http://zemavek.sk/slovania-nepotrebuju-recepty-na-zivot-od-nemcov-ci-americanov/> Accessed: September 24, 2017.

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SOME ASPECTS OF TECHNOGENE SAFETY AND THEIR IMPACT ON FUNCTIONING OF PUBLIC SYSTEMS

Alla BESPALOVA, Vladimir LEBEDEV, Yuri MOROZOV, Inga URIADNIKOVA

Abstract: The questions of technogenic safety are observed at the example of situation at Ukrainian Donbas. It is sown that dust generated by enterprises refers to the factors that gradually accumulate and then disrupt the human health. The greatest danger is represented by dust particles whose dimensions are 5 μm or less. The exposure time of dust particles per person depends on the settling speed of dust particles which is found from the following considerations. For calculating the time of exposure an analytical study was made. It was established that the dust that has arisen as a result of man's anthropogenic activity is deposited extremely slowly - for hours. Based on the time of dust exposure, the certain rules recommended that minimize man-caused hazards.

Keywords: technogenic safety, dust. exposure time, man-caused hazards.

1 INTRODUCTION AND STATEMENT OF THE PROBLEM

Technogenic safety is a state of protection of the population, technical systems and the environment from man-made accidents and catastrophes that cause the emergence of emergencies of anthropogenic nature.

Threats to man-made security are created at all stages of the life cycle of systems: when designing (when the project unreasonably uses potentially dangerous work processes, materials and technologies, unreasonably understated and overstated safety criteria and standards); in the manufacture of technical systems and their components (when the regulatory requirements for technological operations, input and output control of materials and finished products, testing of the development of potentially dangerous components, components and systems are not observed). During operation (with non-observable safety standards and regulations, monitoring of the technical condition of critical areas and critical elements is not carried out, flaw detection and monitoring are not carried out, compensation of increasing safety requirements for modernization and repair of technical systems). evaluates the characteristics of strength, resource, reliability, survivability of load-bearing elements of system systems for cases of normal (normal) and abnormal (emergency) situations. The generalized indicator - the criterion of man-made safety is the risk taking into account the probability of occurrence of emergencies and catastrophes and the mathematical expectation of damage from them. Methods of enhancement T. C. consist in the normatively justified adoption of constructive, technological and operational solutions for each of them, in declaring and maintaining safety at the required level, in monitoring, diagnosing and monitoring the state of technical systems, taking into account the affected and damaging factors, in the readiness of systems, operators and personnel to actions in emergency situations.

From time to time the media reports of various accidents at enterprises, on industrial and transport disasters; entire regions are declared zones of ecological disaster. In most cases, this is due to the technosphere and occurs in the technosphere.

By definition [1], the technosphere is part of the habitat, transformed by the direct and indirect effects of technical means in order to best match the socio-economic needs of mankind. Technogenic human activity is considered as a gigantic conversion system. The object of transformation of this system is the planet Earth [2, 3, 4].

If one understands the natural environment and systems created by the human being under the human environment, then the technosphere must be taken into account in the geographical envelope of the Earth. If the standards of sustainable development of the state are set in the form of indicators of the quality of life of the population and the quality of the natural environment [7], the tasks of optimizing the use of natural resources and environmental protection can not be resolved without taking into account the technogenic safety (TS) of the technosphere. The inadequacy of the situation in the provision of TS to the level of modern technology has long troubled specialists. But, in general, the emphasis was put on health and safety, which seriously hindered the formation of modern scientific ideas about TS.

Two approaches are proposed in the consideration of the category “technogenic security”:

a) in the system “man-production-habitat”,
b) in the “society-technosphere-natural environment” system.

A) TS in industry is the sphere of human activity, an integral system with its own logic. TS should be understood as a combination of the properties of technical means (equipment, technologies, processes) to resist the combined effects of all factors leading to deterioration in health, trauma or death of personnel, as well as to harmful effects on the natural environment. In this case, it is supposed to consider a TS system consisting of objects, subjects, processes functioning in permissible flows of matter, energy and information in some space-time dimension. With this approach to the TS system, it is expected that the theory of security and its main directions will be applied: the theory of terminal control, the theory of analytic construction of regulators, the theory of reliability, etc. In connection with TS problems, it is worthwhile to pay attention to the erroneous concept of identity of reliability theory and safety theory.

The basic concept of reliability theory is failure, and the basic concept of safety theory is an emergency situation.

As noted above, the genesis of the absolute majority of ecological problems lies precisely in the technical activity of mankind [2, 3, 4, 6]. There are two ways to ensure TS: first, prevention of violations of normal operating conditions, protection from the harmful effects of operational loads, prevention of failures and failures of operators: secondly, preventing the dangerous development of arisen violations of normal modes of operation, the exclusion of cases of overgrowth of such violations in emergency and catastrophic situations for humans and the natural environment.

Scientific activities in the field of TB must be carried out in connection with the necessary elements of socio-economic sciences.

B) With a global approach, the sphere of man-caused hazards is divided into three indicators of technogenic risks or three types [3]:

1. The threat to life and health due to accidents, up to the global catastrophe;
2. The threat to life and health due to deformation of the components of the biosphere component;
3. The threat to life and health of people due to a lack of natural resources, down to a global exhaustion.

As is known [5], the problem of sustainable development arose as a result of the analysis of the world economy of nature management.

The conducted studies [2, 3, 8, 9] show that for the solution of this problem the ecological approach, like the concept of the ecosystem or the biosphere, is unsuitable.

Then it is necessary to consider:

1. A specific global system, within which the idea of sustainable development should be realized, is the sociosphere - the sphere of mankind's productive activity [9];
2. The solution of the TS problem is (more precisely, it should be in its final form) the technological component of the problem of sustainable development [3];
3. Implementation of the concept of biotic regulation of the natural environment is impossible without solving TS problems both on a global and regional scale. And it is conceptually important to understand that due to objective reasons (population growth in the world, the desire of all to "live well"), the level of TS will determine the level of environmental safety.

Proceeding from the foregoing, technogenic safety in the "broad" (global) sense is the state of the technosphere as a practically closed technological system for utilization and reutilization of natural resources involved in economic circulation. In its final form, it is the production-economic cycles that are as much as possible isolated from natural exchange and external sources of energy. Perhaps located even outside the planet Earth. Models for the development of a global system for the transformation of integrated resources for the use of natural resources (Fedorenko N.P and Reimers N.F), and also [10] are based on the understanding of two principles: "everything is connected with everything" and "nothing is given for nothing". The central place in the resource models is occupied by the material and energy resources of living and inanimate matter.

The source of the material, as well as a significant part of the energy resources is the lithosphere. It is simultaneously an object of influence (the operand of the transformation system) for such leading industries as chemical, petrochemical and oil refining, mining and metallurgy and fuel and energy industries of the world economy.

These same industries are also the main "pests" of the environment in the industrially developed regions of Ukraine.

If the public system functions in the form of a state, then it is the task of state bodies to create a certain multifunctional system that maintains an acceptable level of technogenic security. The higher the stability of such a system in relation to external disturbances, the higher the level of technogenic safety of society and as a derivative of this, the higher the level of national security, the component of which is technogenic security.

2 OBJECTIVE

The purpose of this work is to study some types of external disturbances that affect the state control system.

2.1 Analytical studies

It is not difficult to see that the perturbations that affect the multifunctional control system can be of two kinds. Disturbances of the first type immediately cause frustration of the system, provoking instant refusals of it work, which can lead to explosions, fires and other emergencies.

Perturbations of the second kind last for a long period of time, the negative effect of their action gradually accumulates and only after a certain period of time leads to a breakdown in the work of the entire system. Very often, disturbances of the second kind act directly on the person, causing immediate damage to his health and gradually disabling an essential component of the system as a result of which her work is disrupted and the immediate harm to the health and life of the person is inflicted not only by the effects of perturbations of the second kind, but also by the results of the disorder of the whole life support and life support systems.

If we talk about Ukraine, at the present time the amount of accumulated waste on the territory of the Donbas is especially large. Thus, more than 38 % of the disturbed lands of Ukraine are located in the Donbas. These are dumps and quarries, slime, slag storage and settling tanks, solid waste landfills, which, taking into account the adjacent territories, pollute the atmosphere on an area of more than 600 000 hectares, with combustion products at a distance of up to 3 km, and with dust up to 1 km.

Dust just refers to the disturbances of the second kind, the negative effect of the dust effect gradually accumulates and only after a certain period of time leads to the disruption of the human factor, directly damaging to its health.

The greatest danger is represented by dust particles whose dimensions are 5 μm or less. These particles have the greatest pathogenic effect on the respiratory system of the human body. In addition, the settling time of these particles is measured in hours. Thus, even after the termination of work, the risk of dust exposure to the human body remains. Insignificant time of inhalation of these particles can lead a person to disability and death.

The exposure time of dust particles per person depends on the settling speed of dust particles which is found from the following considerations.

Let us consider the so-called particle drift model. We will start from the following assumptions:

- the motion of a particle is determined by the strength of Archimedes and the strength of resistance,
- the velocity vector of the particle at the initial instant of time is parallel to the acceleration vector caused by Archimedes' force,
- there is no interaction between the particles.

We can determine the velocity of the particle within the framework of this model. Taking into account the above assumptions, the equation of motion of a single particle can be represented in the following form:

$$m\frac{d\mathrm{v}}{dt} = -C_D\frac{\mathrm{p}S_m}{2}|\mathrm{v}|\mathrm{v} + (p_p - p)V_p\mathrm{g} \qquad (1)$$

Where v is the particle velocity, ρ_p is the density of the medium. ρ is the density of the dust particle, C_D the empirical coefficient of resistance, S_m is the cross sectional area of the particle, g is the acceleration due to gravity, and V_p is the volume of the particle.

2.2 Influence of the particle shape on the deposition rate

The shape of the particles of the dispersed phase can differ from the spherical (snowflakes, polyhedral, ellipsoids, plates, fibers, etc.).

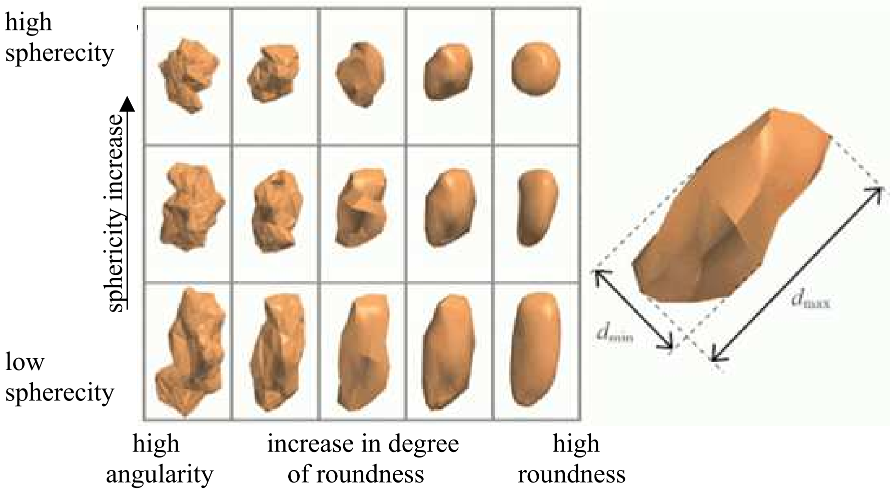


Fig. 1 The shape of the particles

Since the methods of dispersion analysis do not, in their majority, allow us fully characterize each particle of a disperse system in three dimensions, we use an approximation, in other words, the replacement of particles of real material by equivalent particles of regular geometric shape. When analyzing a particle under a microscope, its planar projection is visualized, in which case the particle can be characterized by a number of different dimensional parameters. It is important to understand that each method of determining the size is based on measuring the various physical characteristics of particles (maximum length, minimum length, volume, surface area etc.), and as a result, the sizes obtained by different methods will differ. Figure 3 shows the various options for answering the question what is the particle size. At the same time there are no erroneous results - each answer is subjectively correct - it reflects a physically measured characteristic.

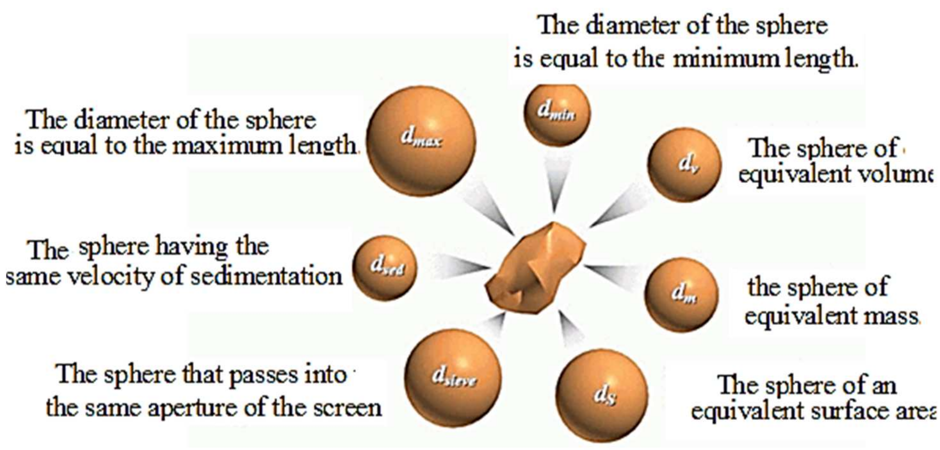
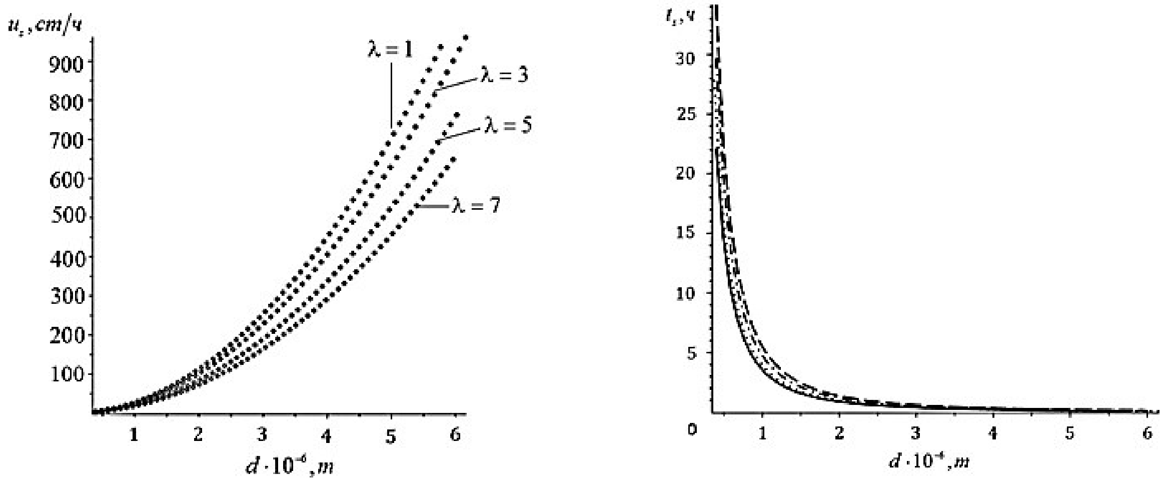

The diameter of the sphere
is equal to the minimum length.
d_{min}
The diameter of the sphere
is equal to the maximum length.
d_{max}
d_v
The sphere of
equivalent volume
The sphere having the
same velocity of sedimentation
d_{sed}
d_m
the sphere of
equivalent mass
The sphere that passes into
the same aperture of the screen
d_{sieve}
d_S
The sphere of an
equivalent surface area

Fig. 2 Equivalent particle diameters

To calculate the motion of such particles, an equivalent diameter d_{pe} is introduced, which is equal to the diameter of a sphere with a volume V_p equal to the volume of a given particle:

If we represent the shape of a particle close to an ellipse with a large axis *a* small axis *b* and represent ellipticity as $\lambda = a / b$. then the results of calculations can be represented by the following graphs.



a)

b)

Fig. 3 Dependence of the deposition rate of a particle (*a*) (cm/h) and the deposition time of a particle (hour) (*b*) on its geometric parameters

3 DISCUSSION

Analyzing the data of the graphs, it can be concluded that the dust that has arisen as a result of man's anthropogenic activity is deposited extremely slowly - for hours. If the generation of dust continues, then we have a permanent negative impact on the social system, and the negative consequences can affect for many years.

