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Dear readers,

Let me present another issue of the journal Science & Military. I am pleased to say that our journal is becoming more and more popular with its readers and contributors. As a result, the quality of submitted articles has risen as well. The journal's editorial staff only accept articles that are written in English, thus making the journal more attractive also for foreign readers and contributors.

This issue contains high quality and very interesting articles that have undergone strict editorial review successfully. I am convinced that they will be inspiring and thought-provoking.

The first article, written by Zdeněk Matoušek, Marián Babjak and Ján Ochodnický, analyses and evaluates the probability of correct range detection versus the jamming-to-signal ratio (JSR) of Doppler pulse radar using simulation software. It also evaluates the advantages of using IM techniques for pulse radar system.

The second article, written by Sergiy Orel and Oleksiy Ivaschenko, presents application of two-dimensional Monte Carlo method to evaluate impacts of the pollution caused by a former missile base in Ukraine on the environment (cancer risk).

Another contribution is from Taras Stukalin and it is devoted to the problems of creating a new optimal model of territorial defense in Ukraine on samples of foreign countries. Topic is very timely and important for reforming of territorial defense in Ukraine and implementation of reforms of the armed forces and their management systems.

The article written by Cezar Vasilescu analyses the findings and synthesizes knowledge of business processes improvement and reengineering. The author presents process design principles (compares approaches of two authors - M. Hammer´s and R. Linden´s) and illustrates the contribution of each principle to a reengineering initiative.

Another article is from Olga Marchenko. The article presents the essence and structure of the professional competence of the teacher. The author evaluates the use of modern teaching methods and recommends implementation of these methods as effective innovation tools in modern teaching. The author has processed and recommends a new study bibliography in this field.

Rules and procedures of accident investigation in civil aviation is the topic of the article by Grzegorz Zajac. The article provides detailed requirements of ICAO and EU regulations and sets out the conditions for accident investigation and procedural requirements of procedures and documentation on the conclusions of the investigation. The complexity of these requirements and procedures is the most important part of this paper. This problem requires cooperation and exchange of experience on international level.

The author Wojciech Gizicky presents brief description of recent development in the field of modern technologies in Poland, involvement of national institutions and companies, introduction of various projects, and application of these technologies to Polish Army.

The final article by Aneta Nowakowska-Krystman presents the formulation of the strategy of the armed forces on the basis of the assumptions of resource-based view. As a result, the armed forces are perceived as a bundle of resources, capabilities and competencies which are used to create and implement the strategy which aims at the satisfaction of the beneficiaries´ needs in terms of security provision.

Dear readers, on my behalf and on behalf of the editorial board, I would like to wish you all the best for the coming year 2016 and thank you for your readers´ interest and quality articles.

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INTRAPULSE MODULATIONS FOR RADAR PULSE COMPRESSION

Zdeněk MATOUŠEK, Marián BABJAK, Ján OCHODNICKÝ

Abstract: Pulse compression in radar systems involves the transmission of a long coded pulse and the processing of the received echo to obtain a relatively narrow pulse in case of pulse radar. The increased detection capability of a long-pulse radar system is achieved while retaining the range-resolution capability of a narrow-pulse system. The second reason for using pulse compression is to optimize the radar waveform for a resistance to many kinds of jamming and distortion. Intrapulse modulation (IM) is technique for pulse compression. This paper evaluates the advantages of using IM techniques for pulse radar systems. A correlation receiver has been implemented, and various simulations were done to evaluate the radar system's resistance to active noise jamming. The analysis of three types of IM signals - signals with continuous (linear or nonlinear) frequency modulation (FM-IM), signals with discrete frequency modulation (FSK-IM), and signals with binary phase modulation (BPSK-IM) utilizing with detection of reflection echo at active noise jamming is presented. The probability of correct range detection versus the jamming-to-signal ratio (JSR) is evaluated and analyzed.

Keywords: intrapulse modulation, pulse compression, correlation receiver, jamming to signal ratio, probability correct of range detection.

1 INTRODUCTION

Pulse compression is a radar signal processing technique to increase the range resolution as well as the signal to noise ratio. This is achieved by modulating the transmitted pulse (spectrum spreading) and then correlating the received signal with the transmitted pulse. Rapid evolution of digital technologies brings also new approaches to the field of designing and processing of radar signals. One of the characteristic parameters of radar system is its resistance against active jamming. It can be achieved by spread spectrum techniques which can be classified according to the method of spectrum spreading to Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS) and Linear Frequency Modulation inside pulse duration (LFM). New types of radar signals were developed by applying spread spectrum techniques into the pulse radar technology. They are known as signals with intrapulse modulation (IM). In this case a radar pulse is divided into multiple subpulses and frequency or phase modulation is applied inside of each subpulse. From this point of view it is possible to classify radar signals with intrapulse modulation into the next following groups [1, 2, 3]:

a) Signals with continuous (linear or nonlinear) frequency modulation - FM-IM;
b) Signals with discrete frequency modulation - FSK-IM;
c) Signals with binary phase modulation - BPSK-IM.

Using of these signals in radar technology enables to decrease transmitted power of radar, improve range resolution and resistance against various kinds of distortion or active jamming. The resistance against active jamming in military radar applications is the most important factor when one compares their quality.

Using of Walsh-Hadamard sequences (WHS) together with BPSK-IM was proposed in [4] together with classification of WHSs of length 8, 16 and 32 according to their performance.

Receiving and processing of IM signals which are reflected from targets is realized in radar receivers by pulse compression algorithm. Usually, the pulse compression algorithm is implemented in equipment with conjugate filters, time inversion filters or correlators [5]. At their output, the signal-to-noise ratio (SNR) is increased due to signal compression and consequently radar power can be decreased while maximal range of radar is retained. At the present time higher gain can be achieved by using digital signal processing implemented inside software defined radars [6].

2 INTRAPULSE MODULATION IN RADAR SIGNALS

Signal with continuous linear and nonlinear FM-IM can be described in time domain by following formulas, respectively [7]

$$s(t)=\begin{cases} A\sin\left(\omega t+\Delta\omega\dfrac{t^2}{PW}\right) \text{ for } t\in\langle i.PRI, i.PRI+PW\rangle, \\ 0 \qquad \text{for } t\in\langle i.PRI+PW, i.PRI+PW+DT\rangle \end{cases}, \quad (1)$$

$$s(t)=\begin{cases} A\sin\left(\omega t+\Delta\omega\dfrac{t^3}{PW}\right) \text{ for } t\in\langle i.PRI, i.PRI+PW\rangle, \\ 0 \qquad \text{for } t\in\langle i.PRI+PW, i.PRI+PW+DT\rangle \end{cases}, \quad (2)$$

where A is a signal amplitude, ω is an angle frequency, $\Delta\omega$ is a frequency deviation, PRI is a pulse repetition interval, PW is a pulse width, DT is a dwell time and i = 0, 1, 2, … I is an integer.

Signal with discrete FSK-IM in the time domain is given by [7]

$$s(t)=\begin{cases} A\sin(\omega_m t+\phi) \text{ for } t\in\langle i.PRI, i.PRI+PW\rangle, \\ \\ 0 \quad \text{for } t\in\langle i.PRI+PW, i.PRI+PW+DT\rangle \end{cases}, \quad (3)$$

where ω_m is a signal angle frequency used in a subpulse and φ is initial phase.

Signal with discrete BPSK-IM is possible in time domain to describe by [8]

$$s(t)=\begin{cases} A\sin\left[\omega t+\Delta\psi_m\right] \text{for } t\in\langle i.PRI, i.PRI+PW\rangle, \\ \\ 0 \quad \text{for } t\in\langle i.PRI+PW, i.PRI+PW+DT\rangle \end{cases}, \quad (4)$$

where $\Delta\psi_m$ is a phase deviation in m-th subpulse, which in the case of BPSK reach the value 0 for modulation signal equals +1 and value π for modulation signal equals -1.

The above mentioned IM signals in time domain are shown in Fig. 1.

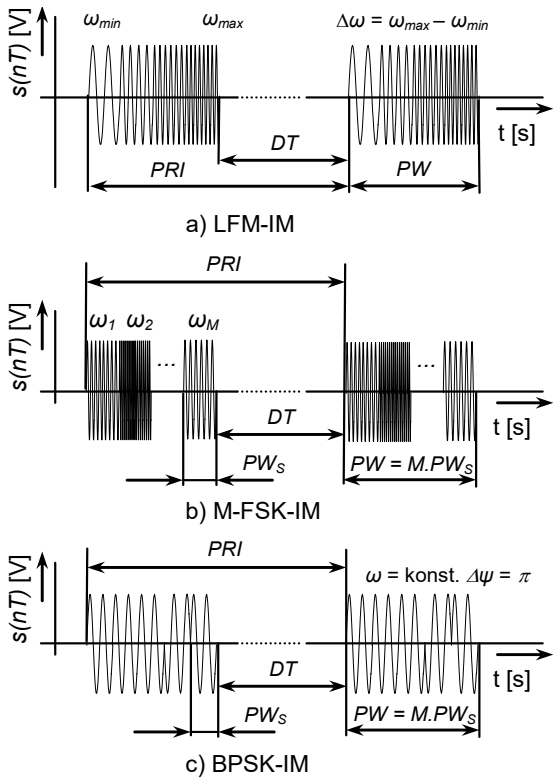

Fig. 1 Three types of signals with IM in the time domain a) continues linear frequency intrapusle modulation (LFM-IM), b) discrete frequency intrapusle modulation (FSK-IM), c) binary phase intrapusle modulation (BPSK-IM)
Source: authors.

As it is obvious from Fig. 1 that basic parameters of IM signals are:

- PW - pulse width – the time in which intrapulse modulation is applied,
- PWS - subpulse width,
- DT - dwell time, time between two subsequent pulses,
- PRI - pulse repetition interval, $\Delta\omega$ - frequency deviation for FM-IM signals,
- ω_m - signal angular frequency for FSK-IM signals,
- $\Delta\psi_m$ phase deviation for BPSK-IM signals.

Agile sensing of the electromagnetic spectrum, signal environment and recognition of the employed waveforms are crucial for efficient and effective operation of the future radar systems. The ever-increasing number of different radar emitters and waveforms require efficient and agile utilization of the electromagnetic spectrum.

3 SIMULATION MODEL FOR RADAR SIGNAL ANALYSIS

For an analysis of using particular IM signals in the case of active jamming, a radar model was designed and coded in Matlab environment. This model simulates the generating and processing of IM radar signals with the different jamming to signal ratio (JSR). The basic parameters of the proposed model are following [4]:

- subpulse width PWS = 0.2 μs,
- pulse width PW = 2.6 μs [PW = 3.2 μs for Walsh-Hadamard sequence (WHS)],
- pulse repetition period PRI = 30 μs,
- IF carrier frequency f = ω/2π = 30 MHz,
- signal frequencies for FSK-IM signals – 13 orthogonal frequencies within the range of f ± 5 MHz,
- frequency deviation for LFM-IM signals Δf = Δω/2π = 10 MHz,
- sample time for all signals T = 1/10 fmax,
- modulation signal for BPSK-IM – Barker code with length of 13 and WH sequences with length of 16,
- jamming signal – Gaussian noise with power spectral density N,
- jamming to Signal Ratio JSR from -3 to 9 dB interval with 0.1 dB step.

The model diagram for IM signals generation and processing is presented in Fig. 2.

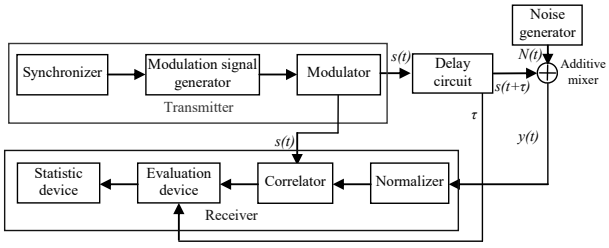

Fig. 2 The model diagram for IM signals generation and processing
Source: authors.

The transmitter generates signals *s(t)* with well-defined pulses width for no IM, FM-IM (linear or nonlinear), FSK-IM and BPSK-IM, respectively. Barker code with length of 13 and WHS with length of 8, 16 and 32 are used for modulation for BPSK-IM signals.

Delay circuit creates random delay of modulation signal within the range from 5 to 25 μs. Delayed signal *s(t)* is mixed in additive mixer with noise *N(t)* that is generated in the noise generator. The result of mixer is an additive mix of delayed signal and noise given by

$$y(t) = s(t) + N(t). \tag{5}$$

The average power of active noise jamming *N(t)* is modified during simulation in order to reach power ratio of JSR within the range from -3 to 9 dB. The JSR ratio is expressed by

$$JSR = 10\log\frac{N(t)}{s(t)}. \tag{6}$$

The modulated signal *s(t)* and delayed signal with additive noise *y(t)* for JSR = 3dB is shown in Fig. 3.

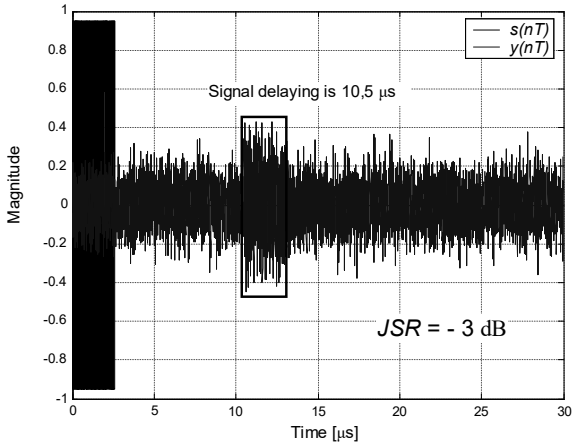

Fig. 3 The behaviour of modulated signal and delayed signal with additive noise for JSR=-3dB
Source: authors.

In the next step, the delayed additive mix signal with noise *y(t)* is normed and it is computed correlation function in a correlator with modulated signal *s(t)* according to equation [9]

$$cor(m) = \sum_{n=0}^{N-m-1} \left[s_{[(n+1)T]}\right]\left[y_{[(n+m+1)T]}\right]^{*}, \tag{7}$$

where *T* is a sample time, n is a number of signal sample, m = 0, 1, 2, … N-1 and * represents complex conjugate.

The graph of correlation function cor(m) versus distance for FSK-IM signal with JSR = 6 dB is shown in Fig. 4.

A target range is evaluated from the correlation function cor(m) (in the evaluation device) and after that it is compared with random delay of modulated signal that is adjusted in a delay circuit. In the statistic device is for given value of JSR evaluated a number of correct detection NCOR and after that is computed the probability of correct range detection P_D which is defined as

$$P_D = \frac{N_{COR}}{N_{PRI}}, \tag{8}$$

where N_{PRI} = 10 000 is the number of periods in which was repeated statistical evaluation for one value of JSR.

The probability of correct range detection versus JSR graph at the input of the correlator for particular signals is presented in Fig. 5.

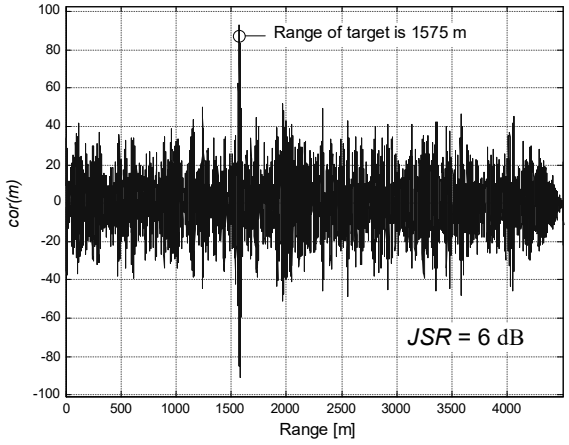

Fig. 4 Graph of correlation function vs. range for FSK-IM signal
Source: authors.

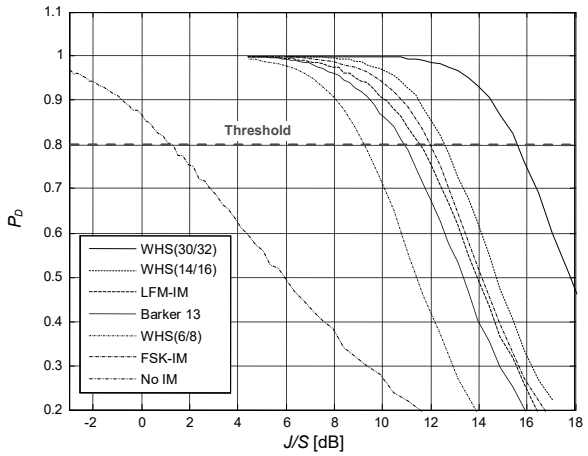

Fig. 5 Probability of correct range detection PD vs. JSR
Source: authors.

From Fig. 5 it is obvious that for detection wanted signal with noise jamming it is very useful to utilize signals with IM in a radar technology. The best results were achieved with discrete FSK-IM signals and longer orthogonal codes BPSK-IM.

Table 1 JSR level vs. P_D for modulated signals

Modulated signals	Probability of range detection P_D			
	0.8	0.85	0.9	0.95
No IM	1.28 dB	0.31 dB	- 0.75 dB	-2.26 dB
LFM-IM	11.55 dB	10.93 dB	10.13 dB	8.92 dB
FSK-IM	11.98 dB	11.49 dB	10.80 dB	9.78 dB
Barker 13	10.91 dB	10.28 dB	9.49 dB	8.32 dB
WHS(6/8)	9.25 dB	8.75 dB	8.09 dB	7.11 dB
WHS(14/16)	12.58 dB	12.09 dB	11.51 dB	10.61 dB
WHS(30/32)	15.59 dB	15.11 dB	14.52 dB	13.57 dB

Table 1 provides the JSR level in which it is possible to detect reflected echo in the correlation receiver with probability of correct range detection P_D within the range from 0.8 to 0.95.

4 WALSH-HADAMARD SEQUENCES FOR BINARY ENCODING OF RADAR SIGNALS

As it is obvious from Figure 5, the best results were achieved with long WHSs. Not all of the WHSs are suitable for interpusle modulation of radar signals. Therefore, in next part of the paper we will focus on classification of WHS with length of 8, 16 and 32 for BPSK-IM radar signals.

Walsh-Hadamard sequences to binary coding of radar signal - spreading the spectrum of radar pulse with BPSK intra-pulse modulation (BPSK-IM). Walsh Hadamard sequences are easy to generate, and orthogonal [4] in the case of perfect synchronization.

The Walsh-Hadamard sequences of the length N; $N = 2^n$, n = 1,2, …, are often defined using Hadamard matrices H_N [4], with

$$H_2 = \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \tag{9}$$

and

$$H_{2N} = \begin{bmatrix} H_N & H_N \\ H_N & -H_N \end{bmatrix}. \tag{10}$$

The resulting matrices HN are orthogonal matrices, i.e. for every N we have

$$H_N H_N^T = N I_N, \tag{11}$$

where H_N^T is the transposed Hadamard matrix of order N, and I_N is the N × N unity matrix.

In such way we can generate N; N = 2n, n = 1, 2, orthogonal sequences WHS(i,N), i = 1, 2, …, N, with length N, each representing the i^{th} row of Hadamard matrix H_N.

The effect of appalling BPSK intra-pulse modulation with N subpulses to radar pulse is spreading its spectrum N times in frequency domain and can be represented as direct sequence spread spectrum system. At the receiver side during reception, signals witch are coherent with used binary sequence are de-spread while all other signals not coherent with it are spread. So we can achieve broadband gain which is proportional to the pulse and the shortest subpulse run (PWs) duration ratio

$$G_{BB} = 10 \log \frac{PW}{PW_S} \tag{12}$$

together with pulse compression.

In this paper H8, H16 and H32 are used for binary coding of radar signal and to produce BPSK-IM inside radar pulse. Walsh-Hadamar sequences (WHS) for various N are shown in Fig. 6.

If we use the WHS from Fig. 6, each row of this matrix represents WHS for binary encoding of radar pulse during its pulse duration (*PW*). Because of WHS orthogonality it is possible to separate two radar pulses spread by two different WHSs from received signal, or in other words, to extract from received signal only that part which was spread by the certain WHS. But not all WHSs provide the same performance from the resistance to active noise jamming point of view.

Aperiodic autocorrelation function, very low or none side lobes in autocorrelation function and small mutual cross correlation are the most crucial parameters required from sequence for binary

encoding of radar signals. Due to orthogonality of WHS they provide zero mutual cross correlation under condition of perfect synchronization. But not all of them provide sufficiently low side lobes in autocorrelation function. By analysis of autocorrelation functions of WHSs, the following conclusions for selection of "good sequences" can be formulated:

- Good sequence should contain so many state transition as possible;
- Good sequence should has difference between the autocorrelation function maximum and the nearest side lobes in autocorrelation function big enough; the bigger difference will produce better performance;
- Good sequence should not contain periodic pattern;
- If there is periodic pattern, sequences with longer period will provide better performance.