The lowest deposition rate and, consequently, the longest time in the atmosphere, have the smallest particles whose shape approximates the spherical.

4 CONCLUSIONS

Based on the example of dust exposure, it is possible to establish certain rules that minimize man-caused hazards.

1. Ensuring the permissible level of man-made risk in the „man-machine-environment" system at the local level, especially in the old industrial regions, such as the Donbass;
2. Ensuring a minimum level of impact of technogenic activity on the habitat and population on a regional scale. The main thing here:

minimization of reception of a waste; recycling and recycling of waste, emissions, discharges, i.e. provision of a production closed for materials and energy;
3. Recycling of waste that has already been accumulated; isolation and safe storage of toxic and radioactive waste;
4. State regulation and management of technogenic safety, technogenic programming. Technogenic safety must be organically built into the social and economic system of the state;
5. The scientific community should take vigorous measures to eliminate the „stains" in the education of decision makers at all levels of management of the technosphere and technogenic security in particular.

References

[1] KARMAZINOV, F. V., RUSAK, O. N. GREBENNIKOV, S. F. and others. *Security life: Dictionary-reference.* St. Petersburg : Lan, 2001. p. 254.

[2] GOLUBETS, M. A. *From the biosphere to the cosmos.* Lviv : Polly, 1997. c. 252.

[3] KHAZAN, V. B. *Technogenic security as a component of (eco) sustainable development.* Assemblage scientific works. Dnipropetrovsk : 2001. vp. 3. p. 163-167.

[4] VERNADSKY, V. I. *Reflections of the naturalist. Scientific thought as planetary phenomenon.* Moscow : Nauka, 1977. p. 51. 892.

[5] *Program of Action. Agenda for the 21st century and other documents in the popular presentation.* Switzerland, Geneva : Center for Our Common future, 1993. p. 70.

[6] MOISEYEV, N. I.: *Ecological imperative.* Kommunist. 1986. No. 12. p. 110-111.

[7] SHAPAR, A. G.: *Criterias of those showing old steel rozvitku: naukovi pididi ix obgruntuvannya.* Science fiction. Dnipro-petrovsk. 2000. vip. 2 from. 8, 10.

[8] GOLUBETS, M. A.: *Living room.* Lviv, Polli : 1997. p. 186.

[9] GOLUBETS, M. A. *Some theoretical and applied aspects of sustainable development.* Selection of materials. K.: IPC of the society "Knowledge" of Ukraine. 2000. p. 27, 29.

[10] SAITOV, V. I., SOLOBOEV, I. S., CHERNYSHEV, A. A.: *Models of global system of transformation of integrated resources of nature use ...* Strategy for a way out of the global environmental crisis: Materials scientific readings. St. Petersburg : Publishing house of MANEL, 2001. p. 26-27.

[11] BASHKATOV, V. G., MARTOVITSKY, V. D.: *Environmental optimization of the technogenic environment in the Donbass.* Strategy of an exit from global ecological crisis: Materials of scientific readings. St. Petersburg : Publishing house of MANEL, 2001. p. 68-69.

[12] GRUDZIN, V. P.: *The global crisis of the Earth is the program stage of the cosmos.* Strategy for a way out of the global environmental crisis: Materials of scientific readings. St. Petersburg : Publishing house of MANEL, 2001. p. 12, 13.

[13] BEZPALOVA, A., LEBEDEV, V. *Investigation of the formation process of Hazardous and harmful production factors.* EUREKA : Physics and Engineering, 2017. Number 5.

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DECOMPILING JAVA BYTECODE: FROM COMMON JAVA TO NEWEST JDK8 FEATURES, FROM OBSOLETE DECOMPILERS TO CUTTING EDGE TECHNOLOGY

Jozef KOSTELANSKY, Lubomir DEDERA

Abstract: Countless various malware families provide huge variety of functionalities which allow them to do many malicious activities. These conditions led to the development of many different analysis methods. In this paper, we focused on reverse engineering, which is elementary part of static analysis. We evaluate current Java bytecode decompilers. We evaluate the output from current Java bytecode decompilers in this paper using test samples and metrics from previous surveys in 2003 and in 2009. Quality boost is really significant between actual results and the results based on research from 2009, in contrast with only slight improvement between researches in 2003 and 2009. Even though we were witnesses of rapid quality boost, still any of the decompilers pass all the tests acceptably. We also give reasons why outdated decompilers from previous research perform almost in the same way.

Keywords: java, reverse engineering, bytecode, decompilation.

1 INTRODUCTION

There are more definitions of malware. Generally, malware (malicious software) is a program focused on collecting data (key logger), disrupt regular operations (ransomware) or to abuse infected systems in favor of the attacker (bitcoin miners, botnets) [1].

In general, there are two methodologies to dissect malware behavior: static and dynamic analysis. Static analysis comprises of all approaches to analyze sample without the sample being executed. On the other hand, in dynamic analysis, the sample is executed, and its behavior is observed [2]. Malware creators are daily trying to circumvent the above-mentioned analysis methods; this usually means usage of obfuscation and encryption, to circumvent with static analysis and usage of some sandbox detecting and antidebugging techniques to evade dynamic analysis.

Based on the stats provided by statcounter.com, Android has the biggest market share, not even from smartphones, but in general. This, together with valuable data which users holds in their smartphones, makes Android very frequent target for malware campaigns. This situation was predicted in 2009 [3]. Since most Android applications are developed in Java, each of the mentioned methodologies has its pros and cons. Since by means of static analysis it is possible to check all malware execution paths, our primary attention will be concentrated on static analysis and obviously we have focused on Java decompilation.

To accomplish complex static analysis, it is ideal to have original source code, but since we usually don’t have access to malware source code, we need to make it in our own way. Although it is easier to decompile Java bytecode than machine code, there are still cases that the decompilers have problems to cope with. These include variable casting or exception handling. Evaluation is focused on those problem areas.

There are many Java decompilers available, some of them are paid, some of them free and open sourced. We have stated two main goals of this research:

- To evaluate current Java bytecode decompilers;
- To compare previous results with our actual results.

In this paper, we have followed the ideas presented in [38] and tried to extend them. The idea has been presented for the first time at the conference [38] and now, based on the conclusion from that work, we tried to elaborate the idea presented there; namely, we will look closer, how current decompilers are able to cope with the newest JDK features like lambdas, string switches and others.

2 JAVA DECOMPILERS EVALUATION STRATEGY

The output of a Java decompiler can, crudely, be divided into three categories:

1. Semantically and syntactically correct;
2. Syntactically correct and semantically incorrect and
3. Syntactically incorrect.

Since last evaluations [4] [5] of Java decompilers were published several years ago and since then most of them became outdated, obsolete and, on the other hand, some new decompilers have been developed. We have used the same samples for decompilation and also the same metrics for evaluation of decompilers output, because we want to compare how they have changed in time. In addition, we recompiled samples with current javac (version 1.8.0_131), current jasmin (version 2.4) [6] and we have tested several new decompilers in our research (cfr [7], fernflower [8], Krakatau [9], Procyon [10]).

The following table contains summary of the measured metrics.

Table 1 Decompilation correctness classification [11]

Score	Semantics	Syntax	Output result	Examples
0	correct	correct	semantically and syntactically correct program with perfect/good source code layout	perfect decompilation
1	correct	correct	semantically and syntactically correct program with `ugly' source code layout and/or no type inference	unreconstructed control flow statements, unreconstructed string concatenation, unused labels, no type inference
2	incorrect	incorrect	easy to correct syntax errors which produce a semantically correct program	boolean typed as int, missing variable declaration
3	incorrect	incorrect	difficult (but possible) to correct syntax errors which produce a semantically correct program	code with goto statements
4	incorrect	incorrect	very difficult (or nearly impossible) to correct syntax errors required to produce a semantically correct program	invalid variable use, obviously incorrect code, massive source re-write required
5	incorrect	correct	easy to correct semantic errors which produce a semantically correct program	missing typecasts
6	incorrect	correct	difficult (but possible) to correct semantic errors which produce a semantically correct program	incorrect control flow
7	incorrect	correct	very difficult (or nearly impossible) to correct semantic errors required to produce a semantically correct program	incorrectly nested try-catch blocks, massive source re-write required
8	incorrect	incorrect	incomplete decompilation	missing large sections of source, missing inner classes
9	Fail	Fail	decompiler fails upon execution/produces no source output	decompiler fails to parse arbitrary bytecode

Table 1 contains a summary of decompilation correctness classification published in [11]. For each input sample and the corresponding decompiled pair, a score between 0 and 9 was given. Referring to the table I., score 0 means perfect decompilation and score 9 means that no output decompiled code was produced.

3 EVALUATION OF CURRENT JAVA BYTECODE DECOMPILERS

The following decompilers were tested. First, here are the decompilers which were used in the previous survey [4].

Mocha [12] was developed in 1996 by Dutch developer Hanpeter van Vliet, alongside an obfuscator named Crema. It is used here just for historical reason, since it is not useful today, because it does not support bytecode generated with the current javac.

SourceTec [13] (Sothink Java Decompiler) supports analyzing Java class files and generating equivalent and compliable Java source codes. This unmaintained tool is a patch to Mocha and also does not support bytecode generated with the current javac.

SourceAgain [14] was another commercial decompiler, which is now unmaintained and unavailable to download, but a web version is available.

Jad [11] (Java Decompiler) is, as of August 2011, an unmaintained decompiler for the Java programming language. Jad provides a command-line user interface to extract source code from class files. The official site http://www.kpdus.com is no longer accessible, but it is possible to download it from many mirrors. It was one of the best decompilers, but it was not open source and was developed in C++, so it cannot be easily reverse engineered. Probably, this is the most popular Java decompiler, but primarily of this age only. Written in C++, so it is very fast.

JODE [15] is an open-source decompiler and obfuscator. The latest version 1.1.2-pre1 was released February 24, 2004. It thus doesn't handle many language constructs that were introduced after JDK 1.3.

jReversePro [16] is another open-source disassembler and decompiler project which is currently unmaintained.

Dava [17] [18] is part of Soot Java optimization framework which is still under development and actually provides nightly builds. Soot framework is developed by Sable Research Group at McGill University in Montreal, Quebec, Canada.

Jdec [19] is another abandoned open source java decompiler with support up to Java 1.4.

Java Decompiler [20] aims to develop tools in order to decompile and analyze Java 5 byte code and the later versions.

Following decompilers are relatively new and, except Procyon, are currently under development.

Cfr [7] is a free, but not open sourced Java decompiler which support modern Java features like Java 8 lambdas. Last version 0_122 was released on 2017-06-12.

Fernflower [8] is a promising analytical Java decompiler, now becomes an integral part of IntelliJ 14 [21].

Krakatau [9] [22] currently contains three tools – a decompiler and disassembler for Java class files and an assembler to create class files. The Krakatau decompiler takes a different approach to most Java decompilers. It can be thought of more as a compiler whose input language is Java bytecode and whose target language happens to be Java source code. Krakatau takes in arbitrary bytecode and attempts to transform it to equivalent Java code. This makes it robust to minor obfuscation, though it has the drawback of not reconstructing the "original" source, leading to less readable output than a pattern matching decompiler would produce for unobfuscated Java classes.

Procyon [10] Updated in 2016. It handles language enhancements from Java 5 and beyond, up to Java 8, including enum declarations, enum and string switch statements, local classes (both anonymous and named), annotations, Java 8 lambdas and method references (i.e., the :: operator).

A. Tests

Different samples were tested in original researches, each of them provides specific area to test. The original research pointed out that all of the decompilers have their weak and strong sides, where none of them were able to decompile all of the samples [4] [5].

In our test we used samples from previous research [4] [11], but we recompile samples with current javac (version 1.8.0_131) or with current Jasmin (version 2.4) [6].

We devide test into two test groups:

Test group 1: Consist of samples used in previous research.

Test group 2: Consist of newly prepared samples with intent to test ability of actual decompilers to decompile new JDK features.

The following tests were in Test group 1:

Fibonacci [11] is a simple test sample for a decompiler. It writes out a Fibonacci number for a given number.

Casting [5] is a simple test sample to test decompiler ability to properly decompile char to int cast.

InnerClass [5] is a simple test sample to test decompiler ability to properly decompile inner classes.

TypeInference [23] is a test sample to test decompiler ability to deal with type inference for local variables.

Optimized [11] is a test sample generated by the Soot optimizer [24] on the TypeInference test program to test decompiler ability to properly decompile optimized byte code.

ControlFlow [23] is test sample to test decompiler ability to properly deal with handling of control flow.

Exceptions [23] is simple sample which contains two intersecting try-catch blocks. Although it is valid java bytecode, it wouldn't be produced by javac. This sample is created using Jasmin [6]. As mentioned in [11], the program used in the original tests [5] is incorrect, so a re-written version is used based on the call graph in original paper [23].

The following tests were in Test group 2:

StringSwitch is a sample taken from the official Oracle documentation. In the JDK 7 release, you can use a String object in the expression of a switch statement. The switch statement compares the String object in its expression with the expressions associated with each case label as if it were using the String.equals method; consequently, the comparison of String objects in switch statements is case sensitive. The Java compiler generates generally more efficient bytecode from switch statements that use String objects than from chained if-then-else statements. [34]

TryWithResources is another sample taken from official Oracle documentation. The try-with-resources statement is a try statement that declares one or more resources. A resource is an object that must be closed after the program is finished with it. The try-with-resources statement ensures that each resource is closed at the end of the statement. Any object that implements *java.lang.AutoCloseable*, which includes all objects which implement *java.io.Closeable*, can be used as a resource. [35]

Underscores in numeric literals are supported in Java from JDK7. Any number of underscore characters (_) can appear anywhere between digits in a numerical literal. This feature enables us, for example, to separate groups of digits in numeric literals, which can improve the readability of the code. For instance, if the code contains numbers with many digits, we can use the underscore character to separate digits in groups of three in an analogous way how one would use a punctuation mark like a comma, or a space, as a separator. The sample was taken from the official Oracle documentation. [36]

Lambda expressions have been introduced in Java 8 and are touted to be the biggest feature of Java 8. Lambda expression facilitates functional programming and simplifies the development a lot. Sample is aimed to test decompilers' ability with handling lambda expressions. [37]

B. Results

Decompiler test results are shown in table II. Every decompiler was tested with all test samples mentioned in III.A. Sample were generated using javac, Soot, jasmin. The results have been evaluated using the effectiveness measure scale mentioned in II. Similarly, as in the previous research, none of the decompilers was able to decompile all samples correctly. Generally, we can sum up that newer decompilers perform much better in the tests.