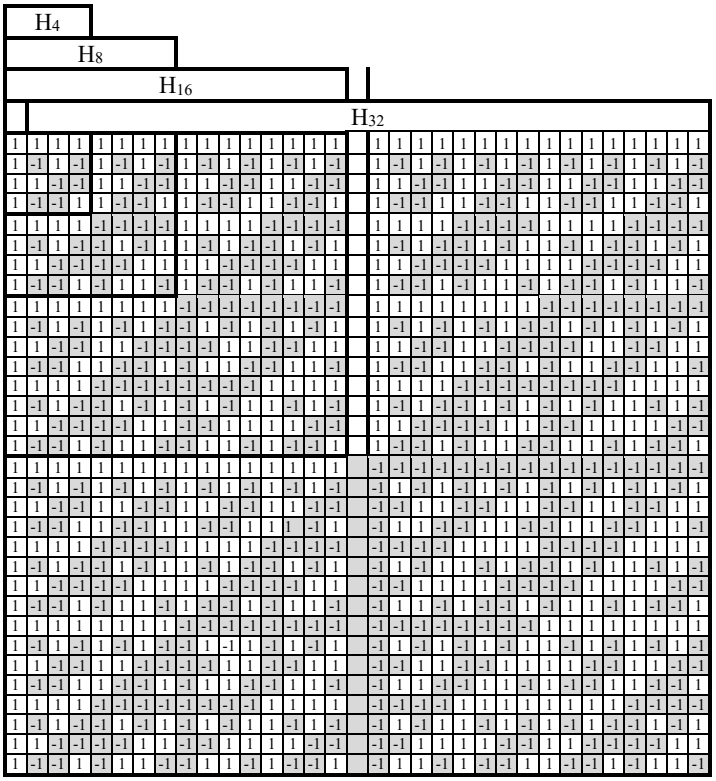

Fig. 6 Walsh-Hadamard sequences for N = 4, 8, 16 and 32
Source: authors.

Walsh-Hadamard sequences with length 16 together with their autocorrelation functions are shown on Fig. 7. First sequence (Fig. 7a) WHS(1,16) contains all ones. There if no state transition in the sequence and its autocorrelation function is the same as autocorrelation function of radar pulse without intra-pulse modulation. First WHS for any N has these properties and it is not suitable for binary coding of radar signal. The 5th sequence (Fig. 7b) WHS(5,16) has only three state transitions and the shortest subpulse run is 4, so GBB = 6 dB. The 11th sequence (Fig. 7c) WHS(11,16) has six state transitions the shortest subpulse run is 2, so GBB = 9 dB. The 14th sequence (Fig. 7d) WHS(14,16) has the best performance from the all above mentioned. It has thirteen state transitions and the shortest subpulse run is 1, so GBB = 12 dB.

As the result of WHS property analysis for N = 8, 16 and 32 we can observe following conclusions:

- The first sequence (all ones) cannot be used for binary encoding of radar signals;
- Other sequences can be divided into 3 groups – the worst, good, the best - according to above mentioned rules;
- All sequences in the group provide approximately the same performance.

The simulations were performed to evaluate performance of WHS encoded BPSK-IM radar signals in presence of active noise jamming.

Decompositions of WHS for N = 8, 16 and 32 are shown in Tab. 2, Tab. 3 and Tab. 4 respectively together with required JSR for PD = 0,8. Decomposition was performed according to the rules described in section II.C and according to required JSR to achieve P_D = 0,8 from simulation results. For each N, N-1 sequences (without 1st sequence) were divided into 3 groups – the best group (BG), the good group (GG) and the worst group (WG).

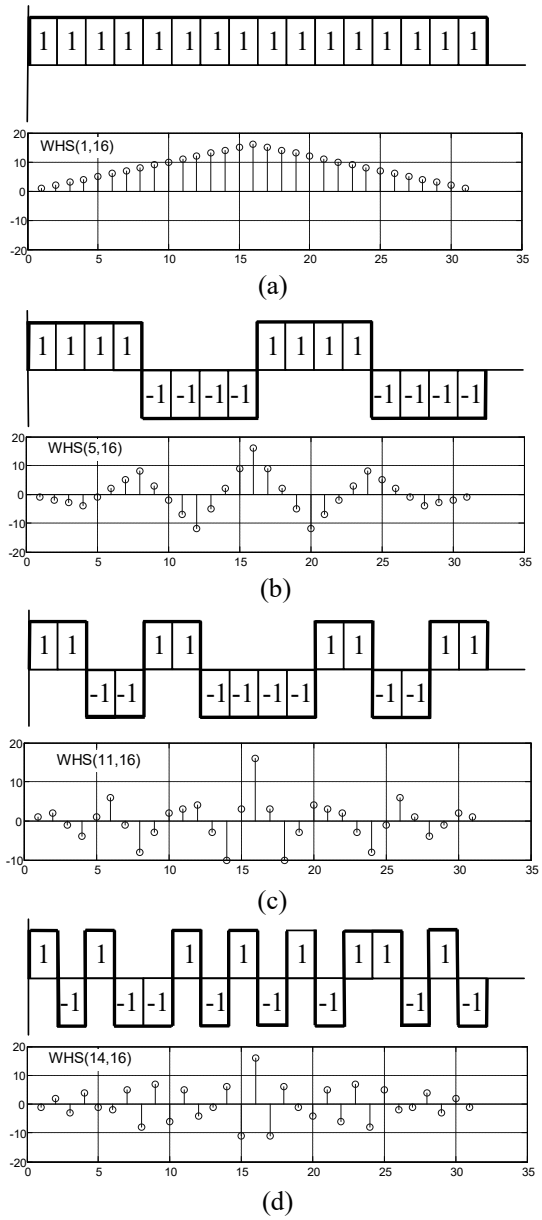

Fig. 7 Walsh-Hadamard sequences and their autocorrelation functions for N = 16, (a) i= 1, (b) i= 5, (c) i= 11, (d) i= 14
Source: authors.

Graph probability of correct range detection versus JSR for WHS with length 8 is shown on the Fig. 8.

Graph probability of correct range detection versus JSR for WHS with length 16 is shown on the Fig. 9.

Graph probability of correct range detection versus JSR for WHS with length 32 is shown on the Fig. 10.

Table 2 Decomposition of WHS for N = 8 into groups (JSR for PD = 0,8)

	The best group		The good group			The worst group	
Row	6	8	2	4	3	7	5
JSR	9,25	9,13	8,74	8,6	8,19	7,57	5,94

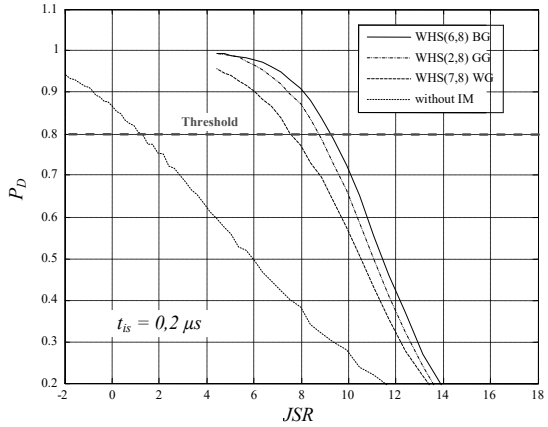

Fig. 8 Probability of correct range detection versus JSR for WHS with length 8
Source: authors.

Table 3 Decomposition of WHS for N = 16 into groups (JSR for PD = 0,8)

The best group						
Row	14	6	10	16	8	12
JSR	12,58	12,43	12,41	12,41	12,39	12,25
The good group						
Row	11	15	4	3	2	7
JSR	11,6	11,22	11,11	10,91	10,74	10,32
The worst group						
Row	5	13	9			
JSR	9,55	8,31	6,27			

For WHS with N = 8 there are 2, 3 and 2 sequences in BG, GG and WG respectively. So we have only 2 sequences with the best performance. To achieve more sequences with the best performance, we have to use WHS with N = 16 or 32. For WSH with N = 16 there are 6, 6 and 3 sequences in BG, GG and WG respectively. Moreover, for WSH with N = 32 there are 10, 10 and 11 sequences in BG, GG and WG respectively.

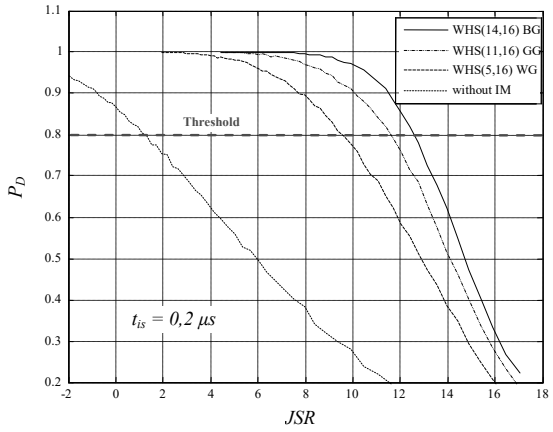

Fig. 9 Probability of correct range detection versus JSR for WHS with length 16
Source: authors.

Table 4 Decomposition of WHS for N = 32 into groups (JSR for PD = 0,8)

The best group					
Row	30	22	32	24	14
JSR	15,59	15,57	15,52	15,46	15,38
Row	26	10	28	16	12
JSR	15,19	15,18	15,13	15,11	15,09
The good group					
Row	6	8	20	27	18
JSR	14,69	14,67	14,63	14,57	14,56
Row	19	11	15	31	23
JSR	14,37	14,21	14,02	13,98	13,65
The worst group					
Row	4	3	7	5; 21	2
JSR	12,89	12,88	12,55	12,34	11,85
Row	29	13	9	25	17
JSR	11,7	10,99	9,83	8,36	6,13

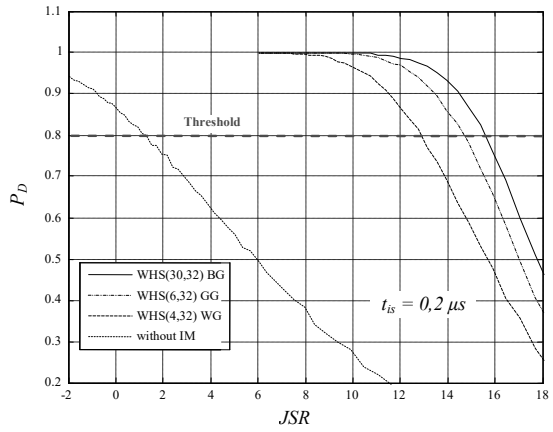

Fig. 10 Probability of correct range detection versus JSR for WHS with length 32
Source: authors.

5 CONCLUSION

The aim of this article was to make an analysis of individual IM signals utilizing with detection of reflection echo. This category of signals is also effective in presence of active noise jamming. The achieved results shown that for IM signals (contrary to no IM signals) it is possible to detect

Reflected

signals that power is smaller than average power of active noise jamming.

Simulation results show, that in case of active jamming it is most suitable to use signals with discrete FSK-IM signals by using of orthogonal frequencies or longer orthogonal BPSK-IM codes (in this case WHS is WH-16). The analysis has shown that with these signals one can reach the highest value of probability of correct range detection versus JSR at the correlator input. At the same time one can say that above mentioned IM signals will be more resistant to active pulse repetition deception jamming because they allow using multiple generating of various code groups as are FM-IM and BPSK-IM signals with using Barker code.

The decomposition of WHS with length 8, 16 and 32 into 3 groups with approximately the same performance was proposed. According to simulation results the best groups for N=16 and 32 will always provide the significantly better performance than systems with Barker 13 binary encoded or linear frequency modulation inside pulse duration radar signals. When using WHS with length 16, even by using of sequences from the good group or WHS with length 32, most of sequences from the worst group provide approximately the same performance as with Barker 13 encoded or linear frequency modulation inside pulse duration radar signals.

The big advantage of using of WHS for binary encoding of radar signals is that we have a set of orthogonal sequences for binary encoding instead of only one sequence in the case of Barker 13. Thus, we can randomly use various sequences in subsequent PRI and to make the system resistant also against the active response jamming, because only echo signals which are coherent with used orthogonal sequence will be processed in receiver. Another advantage of using WHS for binary coding is possibility to avoid mutual interferences of own radar systems. For each radar system only one sequence will be assigned this case.

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EVALUATION OF MILITARY ACTIVITY IMPACT ON ENVIRONMENT USING TWO-DIMENSIONAL MONTE CARLO METHOD

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Abstracts: Presents the results of a probabilistic risk assessment for human activity on the territory where military activity was conducted. The calculations results of possible human risk by carcinogenic and non-carcinogenic compounds which pollute the territory are obtained using two-dimensional Monte Carlo method. It is demonstrated that the use of two-dimensional Monte Carlo method for probabilistic risk analysis provides with more additional information for decision making on the application of measures for its reduction compared to one-dimensional Monte Carlo or deterministic values methods.

Keywords: ecological risk, risk assessment, military activity, human health, probabilistic distribution, two-dimensional Monte Carlo simulation.

1 INTRODUCTION

Military activities even during peacetime has a significant impact on the environment. Pollution, damage to the environment and the need to find appropriate solutions to reduce both, require a mechanism for environmental condition assessment, through which we could make optimal decisions that would ensure the protection of environment at minimal costs. Environmental risk analysis is one of effective tools that integrate environmental data with management decisions [1].

Analysis of the environmental risk and methodology of its assessment are discussed in the literature, for example [2].

Risk assessment is accompanied by the presence of some uncertainties that characterize the lack of precise knowledge in each component of the evaluation stage. The sources of uncertainty are presented, for example, in [3, 4]. These uncertainties can be divided into two categories: ignorance - lack sufficient knowledge about specific factors, parameters and models that are used to analyze risk and variability, meaning the variability of parameters due to their natural heterogeneity [3]. While the first one can be reduced by collecting additional data, increasing measurement accuracy, improving models, etc., it is impossible to reduce the variability in this way.

In real life risk assessment is often based on the use of deterministic, point data. The values of base variables used are normally conservative, usually 90 or 95 percentile of their distributions.

Obviously, this case is used when it is important to avoid underestimating the danger. It is beyond doubts that excessive conservatism may cause serious unjustified expenses in the case of applying measures to reduce risk.

To make a better decision about risk assessment it is worth to assess the existing uncertainties. This can be done by replacing the point values by probability distributions for one or more variables in a risk equation in order to quantitatively characterize variability and/or uncertainty. As a result of model calculations, instead of point risk value we get its distribution. If the input distributions represent variability, then the output risk distribution can provide information on variability in risk in the population of concern. If the input distributions reflect ignorance, then the output risk distribution can provide information about ignorance in the risk estimate. Information from a probable risk assessment (PRA) can be used to make statements about the likelihood of exceeding a risk level of concern, given the estimated variability in elements of the risk equation. Since the results of point estimate methods generally do not lend themselves to this level of risk characterization (e.g., quantitative uncertainty assessment), PRA can provide unique and important supplemental information that can be used in making risk management decisions.

To construct the probability risk distribution, in other words, "to move" the uncertainties from the beginning to the end of the risk model, different methods are used, some of which are described, for example, in [4]. However, the most popular method is a numerical Monte Carlo method. The idea of the method suggests that the model that determines the risk value as a function of environmental parameters, which presented in the form of probability distributions, by the way of combining multiple values of these distributions, selected by the law of random, constitutes a risk existence probability distribution of hazardous substances impact in this space-time area. Comparing the value of risk with the acceptable one for a given area it is possible to identify the domain of unacceptable risk.

The method is called the one-dimensional Monte Carlo method, because it can be used to evaluate the impact of only a single component of uncertainty - either variability, or ignorance. Mixing these components in the probabilistic risk assessment using one-dimensional Monte Carlo method is unacceptable [4].

For simultaneous estimation of variability and ignorance a two-dimensional Monte Carlo method is used. Its idea suggests that when the method is implemented, at first, a random value is chosen from the distribution, which is determined by ignorance

(external loop). This value is "frozen" and used as a substitute in distributions which are defined by variability (for the whole model), and the inner loop is implemented, similar to one-dimensional Monte Carlo method. After that a new value is chosen from the external loop, insert in the inner loop and the process is repeated required number of times.

The usefulness of using two-dimensional Monte Carlo method can be illustrated by using Fig. 1. It reflects the allocation of risk distribution for the average meaning of the value, which is characterized by ignorance (solid line) and upper and lower limits of the confidence interval of the same value (dashed lines) [4].

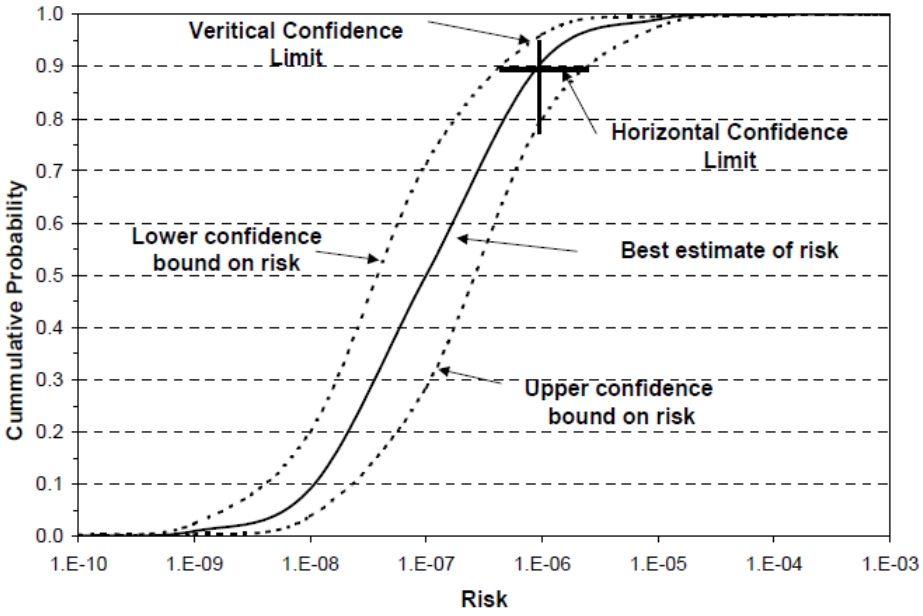

Fig. 1 Illustration of risk assessment using two-dimensional Monte Carlo method
Source: http://www.epa.gov/superfund/RAGS3A/index.htm.

The form of risk distribution is determined by the distribution of values that are characterized by variability.

Analyzing Fig. 1, we can define a quantitative measure of conviction for the population for which the value of risk exceeds the acceptable value (vertical bound of the confidence interval). For example in the case of risk assessment application for its average value, we can state that only for 10 % of population this value exceeds the acceptable value of 10^{-6} (point of intersection of the risk distribution line for the average value with vertical bar of the confidence interval). Taking ignorance into consideration, we can state that, with a certain probability, set for the given confidence interval (e.g. 95 %), no more than for 20 % of population the risk value will exceed acceptable (point of intersection of the risk distribution line for the upper bound of the confidence interval with the vertical limit of the confidence interval).

Additionally, it is possible to define a quantitative measure of conviction for the part of population for which risk value exceeds the acceptable value (horizontal limit of the confidence interval). While using the risk assessment for the average value, one could state that only for 10 % of population the risk value exceeds the acceptable value of 10^{-6}, then considering ignorance, we can add that with certain probability, set for the confidence interval (e.g. 95 %), for this part of population risk value will not exceed $2 \cdot 10^{-6}$ (point of intersection of the risk distribution line for the upper limit of the confidence interval with the horizontal limit of the confidence interval).

The term “confidence interval” is used loosely in this context to convey information about uncertainty; however, it is not the same as a statistical confidence interval that one might obtain by estimating a population parameter from a sample. The lengths of vertical and horizontal bars of the confidence interval can be determined by any percentile of value distribution, which is determined by ignorance.

Using two-dimensional Monte Carlo method we can construct similar distributions for any values of the confidence interval limits and build a trend chart to display confidence intervals for any percentile of risk distribution.

The objective of this work is, using a specific example, to demonstrate the importance and

usefulness of the application of probabilistic risk assessment method in case of environment pollution with the help of two-dimensional Monte Carlo method.

2 CASE STUDY

The materials of paper [5], which analyses the environment condition after a missile base exploiting termination, are the basis for the research.

In the period from 1958 to 1989 Zhytomyr region (Ukraine) housed missile complexes of the former Soviet Union (medium-range missiles 8K63, by NATO classification - SS-4 "Sandal").

After the termination of the base activity its area has not been exploited, with free access for the local population. To estimate the degree of contamination of the territory and, therefore, the danger to the population, the analysis of the soil and underground water sources, which local people use as drinking water, was conducted. The content of chemical compounds of the examined objects is presented in Table 1.

Table 1 Quantitative characteristic of soil and underground water sources of a former missile base

Name of the examined object	The content of chemical, mg / kg					
	Cu	Ni	Pb	Zn	Mn	Fe
Soil	56.7±14.1	4.75±1.18	26.45± 6.6	280.3±69.3	12.8±3.2	21.34±5.3
Bioaccumulation factor UF_p	0.4	0.123	0.123	0.045	0.032	0.123
Water from underground sources	0.0042 ±0.001	0.093 ±0.02	0.00	0.024 ±0.001	0.089 ±0.22	5.20±1.3

Harm that can damage human health depends on the concentration of hazardous chemicals contained in drinking water and food that originate from contaminated territories. Let's consider the risk of effects of carcinogenic and non-carcinogenic compounds on human health.