Mocha [12], **SourceTec** [13], **jReversePro** [16] did not decompile any of the samples. They usually complain about unsupported class file versions.

SourceAgain [14] evaluation version is the only available through web. There are no other versions accessible. This makes this decompiler unqualified for our future research, so it was not processed in the results.

Jad [11] even though is really outdated, produces still quality results. It is probably the result of the chosen test samples, which did not covered newer Java features.

JODE [15] has produced satisfactory results. The bad thing is that even though it decompiled almost perfectly the majority of the samples, at the same time there were samples where it absolutely failed. Good point is that, for example, in testing the sample Exceptions it detected that try and catch blocks are intercepting. Also, it was the only decompiler from the original survey that correctly decompiled the sample Casting (without missing cast).

Dava [17] [18] results placed just behind Jad and JODE, where it produced similar balanced results to Jad. Although these results were not as good as from Jad, it performs really well on arbitrary bytecode produced by other tools but javac.

Jdec [19] with exception of Mocha, SourceTec, jReversePro which do not support current Java bytecode, performed probably the worst. It usually does not decompile bytecode produced by javac or arbitrary bytecode.

Java Decompiler [20] was the decompiler which outperformed the others in the original survey [11]. It has some troubles with decompiling arbitrary bytecode and also it missed together with the majority of the decompilers (Jad, Dava, Jdec, cfr, fernflower) cast statement in the sample Casting.

Cfr [7] is one of the new decompilers, which were not used in the original paper. Even though it outperforms most of the decompilers from the original survey, it finished worst from the new decompilers. Still it produces nice, good readable outputs.

Fernflower [8] produces quality outputs. Together with Cfr it has a problem with proper decompilation of the Casting sample and with arbitrary bytecode.

Krakatau [9] [22] is the only decompiler that was able to properly decompile the Exceptions sample. Its output is not always good readable, but in our tests it almost always produced syntactically and semantically correct output. This is probably the reason of a different approach to decompilation. Krakatau also states on its page, that its assembler and disassembler fully support Java 9, while the decompiler only supports Java 7. In particular, decompilation of lambdas is not supported. This was visible in results, that it wrongly decompiles 2 from 4 samples in test group 2.

Procyon [10] – although a newer decompiler which was not available during the original surveys, currently is not being developed. It produced the second-best results, with problems only with arbitrary bytecode produced by jasmin. As it has been mentioned, the good results of this little outdated decompiler are probably the result of the chosen test samples. Procyon developer also states that:

The Procyon decompiler handles language enhancements from Java 5 and beyond that most other decompilers don't. It also excels in areas where others fall short. Procyon in particular performs well with:

- Enum declarations;
- Enum and String switch statements (only tested against javac 1.7 so far);
- Local classes (both anonymous and named);
- Annotations;
- Java 8 Lambdas and method references (i.e., the: operator).

Results from the test group 2 have proved this, when it accomplished the best results.

Table 2 Decompiler tests results 1

	Fibonacci	**Casting**	**InnerClass**	**TypeInference**	**Optimized**	**ControlFlow**	**Exceptions**
Mocha	9	9	9	9	9	9	9
SourceTec	9	9	9	9	9	9	9
SourceAgain	0	5	8	1	3	1	7
Jad	0	5	2	1	4	1	4
JODE	0	0	9	0	2	1	9
jReversePro	9	9	9	9	9	9	9
Dava	0	5	8	2	2	1	9
Jdec	9	5	8	8	8	7	8
Java Decompiler	0	5	0	2	3	7	8
Cfr	0	5	0	2	2	0	6
Fernflower	0	5	0	0	0	0	9
Krakatau	0	0	2	0	0	0	0
Procyon	0	0	0	0	0	0	6

Fig. 1 together with Fig. 2 depict graphically the research outputs based on test group 1. Fig. 1 shows graphically how effectively are the decompilers able to deal with arbitrary and javac generated bytecode. There are their total scores based on defined metrics (lower result is better). It is clear that newer decompilers perform better and also decompilers in general have bigger problems with decompiling arbitrary byte code rather than bytecode generated by javac.

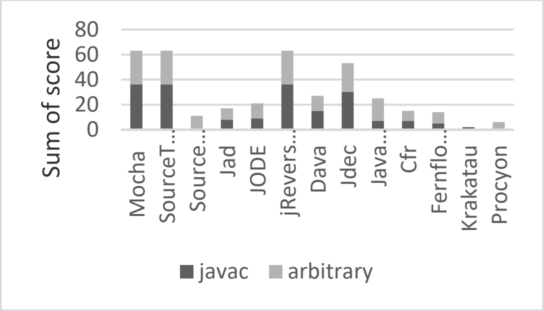

Fig. 1 Decompiler effectiveness on test group 1

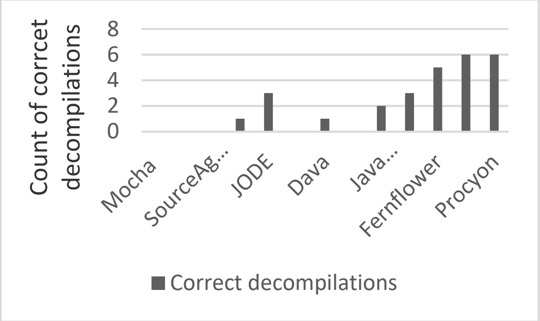

Fig. 2 Correct decompilations of test group 1

Fig. 3 together with Table 3 shows how the decompilers preform with the test group 2. As in the previous results, the performance of all decompilers is the same. As it was visible in the previous table, Procyon showed the best results.

Table 3 Decompiler tests results group 2

	String Switch	**Try With Resources**	**Underscores**	**Lambda**
Cfr	1	1	1	0
Fernflower	1	1	1	1
Krakatau	1	9	1	5
Procyon	0	0	2	0

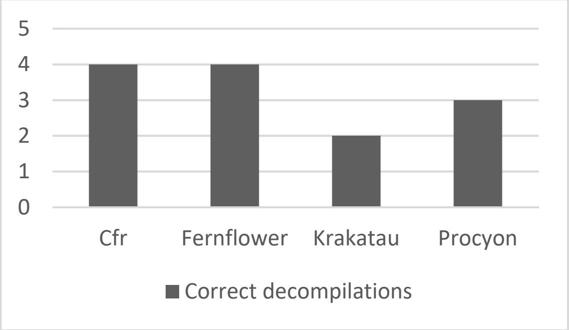

Fig. 3 Correct decompilations of test group 2

C. Comparison of results

As it was depicted in table III., since the original survey conducted in 2003 [5] and 2009 [4], none of the decompilers, with the exception of Java Decompiler, did not get an update. There are four new decompilers. These new decompilers (Cfr, Fernflower, Krakatau and Procyon) almost completely outperformed all the decompilers from the mentioned surveys. This is absolutely visible in fig. 3 as the average score of the decompilers used in the original survey, without those which do not support the current java bytecode (Mocha, SourceTec, jReversePro) and also without SourceAgain (since only web version is available, which is not suitable for our further research) is 4,08, while the average score of the current decompilers is 1,3 and overall average score is 4,33.

Table 4 Decompilers

Decompiler	2003 version [5]	2009 version [4]	Current version	Last update
Mocha	0.1b	0.1b	0.1b	1996
SourceTec	1.1	1.1	1.1	1997
SourceAgain	1.10j	1.1	1.1	2004
Jad	1.5.8e	1.5.8e	1.5.8e	2001
JODE	unknown	1.1.2-pre1	1.1.2	2004
jReversePro	1.4.1	1.4.2	1.4.2	2005
Dava	2.0.1	2.3.0	Nightly build from 20-05-2017	Daily nightly builds
Jdec	N/A	2.0	2.0	2008
Java Decompiler	N/A	0.2.7	0.7.1	2014
Cfr	N/A	N/A	0.122	2017
Fernflower	N/A	N/A	Master branch from 10.5.2017	2017
Krakatau	N/A	N/A	Master branch from 10.5.2017	2017
Procyon	N/A	N/A	0.5.30	2015

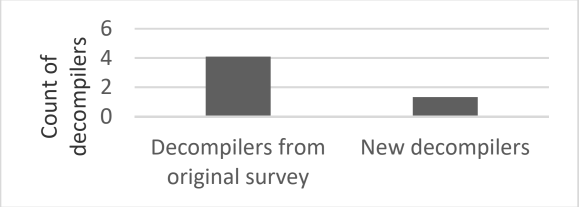

Fig. 4 Comparison between decompilers from original survey and current decompilers

Even though several years have passed since the original survey [4] was published, overall evaluation is roughly the same. This might be caused by the chosen test set, since the same samples have been used. Especially on the side of the decompilers which were previously classified as the weakest, there were no differences. They could not decompile any of the test samples. They usually do not support current *class* files.

On the other side of the spectrum, still no decompiler was able to decompile all the test samples correctly. The best results have been achieved by Procyon and Krakatau. They were able to decompile 6 of 7 samples correctly. Newer decompilers have significantly higher success rate and quality of the decompiled outputs.

When we focus our attention on the test group 2, we can see that almost all up-to-date decompilers, with the exception of Krakatau, are able to handle successfully all new samples. They generally produce output of high quality when used on *javac* compiled bytecode.

4 CONCLUSION AND FUTURE WORK

This paper was prepared with the intent to evaluate current state of art of Java decompilers. We are planning to make Hybrid analysis Android application framework, where we want to combine information gathered using static and dynamic analysis to detect Android malware and analyze its behavior.

Decompilation is one of the main parts of static analysis. To properly determine all execution paths of a sample, it is crucial to properly decompile it. As it was visible in table II., even if the decompiler produces syntactically correct output, it does not always necessary mean that it is also semantically and logically correct. If the analyst during the analysis relies on these wrong outputs, he might, for example, miss some of the malicious functionality. For these reasons, it is essential to properly know the tools and not just blindly trust to their outputs. Quick Android Review Kit (QARK) [25] solved the mentioned problems by an approach in which it applies multiple decompilers on the sample and then merges their outputs.

The results are similar to the results of the previous surveys [4] [5]. Due to this fact, new test samples containing modern Java features like string enum switches or lambda functions and others were prepared. This is the main extension from the previous research published in [38].

During the Android malware analysis itself, another step came into consideration. It is the Dalvik bytecode into Java bytecode transformation. There are tools like enjarify [26] and dex2jar [27] that can handle those transformations. Also, the evaluation of the outputs of these tools would seem to be valuable. Respectively comparison of outputs from combinations of these converting tools together used with Java bytecode decompiler with outputs from direct DALVIK bytecode decompiler such as jadx (free, open source) [28] or jeb [29] (commercial) would be also valuable.

Last, but not least, this year, during the Google I/O conference [30], support for Kotlin language for Android application development [31] [32] has been announced. Therefore, it would be worthwhile to test the ability of current tools to analyze malware developed in Kotlin.

References

[1] EILAM, E., CHIKOFSKY, E. J. *Reversing: secrets of reverse engineering.* Indianapolis : Wiley, c2005.

[2] SIKORSKI, M., HONIG, A. *Practical malware analysis: the hands-on guide to dissecting malicious software.* San Francisco : No Starch Press, c2012.

[3] SCHMIDT, A. D., SCHMIDT, H. G., BATYUK, L., CLAUSEN, J. H., CAMTEPE, S. A., ALBAYRAK, S., YILDIZLI, C. "Smartphone malware evolution revisited: Android next target?" In *2009 4th International Conference on Malicious and Unwanted Software (MALWARE).* Montreal : 2009.

[4] HAMILTON, S. D. James. An evaluation of Current Java Bytecode Decompilers. *In IEEE International Workshop on Source Code Analysis and Manipulation.* IEEE Computer Society, 2009. pp. 129-136.

[5] EMMERIK, M. V. *"Java decompiler tests",* 2003. [Online]. Available: <http://www.program-transformation.org/Transform/Java DecompilerTests>.

[6] MEYER, D. R. Jonathan: "*Jasmin*", 2004. [Online]. Available: <http://jasmin.sourceforge.net/>. [Accessed 01. 04. 2017].

[7] BENFIELD, L. "*CFR*", 12 06 2017. [Online]. Available: <http://www.benf.org/other/cfr/index.html.> [Accessed 12. 06. 2017].

[8] USHAKOV, E. "fernflower", 8. 6. 2017. [Online]. Available: <https://github.com/JetBrains/intellij-community/tree/master/plugins/java-decompiler/engine>. [Accessed 8. 6. 2017].

[9] GROSSE, R. "*Java decompiler, assembler, and disassembler*", 17. 05. 2017. [Online]. Available: <https://github.com/Storyyeller/Krakatau>. [Accessed 22. 05. 2017].

[10] STROBEL, M. "*Procyon*", 18. 08. 2016. [Online]. Available: <https://bitbucket.org/mstrobel/procyon/>. [Accessed 03 06 2017].

[11] HAMILTON, J. "*Decompiling Java*", 06. 05. 2009. [Online]. Available: <https:/ /jameshamilton.eu/sites/default/files/DecompilingJavaWorkingDocument.pdf>. [Accessed 06 05 2017].

[12] VLIET, H. *Mocha, the java decompiler*, 1996.

[13] S. S. Inc. *"Sothink Java Decompiler,"* [Online]. Available: <http://www.sothink.com/product/>.

[14] SOFTWARE, A. "*SourceAgain*". [Online]. Available: <http://www.ahpah.com/cgi-bin/suid /~pah/demo_>.

[15] HOENICKE, J. *"JODE"*, 06. 05. 2013. [Online]. Available: <https://sourceforge.net/projects/ jode/>. [Accessed 03 05 2017].

[16] KUMAR, K. *"JReversePro - Java Decompiler,"* 08. 04. 2013. [Online]. Available: https://sourceforge.net/projects/jrevpro/. [Accessed 22 03 2017].

[17] "*Dava: A tool-independent decompiler for Java"*. [Online]. Available: <http://www.sable.mcgill.ca/dava/>.

[18] MIECZNIKOWSKI, J. *New algorithms for a Java decompiler and their implementation in Soot.* Master thesis. Quebec : 2003.

[19] SWAROOP, B., BETTADAPURA, K. *"Jdec: Java decompiler"*, 18. 07. 2013. [Online]. Available: <http://jdec.sourceforge.net>. [Accessed 03. 03. 2017].

[20] DUPUY, E. *"Java Decompiler",* 25. 03. 2015. [Online]. Available: <http://jd.benow.ca/.> [Accessed 10 03 2017].

[21] CHEPTSOV, A. *"IntelliJ IDEA 14 EAP 138.1029 is out with a built-in Java decompiler"*, 11. 07. 2014. [Online]. Available: <https://blog.jetbrains.com/idea/2014/07/intellij-idea-14-eap-138-1029-is-out/>. [Accessed 11. 05. 2017].

[22] PROEBSTING, T. A., WATTERSON, S. A. Krakatoa: Decompilation in Java (Does Bytecode Reveal Source?). In *Proc. Third USENIX Conf. Object-Oriented Technologies and Systems (COOTS)*, 1997.