Carcinogenic risk is determined by equation (1)

$$CR = \sum_{i=1}^{N_R} ICR_i, \quad (1)$$

where CR – is the meaning of full individual cancer risk caused by the action of N_R carcinogens;

ICR – is the value of individual cancer risk caused by the action of i-carcinogen;

N_R – is the total number of carcinogens.

$$ICR = ADD \cdot SF, \quad (2)$$

where ADD – is an average daily dose of harmful chemicals consumed by the recipient;

SF – is a slope factor for the particular substance, which characterizes the degree of increase of cancer risk with increasing of the dose per unit.

Non-carcinogenic risk is defined by HI index of hazard

$$HI = \sum_{j=1}^{N} HQ_j, \quad (3)$$

where HQ – is the ratio of hazard of j-substance;

N – is the total number of hazardous substances.

$$HQ = ADD/RfD, \quad (4)$$

where RfD – is the reference dose, quantity that characterizes the daily effect of a chemical during lifetime and, probably does not result in appearance of an unacceptable risk to the health of sensitive groups.

The average daily dose of ADD can be determined by equation (5)

$$ADD = C_W \cdot IR_W + C_f \cdot IR_f, \quad (5)$$

where C_W – is the concentration of the chemical in water;

IR_W – rationed per human unit mass quantity of drinking water consumed by a person per day;

C_f - concentration of the chemical in food;

IR_f - rationed per human unit mass quantity of food consumed by a person per day.

It is obvious that, when calculating the risk from consuming food, we concentrate on additional risk caused by the use of products grown on the territory of the former missile base.

Husbandry is not practiced on the lands of the former base, but wild berries and mushrooms are picked up and consumed by locals.

The concentration of chemicals in food C_f was determined by equation (6)

$$C_f = C_s \cdot UF_p, \quad (6)$$

where C_s – is the concentration of the chemical in the soil;

UF_p – is the factor of bioaccumulation of chemicals by a plant from the soil.

UF_p values borrowed from [6] are presented in Table 1.

When conducting a probabilistic risk assessment we will assume that the uncertainty as for the chemical concentration in water and food is based on ignorance (e.g., due to imperfect measurement tools) and uncertainty as for the other values is based on the variability, determined by human body variability.

According to [7] IR_W is determined by log-normal distribution with the parameters given in Tab. 2.

Table 2 The parameters for the lognormal distribution of drinking water quantity, consumed by a person per day (IR_W), ml / (kg · day)

Age group, years	Average value of natural logarithm IR_W	Standard deviation of natural logarithm IR_W
1-3	3.49	0.75
4-6	3.33	0.68
7-10	2.97	0.68
11-14	2.66	0.71
15-19	2.43	0.74
20-44	2.61	0.68
45-64	2.92	0.52
65-74	2.92	0.49
75+	2.88	0.50

The consumption of mushrooms and berries can be displayed using the following lognormal distributions [8] (Tab. 3, 4).

Table 3 The parameters for the lognormal distribution of dry weight of mushrooms consumed by a person per day (IR_{fm}), g / (kg · day)

Age group, years	The average value of the natural logarithm IR_{fm}	The standard deviation of the natural logarithm IR_{fm}
1-75	0.02138	0.00096

Table 4 The parameters for the lognormal distribution of dry weight of berries consumed by a person per day (IR_{fb}), g / (kg · day)

Age group, years	The average value of the natural logarithm IR_{fm}	The standard deviation of the natural logarithm IR_{fm}
1-2	0.053	0.248
3-5	0.039	0.073
6-11	0.014	0.056
12-19	0.011	0.029
20-39	0.024	0.030
40-69	0.031	0.023
70+	0.049	0.040

Risk assessment was conducted for kids - aged 1-6 and for adults – aged 20-75. The results of simulation of risks distributions using the two-dimensional Monte Carlo method after 10 000 iterations for variability and 10 iterations for ignorance are presented in Figures 2 and 3. The modeling was carried out using Excel® spreadsheets and add-on Crystal Ball®.

For probabilistic risk assessment carried out by two-dimensional Monte Carlo method it is convenient to use trending charts. Fig. 2 shows the trends for the assessment of hazard index of non-carcinogenic risk for all groups of population. Fig. 3 shows the trends for the assessment of carcinogenic risk values for all groups of population.

Trend graphs display areas of equal probability to achieve certain values of carcinogenic and non-carcinogenic risks (vertical axis) for a certain percentage of population (horizontal axis).

Thus for 95 % of adults and children with a probability of 90 % hazard index does not exceed the values of 0.38 and 0.65 respectively, that is, from a toxicological point of view, military activity is not a dangerous (HI <1).

Cancer risk for 95 % of children with a probability of 90 % is within the range of (2,4 - 5,7) · 10^{-4}, whereby with 50 % of probability these limits are (3,7 - 5,2) · 10^{-4}, namely, the risk distribution probability is shifted to the area of larger numbers. Similarly, the risk value for adults is within the range of (2,8 - 4,9) · 10^{-4} with a 90 % probability and of (3,1 - 4,3) · 10^{-4} with 50 %. In this case, the probability distribution is shifted to the zone of smaller values. The value of cancer risk for all categories of population is within the range of 10^{-3} - 10^{-4}. This risk value is unacceptable for civilians and needs applying environment protection measures [2].

The question to answer is - which part, either the use of water or plants growing on contaminated territories, makes the greatest contribution to the value of cancer risk?

The answer to this question is given in Fig. 4, which shows the risk probability caused by the use of water and plant food by adults and children.

It is obvious that consumption of contaminated water makes the main contribution to the cancer risk value.

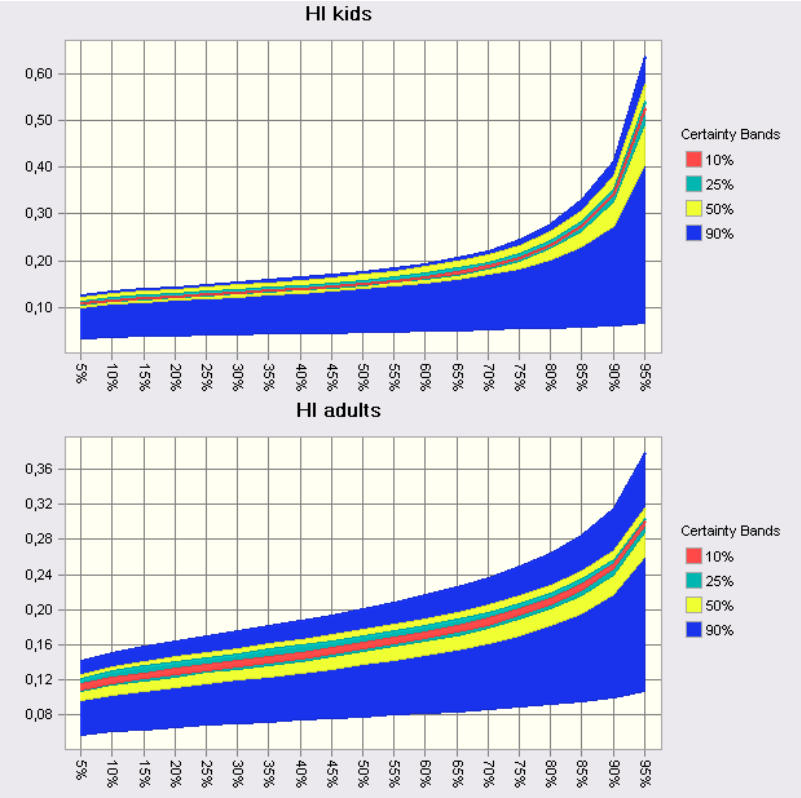

Fig. 2 Trends of hazard Index for kids (top) and adults (bottom)
Source: authors.

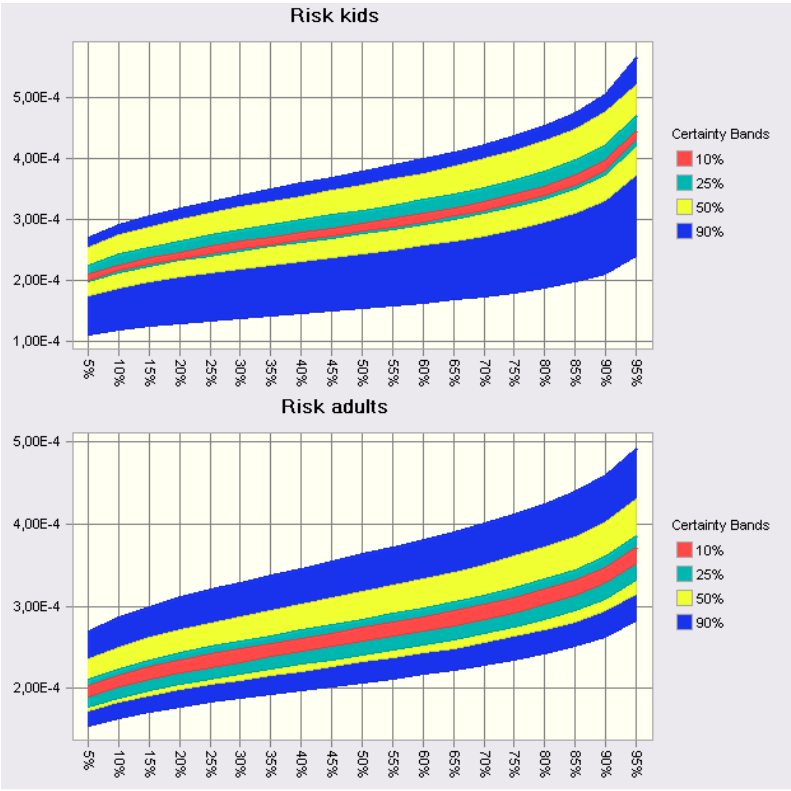

Fig. 3 Trends cancer risk values for kids (top) and adults (bottom)
Source: authors.

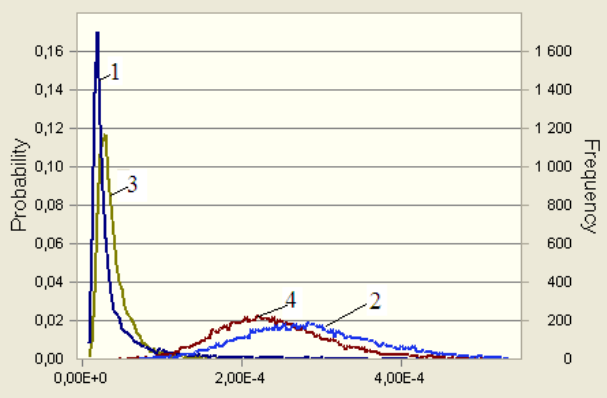

Fig. 4 The probability of cancer risk caused by consumption of water and plant products from territories contaminated by military activities
Kids: 1- consumption of plant, 2 - consumption of water.
Adults: 3 - consumption of plant products, 4 - consumption of water. Source: authors.

3 CONCLUSION

1. The probabilistic risk assessment that uses the two-dimensional Monte Carlo method provides more information in comparison with the one-dimensional and deterministic method. However, it requires additional information and the use of computer technology.
2. Risk assessment should be carried out in stages, proceeding from the simple (determined) to more complex (using one-dimensional, and later, the two-dimensional Monte Carlo method), when the following requirements appear:
   - it is necessary to establish priorities among areas, pollutants, contaminants transport routes, population categories and other risk factors;
   - resources for nature protection measures are limited;
   - significant consequences in case wrong decisions have been made;
   - obtained or available information is not sufficient for making reliable decisions.
3. As for the military activity impact on the environment, the presence of significant carcinogenic risk requires application of environment protection measures - supplying the population with water from alternative, uncontaminated sources. At the same time, consumption of wild plants growing on the grounds of a former missile base is perfectly acceptable.

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THE TRANSFORMATION OF THE CONCEPT OF TERRITORIAL DEFENSE IN UKRAINE IN THE CONTEXT OF THE EXPERIENCE OF THE ANTITERRORIST OPERATION IN EASTERN UKRAINE

Taras STUKALIN

Abstracts: The article is devoted to the problems of creating a new optimal model of territorial defense in Ukraine on samples of foreign countries. The thesis that the national model of territorial defense cannot be blindly copied from the others, and should be based on the unity of all forces and means of defense using the achievements of modern military science and science of public administration in the context of state policy in the sphere of national security is proved.

Keywords: defense, territorial defense, national security.

I INTRODUCTION

The actuality of the research on problems of territorial defense, both at the state and local levels, has been conditioned primarily due to a sharp change in the military-political situation in the world, which is characterized by increased level of threat to the national security of both Ukraine and other countries. A new outbreak of international terrorism forced to change the world opinion on issues of national and international security radically.

The annexation of Crimea by the Russian Federation and the combat operations in Eastern Ukraine cause implementation of reforms of the armed forces and their management systems. Strengthening of military capacity of Russia and return to force methods of solving international problems require a comprehensive analysis of issues on guaranteeing national and military security of the state, the basis of which is territorial defense organization both in theoretical and practical terms. In national science a significant amount of research is devoted to the indicated problems, including works by Efimov H. V., Grynenko O. I., Kostenko H. I., Manachynsky O. Y., Muntiyan V. I., Honcharenko O. M., Hovorukha V. V., Babkov Y. P. and others.

The issues on territorial defense organization, in terms of Russian aggression and so-called hybrid war, are only now gaining actuality. Taking it into consideration, the author has set the task to consider the legal framework of territorial defense organization in modern conditions, determine the tasks of state and local bodies of self-government on their implementation. This issue is important due to the fact that the military organization of the state has had difficulties so far with defining the functions of military units, law enforcement bodies, state and local authorities, organization of interaction and actions coordination between them.

2 THE TRANSFORMATION OF THE CONCEPT

A stable system of state and military control, created and based on modern regulatory framework, is considered to be one of the direction of ensuring state readiness to defend. Considering the condition of the regulatory and legal support, it should be noted that this base was created for the years of independence but the analysis in the context of determination of the main problems on action coordination of all the subjects of management at the time of crisis is lacking today.

The main ones are the laws that constitute regulatory and legal framework. First of all, it is the Constitution of Ukraine [1], the laws "On National Security of Ukraine" [3], "On Defense of Ukraine" [2], "On legal regime of emergency" [6], "On legal regime of martial law" [5] and Decrees of the President of Ukraine "On the military doctrine of Ukraine" [7], "On status on territorial defense of Ukraine" [8-9]. It should be noted that all regulations are interrelated dialectically and some of them are morally obsolete.

According to the Ukrainian law, territorial defense is a complex of nationwide, military and special measures taken at the time of threat or repel the aggression with the aim to protect and defend the state border from external attacks, providing conditions for reliable operation of state bodies, mobilization and rapid deployment of troops (forces), protection of important objects and communication lines, combating sabotage and intelligence forces and other armed formations of an aggressor on the territory of the country, as well as radiation, chemical and biological protection of troops and population from the consequences of accidents (destructions) at nuclear power plants, objects of dangerous chemical respect and maintaining the regime of martial law. In the early 2000s, Ukraine was divided into zones of territorial defense, each of which had its own number. The main structural elements of the territorial defense and its military component are battalions of

territorial defense, which were formed in May 2014 in the regions of Ukraine in accordance with the Law of Ukraine № 1932-XII "On Defense of Ukraine" on December 6, 1991 [2], the Law of Ukraine № 1126-VII "On legal regime of martial law" on March 17, 2014 [6] and the Decree of the President of Ukraine № 471/2013 "On approval of the territorial defense of Ukraine" on September 2, 2013 [8].

The battalions of territorial defense (TrD) are members of the Armed Forces of Ukraine (AFU) and subordinate to the Ministry of Defense of Ukraine, as well as to the heads of regional government administrations where they were formed. The heads of regional government administrations, being the heads of regional defense councils, administrate territorial defense battalions in the area of TrD; Chief of the Armed Forces of Ukraine, the Head of the General Staff, the commanders of the operational command units run the units of TrD in military and land areas of responsibility [8]. The arrangements on battalion recruitment and provision with logistical supplies, weapons and military equipment are carried out by regional military commissariats at the expense of regional budgets and charitable contributions of citizens. According to the law "On Defense of Ukraine", the main tasks of newly created by Ministry of Defense of Ukraine territorial defense battalions are:

- protection of the state sovereignty and independence;
- maintaining security and order;
- support of the government bodies activity in the regions;
- protection of important strategic facilities and communications;
- combating sabotage and other illegally created armed formations;
- assistance in the protection of the state border [2].

In extraordinary circumstances, the troops of territorial defense of Ukraine may be used to counter illegal armed formations outside the areas where they are based. So, on June 18, 2014 it was proposed to subordinate territorial defense battalions, which are involved in anti-terrorist operations in Donbass, to the ATO command. Analyzing the current situation in the zone of the anti-terrorist operation, it should be noted that in the hybrid war the combatants under the slogan of protecting the rights of the population of the region are fighting with at their territory which is the war against the same population. At the time when a part of the population supports militants, the Ukrainian army, without causing loss and damage to their populations, is not able to protect the territory of the state, which in turn strengthens the positions of combatants who allegedly protect civilians. Under these conditions, taking into consideration the global experience in counter-terrorism, joint efforts of all anti-terrorist forces for a long time are required to destroy militants. According to the international experience, the most effective solution of this problem lies in self-defense of populated areas, presence of militarized self-defense units. Only immediate actions (in real time) of the local self-defense units, based on the support of the security forces, may protect residents and populated areas from attacks of bandit groups. Other ways of combat in countries with similar features have only negative world experience. The only possible way to resolve this issue is to provide the appropriate organization of territorial defense.

The armed forces take a main place in the system of territorial defense of the country. The events in the south and east of Ukraine have proved the necessity of revaluation of views on the development of the national army, as the main priority in the reform of the Armed Forces of Ukraine is a creation of small, professional, mobile army composed of advanced defense forces, main defense forces and strategic reserves. In our view, this approach to form troops should be regarded as a wrong one, as eventually it led to the collapse of the army. The advanced countries have different approaches to the formation and maintenance of armed forces, but their main advantage is not the way to maintain troops, but their practicality and consistency in matters of national defense. As well as a steady, logical completeness of planned activities based on the potential of the economy and the political will of the national elite and membership in the military-political alliance. The level of threats to national security is one of the main factors influencing the format of the regular army maintenance. Thus, when combat effectiveness of the armed forces is reduced at peaceful time, usually by reducing their strength, the relevance of territorial defense should be increased and strengthened significantly. It should be noted that maintaining defense capabilities is the rational combination of these interrelated components of defensibility of the state, whose implementation is based on socio-economic opportunities.

The improvement of the territorial defense of Ukraine is the most economically justified reserve to maintain the state defense. According to the international experience, countries (except the USA), which are not able to deter enemy aggression with the strong army at peacetime, remain strong ability to defend its sovereignty actively by strengthening the capacity of regular troops by the local (territorial) defense. The preparation of this defense provides a number of advantages over other methods of preparation of a state for defense. In particular, according to the experts, the maintenance of territorial defense forces costs much less than permanent maintenance of a significant number of

modern regular army, for example, in the USA - in 6 times, in Denmark and Germany – in 10 times [12].

Taking into consideration the shortcomings of more than two decades of reforms of the armed forces, which led to catastrophic consequences, the present leadership of the country is seeking new models for the Ukrainian army. Recent statements of the President of Ukraine Petro Poroshenko show his commitment to the Swiss model. In our opinion, before choosing a foreign model we should analyze the main factors that will contribute or affect negatively the defense of Ukraine. Firstly, we must decide on Military Doctrine, which has been changed repeatedly since the independence in favor of the ruling elite orientation without considering geopolitical realities and national interests. Secondly, the national policy in the sphere of territorial defense should be created considering its geo-strategic position and collective security systems, according to the size of the territory and its condition of operational equipment, depending on the demographic, financial and economic capabilities and also based on the state and national and historical traditions, and the mentality of the population.

For example, the Swiss army is manned on the principles of general military conscription. All the men aged from 19 to 50 do military (alternative) service. A small fraction of the regular professional army maintain modern equipment and weapons, have scheduled trainings for a significant number of reservists held on the basis of the police system and keep small arms, ammunition and equipment. Thus, this neutral country has built the national army to conduct regular defense, including territorial one. The peculiarity is that 95 - 98 percent of military personnel are in reserve, that indicates the compulsory military service of citizens. That is the reason why we do not consider that the Swiss model can be used in Ukraine.

The regular army of Germany is considered an interesting model, as it is manned by the mixed principle. Namely, the regular army is manned by free hire and the territorial defense forces – by calling up and the service lasts up to 6 months, then the service continues in the reserve troops. The main task of territorial defense is to be trained for the Army reserve, the formation of combat units for the Army, maintenance of territorial defense. But this model can be afforded by a state with high levels of socio-economic development.