[23] MIECZNIKOWSKI, J., HENDREN, J. L. "Decompiling java bytecode: Problems, traps and pitfails". In *CC '02: Proceedings of the 11th International Conference on Compiler*, pp. 111-127, 2002.

[24] BODDEN, E. *"Soot"*. [Online]. Available: <https://sable.github.io/soot/>.

[25] LinkedIn, *"qark"*. [Online]. Available: <https://github.com/linkedin/qark>.

[26] *"enjarify"* [Online]. Available: <https://github.com/Storyyeller/enjarify>.

[27] PAN, B. *"Dex2jar: Tools to work with android. dex and java. class files"*. [Online]. Available: <https://sourceforge.net/projects/dex2jar/>.

[28] *"jadx - Dex to Java decompiler"*. [Online]. Available: <https://github.com/skylot/jadx>.

[29] *"JEB: Android Decompiler + Android Debuggers"*. [Online]. Available: <https://www.pnfsoftware.com/jeb2/>.

[30] *"Google I/O is an annual developer festival held at the outdoor Shoreline Amphitheatre. See you next year!"* [Online]. Available: <https://events.google.com/io/>.

[31] SHAFIROV, M. "Kotlin on Android. Now official", 17 05 2017. [Online] Available: <https://blog.jetbrains.com/kotlin/2017/05/kotlin-on-android-now-official/>.

[32] "Kotlin and Android". [Online] Available: <https://developer.android.com/kotlin/index.html#kotlin-android-support-announced-at-google-io>.

[33] DUPUY, E. *"JD Project"*. [Online]. Available: <http://jd.benow.ca/>. [Accessed 01 06 2017].

[34] *"Strings in switch Statements"*. [Online]. Available: <https://docs.oracle.com/javase/8/docs/technotes/guides/language/strings-switch.html>.

[35] *"The try-with-resources Statement"*. [Online]. Available: <https://docs.oracle.com/javase/tutorial/essential/exceptions/tryResourceClose.html>.

[36] *"Underscores in Numeric Literals"*. [Online]. Available: <https://docs.oracle.com/javase/8/docs/technotes/guides/language/underscores-literals.html>.

[37] *"Java 8 - Lambda Expressions"*. [Online]. Available: <https://www.tutorialspoint.com/java8/java8_lambda_expressions.htm>.

[38] KOSTELANSKÝ, J., DEDERA, L. "An evaluation of output from current Java bytecode decompilers: Is it Android which is responsible for such quality boost?" In *2017 Communication and Information Technologies (KIT).* Vysoke Tatry : 2017. pp. 1-6.doi: 10.23919/KIT.2017.8109451

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THE EXPEDIENCY OF IMPROVEMENT OF ARMED FORCES MANAGEMENT BY AUTOMATIZATION OF THEIR BASE FUNCTIONS

Victor GRECHANINOV

Abstract: The article deals with the management process of the team of people that represents as a system of certain sequential interrelated activities called management functions. It is introduced general (basic) management functions that are specific for the Armed Forces. It is disclosed operation of Commander and his staff on the organization preparations for the operation (combat actions). It is proved the necessity of automation of basic management functions of the Armed Forces, as well as modelling of possible actions and processes. It is shown the relevancy of studying at leading military higher education institutions the discipline "Mathematical Principles of Military Art" for future use of military cybernetics in their practice by specialists of command and staff structure.

Keywords: general management functions, automation of management, operational planning, single automated management system.

1 INTRODUCTION

Together with mathematicians, scientists from different fields of human activity reach moving results. Development and improvement of modern management systems are linked inseparably with the development of automation technology and process modelling of complex systems operation.

Analysis of global trends shows that in order to ensure national security in the military sphere are extensively being used innovation in government and military management, information technology and system which architecture creates conditions to obtain qualitative advantages without using of significant resources by achieving automation of management systems.

At this time, the comprehensive automation of management processes and subjects of management system of the Armed Forces of our country (hereinafter - AF) needs further improvement. The level of automation of government activity is only 20-35 % of the needs.

2 THE SYSTEM AND FUNCTIONS OF MANAGEMENT

Management as a complex, universal phenomenon has many definitions.

In systematology, management is the structure and function of ordering, maintenance and purposeful development of a system.

Management process is a purposeful activity on coordination of joint operation and development of all parts (units) of controls that vary in space and time [2,3].

During a management process used sequence of administrative actions that are logically linked together to achieve this goal through the transformation of resources at the "entrance" to the products and services of the "exit" of system.

Modern management process consists of a sequence of subprocesses: forecasting, planning, decision making, accounting, control, etc., which nowadays are called management functions or management functions of processes.

In such a way, the control function is a special kind of activity that reflects the orientation to make managerial influence. This is a stable ordered complex of operations based on the division of labour in the controlled system. This is a real purposeful impact on controllable phenomenon. We can say that the function of management– a specialized part of the management process associated with the regular organizational activity of information and managerial kind and differs by homogeneity of targets, actions or use of objects of such actions.

In order to distribution of functions by common characteristics their classification is made. The main two features of control function are:

1. The type of management activity, which makes it possible to distinguish one from the other work in the division process of management activities;
2. Activity types orientation on the managed object or environmental factors.

By these characteristics it is identified general (basic) and additional (specific) management functions.

The general management functions include:

- Forecasting;
- Planning;
- Organization;
- Monitoring etc.

Additional functions of management:

- Human resources management;
- Financial management etc.

General functions determine the type of administrative activity regardless of place of its manifestation, the type of organization, nature of activity, scale etc. They are inherent to implementation of the management of any organization and like to divide the content of management activity.

Pursuance of management functions requires certain spending of time and effort, which forms control influence, and control body is transferred into the desirable state, that process management is considered as a process of uninterrupted series of development of control influence. To perform the functions in the management apparatus or body it is created appropriate departments and services. All functions of the management process by specific organizational systems are the sequence of actions and operations that are interrelated.

In real conditions of management the functions are not alone, they are closely intertwined and mutually complementary. All managers perform almost the same function regardless of their activity and position. They are involved in planning, organizational issues, control and etc.

3 THE ORGANIZATION AND IMPLEMENTATION OF MANAGEMENT FUNCTIONS OF THE ARMED FORCES OF UKRAINE

The USA has great experience regarding the creation and successful operation of situational centres, where they are regarded as a key element of support for management decisions at the strategic level management. Similar approaches to strategic planning carried out in the Russian Federation, European Union and others.

With the aim of automation of the Armed Forces the Norwegian Defence Research Establishment has conducted research on architectural topics related to the Norwegian Defence Information Infrastructure (INI) [7]. These activities have focused on service orientation; in line with strategic decisions in NATO. NATO has focused on Service-Oriented Architecture (SOA) as the key enabler for interoperability in NATO coalition networks. The focus on standardization within SOA makes it possible to achieve interoperability throughout the coalition, while at the same time supporting the need for autonomy of national systems. Building a federation-of-systems, where each system remains autonomous, relies on the fact that the interfaces between systems are clearly defined if interoperability is to be achieved. The high level of standardization, and the focus on interface descriptions, means that SOA is well suited to build such federated systems.

Sustainable Development Strategy "Ukraine – 2020", which was approved by the Decree of the President of Ukraine on January 12, 2015 establishes the reform of the national security of Ukraine and contains conceptually new position. By the Decree of Cabinet of Ministers of Ukraine on September 7, 2011 № 942 "On Approval of the list of priorities of scientific research and teaching materials for the period till 2015" the establishment and organization of the situation centres has been identified as priority area of research.

The emergence of situational management and its tools – situational centres of the Armed Forces caused by the fact that the existence of such centres is a key element of strategic management tools in defence sphere, its intellectual support. Situational centres of Main Command Centre of the Armed Forces of Ukraine, designed to ensure the effective work of senior officials of the Armed Forces of Ukraine, management and operational structure of the central apparatus of the Ministry of Defence of Ukraine and the General Staff of the Armed Forces of Ukraine.

And in this time automated information systems that created in the Ministry of Defence of Ukraine, unfortunately do not work or do not operate at full (project) power.

The authority to direct AF is divided between the Ministry of Defence of Ukraine (MD) and General Staff of the Armed Forces of Ukraine (GS AF) by the levels, functional features and directions (Fig. 1).

Based on the above mentioned and conducting a thorough analysis of the main functions of AF and tasks which are performed by MD and GS AF, having carefully considered the work of the authorities regarding the process of solving these problems it has been identified logical sequence of interrelated activities relevant officials and departments of government. In such a way, according to the classification of the functions of government control [1] we have established the basic management functions of AF that can be automated at the strategic, operational and tactical levels. On the beginning of implementation of automation in AF it is expedient to automate the following issues:

1. Data gathering of current situation;
2. Conduction, displaying of operation situation:
3. Support of information data of operation structure of control point (CP);
4. Carriage of information-analytical support of the work of operation structure of CP;
5. Carriage of information accounting;
6. Carriage of electronic workflow;
7. Geo-information support
8. and others.

For example, let us consider the operational planning. It includes three consecutive and interconnected stages:

- Organization of operational planning;
- Development and approval of the Concept of operations (combat operations);
- Development of operational plans.

The first stage of operational planning includes phases: analysis of the problem, evaluation of the situation, forming the initial data for planning.

The second stage includes phases: Concept of production operations (combat operations), forming of solution.

The third stage includes phases: a development of operation plan (combat operations), clarifying the operation plan (combat operation).

In its turn each phase of work consists of certain consecutive tasks.

The sequence of work of Commander and his staff during decision-making and preparing of army (forces) for operation conduction, shown on Fig. 2.

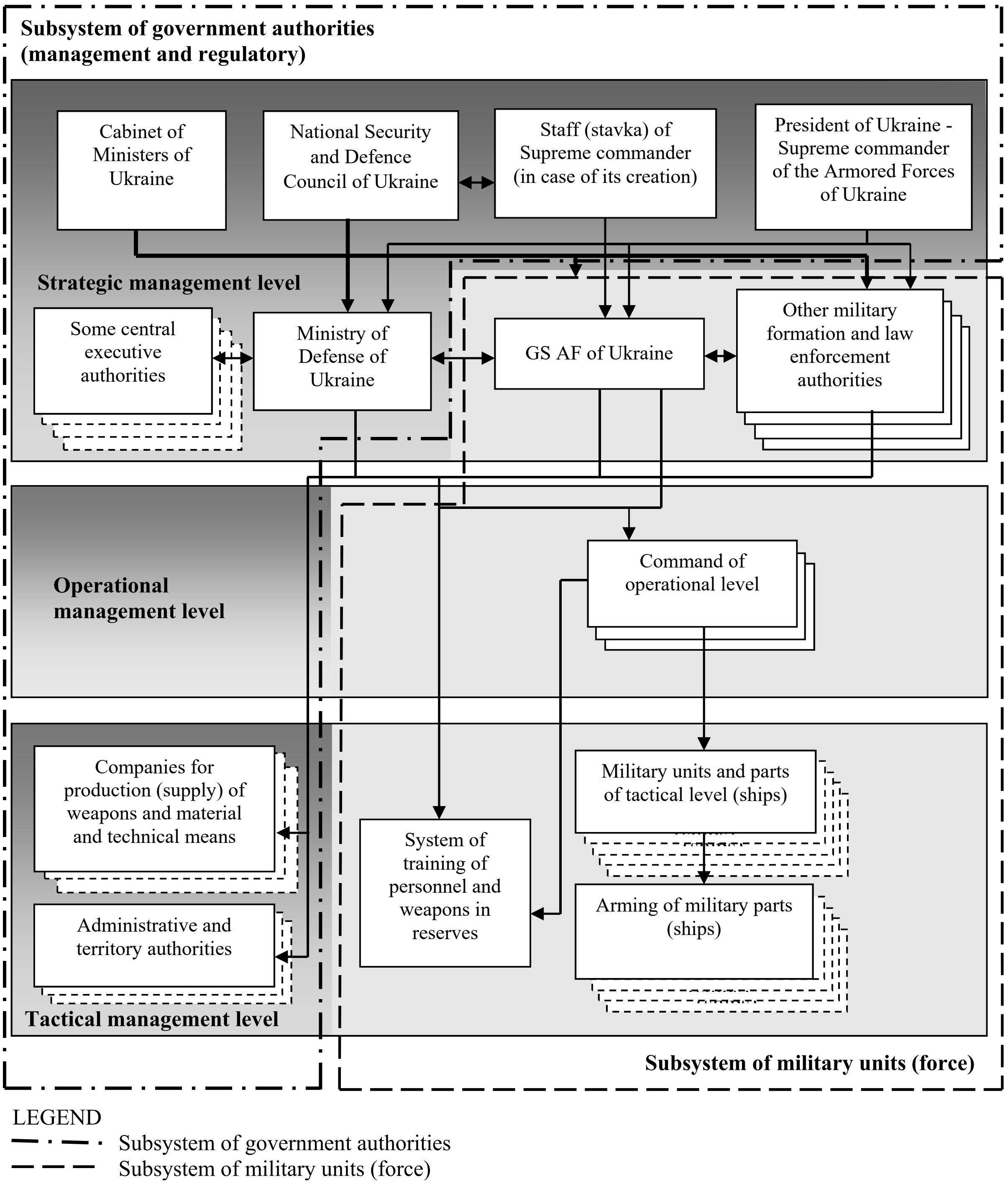
Subsystem of government authorities (management and regulatory)
Cabinet of Ministers of Ukraine
National Security and Defence Council of Ukraine
Staff (stavka) of Supreme commander (in case of its creation)
President of Ukraine - Supreme commander of the Armored Forces of Ukraine
Strategic management level
Some central executive authorities
Ministry of Defense of Ukraine
GS AF of Ukraine
Other military formation and law enforcement authorities
Operational management level
Command of operational level
Companies for production (supply) of weapons and material and technical means
Administrative and territory authorities
System of training of personnel and weapons in reserves
Military units and parts of tactical level (ships)
Arming of military parts (ships)
Tactical management level
Subsystem of military units (force)
LEGEND
Subsystem of government authorities
Subsystem of military units (force)

Fig. 1 Schematic diagram of the military organization of Ukraine (two subsystems)

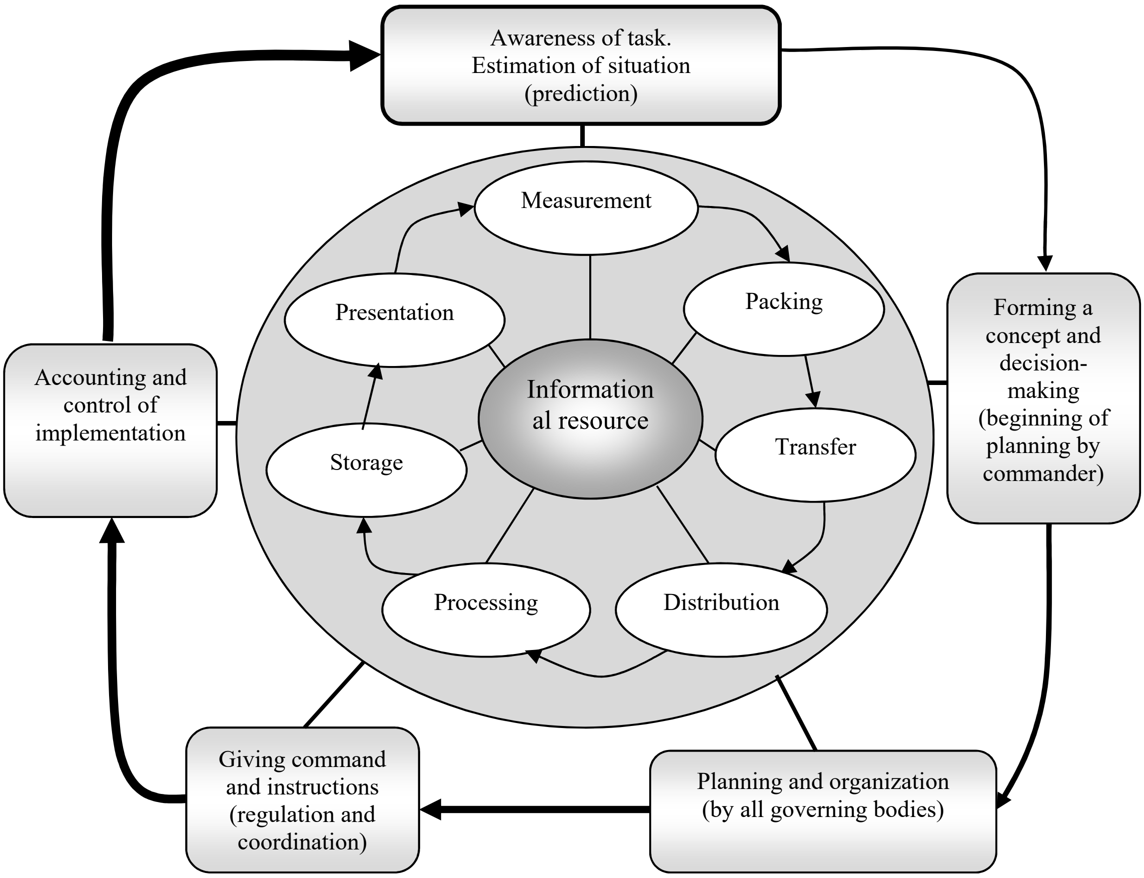

Fig. 2 The sequence of actions and using of information resource during an operation preparation

Therefore, analyzing the operational planning process and the work of officials on its implementation it has been identified basic management functions at the operational level.