The USA maintain a large in strength the National Guard. That is a strong military and law enforcement institution that performs the task to provide national security as a part of the army, and is organized by the US Armed Forces reserve. The National Guard have constituent components at the territory of all the states and subordinate to the governors (there is subordination to federal authorities). It is manned with the military on a voluntary basis, who do a motivated service in reserve and can be called up to active duty by the order of governors or military commanders. According to the legislation, the National Guard is authorized to carry out the tasks on providing security both in military and civilian areas [10].

As we can see, the approaches to solving problems on forming forces and capabilities of territorial defense in advanced countries are slightly different, but there are fundamentally similar features, namely:

- territorial forces are a part of, or the main share of, the regular army;
- maintenance of territorial forces is cheaper than regular troops, it is not free though; the main burden is on the state budget, it is partly provided by the local budget;
- full or partial mobilization of reservists is carried out at the time of thread or at the moment of declaration of martial law (except the USA, where bringing troops of territorial defense in fighting order is carried out at local level);
- mostly free access to weapons which are stored at home or at the enterprise (stock) close to the place of residence, which allows a high degree of readiness for action.

It is all based on the high level of trust of central authorities to citizens and state patriotism, which is the basis of their involvement in territorial defense.

In our opinion, it is premature to talk about distribution of weapons in Ukraine, especially taking into consideration combat actions and conflicts between different social and political groups. First of all, Ukrainian society should become a society of national consensus and strengthened with national statehood idea.

In general, the choice of a model for the Armed Forces of Ukraine can not be based on the experience of a particular country, but primarily on an objective analysis of the current state of the Ukrainian army and territorial defense and causes of failures and miscalculations in the military reform.

The analysis of the modern territorial defense in Ukraine shows that the responsibility for the territorial defense reform was fully vested on the General Staff Command of the Army of the Armed Forces of Ukraine, which considered the task as an additional burden. Therefore, the provisions on territorial defense were viewed several times in favor of reduction of the tasks order on forming forces and means, which led to the elimination of all plans on deploying territorial defense brigades that were formed to protect people and objects of local infrastructure [12].

The management of the Armed Forces did not regard responsibly to the practice of forming forces and means of territorial defense during exercises and worked out just a matter of providing resistance to

the invasion of limited military contingent of the neighboring state. In the course of carrying out these exercises, the issues of communications objects and army logistics protection and carrying out the territorial defense of the state at the times of crisis were left aside.

The exercises on territorial defense were held separately by the decision of GS of the Armed forces of Ukraine. The exercises were only Command Post ones. But during these exercises it was found out that the real capabilities to conduct active defense of the territory composed with the Armed Forces of Ukraine and the state in particular, are not available. Therefore, the representatives of security bodies gave advice on such issues as formation of consolidated units of internal troops, police, Security Service of Ukraine, Frontier Forces, or other virtual force formations and their means to conduct defense, for the period of the training [11].

Since the beginning of destabilization in the Donbas region there has been an immediate need in territorial defense troops and reviewing the regulation on territorial defense of Ukraine. Moreover, the formation of battalions in the areas in the number of 420 persons was already envisaged by the General Staff. This regulation was only approved at the beginning of May 2014. Therefore, the decision of Acting President of Ukraine to mobilize territorial defense battalions was completed only in mid-June. That did not provide defense timely and therefore, the most effective assistance to the military at the beginning of carrying out tasks ATO (in March-May 2014). The practice of deploying battalions TrD showed that the formation of a battalion in the whole area is not enough to maintain territorial defense in the regions and assist the forces involved in the ATO. In total, 46 battalions of different manning and fighting efficiency have been formed in the Armed Forces of Ukraine at the Ministry of Defense of Ukraine since April 2014. According to the thoughts of the professionals, a strategic reserve as a part of the Army Corps with the number of personnel of 30 - 40 thousand people should be formed to improve territorial defense. Taking into consideration the fact that territorial defense forces are an important reserve of combat readiness of the Armed Forces of Ukraine and the defense efficiency of the state, there is an urgent need to introduce innovative approaches to the concept of its development and implementation [12]. These approaches certainly lie in the scope of studying the experience of other countries and rational implementation of the current system, based on the experience of events in Crimea and Donbas. And this experience shows the impossibility of a blind copy of any effective system of territorial defense of another state. As noted, the system of territorial defense, and especially its management mainly depend on the reform of local government and executive power bodies, the essence of which is to transfer a significant part of powers and tasks on carrying out territorial defense to territorial communities and local authorities [4].

According to the military experts, the elimination of general military compulsory service was a strategic political mistake, which led to the suspension of reservist training and state-patriotic education of the population, as the army is the school of patriotic education.

With the restoration of conscription and service in the reserve it will be possible to maintain regular contract army in Ukraine (for example, Germany) and a wide network of territorial defense forces on a compulsory basis (such as in Switzerland), where all the citizens will do motivated service in reserve and can be called up to active duty according to the order of the heads of administrations or councils or the military command (as it happens in the USA) [12].

Such approaches will help to create strong territorial defense and central regions of the state that will enable Ukraine to restrain the aggressor from the intentions of deep invasion and deliver a significant number of trained and organized reserve to the army quickly in any direction. However, territorial defense forces have to be mobile, which will enable them to deploy them to the most difficult areas.

The Law of Ukraine "On Defense of Ukraine" (Article 3) requires the implementation of state authorities (local government) training, forces, means and military management, national economy, the territory and population of the state to implement measures of territorial defense at peacetime [2]. An important step in consolidating the legislative mechanisms of state influence on the defense of the state in terms of aggression was the adoption of a new law "On legal regime of martial law" in May 2015 [5]. This law aimed at legislative regulation of the legal regime of martial law in the circumstances that have arisen with the external aggression and conducting anti-terrorist operations in eastern Ukraine.

According to this law, it is expected to increase and detail the content measures of martial law, provide guarantees of the activity of the President of Ukraine, Verkhovna Rada of Ukraine, regulate the order of deliver and cancellation of martial law conditions more clearly, regulate the procedure and the authority of military commanders, bodies of state authorities under conditions of martial law, military administrations - temporary public bodies established by the president of Ukraine at the territories with imposed martial law to ensure the Constitution and laws of Ukraine, providing military commanders with introduction and implementation of measures of the legal regime of martial law, defense, public order and safety, rights, freedoms and legitimate interests of citizens. Under the draft law, the military command with the military

administrations (in the case of their formation) can take measures independently or with the assistance of executive authorities and local authorities to implement the legal regime of martial law in Ukraine or in its particular areas where the martial law is introduced, but only within the time constraints of constitutional rights and freedoms of people and citizen, and the rights and legitimate interests of legal persons, provided by the Decree of the President of Ukraine on the introduction of martial law. According to the experts of the Center of Research on the Army, Conversion and Disarmament (CRACD), the updated state security sector should include intelligent symbiosis of non-forcible methods of combat and mobile, compact, professional army that is well- prepared as a result of the modernization of mobilization system of territorial defense.

3 CONCLUSION

Thus, the results of the study bring us to conclusion that the territorial defense system of Ukraine is a key component of defense efficiency. The first phase of a possible military conflict or war largely depends on its organization, as its functional purpose is to deter an aggressor to approach the main forces. Local authorities and local governments play an important role in the organization of territorial defense in terms of decentralized power. Therefore, one of the main objectives in the reform of administrative and territorial structure and system of local government is to ensure territorial defense provided by local reserves and attract necessary forces and means from the law enforcement bodies and other organizations and institutions in the region in accordance with mobilization plans.

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HOW TO DELIVER MISSION EFFECTIVENESS IN ORGANIZATIONS USING PROCESS IMPROVEMENT STRATEGIES

Cezar VASILESCU

Abstract: The article proposes an analysis regarding the nature of business processes in organizations and how they can be improved in order to deliver mission effectiveness. In this endeavor there are explored the features and dynamics that define business processes, the factors that rally efforts to improve processes and the types of performance changes that improvements can generate. There are also examined impediments and obstacles to process improvement, leadership challenges, analytical tasks, tools and techniques for process innovation, and implementation management issues associated with process improvement strategies.

Keywords: Process Improvement, Business Processes, Business Process Reengineering (BPR), Chief Information Officer.

1 INTRODUCTION

The focus of this article is to present the concept of process-centered organizations, to provide a synthesis of process improvement and reengineering and to highlight the impact it is creating on the economy, within the framework of the Information Age.

One of the multiple tasks which faces Chief Information Officers (CIOs) is to play a direct role in changing the way their organization does work (through Business Process Reengineering), as well as defining new systems and support structures which complement the way the new work is successfully accomplished. It is important therefore to understand the transitions that are taking place in many public and private sector organizations, as they adopt new and modern approaches of providing products and services to their stakeholders or customers.

The paper has the following main objectives and proposed significant results:

- an analysis of the findings and a synthesis of the information regarding business processes improvement and reengineering;
- highlight the shift away from the traditional tasks orientation of organization to the new process-centering perspective - in order to achieve better, faster, cheaper and easy-to-do-business-with relationships;
- present a comparative analysis of process design principles (separately described by M. Hammer and R. Linden) and illustrate the contribution of each principle to a reengineering initiative;
- offer guidance on how to achieve business success through process reengineering (improvement) and on redesigning work in public and private organization.

In this context, we should remind ourselves a couple of definitions of Business Process Reengineering (BPR) that might help us set the tone of the analysis. The first states that *"Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed"* [1], while the second states how the National Academy of Public Administration (NAPA) recast this definition for government: *"Government business process reengineering is a radical improvement approach that critically examines, rethinks, and redesigns mission product and service processes within a political environment"* [2].

The key word in Hammer's definition of (BPR) is "process", the end-to-end activities that together create value for the customer. Thinking in terms of processes is aimed upon changing the way an organization does its activities. Some scientists may argue that BPR is no longer the latest (or hottest) management trend, but in spite of its many shifts, the concept has lasted and has still much value to offer to organizations, as they move their business processes into the twenty-first century environment.

In the construction of any business strategy, the three main factors for success must be taken in to consideration: Corporation, Customer, and Competition. The 3C business model states that these pillar factors can lead to a sustainable competitive advantage and should be in balance in order to be part of the "Strategic triangle" [3].

Based on the model we could identify not only the factors but also the forces (acting separately and in combination), which are driving organizations deeper and deeper into unfamiliar territory - the 3Cs (Customers, Competition, and Change) (Figure 1).

Customer-seller relationships have changed, because customers now tell the suppliers what they want, when they want it, how they want it, and what they are willing to pay, thus having the upper hand.

Technology has affected the nature of competition, created new alliances between manufacturers and retailers, while globalization changed the rate of interactions and determined an intensified competition. Newly created companies and niche competitors which enter the global virtual market possess no pre-conceived notions about running a business and in many cases they write the rules as they go along.

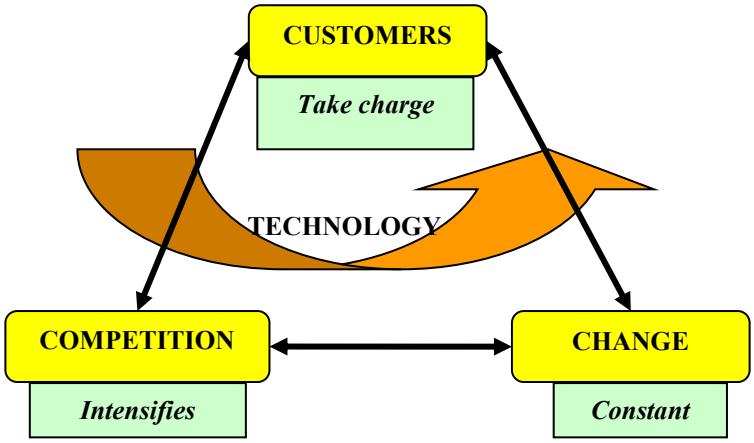

Fig. 1 The three forces which impact business processes
Source: Adapted after Hammer and Champy, 1993.

Persistent and pervasive change has become a norm, due to the fact companies have to move faster and faster in providing their products or services. Organizations regularly engage in strategies of expanding their product lines to create greater pressure on their competitors, because the cycle time for product development and time to market has greatly diminished.

The 3Cs have had a profound effect on the way organizations are changing the way they do business in order to meet the challenges of staying workable and competitive.

2 TYPES OF ORGANIZATIONAL REACTIONS

On today's continuous changing environment determined by competition, customers, and change, an organization can not obtain sustainable competitive advantage without constantly improving the manner in which it conducts activities (business).

Customers are looking for increased levels of quality from products or services offered by suppliers. Because of rapidly changing market conditions, increased competition and customer demands organizations are finding it necessary to reduce cycle times associated with product development and delivery to market.

We should remember also that overhead (referred sometimes as "non-value" added work) - such as administration, reporting, supervising, reviewing, etc., is necessary in order to execute processes, but it adds expense and complexity which customers are not prepared to pay for.

"Easy-To-Do-Business-With relationship" is the notion that commercial organizations accommodate customer expectations by providing services and products adjusted to their specific needs. Customers of public service organizations (such as citizens) have the same imperatives. In this respect, many organizations have met the challenges posed by the 3Cs by implementing either incremental or radical approaches (reengineering) of improving their processes and reducing cycle times. In addition, they have embraced organizational and human resource enablers of process change such as teaming and empowerment.

Organizational change requires a four dimensional change, in [4]:

1. Organizational process;
2. Structure or design;
3. Organizational culture and
4. Organizational politics (i. e. change in organizational power distribution).

If any of us wants to bring change in any of those dimensions, it will raise the need for change in other dimension, as they are interrelated and interdependent.

The current organizational imperative is represented by the need to organize work around processes, to achieve *better*, *faster*, *cheaper* and *easy-to-do-business-with relationships.* This ultimately translates into either:

- Emphasis on incremental quality improvement;
- Emphasis on radical improvement of high level processes;
- Emphasis on cycle time reduction.

3 VIEWING PROCESSES - THE PROCESS CENTRIC VIEW

Any organizational transformation regarding the change of the way regular activities are conducted usually related with the alteration of the actual business processes. This term is used on several occasions without being properly defined. A business process is *"A structured, measured set of activities that takes one or more kinds of inputs (raw material, supplies, etc.), adds value to it by transforming it, and creates an intermediate or final output that is of value to a customer*". In this definition, the customer can be an internal individual from the organization or the final customer who

receives the finished product / service. A business process prospective does not focus on individual tasks done in isolation, but rather looks at the entire range of tasks necessary to achieve the final outcome and this distinction is important - narrow points of view are useless in a process-centered context.

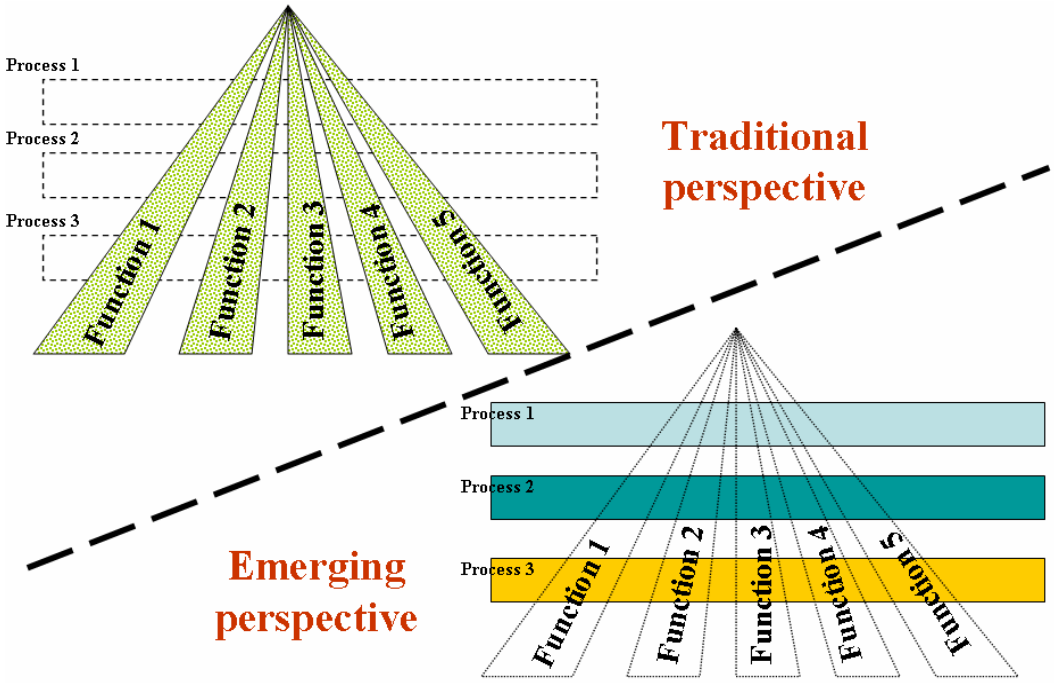

Fig. 2 Perspectives used for viewing processes
Source: Adapted after Hammer and Champy, 1993.

Processes have always been a part of the organization's landscape. As shown in figure 2, the **traditional perspective** placed the processes in the background, *"processes were not even on the business radar screen"* [1]. The focus of redesigning work was on tasks performed by functional departments, where tasks were identified, measured and improved. People were trained and the professional development was focused to execute these tasks, but until the appearance of concepts such as Total Quality Management (TQM) [5] and reengineering, there were no conscious efforts to study, document, and improve "end-to-end processes".

The **emerging perspective** (sometimes refereed to as "process-centering") puts processes into the forefront where it plays a leading role in the way work is redesigned (Figure 2 and 3).

Process centering is a shift from looking at tasks people accomplish to making people to examine and focus on the processes they took part. It also has a profound impact upon the organization's structure, system, culture, value and beliefs. Functional hierarchies move to the background and the focus of improvement initiatives moves toward ways of changing the way work is accomplished, by employing the process design principles and aligning everyone's energy toward the same outcome.

Moving from the traditional perspective to the process-centered orientation is easier to be clamed than accomplished, because change in real life is a difficult operation which requires strong commitment of the leadership and every member of the organization.

It is very important to clarify also what adopting a process-centric view means, which is to bring the processes in the foreground. It could be further explained by a metaphor "what you can't see you can't improve". Here we can mention the objectives that are mandatory to be achieved [6]. It begins with *identifying, naming and documenting* the processes, using techniques like IDEF0 modeling and other business modeling tools, followed by *making people aware* of how they contribute to executing tasks and activities to achieve some final outcome.

A process-centric view also suggests that *outcomes are measured* and performance rewarded on the basis of how well the end-to-end (entire) process is executed, not individual tasks. Finally the last objective to be accomplished is *making someone accountable for the process* (the process owner).

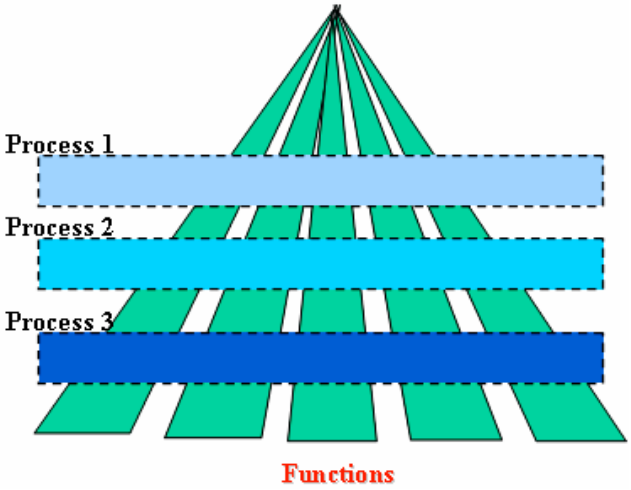

Fig. 3 The process-centering perspective
Source: Adapted after Hammer and Champy, 1993.

4 TYPES OF BUSINESS PROCESSES

Most public and private organizations execute four common processes for providing products or services to their stakeholders/customers:

- Core processes;
- Support processes;
- Asset creating processes and
- Governing processes.

Core processes meet the needs of the external customer. At the highest level, most organizations can categorize their core processes into one or just a few areas. To identify a company's core process we should name some products manufactured, identify what the products have in common with each other and what product the organization produces best.

Support processes can circumscribe many areas including those as contracting/purchasing, information management, human resource functions, etc.

Asset creating processes can include areas such as employee development, budget provisioning, infrastructure planning, etc.

Governing processes include visioning and planning, policy development, and the organizational culture regarding the interactions between individuals/microstructures ("how we do business here"). All underlie to reengineering but care must be taken to ensure alignment among the four types of processes.

In the quest of moving the accent (when it comes to increased efficiency and effectiveness) from structures and functions to processes and outcomes, there are five questions that might help us to identify the core processes [7]:

- What work do we do that distinguished us from other organizations;
- What outcomes do we produce that our customers/stakeholders most value;
- What work can't be outsourced because we have an exclusivity on it (or we do it so well);
- What work do we do that is vital to our organization and critical to our mission;
- What work begins with an important customer need or request, cuts across functional boundaries and ends with a product or service delivered to a customer.

An example of organizing processes inside a private company is depicted in figure 4. Four are core processes related to the core activities of the organization: *Time to Market; Integrated Supply Chain; Market to Collection;* and *Customer Support*. There is also a governing process generic called *"Management process"*, while the infrastructure supports the *"Enabling Processes"* and *"Asset Creating Processes"*. Every product produced and distributed by the company is subject to the aforementioned fundamental processes.

The six top-level processes shown on the previous figure could be further decomposed into Sub-processes and Sub-Sub-processes. Each of these processes (sub-processes) has a process owner.

In the public sector it is sometimes difficult to identify core processes. In most cases government organizations are organized around functions, departments and the budgets required executing its operations.

Classic reengineering methodology reflects a top down model of change management based on assumptions of clear line management and relatively uncontested managerial control [1]. Within contemporary public service organizations, there may be obstacles to radical forms of change, due to several objective realities [8]:

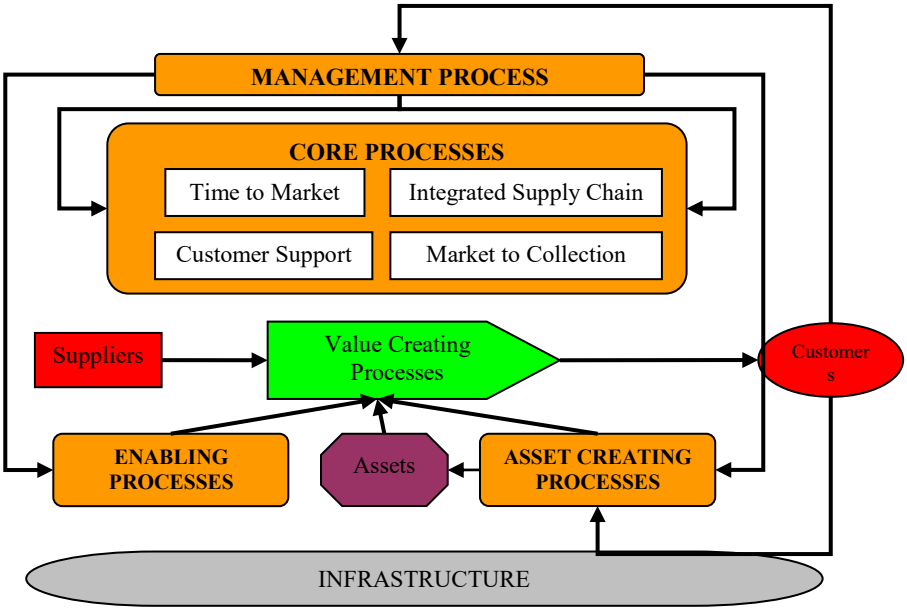

Fig. 4 A basic Conceptual Architecture Processes Model
Source: Adapted after Harmon, P.: *Business Process Change: A Manager's Guide to Improving*, Redesigning, and Automating Processes, 2003.

- Senior management have not all the time and in all situations enough dominant power to be served by a malleable middle management; consequently, top management support and action for change could prove a necessary but insufficient condition for achieving BPR transformation;
- Change initiatives can be shaped and transformed by the very conditions and dynamics they are supposed to transform; due to potential diffusion of responsibility regarding BPR activities, people could be able to control the implications of reengineering for the purpose of protecting local agendas and preferences; moreover, they could interpret, evaluate and negotiate the reengineering agenda;
- The conflict between process and functional models of organizing [9] is augmented by the simple fact that a performance manager is more likely comfortable with a vertical mode of organization (it is easier to hold a clear and subordinate entity accountable, than a loose /vague network or a value chain process).

5 PROCESS DESIGN PRINCIPLES

The process design principles we are going to analyze were stipulated by two authors: Michael Hammer [1] and Russell Linden [7]. The table below suggests the existing similarities and differences between the two sets of principles.

We will examine briefly each principle to illustrate its contributing value to a reengineering initiative.

There are three ways of *organizing around outcomes*: customer, product, or process [7]. A customer's need for example, could be characterized as an outcome. When a customer is not readily identifiable, we should consider organizing the outcome around a product. When neither a customer nor product is easily identifiable then organizing around the process itself might be more appropriate.

There are many varieties of examples of *substituting parallel for sequential processes*, each with the ultimate goal of reducing or eliminating the unnecessary steps of a process, which might lead to errors and delays. The most common include approaches such as:

- Concurrent engineering of new products, where different phases of a product life-cycle are done concurrently and
- Teams connected in an electronic manner (teleconferencing) or general case managers performing multiple (or integrated) tasks versus specialists.

The notion of capturing information once and using it over and over is contrary to the old belief that information might be captured frequently to assure control and accuracy. Instead, capturing information once streamlines processes and provides more accuracy. Bringing downstream information upstream means avoiding surprises. If the information is available bring it to the forefront of the process.

Table 1 Process design principles - a comparative view

Linden	Hammer
Organize around outcomes	-
Substitute parallel for sequential processing	Avoid linear sequence
Information is critical. The aim – capture once and use many times	-
Bring downstream information upstream	-
Customers have single access point for dealings	Case manager
Drive out redundant and non-value adding processes	-
Don't automate existing processes	Do not pave cow paths
-	Distinct jobs or tasks are integrated and compressed into one
-	Decision making becomes part of the work
-	Processes have multiple versions – one size do not fit all
-	Work is performed where it makes sense – not around specialists
Reduce non-value added work	Checks and controls are reduced
Multiple contact points with vendors	Minimize reconciliation
-	Centralized/decentralized operations are present

Two customer imperatives are given by the product cycle time and Easy to Do Business With (ETDBW) concept. Both of these imperatives could be satisfied by *providing a single point of contact for customers* instead of organizing around distinct organizational functions for the convenience of their operations.

Ensuring a seamless flow of work means focusing on activities that directly add value to the product / service expected by customers / stakeholders. *Non-value added work should be eliminated* (diminished) from the main sequence contributing directly to the outcome of the process.

Finally, both authors advocate that automation is the last (NOT first) step in reengineering. We should streamline work processes, and then introduce technology where it makes sense.

Process design principles include *combining or integrating formerly distinct jobs into one* (i.e. creating generalists as opposed to specialists). Based on the process-oriented concept, peoples' attitudes in organization should change and they should learn how to work across functional boundaries and accept the responsibilities. In addition, people should learn to integrate their work to other efforts to achieve process outcomes [10].

Making decisions part of the work (not a separate or distinct function performed by the management hierarchy) facilitates a seamless and uninterrupted work flow, which contributes to reducing delays, lowering overhead costs, increasing customer response, and empowering workers.

Processes need to be tailored to meet requirements of markets and customer expectations. A single process standard is no longer appropriate and we should be able to determine which process version is more appropriate to be used in a given situation.

Work should be shifted across functional boundaries where it makes sense to do so thereby eliminating hand-offs that increase process cycle time and costs.

Checking and controlling functions are used to ensure that people are correctly executing processes, but they do not contribute to adding value to processes. Overhead costs, cycle time, and effort are considerably reduced by minimizing checks and controls and adopting pendant, random, or exception based control systems.

Also the number of external contact points in the process should be decreased, thereby reducing the need to reconcile process problems due to inconsistent data.

Finally, both centralization and decentralization can co-exist in a process design, because information technology enables individual units to operate both autonomously and as part of the whole organization.

6 CONCLUSIONS

Reengineering processes entails redesigning work that is narrow and segmented, which results in complex processes to broader, multidimensional work having leaner processes. Work units change from functional departments to process teams (units that falls together to complete a whole piece of work), while jobs change from simple tasks to multi-dimensional work. This often means shifting the boundaries of work between different kinds of work. Checking, reconciling, waiting, monitoring, tracking

and other forms of unproductive work disappear and replaced by real work adding value to the customer.

Workers are empowered to execute tasks and activities without adding unnecessary control mechanisms. In today's environment, a self-disciplined type of worker is required to meet customer's expectations. Also preparation for jobs changes from training to education. Instead of training employees *how* to do the job, reengineering demands those employees to be educated on *why*. Linear and sequential tasks are replaced by parallel processing of tasks and both centralized and decentralized forms of organizational structure coexist.

Table 2 A synthesis of process improvement and reengineering

FROM	TO
Narrow, segmented jobs / Complex processes	**Broader Multidimensional Work / Leaner processes**
Task specialization and work fragmentation	Task compression and integration
Separation of duties and functions	Cross functional process teams
Hierarchical decision making	Empowering workers
Training = teaching how to perform a job	Education = teaching why by increasing insights and understanding
Measure and pay employees based on work efficiency	Measure and pay people based on results
Hierarchical organizational structure	Fewer managers
Executives are scorekeepers	Executives shape processes

In summary a process-centric view is a multi-faceted change. As we change business processes, the way work gets done changes also the skills and knowledge of the people performing the work. In turn, the ways people are hired, measured, and rewarded changes ultimately the organizational culture (what people value and believe).

Reengineering must not only address how processes change but also:

- jobs and structures;
- management and management systems;
- people's values and beliefs.

To be successful, reengineering initiatives must align all of these elements in order to promote congruency and consistency in the way the organization operates. Of course, in the short run it may not be possible to align everything at once. While processes and the new jobs they entail, followed by developing skills and knowledge are easiest to align, management, reward, and performance systems must closely follow. To be fully successful in a reengineering initiative, in the long run everything must be aligned and consolidated inside the organizational culture.

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THE FORMATION OF PEDAGOGUE'S PROFFESSIONAL COMPETENCE BASED ON THE HUMANITARIAN APPROACH

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Abstracts: The essence and structure of the professional competence of the teacher (cognitive, activity-, personality-based and axiological components) has been specified. The content, principles, pedagogical conditions, educational strategies, technologies of the professional competence of the teacher on humanitarian grounds has been determined. The expediency of forming pedagogical competence on the basis of humanitarian approach has been substantiated. The parameters for evaluation of formation of the teacher's professional competence has been chosen.

Keywords: professional competence of the teacher, the formation of professional competence of teachers, educational technology, humanitarian approach.

1 PROBLEM STATEMENT

By its high mission a pedagogue carries out the most important constructive social function as in the process of professional pedagogical activity not only a personality is formed and developed but the future of the country is determined, its productive and cultural potentials are provided. That is why it is essential for a future pedagogue not only to be aware of his/her professional-specific but also large-scale social tasks, personal perception of the humanitarian problems of the present, to specify and work out goals and tasks of his/her professional activity based on these.

When specifying the requirements to the pedagogue's personality that provide his readiness for professional activity, psychological and pedagogical science tends to combine them into more generalised integral properties: pedagogical skills, techniques, proficiency and qualification. In our opinion, the integral property that most completely characterises pedagogue's capability to solve typical and non-standard professional tasks is *professional competence.* A competent pedagogue distinguishes oneself by theoretical and practical readiness for professional pedagogical activity, ability to effectively solve pedagogical problems, probable conflicting situations.

The problems of formation of professional competence are dealt with by such foreign scholars as J. Raven (obvious and latent components of personality competence as psychological phenomenon), U. Kanning (pedagogue's social competence), A. Meyhew, R. Higheti (types of pedagogue's professional competence).

Theoretical and practical problems of competence-based approach are being developed by the country's pedagogues N. Bibik (general points to the realization of the competence-based approach in the area of education), S. Bondar (personality's competences as an integrated component of educational achievements of students), O. Gura (the essence of professional competence of higher educational institutions pedagogues), O. Pometun (the experience of the realization of the competence-based approach in the process of studying social science), I. Rodygina (formation of schoolchildren's basic competences), O. Savchenko (schoolchildren's key competences). However, educational professional theory and practice obviously lacks the researches that deal with formation of professional pedagogical competence based on the humanitarian approach.

The aim of publication is to specify the content and structure of pedagogues' professional competence as well as the principles, strategies and technologies of organization of the process of professional based on the humanitarian approach.

2 BASIC MATERIAL REPORT

By the results of ranking professional qualities that a modern teacher should possess, in students' opinion, the most important are professionalism (14.5 points out of 16), profound knowledge of the subject (14.47), ability to communicate, establish good relations with students (13.54), understandable for students, logical and interesting material delivery (12.02), benevolence, tactfulness (11.9), fairness (10.98), sense of humour (10.06), grasp of psychology (ability to understand everyone) (8.94), ability to work individually with every student (8.1), being emotional, sincere (7.65), objective (7.49), self-confident (7.2) and demanding (6.84). Students consider to be less important for a pedagogue such qualities as a tidy and neat look (5.48), smart dress (5.39), inflexibility. To complete the professional portrait of "an effective teacher", we will add to this skilful stimulation of students' activity, formation of their cognitive needs, needs for success, openness for communication [4; 7].

When generalizing empirical data and results of scientific theoretical researches of foreign and Ukrainian scholars dealing with the problem of formation of pedagogue's professional competence, the degree of theoretical and practical readiness for teaching activity is determined by the level of mastering by a teacher the system of psychological and pedagogical, general scientific knowledge as well as knowledge on the subject (*cognitive component*), pedagogical technology and technique

(*activity component*), acquiring professionally essential qualities (*personality component*), values, motivation attitudes (*axiological component*).

Let us specify in more details each of the above mentioned components. Thus, *cognitive* (knowledge) readiness for successful professional activity, first of all, provides for mastering by a pedagogue the main fundamentals of general theoretical subjects: proficiency in the national language, general laws of thinking and ways of its results taking shape in oral or written speech, fundamentals of philosophy, knowledge in the world and national history and culture, forms and methods of scholastic cognition and their evolution, the role of science in the development of the society, fundamentals of society's economic and social life, fundamentals of law and principal legal papers.

A teacher has to possess the system of methodological and conceptual knowledge that help him to be conscious when constructing pedagogical process, to be more exact, the knowledge about essence of education as a social phenomenon, about the functions of education, principal trends of its development. It is understood that a subject teacher should be proficient in his/her subject area of scientific knowledge and methodology of its teaching. It should be mentioned that a teacher should have a grasp in other fields of his/her professional activity: scientific and methodological, social and pedagogical, collection, development and management.

Out of the psychological and pedagogical knowledge essential for a teacher, we will single out the knowledge of age-related and individual peculiarities of schoolchildren, psychological and pedagogical basics of teaching, education and communication, peculiarities of pedagogical activity, its structure and demands brought forward by professional pedagogical activity towards pedagogue's personality, fundamentals of professional and personality-based self-education and self-development.

Professional and pedagogical competence in the area of self-education activity is supported by the knowledge of fundamentals of scholastic work organization: ways of searching, processing, storing and using information and modern teaching techniques. It should be said that professional knowledge which makes cognitive base of pedagogical competence has to be of complex and synthetic character and the teacher has to turn it into personal acquisition, a tool of efficient pedagogical activity, professional and personal self-improvement.

The *activity* (practical, praxeological) basis of pedagogue's professional competence is made by the complex of abilities (mastered methods of activity) and skills (automated abilities, pedagogical technologies and techniques), that are formed on the basis of available knowledge. For instance, higher pedagogical educational institution graduate is supposed to be able to: carry out the process of learning with orientation towards education and development of pupil's personality taking into account the specificity of the subject which is taught; stimulate the development of pupils' extra-curriculum activity taking into account psychological and pedagogical demands; systematically increase his/her professional qualification, fulfil methodological work as a member of school, district, municipal and regional methodological organizations; perform work of a form master, keep in touch with pupils' parents and render them help in family upbringing; follow the rules and standards of occupational safety, safety measures and fire protection techniques, provide pupils' life and health protection in their learning environment; resolve organizational and management problems.

Being able to construct the pedagogical process provides for the teacher to master such a pedagogical technique as the complex of psychotechnical skills (control oneself, one's body, ways of relaxation and emotional self-regulation), means of influencing people around oneself (speech techniques, non-verbal methods).

Among professionally essential qualities that make the *personality* basis of pedagogical competence, let us single out: *sociability*, which is characterised by need for socialising, being communicable, capable of arousing interlocutor's positive emotions; *perceptive* abilities that provide for professional sensitivity, consideration, intuition, ability to perceive and understand the other person; *suggestive* abilities – personality dynamism which means the active and emotional ability to influence pupils by means of kind words and will power; *emotional stability* that is provided for the ability to control oneself, carry out self-regulation, resistance to an emotional breakdown; *empathy*, benevolence; *optimistic prognostication* of personality development; *creativity* that is shown by the ability to be creative, generate extraordinary ideas, reject traditional patterns, quickly solve problematic situations.

Axiological component includes the system of values that determine the teacher's attitude towards his/her activity, its aims and means, towards him/herself as a pedagogue, the system of knowledge, norms and traditions which make the basis of pedagogical activity [5].

The analysis of the above mentioned components indicates the humanitarian orientation of such 'personality-based professional' new formation of personality as pedagogue's professional competence that stipulates the topicality of the humanitarian approach towards its formation.

By explanatory dictionaries 'formation' means action by the meaning 'to form' (from Latin formo – creating, forming, development; formare – to form,

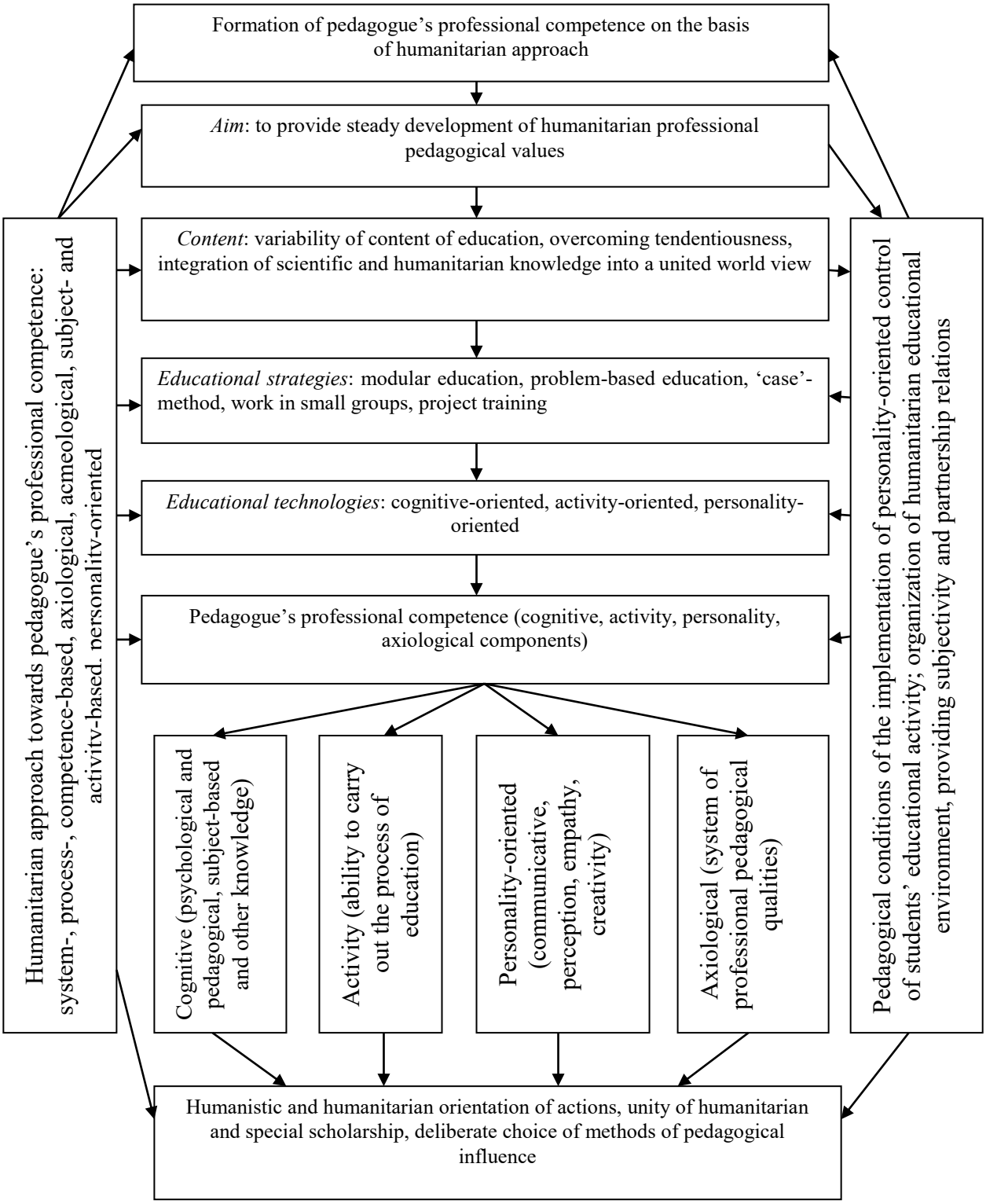

Fig. 1 The model of the formation of the teachers' professional competence based on the humanitarian approach
Source: author.

compose, generate), that is to shape something, make it look a certain way; cultivate someone's certain qualities, characteristic features; make something complete, perfect, certain and of standard look. The analysis of the psychological and pedagogical researches has enabled to distinguish the following scientific approaches as for defining its essence, as a stage of personality development, purposeful and organized process of acquiring properties of completeness by a certain

psychological and pedagogical phenomenon, pre-planned result (standard) of certain process realisation [8].