Methods of commanders' work and staffs during planning of operations (combat) may be at higher and middle levels of management - parallel work, in the middle and lower levels – of parallel-counter, at the bottom – consecutive.

At the tactical level tasks of planning and conducting a combat for commanders and staffs are defined in the relevant Battle statutes. The analysis of tasks of military departments and their units and also work of commanders and staffs of the organization of combat (actions), made it possible to determine the basic management functions at this level.

Operational command and control of army is performed through a system of battle control. The realities of life in the twenty-first century require from military personnel to improve and seek new forms of warfare constantly both on tactical and operational levels. You need to imagine that in today's conditions, during the usage of armies (forces) there is a very complicated dynamic situation, there are sudden unexpected and diverse operational tasks. It is necessary to make decisions and bring it to performers (subordinates) during combat operations, often without adequate (complete) information and time for its detailed analysis and selection of optimal variant, in the so-called "manual control mode". To be ready for immediate response, perhaps in the most unexpected time, that has created the situation. All this complicates the management activity of commanders and executive activities of officials, bodies of the management system, increasing psychological stress and reduces the efficiency and quality of management actions of army (forces) using of "combat" system. It is the need of modern, including computer software of officials' activity, authorities of the management system for organizing and operational control of forces of "combat system". Management cycle of preparation of decision for operation (combat action), shown on Fig. 3.

Automation of management work of a commander must provide:

- Support of acceptance of decision using of people and information-calculated tasks;
- Fast transfer of the order to subordinates and other tasks;
- Objection control over the implementation of tasks by subordinates.

And here it needs a modern automation of management process as collecting of fast, objective, comprehensive and surely protected information that provides to the higher levels of management, and also pass to subordinates quickly and for sure. The level of automation of activity of organs of army control is low, and the level of information support of management systems of national defence subjects, compared with the army forces of leading countries is very low.

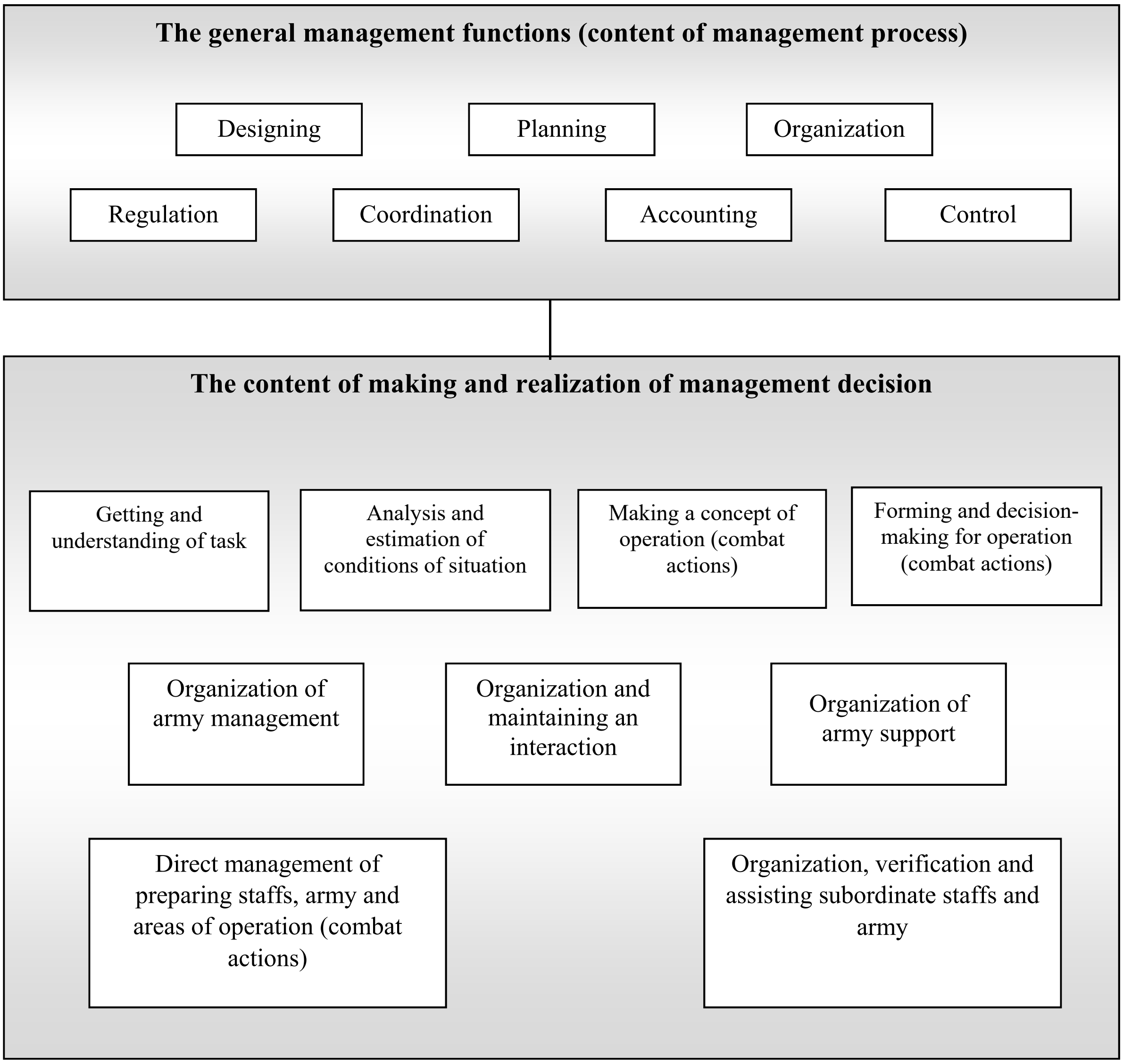
The general management functions (content of management process)
Designing
Planning
Organization
Regulation
Coordination
Accounting
Control
The content of making and realization of management decision
Getting and understanding of task
Analysis and estimation of conditions of situation
Making a concept of operation (combat actions)
Forming and decision-making for operation (combat actions)
Organization of army management
Organization and maintaining an interaction
Organization of army support
Direct management of preparing staffs, army and areas of operation (combat actions)
Organization, verification and assisting subordinate staffs and army

Fig. 3 The process and content of cycle of operation (combat actions) preparing

4 SOME ISSUES OF AUTOMATION AND MODELING OF MANAGEMENT PROCESS OF AF

For solving defence issues the most important are technologies of control of army (forces), forces of combat alert and process of conduct of a battle, and also various technology of creation and application of modern systems of all subjects of management system of country defence. However, at this time, a complex automation of management processes and subjects of management system of AF is almost absent. Acting management systems of defence subjects of AF of Ukraine are not completely meet the requirements of modern military management systems, they are not enough focused on the interaction between them. In order to improve the management of the Armed Forces, namely the improvement of efficiency and quality of operation, it is necessary to create a single automated management system of the Armed Forces (hereinafter –SAMS).

With this aim it is necessary to change (improve) the system of AF management. To lead automation it is necessary to determine and establish a list of processes (research-constructor works). In every project military must make a description of processes of management and tasks. Analysts this verbal description change into formulas, and programmers develop special soft ware. To succeed in such work it is organized relation of executors. Simultaneously it is necessary to educate key users.

To implement the policy in the area of state defence on direction of activity of MD and GS AF the components of the control system are divided into those that provide: military-political, administrative and operational management (Table 1).

Table 1 Distribution of powers of leaders of Armed Forces of Ukraine

Ministry of Defence of Ukraine		GS AF of Ukraine
Military and political leadership	Administrative managers	Direct military leadership
Ensuring the implementation of state policy in the Armed Forces	Comprehensive support of the Armed Forces activity	Determination of the basis of a Armed Forces use
Providing the implementation of political and strategic objectives in the field of defence	Comprehensive functioning and development of the Armed Forces within the implementation of the main tasks of the state policy in the field of defence	Determination of the basis of a Armed Forces control
Ensuring the implementation of the principles and directions of the Armed Forces		Taking measures to ensure the complete support of Armed Forces
		Taking measures to prepare Armed Forces

According to the assignment area SAMS's components of the system should be divided into those that provide: comprehensive automation of state leaders to manage the defence and the AF of Ukraine, control of army (forces), administrative and economic processes and so on [4,5].

We draw attention to the relevance of modelling issues, their importance for work of leaders of AF. For fast complete analysis of possible situations, comparing the options of operation (fight) conduction, selection of the optimal (in the opinion of the commander – the best) solution, professional simulated or mathematical models of operation (combat) that involve the most possible amount of information that contain in matrix can and must assist them.

These "helpers" not only minimize the time of the decision, but also enable almost in real-time to consider various options for grouping, manipulate options of change of the direction and force of impact or concentration of forces, observe mathematically calculated and appropriately justified variants of possible outcomes of the army in operation (fight) at different areas, in different seasons and different weather conditions.

It is clear that any model will not replace man-commander in the war. But modelling will allow passionlessly, that is why objective enough, to show military potentials of the parties, possible losses and many other very important parameters, so – to tell the commander sufficient information to make informed decisions and win not by the number but skills.

To make programs for such models is quite difficult. It is necessary complete understanding among military commanders and mathematicians, the ability to speak the same language on this issue. One of the factors that complicate the construction of models is the presence of management elements. Taking this into account, special means are used for management system description. Therefore, the quality of their usage in integral system depends on the quality of models even on design stage [6].

Today it is too difficult to manage army (forces) and weapons effectively and skilfully without the proper knowledge and use of military cybernetics. Exactly the military cybernetics is reliable assistant of commanders as a science of management. It will also help and allow military officers to create and apply sophisticated combat system "armies" ("power") properly and reliably in the planning, preparation and operation conduction, promptly and adequately respond to all possible changes in the situation.

To prepare for such work of all command and staff of the Armed Forces in the operational (professional, military) system of training now it is advisable to introduce discipline "Mathematical Principles of Military Art" (systemic approach). Then commanders will take an active part in the creation of simulation models and together with mathematicians to make logical and mathematical description of the system that can be investigated during the experiments on computers. They will professionally come to the key point: the definition and description of the system state. An understanding that it can be built using different approaches is important during development of specific simulation model.

It is necessary officials of command and staff profile to engage to work with these models at all staff training and games, command post and other exercises constantly and persistently so that they obtain good skills in working with models.

It is essential to say about making the automation of calculation management tasks in the operation. Due to them, you can accurately calculate, for example, the necessary data about military power, resource power, time of operation and more.

Such calculations make it possible to objectively and accurately plan the distribution of means on complex objects of use and distribution of forces on the operational tasks to improve their effectiveness in battle. The results of calculation tasks for official that makes decision are documented reasonable.

With a aim of permanent work with models, it is the time to define in guiding documents about the use of the Armed Forces (army, forces), that after hearing the proposals of relevant subordinate a commander must personally work on computer with models of operation (battle) and personally select or specify a variant over which to focus the work of management apparatus (staff) association (part).

This cannot be achieved without the creation of conditions to ensure the management of military bodies by appropriate facilities and software products that will reduce the time spending on various types of calculations, mathematical modelling of possible actions and others. In its turn, the improvement of efficiency and quality of functioning of management system can be realized only under conditions of gradual creation of SAMS. The SAMS's structure must correspond to the appointment with the ability to adapt to changes in the structure of command and control bodies.

5 CONCLUSIONS

Creation and implementation of SAMS and essential modelling will allow providing the efficiency of the Armed Forces leadership, operational (combat) control of army (forces) and military equipment (weapons) and will give an opportunity to get the following results:

- To reduce the time spent on the collection, processing, transmission and display of operational information on its automated workplace of employees of military administration from the lowest to the highest level;
- To decrease terms of decision-making at the realization of simulation and mathematical modelling of the likely actions of the Armed Forces and the timing of carrying tasks, commands, signals to subordinate army (forces);
- To ensure a raise of implementation of the combat capabilities of army (forces);
- To improve the efficiency of work of commanders and staffs of all levels and validity of operational (combat) documents that are being developed;
- To set indicators of efficiency, stability and secrecy of control to the proper level as components of management efficiency.

References

[1] Державне управління. [Deržavne upravlinnja.] Навчальний посібник. Під ред.. В.Я. Малиновського – 2-е видання, доп. та перероб. К.: Атіка, 2003. – 576 с.

[2] Теорія і практика прийняття управлінських рішень. [Teorija i praktika prijnjattja upravlins"kich rišen".] Навчальний посібник. Під ред.. В.М. Колпакова 2-е видання, доп. та перероб. К.: МАУП, 2004. 504 с.

[3] Технологія прийняття управлінських рішень. Підручник. [Technologija prijnjattja upravlins"kich rišen".] Під ред. А.С. Крупника, К.О. Линьова, О. М. Рудика. 2-е видання. – К.: НАДУ при Президенті України – 2006, 286 с.

[4] МОРОЗОВ, А. А. [MOROZOV, A. A.] Проблемно-ориентированный контент-анализ в структу-ре системы поддержки принятия решений (СППР). А. А. Морозов, В.И. Вьюн, Г.Е. Кузьменко. Математические машины и системы. 2011. № 3. с. 98-104.

[5] СОПКО, І. В., ХАРЧЕНКО, О. В. [SOPKO, I, V., CHARČENKO, O. V.] *Структуризація моделей для консолідації даних в багаторівневих ієрархічних моніторингових системах.* Десята Міжнародна науково-практична конференція "Математичне та імітаційне моделювання систем МОДС 2015". Тези доповідей. Чернігів. 469 с.

[6] Ситуаційні центри. [Situacijni centri.] Теорія і практика. НАН України, ІПММС, Київ, 2009. 347 с.

[7] BLOEBAUM, T. H., HANNAY, J. E. HEDENSTAD, O. E., HAAVIK, S., LILLEVOLD, F. *"Architecture for the Norwegian defence information infrastructure (INI) – remarks on the C3 Classification Taxonomy".* FFI-rapport 2013/01729, Norwegian Defence Research Establishment, 2013. ISBN 978-82-464-2294-7.

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ACTIONS OF POLICE AND LOCAL AUTHORITIES AFFECTING IMPROVEMENT

Mariusz ROZWADOWSKI

Abstract: All modern countries strive to provide their societies with security. The basic safety determinants are hazards and risks. Assessment of the sense of safety of residents of local communities should be assessed using the above-mentioned determinants. Local police and authorities seeking to improve the sense of security of these communities should minimize threats and risks occurring in a given area.

Keywords: safety, police, safety determinants, local community.

1 INTRODUCTION

Security is the ability to creatively engage the subject and means an objective state of no threat, perceived subjectively by individuals or groups[1]. Some authors distinguish a positive understanding of security as shaping the certainty of survival, possession and other developmental freedoms of the subject, as a negative understanding defining security as a lack of threats[2]. Security is a function of many different factors.

To formulate the definition of public security, in which the category of local security is included, the notion of security should be narrowed to such an understanding as it has been adopted in the science of criminal justice[3]. The basic safety determinants are risk and risk. These two determinants should play a key role in creating the so-called secure local spaces and improving the security of local communities. The way to achieve this goal is to create and then consistently implement preventive programs designed for the needs of local communities. The creation and implementation of such programs should be preceded by a strategic criminal analysis diagnosing the most serious problems occurring in the area that is the property of local authorities and affecting the assessment of the level and sense of security of residents and other people staying there. Only the creation of such a program after fulfilling the above-mentioned conditions can guarantee the improvement of security and raising the sense of security of local communities to a higher level.

2 SECURITY SELECTED DEFINITIONS AND DETERMINANTS

Safety is one of the most important values[4] in a person's life. Man, together with the development of civilization, creates more and more threats for himself and others, which is why security, as a value, is appreciated by individual individuals as well as entire societies.

The opposite of security is the state of danger[5]. When analyzing the word "security" from the etymological perspective, some authors consider that it comes from the words "without" and "custody". Care means care, care as well as protection and protection of others, and the prefix "without" indicates the lack of a characteristic, thing or person. L. F. Korzeniowski, after extensive research, showed errors of this hypothesis.

According to Korzeniowski, the source of the term security should be sought in ancient Rome and in Latin[6]. Security in Latin is referred to as securitas. In the beliefs of the Romans, Securitas was a goddess who embodied safety. In the Cohen catalogs, the Warsaw Numismatic Center and auction houses around the world, in the Numismatic Bulletin and other publications are copies of a few dozen sesters, denarii, antoninians and aureus with inscriptions

[1] KORZENIOWSKI, L. *Zarządzanie bezpieczeństwem. Rynek, ryzyko, zagrożenia, ochrona.* Kraków : PSB, 2000. s. 437.

[2] NYEJ, S. Jr. *Problemy badań nad bezpieczeństwem.* Sprawy Międzynarodowe. 1989, nr 6, s. 51-64.

[3] "*Wymiar Sprawiedliwości w sprawach karnych*" (Criminal Justice) jest częścią unijnego programu ogólnego "Prawa Podstawowe i Sprawiedliwość", który ma na celu promowanie rozwoju społeczeństwa europejskiego w oparciu o obywatelstwo europejskie, które szanuje prawa podstawowe, przeciwdziałanie antysemityzmowi, rasizmowi, ksenofobii oraz służy wzmocnieniu społeczeństwa obywatelskiego. Jako program szczegółowy Criminal Justice został ustanowiony na mocy decyzji Rady Unii Europejskiej z dnia 12 lutego 2007 r.

[3] WIDACKI, Z. *Kryminalistyka.* Warszawa : wyd. C. H. Beck, 1999. s. 59.

[4] KORZENIOWSKI, L. *Zarządzanie bezpieczeństwem. Rynek, ryzyko, zagrożenia, ochrona.* Kraków : PSB, 2000, s. 437.

[5] WIDACKI, J. Z. *Kryminalistyka.* Warszawa : wyd. C. H. Beck, 1999. s. 59.

[5] DUNAJ, B. (red. nauk.). *Popularny Słownik Języka Polskiego*. Warszawa : 1999, s. 30.

[6] KORZENIOWSKI, L. F. *Securitologia. Nauka o bezpieczeństwie człowieka i organizacji społecznych*. Kraków : EAS, 2008. s. 33. Korzeniowski L. F. *Podstawy nauk o bezpieczeństwie.* Warszawa : Difin, 2012. s. 49; Yarothkin W.I. (ros.) Ярочкін В. И.: *Сек'юритология – наука о безопасности жизнедеятельности.* Москва : 1989. s. 12.

(inscriptions) on the reverse: SECURITAS. Latin remained the official official language in Poland until the end of the 18th century.

The Latin language was a communication tool of the church elite of that time, hence the inscriptions written in this language must be considered as unambiguous evidence for understanding securitas, as safety, lack of threats.

Korzeniowski, in the old Polish texts quoted[7], repeatedly reveals the applied concept of "beseczeństwo" or "securitas" to describe the situation in which there are threats. In the resolutions of the Sejm of the Kingdom of Poland and the Grand Duchy of Lithuania from 1347 to 1764, "securitas" and "besurance" are interchangeably and repeatedly used. Security is inextricably linked with the functioning of the state and the idea of law and its formation. The feeling of internal security of citizens is the result of many different factors. They are affected by both objectively existing conditions, as well as past experiences and mass media activities, which often present and amplify extreme and atypical events, but which have an impact on social awareness. Internal security is one of the types of security related to threats and counteracting them inside the state. Ensuring a sufficiently high level of internal security is an important element of the internal policy of the state. Personal safety and individual sense of security becomes the most important, constitutional value[8].

The notion of security, therefore in colloquial language means a state in which the individual has a sense of confidence, support in the other person or in an efficiently operating legal system. The opposite of security is the state of emergency[9] being its basic determinant. Threats are not an intrinsic category, they always refer to an entity. These hazards can cause harmful consequences for a given entity. To generate threats, you need certain possibilities that lie in the entity itself, in its environment or in the relationship of the subject with the environment. According to the definition contained in the Modern Dictionary of the Polish language the threat is considered in meanings: objective (dangerous situation for life and health), subjective (psychological or legal state in which the individual has no sense of confidence, support in the other person or in an efficient system)[10]. Objective threats are real, real, independent from human possibilities of destruction and damage, while subjective threats refer to: awareness of threats, lack of awareness of threats, lack of knowledge about possibilities of preventing danger[11].

The sense of external and internal security of citizens is the result of many different factors. They are influenced by both objectively existing conditions, as well as experience from the past and the activity of the mass media, which often present and amplify extreme and atypical events, but which have an impact on social awareness[12].

Undoubtedly, the skill of risk analysis is important for safety management, which is a safety determinant next to the threat state. The risk is an objectified uncertainty of an undesirable event, the risk changes along with uncertainty, not probability[13]. There are many methods of risk assessment. These include in practice, intuitive, indicator, punk, simplified, simulation, statistical and discriminative methods. In economic practice, eliminating the risk is not possible, but it can be reduced by proper

[7] KORZENIOWSKI, L. F. *Podstawy nauk o bezpieczeństwie, Zarządzanie Bezpieczeństwem.* Warszawa : Wydawnictwo Difin, 2017. Korzeniowski przytacza: *Prawa Konstytucyje y przywileie Krolestwa Polskiego y Wielkiego Xsięstwa Litewskiego, y wszystkich prowincyi należących: na walnych Seymach Koronnych od Seymu Wiślickiego Roku Panskiego 1347 az do ostatniego Sejmu uchwalone.* Warszawa: Scholarum Piarum, 1782; *Konfederacya Generalna Omnium Ordinum Regni Et Magni Ducatus Lithvaniae na Konwokacyi Głowney Warszawskiey uchwalona dnia siodmego miesiąca maia, Roku Pańskiego tysiącznego siedmsetnego sześćdziesiątego czwartego. Volumina Legum.* Przedruk zbioru praw staraniem XX. Pijarow w Warszawie, od roku 1732 do roku 1782, wydanego. Tom VII. Petersburg: nakładem i drukiem Jozafata Ohryzki, 1860.

[7] Korzeniowski podaje, że securitas użyto 6-krotnie, na przykład: "Securitas bonorum et honorum", s. 20; "Securitas bonorum Naborowo, et Trębki terrestrium", s. 20; "Securitas Dobr Hibernowych Rypuana", s. 417; "Securitas Dobr Ziemskich Wsi Serebryszcze", s. 794. *Prawa Konstytucyje y przywileie Krolestwa Polskiego y Wielkiego Xsięstwa Litewskiego, y wszystkich prowincyi należących: na walnych Seymach Koronnych od Seymu Wislickiego Roku Panskiego 1347 az do ostatniego Seymu uchwalone.* Warszawa: Scholarum Piarum, 1782.

[7] Korzeniowski podaje, że bespieczeństwo użyto 8-krotnie, na przykład: "Bezpieczeństwo zewnętrzne", s. 20; (...) "dla ochrony własney y domowego bezpieczeństwa", s. 75. *Prawa Konstytucyje y przywileie Krolestwa Polskiego y Wielkiego Xsięstwa Litewskiego, y wszystkich prowincyi należących: na walnych Seymach Koronnych od Seymu Wislickiego Roku Panskiego 1347 az do ostatniego Seymu uchwalone.* Warszawa: Scholarum Piarum, 1782.

[8] IV poprawka (Karta Praw) z roku 1791 roku do Konstytucji Stanów Zjednoczonych Ameryki.

[9] DUNAJ, B. (red. nauk.) *Popularny Słownik Języka Polskiego*. Warszawa : 1999, s. 30.

[10] *Słownik współczesnego języka polskiego.* Leader Digest Przegląd. Warszawa : 2001, tom 2 s. 607.

[11] KORZENIOWSKI, L. *Securitologia - Nauka o bezpieczeństwie człowieka i organizacji społecznych.* Kraków : EAS, 2008. s. 59.

[12] MOCZUK, E. *Postrzeganie bezpieczeństwa publicznego w środowisku lokalnym.* Rzeszów : Wydawnictwo Uniwersytetu Rzeszowskiego, 2003, s. 73.

[13] WILLET, A. H. *The Economic Theory of Risk Insurance.* Philadelphia, 1951. s. 6.

management. Risk management is the identification, measurement, control and control of risk in order to limit it as much as possible and to protect against the effects of risk. The following stages can be distinguished in risk management:

- identification based on determining which types of risk and in which period the entity is threatened,
- quantification, i.e. a measurement using different methods depending on the type of risk and size of potential damage,
- deciding in conditions where it is possible to determine the threats to the expected result and when the probability of occurrence of a specific result is known or possible to estimate,
- controlling to examine the effectiveness of undertaken undertakings in the area of risk reduction.

The value of security changes over time, because environmental conditions change, and people and the whole society are also changing. Therefore, it must be stated that these changes must be observed and must affect the change of the level of security, by promoting sustainable work safety it is possible to create a sufficiently secure society[14].

The security definitions presented above focus on its subjective and objective figures. The feeling of security in a subjective form refers to the awareness of the existence of threats, the lack of awareness of the existence of threats and the lack of knowledge about the possibilities of preventing danger. The objective security state refers to the existence or absence of real threats independent of individual observations. The above rules apply to the security of local communities.

3 LOCAL COMMUNITY, DEFINITIONS CONSTITING ELEMENTS

The local community is defined differently depending on it from the perspective of what science defines this concept.

In social ecology, the local community is considered due to the functional diversity of space, the adaptation of individuals to this space.

In this approach, the local community is treated as a social system determined by the spatial arrangement of a given territory, taking into account many factors determining the functioning of the local community in functional terms, while the social space is perceived as a social creation, less dependent on the conditions natural or typological. The aim from the point of view of ecology is to provide the community with nature protection and to shape support for protected areas among local communities and tourists[15].

Taking into account the conflict approach, the local community is perceived as a scene where local conflicts between residents, representatives of self-government authorities are taking place, or, as the third party, entrepreneurs operating on the territory of a given community are mentioned. The subject of the conflict are usually:

- distribution of goods in the social space,
- growing economic diversification,
- competences of leaders of local communities,
- symbolic appropriation of public space.

The spatial, social and psychological dimension is important in defining the local community. People express their emotional attitude to space - family land, home country, private homeland. An element that has a large impact on the implementation of common interests of the local community, in particular in urban communities, are associations operating in their area, non-governmental organizations or social groups that express their interests. In traditional societies, local communities have more autonomy, their own social norms regulating their activities. In modern societies, the macro-social system begins to prevail normative, while the boundaries of local communities are established administratively, to a lesser extent their cultural boundaries are important. The factor that catalyzes the process of transformation of territorial communities in local communities is the participation of residents of a given territory in social actions, with a higher probability of participation in such actions occurring in the case of people with a higher social status.

In conclusion, it can be stated that the local community is a community inhabiting a separate, relatively small territory, such as a parish, village or housing estate in which there are strong ties resulting from a community of interests and needs, as well as a sense of rooting and belonging to a inhabited place. As elements constituting the local community, it is mentioned in sociology:

- space (geographically separated area) and territory (the area is located by the human population),
- the population living in this territory,
- social interactions between people living in the territory,
- common ties between people and institutions, which makes the community characterized by internal integration, which in turn enables taking joint actions to solve local problems,

[14] WELANDER, G., SVANSTROM, L., EKMAN, R. *Safety Promotion and Introduction*. Revised edition. Stockholm : Krolinska Instituet, 2004. s. 10.

[15] PODEDWORNA, H. *Analiza struktur społecznych. Wybrane przykłady.* [w:] *Socjologia ogólna: wybrane problemy.*, red. J. Polakowska-Kujawa, *Socjologia ogólna: wybrane problemy.* Warszawa : Oficyna Wydawnicza SGH, 2007. s. 111-119.

- a sense of belonging to a place of residence, expressed in the attitudes referred to as so-called local patriotism.

4 INFLUENCE OF A DETERMINANT ON SAFETY AND BUILDING A SAFE SPACE

The concept of security discussed above, as well as its determinants, i.e. the state of emergency and risk, is undoubtedly of great importance for assessing the sense of security in local communities. Security is a state in which the individual has a sense of confidence, support in the other person or in an efficient legal system. This state in relation to local communities is determined by features characteristic for this community. Belong to them:

- greater autonomy,
- their own social norms regulating the activities of a given community,
- strong cultural and human ties,
- inhabiting a separate, relatively small territory,
- feelings of rooting and belonging to the inhabited place.