By formation of pedagogue's professional competence we understand purposeful process of the teacher's training for his/her professional activity, which is attended by integration of professional knowledge, abilities, skills, professionally essential qualities and axiological guidelines. It should be mentioned that formation of pedagogue's professional competence is not limited by the training period at higher pedagogical educational institution, but takes place during his/her whole active professional life. One should say that the humanitarian approach towards formation is complex, by its nature, and integrates system, process, competence, axiological, acmeological, 'subject- and activity-based', personality-oriented methodological approaches towards professional training and education of teachers [3]. We will understand the humanitarian approach in formation of pedagogue's professional competence as the principle of the above mentioned process organization that provide for the selection of content, strategies, technologies of professional pedagogical education on humanitarian principles.

Thus, the realization of the humanitarian approach provides for:

a) At the level of aims of professional training – the necessity to provide steady development of pedagogue's humanitarian professional values, integrity and harmonic interaction of professional competence components, development of personality and professional potential, pedagogue's self-realisation;
b) At the level of professional education content – variability of content of education, overcoming tendentiousness about educational material selection, viewing scientific and humanitarian world views in their unity;
c) At the level of technologies of teachers' professional training – dialogueness in constructing educational professional process, support of professional self-education, individualization in selection of methods, ways and forms of organization of teachers' professional training, mastering the content of academic subjects based on the personality importance of knowledge.

The realization of the humanitarian approach towards formation of teachers' professional competence provides for creating such pedagogical conditions as: introduction of personality-oriented control of students' educational activity; organization of humanitarian educational environment; providing subjectivity of teachers in the course of their professional making; partnership relations between teachers and students. Basic methods of realization of the humanitarian approach towards formation of teachers' professional competence include: focusing on supporting student's professional self-determination, his/her ability for full-fledged functioning under the conditions of uncertainty, non-standard situations; self-preservation, resistance to emotional 'burn-out', emotional destruction; interaction with the student as with independent personality having his/her internal freedom; providing independent socio-cultural environment with the priority of humanistic and moral values where student's immediate activity is taking place, creating conditions for developing his/her subjectivity and providing interpersonal communication at the level Teacher - Student; harmonic combination of scientific and humanitarian knowledge.

The process of formation of teachers' professional competence is provided by the use of the following strategies in the educational process:

1. Modular education that provides for students' individual work organization according to the syllabus that consists of modules. Modular education appears reasonable when carried out by the following sequence: a survey and overview lecture, tasks and questions for individual work, students' individual work, consultations, tutorials by certain source materials;
2. 'Case-method' the idea of which is that the teacher selects educational material according to his/her real experience of professional pedagogical activity, puts it in the form of business situations and assignments and offers it to the students. They, in their turn, take part in discussing the content of the 'case', look for different variants of given tasks;
3. Work in small groups, brainstorming, Delphy's methods, purpose-based discussions, incidents, questions, "Drawing the fire upon myself", comparative assessments, free associations, forced interrelations, lateral thinking, individual notebooks, utopian games, "Aquarium", "British debates", "Philips 66", "Debates" and other methods of *socio-cultural interaction*, the idea of which is a group problem discussion, break it into sub-problems, ranking elements by their importance, making a joint decision (felicitous examples of the teacher's monitoring an academic group on the basis of the humanitarian approach that is expressed by harmonic interweaving into the lesson's tissue real events, situations, popular movie stories, fragments of musical compositions, elements of youth sub-culture, given in [1]. For example, the teacher starts the lesson on the theme "Oscillations and waves" with a tape recording of the rote, a seagull's screech, heart thumping, "The song about the petrel", musical illustration);
4. Project training that implies independent solution of the problem starting with its

formulation and finishing with the analysis of the obtained results, is attended by search for additional information, application of knowledge under new conditions that contributes to the intellectual, creative and psychological education of the future teacher. Technologically the above mentioned process is supported by introducing:

- cognitive-oriented techniques (dialogical, problematic, task-based, information-communicative), or techniques of complete knowledge mastering that provides for mastering educational material within student's acceptable pace;
- activity-oriented techniques (project-, game-based, organization-activity, imitation-gaming, modelling), which provide for all-round use of student's learning activity at all stages of the lesson;
- personality-oriented (reflexive, interactive games development training), realisation of which is based on recognition of each person's being individual, peculiar, having his/her inherent value, his/her development not as a 'collective subject' but, first of all, as an individual endowed with his/her unique life experience that has been acquired in the conditions of the socio-cultural surrounding. The realisation of the above mentioned techniques provides for special construction of educational texts, didactic materials, methodological recommendations concerning their application [6]. Based on the analyses of the psychological and pedagogical literature the model of formation of pedagogue's professional competence on the basis of humanitarian approach has been developed.

In the terms of the humanitarian approach pedagogue's professional competence can be characterised and evaluated by the following *parameters*: level of humanitarian and subject-special scholarship in their unity and interconnection; awareness in selecting ways of actions and behaviour in various professional situations that reflects humanistic and humanitarian orientation; involvement in socially important processes of professional activity; pursuit to realise own professional opportunities by humanitarian methods; openness for accepting new experience, its constant replenishment in the course of the educational process and professional activity; reflection of professional self-education.

3 CONCLUSIONS

Thus, the basis of pedagogue's professional competence is made by his/her theoretical, practical and personal readiness for organization of his/her professional activity. The humanitarian approach towards pedagogue's professional competence is topical at all levels of his/her professional training and improvement: aim, content-based, organizational and procedural and technological. Humanitarization of teacher's professional training provides the unity of subject-special scholarship, humanistic and humanitarian orientation of his/her activity and behaviour.

The prospect of further research provides for specifying criteria, characteristics and levels of pedagogue's professional competence development.

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RULES AND PROCEDURES OF ACCIDENT INVESTIGATION IN CIVIL AVIATION

Grzegorz ZAJAC

Abstract: This paper describes the intenrational and European standards concerning air accidents and incidents investigation. It is shown the procedures and mechanism of conducting the investigation and the role of State of Occurrence and other States interested in participation in this investigation. There are also statistics concerning air accidents worldwide and in Europe in recent years. The paper is to show the aim of accident investigation which is to prevent form similar occurrences in the future.

Keywords: investigation, air accidents, incidents, Annex 13, occurence.

1 INTRODUCTION

Air transport is one of the safest means of communication. Accidents, though sometimes very spectacular and causing the death of all or many of the passengers, are extremely rare, taking into account the increasing annual number of flight operations, both freight and passenger. Technological quality of manufactured aircrafts is becoming more perfect. The aviation industry uses all the latest technical solutions in order to increase the safety of passengers and crew. Air carriers with very good financial situation constantly increase their fleet by purchasing modern aircraft that meet all the technical requirements. Unfortunately, air carriers, who do not succeed in the aviation industry, not necessarily coming from poor countries, use aircrafts that are quite old, and their safety level due to their technical condition is far less than satisfactory. According to statistics, the most accidents happen in this group.

It is impossible to completely eliminate the risk of an accident. Statistics show, however, that the level of flight safety is the highest in comparison to other means of transport. According to the data carried out in 2011 by Boeing Company, 1757 accidents happened in the 1959-2010 years, which caused death of 28851 passengers on board and 1173 people "on the ground" (a total of over 30 thousand). The 50-year period, however, is very unreliable, because in the last decade, flight safety is significantly improved mainly through modern technology and a high level of training of the personnel. There were 399 accidents in the period 2001-2010, which caused death of 4774 passengers on board and 231 people died "on the ground"[1]. These figures can be compared with the data in the European Union, where extremely stringent standards for safety are in force. For example, there were only 7 people who died in the 2003-2004 period in this region. This figure can be compared with the number of people travelling by air in Europe each day. Every day, in fact, more than 25 000 aircrafts perform operations in the airspace in Europe[2]. In recent years, about 2.3 billion people travel by air per year globally (upward trend), and the number of deaths does not exceed a few hundreds per year [3]. These figures can be compared with the number of fatalities in road accidents. In the European Union only, more than 35 thousand. People were killed in 2009 in road accidents, which is much higher than the number of fatalities in aviation through the half of the century [4]. These data show the scale of victims of road accidents and air accidents.

No matter what method of security the air carrier will undertake, it's never possible to avoid the risk of accidents. The plane is just a machine, and the flight crew are only people. A technical or human error can always happen, even by ensuring all circumstances of the risk. If it was possible to predict the accident, there wouldn't be any of them. However, despite the very good personal and technical cooperation, accidents do happen. Luckily, these are rare situations, or even very rare situations. According to IATA, 2014 was the safest year in the world in the history of aviation, because statistically there has been one accident resulting to 4.4 million flights. In total, there have been 12 accidents on over 38 million flights (scheduled and non-scheduled)[5]. In turn, ICAO provides the results of the total accidents (including fatal) for regular flights. According to the ICAO, in 2013, there were 2.8 accidents per 1 million flights[6]. In the following table one can note the number of accidents in the years 2009-2013.

[1] *Statistical Summary of Commercial Jet Airplane Accidents. Worldwide Operations 1959-2010.* Boeing Commercial Airplanes, June 2011, p.15.

[2] *White Paper – „European transport policy for 2010: time to decide"*, COM (2001) 370 final, 12.09.2001, or printed version under the same title. Luksembourg : 2001, p. 36.

[3] Press Release IATA, *Aircraft Accident Rate is Lowest in History - Still Room for Improvement, Regional Concerns Remain*, 23.02.2011.

[4] The European Commission, *Road Safety Programme 2011-2020: detailed measures,* MEMO 10/343, Brussels, July 20, 2010.

[5] IATA *Annual Safety Report 2014*, ICAO, Montreal 2015, p.16.

[6] *ICAO Safety Report 2014*, ICAO, Montreal 2014, p.5.

However, according to the Aviation Safety Network, there were 21 air accidents in 2014, which gives an average of 1 accident on the 4.1 million flights (33 million scheduled flights, in total). Of those 21 accidents, 10 were cargo flights, and 8 were passenger aircraft accidents[7]. Different data supplied by the individual institutions arising from the fact that they differently categorize the term "accident". Some will take into account passenger aircraft accidents, other regular aircraft of all types, and others will present data of all carriers, regardless of the type of flights performed.

Every time, when aviation accident happens, there are efforts undertaken to improve safety of travellers. Air accidents investigation is to prevent similar situations in the future. To determine the causes and circumstances of this accident, and an indication of the appropriate solutions contributes to the development of better methods and training standards, and improve the technical conditions of the aviation machines and equipment. Taking into account the fact, that aviation is not only of local or national dimension, and it is functioning in the international level, air accidents investigation must be therefore characterized by harmonized norms and standards. The harmonization of rules and consistent interpretation of the procedures on a global scale allows everyone to quickly make recommended solutions and avoid the occurrence of the plethora of regulations which reduce the level of safety of flights. International aviation is the kind of area, which requires cooperation and exchange of experience.

2 THE ESSENCE OF ACCIDENT INVESTIGATION IN CIVIL AVIATION

Aviation, however, is not a homogeneous entirety, because you need to distinguish the State aviation from the civil aviation (formerly known as "private"). This Division applies to the application and the purpose of the aircraft. Some will be used in military, customs or police service – and will be called as "State aircrafts", while other aircrafts will apply to commercial flights – and those will be called as "civil aircrafts". The above mentioned distinction is reflected in international law, and especially in Convention on International Civil Aviation (Chicago Convention) of 7 December 1944[8]. In accordance with its article 3, State aircrafts shall be deemed to be those that are in the military, customs or police service. All other aircrafts are civil. Such a distinction was adopted from the first multilateral Convention on Civil Aviation. The Paris Convention of 1919r. Similar disposition is reflected in article 30 of the Paris Convention, however, with the subtle difference that instead of the term "civil", the phrase "private" is used.

As far as in the first international regulations nothing was mentioned about the issue of air accident investigation, but the Chicago Convention provides for this in article 26, the content of which is as follows:

"In the event of an accident to an aircraft of a contracting State occurring in the territory of another contracting State, and involving death or serious injury, or indicating serious technical defect in the aircraft or air navigation facilities, the State in which the accident occurs will institute an inquiry into the circumstances of the accident, in accordance, so far as its laws permit, with the procedure which may be recommended by the International Civil Aviation Organization. The State in which the aircraft is registered shall be given the opportunity to appoint observers to be present at the inquiry and the State holding the inquiry shall communicate the report and findings in the matter to that State".

Due to the fact that the Convention applies solely to civil aviation, this rule also indicates air accident investigation in civil aviation. However, a question must be made, whether this rule is of restrictive nature, or it can be extended to State aviation. Before you answer, it is necessary to lay down the essence of the distinction between "civil" and "State" aviation.

The main distinguishing factor in aviation is the purpose for which the aircraft is used. In accordance with article 3, point (b) of the Convention of Chicago we have enumerative indication, which aircrafts will be classified to State aviation (which are in the police, customs and military service). International law does not specify which aircrafts will be used in civil aviation, but they are definitely different than the above mentioned aircrafts. According to some authors, nothing stands in contradiction with the fact that aircrafts used in another type of State service could be categorized as State aviation[9]. Perhaps you can point out the Polish example, the aircrafts used in the service of the border guard. As you can notice, the widest application is civil one, because it concerns mainly commercial aviation, or more rarely "General" (general aviation). The national law of the various Member States must not be in contradiction with the dispositions of international law, therefore, national law may establish or refine the international provisions, but cannot change them. The entire international aviation law which is laid down by the regime of the Chicago Convention applies to civil aviation. While State aviation is, in principle, "taken

[7] Available at: http://news.aviation-safety.net/2015/01/01/despite-high-profile-accidents-2014-was-the-safest-year-ever-according-to-asn-data/, access 10.08. 2015.

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[9] ŻYLICZ, M.: *Prawo lotnicze międzynarodowe europejskie i krajowe.* Warsaw : 2002. p.25.

out" of these regulations, however, with some reservations.

State aviation may not act on the basis of the absence of any rules in the international relations. In this case, it is always mutual agreement of the Member States as to the specific aircraft flight over the territory of another State. This principle derives from international law – from the principle of State sovereignty. In accordance with article 1 of the Chicago Convention „*The contracting States recognize that every State has complete and exclusive sovereignty over the airspace above its territory*". For the first time the principle of the jurisdiction of the State in the airspace had already been established in the Paris Convention of 1919. It was considered that the State has a total jurisdiction over its territory, including the air territory in its administrative borders. In the Chicago Convention this principle is reflected in article 3 (c), which is read as follows: „*No state aircraft of a contracting State shall fly over the territory of another State or land thereon without authorization by special agreement or otherwise, and in accordance with the terms thereof*".

The principle of State sovereignty has been repeated in article 2 section 1 of the Charter of the United Nations, which states that *„The Organization is based on the principle of the sovereign equality of all its Members*"[10]. It is recognized from the principle of State sovereignty, that the powers of State is suzerain and indivisible. The State shall decide about all the matters in its airspace and conditions of being in this airspace of foreign aircrafts. The Chicago Convention regulates aspects of civil aviation, but the State aviation there is a rule of every acceptance or special agreement between the relevant Member States. This is the domain of the interior prerogatives of the Government. Each State independently decides whether it agrees to be bound by international regulations[11]. Therefore, in relation to the State aviation some elements of the Chicago Convention apply.

3 THE INTERNATIONAL MECHANISM AND THE NATIONAL LEGAL BASIS CONCERNING AIR ACCIDENT INVESTIGATION

Chicago Convention provides a structured and unified set of rules and conduct of States in the sphere of aviation relations. On the basis of this Convention the following international regulations are adopted, which create in full the aviation regime based on a solid foundation which is the Chicago Convention. As already mentioned, in the Convention one can find an article 26 concerning air accident investigation. In accordance with the disposition, the State in which the accident occurs will institute an inquiry into the circumstances of the accident, with the opportunity to appoint observers of the State, in which the aircraft is registered, to be present at the inquiry. Such a rule is not of free nature, while it has been made reservation regarding the application of the principles recommended by International Civil Aviation Organization (ICAO). This rule should be linked with article 37 of the Convention. According to this article, the International Civil Aviation Organisation shall adopt the standards and recommended practices in a variety of matters, including in the field of air accident investigation. In view of the above, ICAO has been committed to the implementation of the detailed procedures relating to the matters referred to in article 26 of the given Convention.

In this regard, ICAO shall adopt special documents, known as "annexes" to the Chicago Convention[12]. Annex 13 has been dedicated to study air accidents, which is named as "Aircraft accident and incident investigation". It was adopted for the first time on April 11, 1951, and in subsequent years was changed – the latest modification, the ninth, in turn, comes from the 2001. In the period from 1947 (i.e. after the entry into force of the Chicago Convention) to 1951, the article 26 of the Convention was the only legal binding rule in the field of air accident investigation. However, later Annex No. 13 was a *lex specialis* in relation to article 26 and had precedence in the application of these provisions, though they do not interfere with each other.

The international ICAO regulations undoubtedly influenced the emergence of air accident investigation system in the European Union and individual Member States of the ICAO. The regime of the Chicago Convention provides a starting point for the implementation of relevant provisions in national or regional legislation.

4 ACCIDENTS INVESTIGATION IN EUROPEAN LEGAL REGULATIONS

Though currently in the European Union new rules apply from 2010, referred to later in this paper, it should be discussed the previously existing facts. In the case of the European Union, together with the start of the implementation of the creation of a common aviation policy in the late 1980s. and in the beginning of the 90. of the last century, the

[10] The Charter of the United Nations, signed in San Francisco, on June, 26th, 1945.

[11] The principle of State sovereignty has been widely described. In: ANTONOWICZ, L. *Podręcznik prawa międzynarodowego.* Warsaw : 1998, pp. 39-42.

[12] „Annexes (annexes) shall be adopted by the Council of the ICAO on the basis of article 54 (l) of the Chicago Convention. So far, 19 such annexes have been adopted – each dedicated to a different theme. They are updated periodically to adapt them to the changing reality and respond to current and future challenges for civil aviation.

process of improving the air travel security system also took place. One of its features was the harmonization of regulations in the field of air accident investigation. It must be noted, however, that despite the best legal solutions, accidents and incidents continue to happen, because it will never be possible to fully safeguard the flight safety. The essence lies in the fact that the risk of such tragic events should be the minimum. Therefore, carrying out an independent examination of accidents and incidents and appropriate drawing of conclusions for the future will keep the risk at relatively low level.

Much more before the process of creating a common aviation policy, the issue of aviation safety has been the subject of focus of attention of the bodies of the former Community many years earlier. The first regulation in this field in the former Community (currently the European Union) was a Directive 80/1266/EEC on cooperation and mutual assistance between the Member States in the field of air accident investigation[13]. The adoption of such solutions was an important step towards the development of common standards for aviation accident investigation. However, the lack of clearly defined obligation of action and its voluntary nature did not produce the expected results. In addition, legal institutional changes in the European Union and profound changes in the air transport sector forced the creation of new solutions adjusted to contemporary realities and challenges.

For this purpose, the European Union adopted in place of the existing new directive 94/56/EC of 21 November 1994 establishing the fundamental principles governing the investigation of civil aviation accidents and incidents[14]. The new provisions were more detailed and clearly précised the proceedings of a State. This directive was at the same time, the implementation of international solutions existing in annex 13 to the Chicago Convention. There have been laid down the fundamental principles of investigation of accidents and incidents in aviation.

Member States were obliged to investigate every accident or serious incident. This regulation results from international standards adopted in annex 13 to the Chicago Convention, where a reference is made that the investigation of the accident should be carried out under the responsibility of the Member State in which the accident occurred. In accordance with the directive, the scope of and procedures for the investigation of accidents need to be specified by individual Member States. The purpose of such an investigation in accordance with article 4 (3) of the directive could not be to determine the guilt or liability for an accident.

Any investigation must have been supervised by a permanent civil aviation body or other authority. It was also guaranteed the autonomy of such entity in relation to the national aviation authorities. The use of such a solution was to allow efficient and objective approach to the study of the circumstances of the accident. The task of carrying out an investigation or serious incident could be also entrusted to other State.

It has been established the basic principles for publishing reports of the activities carried out, as well as the bodies were indicated whom safety recommendations were necessary to disseminate. These bodies were to be airlines, national aviation authorities and the European Commission. The formulation of the recommendations could not be the presumption of blame or liability for an accident[15].

Complementary to the above regulation was directive 2003/42 of the European Parliament and of the Council of 13 June 2003 on occurrence reporting in civil aviation[16].The main purpose of its adoption was the fact that before an accident took place a number of incidents and a number of shortcomings often happened, which pointed to the existence of threats to air safety.

The issue of "occurrence" is defined in article 2 (1), in accordance with the terminology used in Directive No 94/56, as *an operational interruption, defect, fault or other irregular circumstance that has or may have influenced flight safety and that has not resulted in an accident or serious incident*. In other words, these are the events that have caused or may cause a hazard or could lead to such a state. Only these events are subject to compulsory notification. Each Member State is obliged to create a competent authority responsible for the collection and storage of information.