Assessment of the sense of security of residents in a small territorially area, eg a commune, parish, village or housing estate, should be considered through the prism of the above-mentioned elements. Individual norms and activities for a given community do not always coincide with generally applicable ones, an example may be the usual belittling of illegal activities, eg after mass Sunday alcohol consumption by male members of the community, often ending with fights or quarrels in the place of residence. Such activities are allowed in given communities only and exclusively in relation to members of these communities. In the case of such actions by women or the so-called strangers, the local community clearly condemns them. Another example can be making between neighboring accounts often not reported to law enforcement agencies. Despite these events, the sense of security in the community is high. In the event of a criminal incident such as a traffic accident, residents are very likely to declare themselves as witnesses when the potential perpetrator is a person outside this community. However, if a person in this community is guilty of an accident or other road accident, nobody wants to testify. The examples described above show a sense of rooting and belonging to the inhabited area, this is characteristic of rural areas in particular.

In the case of local communities, the threat to the subject, which is this community, may be the appearance of "strangers" - understood as people outside this community. When these people are stealing, actions are taken in the community to eliminate negative phenomena, eg in the form of civic guards, granting neighborly assistance and close cooperation in detecting criminals with local law enforcement agencies.

When in the area of living in the local community there are objective threats, real, independent from human, for example landslides, floods, large frosts, residents jointly try to counteract these phenomena. An example of this is cooperation on embankments against floods or assistance in removing the effects of landslides.

It is not possible to eliminate the risk in the local community, but it can be reduced by proper management. Risk management is identification, measurement, control and control of risk in order to limit it as much as possible and protect against the effects of risk[16]. The following stages can be distinguished in the risk management of a given local community:

- identification based on determining what kinds of risks and in what period the given local community is at risk,
- calculation, i.e. measurement using various methods depending on the type of risk and the amount of potential damage,
- making decisions in conditions where it is possible to identify threats for a given community,
- administration aimed at examining the effectiveness of undertaken undertakings in the scope of reducing the risk characteristic for a given community.

Summing up, one can draw the thesis that proper risk management and shaping of public space understood as an area of special importance for satisfying inhabitants' needs, improvement, quality of life and favorable social contacts due to its location and functional and spatial features / in cooperation with local community can contribute to the elimination of criminal threats to local communities. While implementing specific actions to minimize criminal threats, the following directions should be drawn:

- multi departmental and structural partnership (local authorities, the police, planners, planners, architects, local community),
- it is necessary to diagnose the causes of criminal behavior and to plan actions in order to eliminate them completely,
- connection of physical space and social environment (local community).

Physical space can have a direct impact on criminal behavior by:

[16] DZIAWGO, D. Zarządzanie ryzykiem w banku komercyjnym. [w:] *Bankowość. Podręcznik dla studentów*, (red. nauk.) Głuchowski J., Szambelańczyk J. Poznań : WSB, 1999. s. 351-398. Por. też Korzeniowski L. *Firma w warunkach ryzyka gospodarczego.* Kraków : EAS, 2002. s. 95.

- separation of protected areas,
- increasing or reducing access by means of barriers, fences,
- influencing the possibility of observation by citizens and police services (monitoring of housing estates, villages and cities).

These elements and civic activity of members of local communities may contribute to eliminating threats, significantly reducing the occurrence of criminal phenomena and limitations of often hidden pathologies characteristic for a given local community, such as:

- violence in the family,
- alcoholism,
- drug addiction.

The activities of local authorities elected from among local community members are of great importance to counteracting these threats and pathologies. Especially in the area of public safety and order. The basic tasks in this area include:

- ensuring public order, eg by appointing a Municipal Guard,
- fire protection, sanitary safety,
- combating the effects of natural disasters.

An important element in the scope of securing public order and safety in the local area, and thus practical counteracting threats and locally occurring risk, is the construction of local preventive programs, which should include the following elements:

- hierarchizing criminological problems occurring in a given area,
- defining target groups,
- defining the objectives of preventive and main actions and partial,
- definition of tasks, areas on which actions will be implemented,
- determination; entities interested in cooperating in the implementation, forms and methods of activities and deadlines for their implementation,
- development of assumptions for the management system of the prepared prevention program and incentive system for persons undertaking activities and being the recipient of activities,
- development of evaluation assumptions,
- indication of the directions of media activities,
- estimation of the costs of individual activities and the entire program,
- indication of the person responsible for developing the prevention program document,
- conducting consultations and obtaining approval of entities implementing the program.

Implementation of properly prepared local preventive programs of a nature will contribute to a sense of security among members of these communities, as well as visitors and tourists.

5 CONCLUSION

When considering the definition of security through the prism of local communities, it can be said that it means an objective state consisting in the absence of a threat in this community, but felt subjectively only by members of this community. In this sense, security is a function of many diverse factors specific to a given community. In order to determine the causes of an undesirable condition, i.e. to determine the threats characteristic for a given community and to diagnose the basic risks occurring in this community: obtain statistical data on existing criminal threats, determine the geography of crimes and offenses, get the residents' opinion, eg in the form of complaints, collect press information on negative phenomena, but characteristic for a given local community. Conclusions formulated on the basis of these data play a leading role in the creation and implementation of local prevention programs. Preparing a preventive program and consistent implementation of the tasks contained in it, in cooperation with members of local communities with the Police, Municipal Police, Fire Brigade and other local services, contribute to the improvement of security and raising the sense of security of members of local communities. By means of these programs, a space that is safe for members of the local community is shaped.

References

[1] DUNAJ, B. (red. nauk.): *Popularny Słownik Języka Polskieg*o. Warszawa : 1999.

[2] DZIAWGO, D.: Zarządzanie *ryzykiem w banku komercyjnym.* [w:] *Bankowość. Podręcznik dla studentów*, (red. nauk.) Głuchowski J., Szambelańczyk J. Poznań : WSB, 1999.

[3] JAWORSKI, P. *Srebrne monety rzymskie w skarbie znalezionym w Ptolemais.* s. 169. „Biuletyn Numizmatyczny" 2011.

[4] KORZENIOWSKI, L. *Zarządzanie bezpieczeństwem. Rynek, ryzyko, zagrożenia, ochrona.* Kraków : PSB, 2000.

[5] KORZENIOWSKI, L. F. *Podstawy nauk o bezpieczeństwie, Zarządzanie Bezpieczeństwem. Warszawa :* Wydawnictwo Difin,2017.

[6] KORZENIOWSKI, L. F. *Securitologia. Nauka o bezpieczeństwie człowieka i organizacji społecznych*. Kraków : EAS, 2016.

[7] KORZENIOWSKI, L. F. *Podstawy nauk o bezpieczeństwie.* Warszawa : Difin, 2012.

[8] MOCZUK, E. *Postrzeganie bezpieczeństwa publicznego w środowisku lokalnym.* Rzeszów : Wydawnictwo Uniwersytetu Rzeszowskiego, 2003.

[9] NYE, J. S. Jr. *Problemy badań nad bezpieczeństwem.* Sprawy Międzynarodowe, 1989.

[10] PIEŃKOS, J. *Słownik łacińsko-polski*. Warszawa : Wydawnictwo Prawnicze, 1996.

[11] PODEDWORNA, H. Analiza *struktur społecznych. Wybrane przykłady*, [w:] *Socjologia ogólna: wybrane problemy*., red. J. Polakowska-Kujawa, *Socjologia ogólna: wybrane problemy.*, Warszawa : Oficyna Wydawnicza SGH, 2007.

[12] SERAFIN, T., PARSZOWSKI, S. *Bezpieczeństwo społeczności lokalnych, Programy prewencyjne.* Warszawa : wyd. Difin, 2011.

[13] *Słownik współczesnego języka polskiego.* Leader Digest Przegląd. Warszawa : 2001.

[14] *Słownik współczesnego języka polskiego.* Warszawa: Wilga, 1996.

[15] WELANDER, G., SVANSTROM, L., EKMAN, R. *Safety Promotion and Introduction, Revised edition.* Stockholm : Krolinska Instituet, 2004.

[16] WIDACKI, Z. *Kryminalistyka.* Warszawa : wyd. C.H.Beck, 1999.

[17] WILLET, A. H. *The Economic Theory of Risk Insurance.* Philadelphia : 1951.

[18] YAROTHKIN, W. I. (ros.) Ярочкін В.И.: *Сек'юритология – наука о безопасности жизнедеятельности.* Москва : 1989.

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GENDER AND LEADERSHIP IN THE MILITARY

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Abstract: Since time immemorial, the world has known female soldiers and warriors. Some very brave women have gone down the annals of history for their heroic acts in the military of their individual countries. However, one thing still stands clear the achievements of the previous female generations not withstanding − the role of the female soldier, especially in combat remains a highly controversial subject. Several arguments have been advanced for the exclusion of female soldiers in real combat and other senior military positions in some countries. These arguments range from what many consider as sexism to what qualifies as serious food for thought worth exploring. It is really interesting that inasmuch as the emancipation of women is much evident in other careers, their ability is highly doubted when it comes to most militaries in the world. This paper discusses the role of women and the obstacles they face all over the world in their attempts at military leadership.

Keywords: female, soldier, military, leadership, role of women, model, gender, femininity.

1 INTRODUCTION

There is no denying that most world militaries would never trust a female to sit at the helm. Despite the great advances made at promoting equality in the workplace, the military still largely remains a man's zone where women struggle to prove their worth.

In fact, there are very many militaries in the world where the role of a female soldier is mainly restricted to clerical and other logistical roles[1]. They are thought as subordinate staff where civilians wouldn't be the appropriate choice and their role in most militaries is just cosmetic.

2 LEADERSHIP CONCEPT AND THE ROLE OF WOMEN IN THE MILITARY

It is very important to understand what leadership entails before embarking on understanding why female leadership in the military is such a controversial subject. Scholars have advanced various leadership concepts for so many years because leadership is considered complex and has so many facets that cannot be measured. Most people will define leadership as "the act of motivating others to work towards organization goals"[2]. It is a fact that leadership requires a complex set of skills and this is the sole reason why all of us cannot be leaders. A good and effective leader must be a good communicator, must have incredible planning and decision making skills besides being good at working with people[3].

In the prevailing views on women, men and leadership, female leaders are usually disadvantaged. These common views are influenced by both historical and cultural tendencies. Cultural prejudices about women, men and leadership have moved in a feminine direction, but these shifts are still scarce. Even though prejudice has decreased, there is still a preference for male leaders. Men's roles have changed much less than women's roles, despite several men moved into an environment in which women predominate[4].

Going way back into human records, women have always had a role to play in the military.

a) Combat troops

It is alleged that during the American Civil War, a number of women fought in the war cross-dressed as men[5]. But it is during the World War I that their role in the military began to clearly show when Russia deployed some female soldiers on the frontline. During the Eritrean-Ethiopian war, it is reported that a quarter of the Eritrean soldiers were female[6]. Many women serve as fighter pilots in many world militaries today.

b) Medics

Women in military uniform have served as nurses in the battlefield. In World War II, most nations involved used women as medical personnel to treat and nurse injured soldiers. This role was extremely important as it ensured the troops survival by cutting down on unnecessary fatalities. To this day, most militaries in the world still have trained medics as female soldiers and their role remains unchanged.

c) Clerical and support staff

Women in most militaries work as clerical officers, taking care of office paper work and other related logistics. Women have served and still serve as cooks and cleaners in militaries worldwide. These tasks are mostly considered easy and not appropriate for a male soldier in some African militaries where

[1] SCOTT, T. *Science Says Putting Women Into Combat Endangers National Security.*

[2] FENER, T., CEVIK, T. *Leadership in crisis management: the Separation of Leadership and Executive Concepts.*

[3] Ibid.

[4] SHIELDS, P. M. *Women as Military Leaders*. Promises and Pitfalls.

[5] GULLEY, H. E. *Women & the Lost Cause: Preserving a Confederate Identity in the American Deep South.*

[6] AKRESH, R., LUCCHETTI, L., THIRUMURTHY, H. *Wars & Child Health: Evidence from the Eritrean-Ethiopian Conflict.*

sexism is much pronounced[7]. Paradoxically, women have served as drivers in the same militaries.

d) Factory workers

During the World War II, it is common knowledge that women served as factory workers where military hardware was being manufactured. They operated machines and worked at the assembly lines to guarantee a consistent supply of weapons to the troops fighting on the frontline. Women still serve in this role in most militaries worldwide although this is no longer considered an exclusive female role.

3 OBSTACLES TO WOMEN ADVANCEMENT IN THE MILITARY

a) Leadership style

The military is not an easy place for a woman to belong. Everything about military leadership screams masculine. Most orders are shouted and the leadership style is very aggressive[8]. A lot of women cannot measure up to the kind of authoritarianism expected of military leaders. The need to be unnecessarily harsh and rude while expecting subordinates to take orders kindly seems like something most women cannot stand. Naturally, women are more kind compared to men.

b) The fairer sex

A woman is considered just not build for ragged combat where bullets, kicks and fists fly. They are viewed as the fairer sex that needs to be shielded from the harsh reality of what real combat entails[9.] This idea seems to emanate from the interactions most people have with the women in their lives - they are soft, loving and ever warm. It therefore comes as no surprise that most military bosses who are men would never put a woman in harm's way. In that female soldier, they see their mother, wife and even daughter.

c) Too much pressure and stress

It is not easy being a boss in the military just like in any other job market. In fact, leadership is not for the faint hearted. Most people thirst for the power that comes with being a leader but only a few can actually cope with the pressure it presents. By being a leader, you're literally responsible for everyone else in your team and it is your job to look out for their welfare. If anything goes wrong, it is often the leader who shoulders the blame and gets to live with the bloat that comes with it. This is certainly a deterrent enough to make most soldiers including women feel contented with the peace that comes with some junior ranks that don't carry so much responsibility.

d) Inequality at home

It is tough enough being a career soldier and a mother at the same time let alone being a military boss. In most cultures of the world, a wife often has more responsibilities than the husband even in situations where both are in full time employment[10]. Raising children is almost exclusively a woman's business in most parts of the world with the man only chipping in with financial assistance. Therefore, taking up a job as a military boss means adding even more responsibilities to an already overwhelmed woman.

e) Gender stereotyping

It is a fact that despite the great advancements made by women in many other fields, there are many men and women who still find it very difficult to take orders from a female boss. Both subordinate and superiors of a female military boss will do whatever it takes to discredit her especially if they don't believe in female leadership. It therefore becomes very difficult for women to attain leadership positions due to the constant risk of insubordination.

f) The historical factor

For a very long time, women have been excluded from positions of influence and leadership within the military where they have mostly served in less prestigious roles. This makes them less conversant with the inner workings of the military as they are blind to most of the unwritten rules within the organization. Only recently have most world militaries began appointing female soldiers to minor influential positions. It is therefore considered a risky affair to allow a woman to take charge of a country's military because she is generally considered inexperienced.

g) Women are their own enemy

Some female soldiers blatantly argue that a female soldier cannot survive serious combat and shouldn't therefore be deployed to the frontline where enemy fire rages. Serrano perfectly elaborates why women don't belong in the U.S. infantry. In her argument, she states that her opinion is widely supported even within the military itself. In her opinion, the seasoned veterans of war within the military think it is a very bad idea to have women in the U.S. infantry because they know better and have a solid idea of what war actually is. Serrano is a captain in the U.S. army and her doubts in even her own ability don't augur well for the clamor for female leadership in the military[11].