The legal institutional regime in the field of air accident investigation within the European Union, established on the basis of the Regulation 996/2010 and Directive 2003/42 greatly contributed to reducing the risk of accidents and caused far-reaching changes in the comprehensive approach to the safety and security of civil aviation. There has been presented data at the beginning of this article on the number of accidents in the past few years in Europe. Below is a table showing also the comparison of the fatal accidents among European and non-European air carriers. Passenger services are highly safe, as it can be seen from the statistics, that taking into account more than 30 million flights (operations), only a few of them annually were fatal accidents in Europe in recent times. In the total number of fatal accidents in the world it can be perceived a downward trend in passenger transport accidents.

[13] OJ, L 375, 31.12.1980, pp. 32–33.
[14] OJ, L 319 of 12.12.1994, p. 14.
[15] ZAJĄC, G.: *Wspólna polityka lotnicza Unii Europejskiej.* [Eng. The common aviation policy of the European Union]. Przemyśl : 2009. p. 152.
[16] OJ EU, L 167, 4.07.2003, p. 23.

Table 1 The number of fatal accidents in the world in the commercial air transport – aeroplanes registered in EASA Member States and third countries in the years 2004-2013

Fatal accidents	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Third country's air carriers	57	53	38	45	43	36	37	36	28	28
European carriers (registered in the area of EASA)	1	4	3	4	1	1	0	1	1	0

Source: Own elaboration based on the Annual Safety Review 2013, EASA 2014.

However, after a few years of validity of the provisions of Directive No 94/56 they were less and less beginning to match the quickly changing situation in aviation and the European Union. The reasons to take rapid necessary actions were the following:

a) No single research capabilities of all Member States of the European Union in comparison with the situation with 1994 (in 2011, the number of Member States was 27, and in 1994 – 12);
b) More and more technologically advanced aircraft and their systems require a more comprehensive knowledge and resources, than it was even a decade ago, in the field of air accident investigation;
c) Significant expansion the EU common aviation market over the past ten years, both in terms of subject (currently 27 Member States), and its complexity (the emergence of operators having more bases, increase the scope of subcontracting maintenance, international cooperation in the field of design and production), affecting the same on new challenges in safety supervision;
d) Greater responsibility of the European Union for air safety in connection with the development of the legal status of the common aviation policy;
e) The creation of a new institutional framework in the field of air safety (the establishment in 2002 of the European Aviation Safety Agency responsible for certification of aircrafts in the EU)[17].

These above mentioned arguments were a serious assumption to change that regulation and to adopt a new European legal instrument in the form of Regulation (EC) No 996/2010 on October 20, 2010. The change from "directives" to "regulation" underlines the rank and importance of new provisions, and also strengthens the European system of air accidents and incidents investigation. It was estimated that the objective to establish common rules in this area can only be achieved at Union level, therefore a form of "regulation" is appropriate and consistent with the principle of subsidiarity and proportionality, as referred to in article 5 of the Treaty on European Union.

A new adjustment is compatible in relation to the international provisions contained in annex 13 to the Chicago Convention. The adoption of the new regulation in place of the existing directive was also dictated by the fact that there are new unmanned aircraft, which also cause accidents. In connection with the development of advanced technological systems it was necessary to introduce the new regulation covering the areas of unregulated so far sphere as unmanned aircrafts. More and more sophisticated and technologically improved unmanned aircraft and their systems require a more comprehensive knowledge and resources, than it was even at the turn of the Millennium, in the field of air accident investigation. Jest to pierwsza tego typu regulacja w Europie.

It also strengthened the European organization EASA by ensuring the participation of its representative in the air accidents and other occurrences investigation. It was considered that the EASA has similar permissions as States, because it carries out on behalf of Member States, functions and tasks of the Member State, the Member States of the producer and Constructor, the Member State of the Registry in connection with the approval of the project18. Permitting the representatives from these States to take part in the accident circumstances investigation is guaranteed by the Annex 13 to the Chicago Convention. This is to streamline the process of occurrence investigation and to contribute to its effectiveness. Since 2002 EASA has proved, that its creation was intentional, since it has contributed to the increase of the flight safety level as the initiator of proposing many legal instruments in this area.

In achieving the purpose of this regulation it has been established the "Network" (European Network of Civil Aviation Safety Investigation Authorities–

[17] The Commission of the European Communities, *Proposal for a Regulation of the European Parliament and of the Council on investigation and prevention of accidents and incidents in civil aviation*, COM (2009) 611 final, 29.10.2009, p. 3.

[18] Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and repealing Directive 94/56/EC, OJ EU, L 295, 12.11.2010, p. 36.

EURONEST). The "Network" is not an institutionalized form of cooperation, because it does not have a legal personality. It is a coordinating body and at the same time it is a forum for the exchange of experience of all national authorities for occurrence investigation in aviation. The Network shall seek to further improve the quality of investigations conducted by safety investigation authorities and to strengthen their independence. In particular, it shall encourage high standards in investigation methods and investigator training in the European area.

The responsibilities of this Network shall be in accordance with article 7 (2) of the Regulation 990/2010, which are as follows:

a) Preparing suggestions to and advising EU institutions on all aspects of development and implementation of Union policies and rules relating to safety investigations and the prevention of accidents and incidents;
b) Promoting the sharing of information useful for the improvement of aviation safety and actively promoting structured cooperation between safety investigation authorities, the Commission, EASA and national civil aviation authorities;
c) Coordinating and organizing, where appropriate, 'peer reviews', relevant training activities and skills development programmes for investigators;
d) Promoting best safety investigation practices with a view to developing a common EU safety investigation methodology and drawing up an inventory of such practices;
e) Strengthening the investigating capacities of the safety investigation authorities, in particular by developing and managing a framework for sharing resources;
f) Providing, at the request of the safety investigation authorities appropriate assistance, including, but not limited to, a list of investigators, equipment and capabilities available in other Member States for potential use by the authority conducting an investigation;
g) Having access to information contained in the database and analyse the safety recommendations therein with a view to identifying important safety recommendations of Union-wide relevance.

Let's take a look in the Network organizational structure. This body is composed of the heads of the safety investigation authorities in each of the Member States for a period of three years. They choose a chairman from themselves, whose main duty is to draw up the annual work programme of the Network. The chairman shall also draw up the agenda for the meetings of the Network. The members of the Network shall act independently from their States, which have assigned them to the position. EASA can be invited as an observer to the meetings of the Network. Moreover, the Network can also invite as an observer safety investigation authorities of third countries and other relevant experts. The Network shall be assisted by the European Commission with all necessary information and instruments. It shall also put forward an annual report of its activities to the Commission, and the latter shall transmit it to the European Parliament and the Council.

After such investigation is finished, it shall be concluded with a report in a form appropriate to the type and seriousness of the accident or serious incident, in accordance with article 16 (1) of the Regulation 990/2010 and in accordance with recommended practices and standards of the Annex 13 to the Chicago Convention. Nevertheless, the report shall protect the anonymity of any individual involved in the accident or serious incident. There shall be also undertaken all actions to assist the victims of air accidents and their relatives. Therefore, Member State shall establish a civil aviation accident emergency plan at national level in this sphere.

5 DEFINITION AND AIM OF CONDUCTING OF AIR ACCIDENTS INVESTIGATION

This study is all about air accidents investigation. However, it should be pointed out the distinction, with which we are dealing in aviation, namely the study of the various "accidents" and "incidents".

The basic interpretation of the "accident" is set out in annex 13 to the Chicago Convention. This term means „*An occurrence associated with the operation of an aircraft which takes place between the time any person boards the aircraft with the intention of flight until such time as all such persons have disembarked*". It is provided, however, that it must be related to one of the following reasons:

a) A person is fatally or seriously injured as a result of:
   – being in the aircraft, or
   – direct contact with any part of the aircraft, including parts which have become detached from the aircraft, or
   – direct exposure to jet blast,

except when the injuries are from natural causes, self-inflicted or inflicted by other persons, or when the injuries are to stowaways hiding outside the areas normally available to the passengers and crew; or

b) The aircraft sustains damage or structural failure which:
   – adversely affects the structural strength, performance or flight characteristics of the aircraft, and
   – would normally require major repair or replacement of the affected component,

except for engine failure or damage, when the damage is limited to the engine, its cowlings or accessories; or for damage limited to propellers, wing tips, antennas, tires, brakes, fairings, small dents or puncture holes in the aircraft skin; or

c) The aircraft is missing or is completely inaccessible.

„An incident", however, is an occurrence, that didn't lead to the accident, and it is not an accident itself, but which affects or could affect the safety of operation. You can still distinguish the indirect category, namely "serious incidents". These are incidents involving circumstances indicating that an accident nearly occurred. So it was very close to an accident.

The proposed terminology in international regulations has been transposed into the national laws of the individual Member States. Some regional agreements also took over to the internal application of similar solutions, e.g. the European Union. It should therefore be noted that harmonization of the provisions was made concerning air accident investigation, as it has a fundamental impact on the safety of the whole of the aviation environment. Thus there is no risk that the State wrongly interprets the specified event and consequently will draw the wrong conclusions. To prevent this, there has been also developed a unified procedure related to the investigation and examination of the causes and circumstances of the occurrence.

6 MECHANISM AND PROCEDURES FOR ACCIDENT INVESTIGATION

Annex 13 to the Chicago Convention contains, in particular:

a) Definitions;
b) Objective of accident investigation;
c) Protection of evidence;
d) Responsibility of the State of Occurrence;
e) Participation and responsibility of the State of Registry, the State of the Operator, the State of Design and the State of Manufacture;
f) Preparation and release of the Preliminary Report and Final Report.

Important:

The main and only objective of air accidents and incidents investigation is to prevent the occurrence of similar situations in the future.

The investigation leads the State in which the accident took place. It is obliged to take all measures to protect the place of occurrence, including to protect the evidence, and to protect from unauthorized access of a third party to this place. This State shall inform all interested entities about this occurrence, namely the State of Registry, the State of the Operator, the State of Design and the State of Manufacture, as well as ICAO. The notification shall contain the following information:

a) For accidents the identifying abbreviation ACCID, for serious incidents INCID;
b) Manufacturer, model, nationality and registration marks, and serial number of the aircraft;
c) Name of owner, operator and hirer, if any, of the aircraft;
d) Name of the pilot-in-command, and nationality of crew and passengers;
e) Date and time (local time or UTC) of the accident or serious incident,
f) Last point of departure and point of intended landing of the aircraft;
g) Position of the aircraft with reference to some easily defined geographical point and latitude and longitude;
h) Number of crew and passengers; aboard, killed and seriously injured; others, killed and seriously injured;
i) Description of the accident or serious incident and the extent of damage to the aircraft so far as is known;
j) An indication to what extent the investigation will be conducted or is proposed to be delegated by the State of Occurrence;
k) Physical characteristics of the accident or serious incident area, as well as an indication of access difficulties or special requirements to reach the site;
l) Identification of the originating authority and means to contact the investigator-in-charge and the accident investigation authority of the State of Occurrence at any time; and
m) Presence and description of dangerous goods on board the aircraft.

The State of Occurrence must conduct the investigation in accordance with international standards set out in the Annex No 13 to the Chicago Convention. As regards the participation of other Member States in the process of investigation of the case, they may appoint an accredited representative, together with the accompanying consultants. They can take part at every stage of the investigation, and make statements on the various elements of it. The obligations of the accredited representatives and their advisers is to provide the State conducting the investigation with all relevant information available to them. They cannot not divulge information on the progress and the findings of the investigation without the express consent of the State conducting the investigation.

The investigation must be completed with the Final Report. The State conducting the investigation is obliged to prepare the Preliminary Report and to send it to all the entities involved in the investigation

process. These entities, can make their own comments, that the State of Occurrence receives. These comments do not have to be found in the Final Report – it depends on the State conducting the investigation.

The Final Report in accordance with the provisions of international air law aims to describe and analyze the facts, indicate the causes and circumstances of the accident and to state recommendations to avoid similar accidents in the future. It's worth pointing out that the purpose of the report is not to indicate the guilt and who bears the responsibility for the disaster. The Final report consists of the following four parts:

a) Factual information;
b) Analysis;
c) Conclusions;
d) Safety recommendations.

Each chapter can also consist of attachments, if this is helpful in clarifying the circumstances of the occurrence on each stage of investigation.

Factual information is about the history of the flight and contains brief narrative of the following information: flight number, type of operation, last point of departure, time of departure (local time or UTC), point of intended landing, flight preparation, description of the flight and events leading to the accident, including reconstruction of the significant portion of the flight path, if appropriate, and also location (latitude, longitude, elevation), time of the accident (local time or UTC), whether it happened during the day or at night. In this part of the report it should be also indicated damages to persons, damage to aircraft and other objects. This part of the Report must also contain information about the flight crew members, including their qualifications and experience, as well as the technical characteristics of the aircraft and weather conditions related to a particular flight. Apart from that, there must be also other information specified in the international standard. The information contained in this first part of the report must be devoid of any subjective element. It must be a special report on what actually happened.

The second part of the final report consists of a substantive analysis of the information contained in the first part, which are necessary to draw conclusions.

The third part is a summary of previous findings. This must be the most important concise indication of the reasons and circumstances established in the course of the investigation. The list of causes should include both the immediate and the deeper systemic causes.

The last part of the Report is the recommendations made for the purpose of accident prevention and any resultant corrective action. This is an extremely important part of the entire report, as it points out the shortcomings of the given factors that contributed to the accident. The information in this section is to prevent similar events in the future by eliminating the adverse factors that led to the conduct of the investigation. In this connection, it must be proposed corrective action. In drawing up this part of the report, it should be noted that some of the recipients of this report may challenge the findings and recommendations made, as this may be contrary to their interests. However, the State conducting the investigation must do it very reliably, leaving emotions aside and the pressure of the public opinion seeking rapid explanation. The Final Report of the investigation of an accident must be sent by the State conducting the investigation to:

a) The State that instituted the investigation;
b) The State of Registry;
c) The State of the Operator;
d) The State of Design;
e) The State of Manufacture;
f) Any State having suffered fatalities or serious injuries to its citizens;
g) Any State that provided relevant information, significant facilities or experts.

The regime of the Chicago Convention very carefully specifies the activities of the Member States in the conduct of air accident investigation. Appendix 13 provides a foundation not only for civil aviation, but also for State aviation, provided that the Member States agree to apply its provisions.

7 ACCIDENTS INVESTIGATION IN STATE AVIATION

In the State aviation there is no automatic application of the procedure defined in the international air law. In civil aviation, however, it is an automatic procedure, as parties to that Convention are almost all countries in the world (except for Dominica, Lichtenstein and Tuvalu). Member States are required to apply the procedures set out in annex 13 to the Convention concerning the investigation of aircraft accidents and incidents. While in the State aviation, the situation is more complicated. If there is an accident of an aircraft belonging to the State A on the territory of State B, then you have to agree which procedure to apply. There are two options in that case. Either States may agree to apply the international civil aviation rules, or States will likely to argue about how to proceed. Since there is no uniform standards in State aviation, this cooperation may be difficult, because States can often talk about State' secret and the protection of their territory and in that case there is no obligation to allow observers to come and inspect the place of occurrence. Each State has the sovereign power, which alone shall decide on all matters within its

territorial borders[19]. It cannot be expected that the State would agree to a hassle-free admittance of foreign country's services to participate in internal investigations involving data with secrecy clause.

In each country there are competent authorities explaining the air accidents and incidents in State Aviation. The powers of this body are similar to the Commission in civil aviation. In its discretion it is necessary to clarify the circumstances of aircrafts' accidents belonging to State aviation of third countries that took place on its territory or in its airspace, as well as beyond its borders, if special international agreements provide for.

In the case of State Aviation, States can make an appointment, whether they will apply the regime of the Chicago Convention, or the bilateral agreement will be binding between them, or apply other rules, which are not specified by international aviation law. The proper decision shall always be taken by entitled constitutional bodies of a State. On behalf of the State in international relations (external) there are bodies referred to in article 7 (2) of the Vienna Convention on the law of treaties (UN Treaty Series, 1980, no 18232). These are the head of State, head of Government and minister of Foreign Affairs.

Oral statements are binding for a State if they are spoken by the head of State, head of Government or Minister for Foreign Affairs. This is confirmed by the judgment of the Permanent Court of International Justice (PCIJ) in 1933, on the "Ihlen" declaration, as well as judgement of International Court of Justice (ICJ) of 1974 on nuclear tests done by France at Mururoa and Fangataufa Atolls. Of course, the best form of expression of a will is written form, but international law permits also oral form, which is also binding.

A very important element that decided of the adoption of the regime of the Chicago Convention was a time. In air accidents investigation it is very important. Time is the enemy of accident investigation. It appears a matter of appropriate protection of evidence, carrying out activities related to the identification of the victims, etc. Quick decision allowed the proper clarification of disaster. The State of Occurrence conducts air accident investigation and bears full responsibility for it, including with the preparation of the Final Report inaccordance with annex 13 to the Chicago Convention.

8 CONCLUSIONS

International system of air accident investigation is to standardize procedures in all Member States of the ICAO, and to contribute to the uniform interpretation, evaluation and classification of incidents in civil aviation. The adoption of international regulations in States' legislation increases the safety of air navigation, which in contemporary times of more common phenomena „air congestion" related to the growth of supply and demand for air services is fundamental.

The conduct of air accident investigation and incidents in civil aviation is a complex and responsible task. This must be done by people with high qualifications in accordance with international procedures. They are defined in the international air law, i.e. the Chicago Convention and its annex 13. Individual States are obliged to act in accordance with international standards issued by ICAO, which contributes to more precise action to improve the flight safety and to prevent similar incidents in the future.

Hence, State aviation is devoid of international instruments and regulations in the field of air accident investigation. This condition raises many uncertainties. The proceedings without specific rules will result in multiple handicaps for both parties interested in an explanation of a specific occurrence. The most appropriate form would be the application of the Chicago Convention regime to accidents in aviation, because it will allow efficient, effective and transparent conduct of investigation.

Air accidents investigation is designed to prevent similar situations in the future. The determination of the causes and circumstances of this accident, and an indication of the appropriate solutions contributes to the development of better methods and training standards, and improve the technical condition of the aircraft and aeronautical equipment. Taking into account the fact, that aviation is not only of local or national dimension, but it is of international nature, so air accidents investigation must be characterized by harmonized norms. The harmonization of rules and consistent interpretation of the procedures on a global scale allows for a rapid implementation of recommended solutions and to avoid the existence of plenty of regulations diminishing the flight safety. International aviation is this kind of area, which requires cooperation and exchange of experience.

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NEW TECHNOLOGIES AND DEFENCE INDUSTRY THE CASE OF POLAND

Wojciech GIZICKI

Abstract: Modern technologies are a great opportunity for improving security at the national and international levels. Thanks to these new devices, it is possible to better protect people and structures and to more efficiently combat new threats that are constantly appearing. But if misused, they can constitute a real threat to millions of people. The aim of the present article is to analyze some issues related to new technologies in terms of national security, with particular emphasis on Poland's experiences.

Keywords: defence industry, new technologies, security of Poland.

The appearance of electronic brains is the beginning of the evolution of artificial means of thinking. They can potentially become independent of man, just as in past centuries the effects of his social and production activities gained independence from man. As a result of the appearance of division of labor in society, the nature of manufacturing procedures created a machine that, by becoming independent of human will, has begun to increasingly burden the lives of individuals. Finally, in some eras, people began to give an almost divine honor to the machine and the state. (Stanisław Lem, Dialogs)

1 INTRODUCTION

Modern technologies have revolutionized the contemporary world. This concerns both civilian life as well as the military. It is difficult to imagine functioning in daily life without access to the internet, mobile phone resources and computer applications. Knowledge and its application on an industrial scale for military needs is at the same time an asset and advantage in the weapons potentials of the world's biggest armies. This gives additional motivation for systematic research and intelligence. It even requires a systematic search for personal solutions and technological proposals. At the same time, obtaining information in order to carry out tasks in the area of new technologies has become an indispensable part of the activities of the services of every nation. The present issues are relatively little known in scientific literature. At the same time, the subject is extremely important and dynamically developing.

The purpose of this article is to discuss the some issues related to new technologies in terms of national security, with particular emphasis on Poland's experiences. This is not an easy task, especially in view of the subject of analysis, which to a great extent remains implicit. Many questions, both ethical and pragmatic, arise: what is man's place in using technological achievements? How can they influence his sense of security? What are the major technological achievements in building the strategic foundations of Poland's security?

The contents presented in the text relate to both existing and projected technological creations, with particular emphasis on Poland. Some of them to a large extent are already operating in the area of defense, and may soon revolutionize the military. The main challenge, however, is that, they be used for tasks that are positive and develop humanity character. It is crucial that they have a defensive, not offensive nature.