[7] WHITESIDE, A., DE WAAL, A., GEBRE-TENSAE, T. *AIDS, Security & the Military in Africa: A Sober Appraisal.*

[8] BOE, O., HOLTH, T. *Investigating Correlations Between Personality Traits & Leadership Styles in Norwegian Military Cadets.*

[9] SCOTT, T. *Science Says Putting Women Into Combat Endangers National Security.*

[10] KRALOVANSKY, WAHL, CH. *Military Women as Wives and Mothers.*

[11] SERRANO, L. *Why Women Don't Belong in the U.S. Infantry.*

e) Women are not courageous enough

According to Bowman, a recent call of duty on National Public Radio in USA seeking combat-ready women exposed the lack of courage in women. Furthermore, he argues that there is anecdotal evidence that female marines are not rushing to serve in ground combat. This could mean a lack of interest or a sense of fear knowing very well what lies in wait in the battlefield. Unlike men, female are believed to have a greater sense of danger and would therefore avoid dangerous situations when they can. Since military is all about acts of valor and courage, it will take a very long time to see many women at the top of world militaries[12].

f) The tyranny of numbers

The politics of numbers cannot be ignored even in the military. Male domination of world militaries means their voice is heard much louder and they can therefore easily advance their own interests at the expense of the women in the force. This fact is much clear in third world countries where almost their entire forces are made up of men. It will be very hard to convince such a force to surrender to a female commander when there are not even a handful of female soldiers around. This lack of bargaining power has seen women stagnate in many world militaries because they are not considered interested enough in military matters.

g) Lack of government support

It is a fact that the military and government work hand in hand. For most countries, the President acts as the appointing authority of top ranking military officials. In some countries, such appointments may not be final as they still need to be vetted by other oversight bodies. For any woman to end up at the top in the military, then it is obvious that the President and the military top cream must be supportive of the idea. Unfortunately, this doesn't seem to be the case as very few women hold significant positions in world militaries. It is definitely obvious that inasmuch as some world leaders claim to be feminists, they fail miserably to promote the female interest in the military preferring a pair of male hands to be in charge. It would be very easy for women to rise in the military if most Presidents considered them worthy of appointment to the drive seat as they will serve to inspire more women to join the military having seen the prospect for career growth.

h) Objectification of women

It is unfortunate that women are considered as sex symbols and are even treated as such in some world militaries. Some female soldiers have been raped by their male counterparts in the jungle. This convoluted view of female soldiers as a means of channeling out sexual tension has only served to further discourage women from joining the military leave alone seeking higher military positions. Those who have been abused in the military become the symbol of why women shouldn't serve in the military. Sexual harassment is a serious problem in most militaries where internal conflict resolution mechanisms keep it suppressed from public exposure[13].

i) Cultural perception of soldiers

In some countries, a soldier is the epitome of evil. This is especially the case in unstable democracies where soldiers have committed some of the worst crimes known to man against civilians just to keep a despotic leader in power[14]. For most women in such countries, joining the military is considered taboo and the level of machismo paraded within the military will just make any female soldier quit and go into hiding. Moreover, no woman will be forgiven for being part of a military that tortures the very people it was supposed to protect. Instead of becoming social pariahs, most women in unstable countries will not even dare consider joining the military. As a result, it can never be any female leadership in such militaries.

j) Women are physically weak

There is a very high risk of attracting abominable condemnation from all quarters imaginable but it is true that women lack the physical strength required of a proper soldier. Most military tasks require exceptional physical strength that most women just don't have.

k) Privacy and hygiene concerns

Davis argues that it will be a logistical nightmare to send women into combat zone due to complications related with female privacy and other hygiene matters. Having fought in Desert Storm, he describes extremely harsh living conditions with no privacy at all and concludes a female soldier will find the going tough. Since there is no military in the world made up exclusively of women, it will be tempting fate to mix up male and female soldiers in conditions that offer zero privacy. This need for special privacy and hygiene facilities limits female career growth by denying them the opportunity to prove themselves like their male counterparts and earn promotions[15].

[12] BOWMAN, T. *Looking for a Few Good (Combat Ready) Women.*

[13] MATTOCKS, K., HASKELL, K., KREBS, E., JUSTICE, A., YANO, E., BRANDT, C. *Women at War: Understanding How Women Veterans Cope With Combat& Military Sexual Trauma.*

[14] ADEAKIN, I. *The Military and Human Rights Violations in Post-1999 Nigeria: Assessing the Problems and Prospects of Effective Internal Enforcement in an Era of Insecurity.*

[15] DAVIS, D. *The Truth About Women in Ground Combat Roles.*

3 FEMININITY AND MILITARY LEADERSHIP – K. M. WALKER'S MODEL

Gender parity has been a critical issue when it comes to leadership and other social affairs, more so, in the military. The issue affects not only lesser countries based on global dominance, but also prominent nations such as the United States, Russia, and the United Kingdom. It has been a long journey in the United States and other nations trying to create the gender equality although there have been inevitable challenges. Men have therefore dominated strong positions in political, social, and economic leadership. As much as this can be seen in many countries, there are efforts put in place to empower women and enable them to have a voice in the society. This aspect is fulfilled by avoiding looking at women in terms of their feminine nature but as special people who can perform a major task in the development of the society.

Karen M. Walker, American psychologist focused on gender and leadership research, developed a model of feminine military leadership.

In her work *A Model for Femininity and Military Leadership*[16] Walker takes us back to the era when women were viewed as nonentities in the society. In fact, they had no say before men. All that they could do was to remain silent and accept to be controlled by men. This was a cultural thing and belief for many people across the globe. The author tries to reflect on the instances of years before the 1940s in the United States and many years past 1940s. The reason for comparing the two eras is to examine the remarkable changes that have been achieved based on gender equity as well as female leadership in the society. Women went through different forms of humiliation but the main focus, in this case, is the leadership race in the military. Before the 1940s, women had limited access to many things including joining the military department. Women were seen as cowards and weak creatures until the experience of world war. This was the time when their true colors became evident in terms of having the potential to serve in the military. Instead of having increased gender discriminations among women; the society began seeing them from a different angle of having a major role in the military.

Today, many women in the United States and other parts of the world have joined military departments and have emerged successful by winning battles. It is not all about being members of the military but taking playing an active role as leaders who control male and female persons in the military base.

The fundamental concept addressed by Walker is the *F-SET leadership model.* In her opinion, this model is based on femininity, but it has a lot to do with that by assessing leadership from a different angle. This model has a basic meaning behind the acronym. The acronym is basically meant to address the leadership discipline. For instance, *"F"* represents *femininity* or the act of considering the validity of being a valuable female in the society. This is a way of encouragement to all women to stand strong and believe in their capabilities. *"S"* stands for *self-efficacy* which trains females to develop self-esteem and trust that they can as well accomplish great things regardless of their gender. *"E"* for *emotional intelligence*, on the other hand, empowers women to be intelligent enough in controlling their emotions if they are determined to achieve a particular goal. For instance, they have to withdraw fear, anger, and sorrow if they have to become successful military officers. All they need is to have courage, determination, perseverance, and persistence. The last approach of the model is the encouragement of *teamwork* - *"T"* - which calls upon both males and females to work together and overcome factors that may lead to collapsing of military services[17]. The F-SET leadership model is significant in the sense that it champions for gender equity, promotes unity through teamwork, improves confidence and self-esteem to female through self-efficacy and considers females as part of the society when it comes to femininity.

Indeed the issue of gender and leadership in the military is a highly controversial one. As seen in the paper, concerted efforts to address gender equality in military leadership have widely been unproductive at a time when gender equality is gaining traction across all social spheres. The underlying issues of maligning women have been widely attributed to socio-cultural aspect of the society. The underlying gender stereotypes continue to dominate top decisions in respected entities such as the military.

4 RECOMMEDATIONS FOR IMPROVING FEMALE CHANCES AT MILITARY LEADERSHIP

1. There is a reason to believe that the military remains one of the last vestiges of male superiority. Massive educational campaigns should be conceived to bring the world militaries to the new world order where women have equal rights and chances as men;
2. Every conceivable effort should be put in action to create role models for aspiring female soldiers especially in developing countries. This can best be achieved by promoting female soldiers to higher ranking positions within their respective militaries;
3. The idea of limiting women's effective participation in the military due to biological factors has clearly been overtaken by events. In

[16] WALKER, K. M. *A model for femininity and military leadership.*

[17] Ibid.

this modern era where technology defines warfare, it doesn't take much physical strength to have a woman leading a military. Unlike in the past where boots and guns were physically required on the ground, modern warfare is fought with drones and other sophisticated technologies that can be controlled remotely. Unfortunately, this will only work for developed countries with such advanced military capabilities;

4. There should be concerted efforts to bring equality at the home level. How this can be achieved is a challenge worth scholarly debate. However, one thing is certain—if couples could be encouraged to share out equal responsibilities and chores at home, more women serving in the military could find the time required to become a military leader;
5. Seeing that a lack of skills is one of the crippling factors for the failure of female military leadership, more women should be encouraged to acquire the necessary skills by creating a conducive environment for them to learn within the military.

5 CONCLUSION

The gender equality issue is still a major challenge in most militaries worldwide. Save for a few developed countries that have opened up their military to women at all levels, most countries still offer female soldiers a traditional role hence they largely remain a supporting arm of the male soldiers. Indeed several arguments have been advanced for the exclusion of female soldiers in real combat and other senior military positions in some countries. These arguments range from what many consider as sexism to what qualifies as serious food for thought worth exploring. It is really interesting that inasmuch as the emancipation of women is much evident in other careers, their ability is highly doubted when it comes to most militaries in the world.

This paper has discussed the role of women and the obstacles they face all over the world in their attempts at military leadership. It is going to take inconceivable skills to bring female leadership into most militaries of the world due to factors discussed in this paper.

References

[1] ADEAKIN, I. 2016. The Military and Human Rights Violations in Post-1999 Nigeria: Assessing the Problems and Prospects of Effective Internal Enforcement in an Era of Insecurity. In *African Security Review* [online]. 2016, Vol. 25, Issue 2. p. 129-145. [cit. 11.11.2017] Accessed: <http://www.tandfonline.com/doi/abs/10.1080/10246029.2016.1148064>

[2] AKRESH, R., LUCCHETTI, L., THIRUMURTHY, H. 2012. Wars and Child Health: Evidence from the Eritrean-Ethiopian Conflict. In *Journal of Development Economics* [online]. 2012, Vol. 99, Issue 2. p. 330-340. [cit. 11.11.2017] Accessed: <https://pdfs.semanticscholar.org/d7c6/d1711f62cbb991d6a3c1dfb7a4a6095bfe2b.pdf>

[3] BOE, O., HOLTH, T. 2015. Investigating Correlations Between Personality Traits and Leadership Styles in Norwegian Military Cadets. In *Procedia Economics and Finance* [online]. 2015, Vol. 26, Issue 1. P. 1173-1184. [cit. 11.11.2017] Accessed: <https://ac.els-cdn.com/S2212567115009491/1-s2.0-S2212567115009491-main.pdf?_tid=cf2a8700-c791-11e7-83c0-00000aacb35d&acdnat =1510481652_3bfd46444439712b5153f47b292386df>

[4] BOWMAN, T. 2014. *Looking for a Few Good (Combat Ready) Women* [online]. KUOW, 7 July 2014. [cit. 11.11.2017] Accessed: <http://kuow.org/post/marines-are-looking-few-good-combat-ready-women>

[5] DAVIS, D. 2016. *The Truth About Women in Ground Combat Roles*. *The National Interest* [online]. 2016. [cit. 11.11.2017] Accessed: <http://nationalinterest.org/blog/the-skeptics/the-truth-about-women-ground-combat-roles-14904>

[6] FENER, T., CEVIK, T. 2015. Leadership in crisis management: the Separation of Leadership and Executive Concepts. In *Procedia Economics and Finance* [online]. 2015. Vol. 26, Issue 1. p. 695-701. [cit. 11.11.2017] Accessed: <https://fardapaper.ir/mohavaha/uploads/2017/10/Leadership-in-Crisis-Management-Separation-of-Leadership-and.pdf>

[7] GULLEY, H. E. 1993. Women and the Lost Cause: Preserving a Confederate Identity in the American Deep South. In *Journal of Historical Geography* [online]. 1993, Vol. 19, Issue 2. P. 125-141. [cit. 11.11.2017] Accessed: <https://www.researchgate.net/publication/222045408_Women_and_the_Lost_Cause_Preserving_a_Confederate_Identity_in_the_American_Deep_South>

[8] KRALOVANSKY, WAHL, CH. 1996. Military Women as Wives and Mothers. In *Women's Health Issues* [online]. 1996, Vol. 6, Issue 6. P. 315-319. [cit. 11.11.2017] Accessed: <https://www.researchgate.net/publication/14217165_Military_women_as_wives_and_mothers>

[9] MATTOCKS, K., HASKELL, S., KREBS, E., JUSTICE, A., YANO, E., BRANDT, C. 2012. Women at War: Understanding How Women Veterans Cope With Combat and Military Sexual Trauma. In *Social Science & Medicine*

[online]. 2012. Vol. 74, Issue 4. p. 537-545. [cit. 11.11.2017] Accessed: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1183&context=publichealthresources>

[10] SCOTT, T. 2016. *Science Says Putting Women Into Combat Endangers National Security.* The Federalist [online]. 2016. [cit. 11.11.2017] Accessed: <htpp://thefederalist.com/2016/12/09/science-says-putting-women-combat-endangers-national-security>

[11] SERRANO, L. 2014. Why Women Don't Belong in the U.S. Infantry. In *Marine Corps Gazette* [online]. 2014, Vol. 98, Issue 9. [cit. 11.11.2017] Accessed: <http://www.mca-marines.org/gazette/2014/09/why-women-do-not-belong-us-infantry>

[12] SHIELDS, P. M. 1985. *Women as Military Leaders. Promises and Pitfalls.* National Conference of the American Society for Public Administration, Indianapolis, Indiana, March 24-27, 1985 [online]. 27 p. [cit. 11.11.2017] Accessed: <https://www.researchgate.net/profile/Patricia_Shields2/publication/36443072_Women_as_Military_Leaders_Promises_and_Pitfalls/links/53e517db0cf25d674e96af0a/Women-as-Military-Leaders-Promises-and-Pitfalls.pdf>

[13] WALKER, K. M. 2012. A model for femininity and military leadership. In *Journal of the Psychological Issues in Organizational Culture* [online]. 2012, Vol. 2, Issue 4. P. 22-37. [cit. 11.11.2017] Accessed: <https://www.deepdyve.com/lp/wiley/a-model-for-femininity-and-military-leadership-XbqEwzrP8h?articleList=%2Fsearch%3Fquery%3DA%2Bmodel%2Bfor%2Bfemininity%2Band%2Bmilitary%2Bleadership>

[14] WHITESIDE, A., DE WAAL, A., GEBRE-TENSAE, T. 2006. AIDS, Security & the Military in Africa: A Sober Appraisal. In *African Affairs* [online]. 2006. Vol. 105, Issue 419. P. 201-218. [cit. 11.11.2017] Accessed: https://academic.oup.com/afraf/article-abstract/105/419/201/14766?redirectedFrom=fulltext

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