2 OPPORTUNITIES AND RISKS OF NEW TECHNOLOGIES

Pragmatism, usability, improving the quality of life and access to information are the main reasons for the development of new technologies in the area of civil life. The possibilities associated with it include the need to analyze information, which may be an advantage in everyday life, e.g. professional work, and contribute to maximizing the sense of individual and social security (Liedel, Piasecka, Aleksandrowicz, 2012). Today, the use of the global Internet resource network is quite common and depends solely on availability and coverage. Wireless Internet technology increases the possibilities in this regard. Almost all mobile devices, phones and PCs (laptops) are equipped with wireless applications. Advanced progress in this field even makes it possible to install such equipment in passenger cars. Thanks to this, the possibility of using this potential to the maximum is increasing. Visiting social networks, shopping directly from home, browsing through pages of cultural institutions or sports are just some examples of the wide application of these new technologies. They not only make personal time more pleasant, but also help us to plan and manage our lives, including security. Controlling road conditions, risks associated with weather conditions, crimes etc. are now much easier and faster.

Modern technologies are being more and more often introduced into the military domain. Of course, they generate substantial expenses. But, at the same

time, they allow for faster, more-efficient and, what is very important, effective reconnaissance and combat activities, etc., often without human participation and casualties. These technologies are especially helpful in the field of the broadly understood fight against terrorism, cyberterrorism and bioterrorism. The most-widely known and spectacular examples of possible technological success are the activities of, e.g. Sikorsky and its prototype of the unmanned Black Hawk transport helicopter. The activity of Advanced Tactics Inc. and marketing the remote-controlled Black Knight Transformer can be another potential success.

The armed forces of many countries are also placing great hope on unmanned technologies, meaning drones (Unmanned Aerial Vehicles) (Cwojdziński, 2014; Medea 2013). These are used in combat tasks within the framework of security activities as support measures for uniformed (and civil) services such as the police or border patrol[1]. One of their advantages is the significantly lower cost of construction and maintenance when compared with conventional helicopters and smaller losses in the event of a shootdown (no casualties in crew members). They are a good support tool for maintaining public order, during rescue missions and can also be used in drawing and updating maps.

However, we should also notice the ethical consequences of actions characterized by the involvement of drones or unmanned machines and vehicles (Barel, 2015). Operating these machines does not make it possible to really see the target located around other units or people. A soldier on the battlefield can assess the involvement of uniformed services in military actions. He or she is very likely to distinguish between these services and the civilians who are not involved in the fighting. A person operating an unmanned vehicle or a drone can be focusing solely on task execution, irrespective of possible casualties. This is due to the lack of real analysis of the environment of the target of the assumed or imposed action.

Modern technologies are a great opportunity for improving security at the national and international levels (Doherty, Łukaszewicz, Skowron, 2006; *Cyberinfrastructure vision for 21st century discovery*, 2007). Thanks to these new devices, it is possible to better protect people and structures and to more efficiently combat new threats that are constantly appearing. Due to substantial resources needed to conduct research tests and construct more and more effective equipment, modern technologies can be developed by countries or international corporations (and sometimes by large national corporations). This does not mean, however, that modern equipment does not get to criminal and terrorist groups. Furthermore, modern technological solutions can malfunction, go out of control or be misused. This can become a source of great crisis or terrorist actions. Terrorists are becoming more and more willing to employ unconventional methods of action, utilizing complex equipment or misusing everyday appliances. Sadly, terrorists can now use remote-controlled equipment featuring wireless, electronic and electro-optical detonators (Adamski, 2007).

3 POLAND'S EXPERIENCES IN THE FIELD OF MODERN SECURITY TECHNOLOGIES

Poland's geopolitical location as well as its geographical and demographic potential are, on the one hand, its great assets; on the other hand, however, these require increased actions aimed at the optimization and betterment of the country's security. This process has been dynamically developing since 1989. A change in the balance of power in Europe, a new security environment, transformations of political objectives, a change in ally-forming directions and new challenges for security have all resulted in the necessity to undertake multidimensional actions. These changes also resulted in the restructuring of the Polish Army in terms of equipment and armaments (Lewandowski, 2011). Therefore, work is being carried out on technological solutions that would meet the requirements and challenges faced by the armed forces (Rawski, 2013). This also applies to different domains and types of military services: land, air force, the navy and special forces.

The need to modernize Poland's armed forces (and in other states in Central Europe) results from several conditions (Gizicki, 2013; Gizicki, Hlaváček, Usiak, Wagner, 2014). The most important conditions are strongly associated with the change of the international situation in terms of security. There are more and more asymmetric threats that require new approaches and new solutions. After many years of stabilizing the international situation, there is a new threat and a challenge in the form of Russia's imperial ambitions and its direct involvement in the formation of a new geopolitical order in Central and Eastern Europe. This must result in an increased commitment on the part of Poland's security system. In addition, the reform of the armed forces is to increase the capacity and efficiency of Polish soldiers under these new, asymmetrical international conditions (global terrorist organisations, global crime, hybrid warfare). Rationalizing expenditure and maximizing the benefits related to this are an essential element of state activity.

[1] In Poland drones are used to patrol borders with Russia, Ukraine, Belarus, to monitoring on the street by police, city guard and by PKP Cargo, (rail freight operator).

Expenditures on state security are also systematically increasing. Subsequent governments have already announced increases for this purpose from 1.95 % GDP to 2.00 % GDP starting 2016. A substantial part of these resources will be allocated for equipment, including new technologies. In this regard, sensible order and purchase management is of crucial importance so as to ensure that the procured equipment is modern, high-quality and technologically advanced. It is also very important to ensure that an appropriate part of orders for the army be based on technologies implemented by native, Polish arms institutions. The arms industry has a rich tradition. After a slump and thorough modernization in the 1990s, it has been gradually regaining its importance. The Polish Army and the country's economy have placed great hope in this industry. Bogusław Pacek[2] stated that "the consolidation of the Polish defense industry is a rational action allowing the state to respond effectively to changes in the security environment, the implementation of the economic interests of Poland and the technological development of the whole economy"(Pacek, 2014, p.24).

An essential element of any national security policy is the precise and long-term planning of the objectives, tasks and opportunities for action, including the area of new technologies undertaken within the framework of strategic documents. In the case of Poland, some of these are crucially important. However, for the purposes of the following text, we will limit ourselves to two: the Strategy of Development of the National Security System of the Republic of Poland 2022, adopted by the Resolution of the Council of Ministers on April 9, 2013, and the National Security Strategy of the Republic of Poland in 2014, adopted by the Resolution of the Council of Ministers on October 21, 2014.

Both documents point to necessary and possibly outdated cooperation on behalf of strengthening the defense industry, which is largely based on indigenous, domestic resources. A necessary condition is the effective cooperation of state, public, private, military and scientific research institutions. The necessity to strengthen innovative solutions in the area of new military technologies and the overall strengthening of the state economy, including creating new jobs, was particularly emphasized. The sharing of experiences on an international level and supporting defense processes in the Euro-Atlantic area (EU, NATO) are significantly important[3].

For the purposes of implementing the research objective, we will present and analyze three key activities of Polish companies operating for the benefit of the Polish defense industry: Polish Defence Holding, Proteus Project and WB Electronics[4].

[2] Major General, Polish Army, Adviser to the Minister of National Defence; Adviser to NATO for the reform of the military education of Ukraine; from 2012 to 2014 Rector-commandant of the National Defence University of Warsaw.

[3] "It is necessary to strengthen the competition and innovation of the national defense industry and the scientific and research sectors related to it. Government administration should create the legal conditions, investment incentives and institutional coordination mechanisms for the development of the defense industry, including increasing its innovations. On its part, the defense industry needs to better recognize the needs of the main users of military equipment, to diversify and offer more attractive modern products on the market, as well as to seek opportunities to rationalize the range and costs of production as well as develop cooperation with foreign partners. The actions of both parties must be designed to achieve a high quality of production in accord with the expectations of Poland's Armed Forces, and to obtain the degree of competitiveness that would allow for partnerships with European companies and global arms corporations".
National Security Strategy of the Republic of Poland 2014, p. 49, source: www.bbn.gov.pl.
„Strengthening of the state's capacity for defence, including provision of population survival, functioning of the state's structures and its armed forces, requires considerable involvement of its economic structures forming the industrial defence potential and carrying out the economic and defence assignments.
Polish potential, which enables production of the definite armament and military equipment systems, constitutes one of the determinants of the state's sovereignty and mobilisation readiness of its structures. Domestic industry remains the key supply source of armament and military equipment for the Polish Armed Forces and Polish research and development centres are the important suppliers of technology and technical ideas within the scope of defence technologies.
Strategy of Development of the National Security System of the Republic of Poland 2022, p. 23, source: www.mon.gov.pl.

[4] „Managing challenges and threats requires from the armed forces to be a combination of joint modular components. They must be mobile, network-centric and capable of performing missions in every environment. The ability to carry out any mission or assignment, to act immediately and to strike effectively and precisely will decide about their value. For this purpose, they should be equipped with technologically advanced, combat effective and resilient to threats from cyberspace, highly automated, robotic equipment and armament. To manage the aforementioned, operational capabilities will be developed in the field of: command and control, reconnaissance, engagement, survival and protection of troops, logistic support".
Strategy of Development of the National Security System of the Republic of Poland 2022, p. 59, source: www.mon.gov.pl.
You can find out more information about this companies and project in the Polish Defence Industry, especially numbers 1-2/2012 and 1-4/2013. See: www.przemysl-obronny.pl

3.1 Polish Defence Holding

Polish Defence Holding (PDH) is the leading actor in the arms industry in Poland[5]. Its origins date back to 1868, the time when Poland was still under partition. This armaments concern was developing very rapidly in the Inter-war Period (1918-1939), when Poland was independent. After World War II, Bumar company was established (1953), which in 2002 was transformed into the Bumar Group, constituting a direct resource base for PDH. The concern is composed of around 20 entities and is a major employer with approximately 10 thousand workers. The company's income in 2012 amounted to nearly 1.2 billion USD, with almost 20% of revenue coming from exports. Research & development comprises a substantial part of the company's expenses. The holding allocates for this purpose ca. 60 million USD a year. The company's product portfolio includes almost all areas connected with defense.

The main activity of the holding revolves around the five leading programs: 1. Future Soldier Individual Equipment Program; 2. Missiles and Ammunition; 3. Simulators and Trainers; 4. Armored Program; 5. Shield of Poland.

The Future Soldier Individual Equipment Program includes all the needed elements that determine a soldier's safety on the battlefield. The program encompasses several diversified state-of-the-art technologies. They are to improve the effectiveness and reliability of soldiers' operations under all combat conditions. These include both combat equipment, such as arms, sights, night-vision devices, and personal protective equipment, e.g. helmets, bulletproof vests and gas masks.

Missiles and Ammunition is a program that aims to supply cutting-edge ammunition, anti-air and armor-piercing equipment for the army. The manufactured ammunition is a result of comprehensive cooperation with Research and Development (R&D) institutions. In addition to this, the holding offers the production, supply, servicing and utilization of used and unused reserves. GROM's/PIORUN's Portable Anti-Aircraft Missile System deserves to be mentioned here. This device is relatively light (ca. 19 kg), can be used by a single soldier, and is a very efficient weapon in fighting air and land targets. It also boasts substantial danger zone distance (even exceeding 5 km). Another interesting missile solution is the Spike anti-tank system[6]. It is a very easy to use and efficient weapon for combating targets located at a distance of up to 4 km. More than 400 missiles of newer version, Piorun for the polish army, will be produced by the end of 2017.

The objective of the Simulators and Trainers program is to prepare soldiers for operating real combat systems. Owing to the implementation of various programs that can reflect real combat activities based on, among other things, laser kits, shooting ranges, simulated combat conditions and changing atmospheric conditions, soldiers can repeatedly practice the schemes of utilizing real equipment. Work utilizing these kinds of simulators makes it possible to minimize costs and repeatedly practice the same or similar situations in different configurations. This allows increasing the effectiveness and combat efficiency of the armed forces in future actions on the battlefield.

The Armored Program aims at preparing and modernizing combat equipment for the purposes of the armed forces responsible for the direct protection of the country's borders and territory. This applies mainly to the PT-91 and the Leopard 2A4 tanks. Thanks to support from new materials and spare parts, the Polish Army receives its equipment after thorough overhauls and repairs, which can be effectively used for combat purposes. Moreover, as part of its design work, the holding is preparing a new armored project – the PL-01 CONCEPT tank – in cooperation with British BAE Systems (see Fig 1). The idea behind this project is to hand over to the Polish Army a light 3-man combat vehicle by 2018. The protective measures of the vehicle, in addition to the armored turret, include ceramic anti-ballistic armor and active protection systems (thermal masking). The vehicle weapons design also looks groundbreaking, with several cannons, including unmanned, fully automated and remote-controlled guns. The presented vehicle is also equipped with advanced opto-electronic solutions that make it possible to maintain constant surveillance of the vehicle's vicinity during both day and night. It will also feature automatic target detection, missile guidance and friend-foe identification systems. All this will be connected to the central battlefield management system. The concept behind the project is extremely ambitious. A successful conclusion of design work would certainly be a great success of both the Polish arms industry and the Polish Army.

Another important element of the company's activities is its involvement in the field of reconstructing military equipment that was the core of the Polish Army years ago. Here we mean the legendary FT-17 tank, which constituted the important part of the Polish Army as early as in 1919. This offers an opportunity for maintaining and cherishing the national memory of particularly valuable products of the Polish defense industry.

[5] Available at: www.pho.pl

[6] Designed by the Israeli company Rafael, manufactured in Poland by the Mesko facility, (part of the Bumar Group).

Fig. 1 Prototype Light Tank PL-01 CONCEPT
Source: www.defence24.pl

The Shield of Poland is one of the major projects for the state security system. It constitutes technical and material support of Poland's air defense concept, a program of key importance both from the point of view of the state security strategy and complementing the NATO air security system. One crucial task is the transition from an obsolete air defense system (a part of the ex-Warsaw Pact), to a modern system fully correlated with NATO equipment. This will be facilitated by solutions that enable neutralization of threats located within short- and mid-range. Poland's air defense system is composed of 3 levels: 1. short-range anti-aircraft missile systems, artillery and artillery-and-missile systems; 2. short-range systems; and 3. mid-range systems. It is worth highlighting that the air defense project, commonly referred to as the anti-missile shield, is not intended for offensive use, and is not aimed against any of the neighboring countries, especially Russia. Concerns expressed by many entities appear groundless in this regard.

3.2 Proteus Project

The Proteus Project is officially named the "Integrated mobile system for supporting anti-terrorist and crisis management operations" (Wojtkiewicz, 2009). Proteus is an extremely ambitious project fully based on Polish R&D entities headed by the Industrial Research Institute for Automation and Measurement (PIAP). This appears especially advantageous from the organizational and financial perspective. This project, valued at ca. $21 million USD, is 85 % supported by resources procured under the European Regional Development Fund (ERDF). Benefits connected with the implementation of the project are an important part of creating our own industry to support Poland's security system. This system is being established in connection with both anti-terrorist measures and the necessity to support the operations of the police, fire department, border patrol and the other services responsible for anti-crisis activities. The validity of the project and the necessity of providing the appropriate level of actions by the aforementioned services under crisis conditions are corroborated by more and more frequent challenges connected with violent atmospheric phenomena as well as with chemical and biological hazards. The severity of the effects of floods that are more and more often hitting Poland and other countries makes us realize the need for such actions.

The Proteus System is composed of several different but mutually integrated devices. The most important ones are: 1. A Mobile Command Centre; 2. A Mobile Robot Operator Centre with three Mobile Robots; 3. An Unmanned Aerial Vehicle (see Fig 2).

The Mobile Command Centre is the key element of the system. It is responsible for creating a modern environment for commanding action in the event of a crisis or threat. Owing to cutting-edge IT technologies, this command center facilitates making the best choices based on a thorough assessment of the crisis situation. The vehicle is equipped with extensive satellite systems and devices for the processing and analyzing of data coming from various sources, including the remaining Proteus components. Thanks to this, it can become a key stand-alone command post.

Fig. 2 The Elements of Proteus Project
Source: www.projektproteus.pl

The Mobile Robot Operator Centre looks similar. This vehicle is responsible for transporting three mobile robots to the site of operations. These can operate as a component of the vehicle, both in stationary and mobile forms, and outside it, in direct contact with the remaining parts of the system. The mobile robots work as three systems: the small robot, the medium-sized robot and the large robot. The small robot is intended to work in hard-to-access locations and spaces. Its compact dimensions facilitate easy use by one operator. Furthermore, the employed observational equipment (video and thermographic cameras) facilitate having an excellent view of the site of operations. The medium-sized robot is of interventional nature. It is used mainly in hard-to-access and architectonically complex locations. Owing to the utilization of advanced technologies, it can traverse, among other things, stairs. Its logistic operation involves 4 people. The machine is equipped, in addition to the aforementioned cameras, with explosive, chemical-agent and radiation detectors. The large robot is a heavy machine (ca. 300 kg) with enhanced functions. They allow to use the robot in extraordinary situations, in a complex environment, both in large areas and vast open spaces, facilitated by special suspension and wheels. The vehicle was designed as a partly autonomous system that will allow efficient operations, also without any external interventions. Thanks to the utilization of a manipulator with replaceable tips, it can be used to lift and carry different loads (up to 40 kg) and do other work, e.g. with a drill.

The Unmanned Aerial Vehicle will be primarily used for the surveillance of the site of operations. It has been designed as a largely autonomous machine that supports ground crisis response systems. Due to being equipped with video and thermographic cameras, it can record, monitor and transmit a picture to the Mobile Command Center. Its flight route can be appropriately programmed, so there is no need for constant monitoring. What is more, the aircraft can gather various information, since it is equipped with an array of sensors, including a fire sensor.

3.3 WB Electronics

WB Electronic is a joint-stock company operating in the field of supporting security and defense systems. As one of the few private companies operating for nearly 18 years in this hermetic sector, it is largely dominated by companies in which the State Treasury holds shares. This is the core company in a group of cooperating entities, and is especially known for its significant successes in the field of unmanned technologies. It has a monopoly on the production and trade of this kind of equipment in Poland. One of the main objectives of the group is the systematic design and construction of unmanned aircraft for the purposes of the Polish Army. The company is planning to deliver ca. 100 such machines within the next 10 years. Therefore, the company enjoys a high level of reputation and prestige among national institutions dealing in security. A substantial part of the company's revenue comes from exports (approx. 80 %). However, because of the increasing number of orders from the Polish Army, the company anticipates the balancing of the share of local revenues. In 2013, WB Electronics' revenue amounted to 48 million USD. The group is furthermore involved in operations in the field of electronics, wireless communication systems and remote control. It is cooperating with recognized R&D entities and higher-education institutions.

The operations of WB Electronics concentrate on 4 main areas: 1. C4ISR Systems; 2. Platform Integration; 3. Military Electronics; and 4. Systems Integration.

C4ISR Systems play a special role in the field of command support, especially for artillery forces. Owing to various communication, reconnaissance and information management systems, it can provide commanders with the intelligence and analyses needed to devise battlefield tactics. These operations are also based on reconnaissance activities. All this directs the commander in making the optimal decisions. WB Electronics associates special expectations and benefits in this field with remote-controlled vehicles and drones. The Fly Eye is a flagship project in this regard (see Fig. 3). This system can have a variety of implementations, both in terms of combat (e.g. artillery support), monitoring (e.g. battlefield) and control (e.g. state borders), as well as provides a solution for preventive, organizational, security and threat-elimination services (natural disasters and fires).

Fig. 3 The Elements of Fly Eye
Source: www.wb.com.pl

Platform Integration is a system connected with the implementation of tasks in the field of equipping different kinds of vehicles (combat, command, reconnaissance and specialized vehicles) and cannons with cutting-edge communication devices. This enhances the operational and combat value of the aforementioned equipment. Applications implemented by the company can be used in many ways and provide operators with different action options. The company enhances reporting, surveillance, enemy control, hazard warning systems.

Military Electronics are solutions in the field of communications, computer software and surveillance. These allow more-efficient information sharing, monitoring and reporting, and also the utilization of modern technologies for task planning by commanders and combat vehicle crew. The utilization of sensor technologies makes it possible to perform precise target tracking and identification operations.

Systems Integration facilitates cooperation between different devices and combat equipment by coordinating them into a single system. This applies first and foremost to cooperation between artillery systems and the capacities of radars and weather stations. Thanks to this, the commander can receive accurate data, among other things, on the activities, location and type of target, and also on weather conditions. In many cases, this can prove decisive when it comes to the effectiveness of combat operations connected with, e.g. bombardment.

WB Electronics is also leading a series of development projects. Some of these can soon become a regular part of the equipment of the armed forces. The nature of this work is consistent with the above-mentioned communications and surveillance products and technologies. It is to a large extent based on the search for modern and optimal solutions in the field of unmanned technologies.

4 CONCLUSION

New technologies are the future of active management and operations, both at the civilian and military levels. The ongoing changes in the field of industry and IT do not appear to be slowing down. Of paramount importance here is the magnitude of their impact and possible dependence of man on modern devices and programs. Not so long ago, the world we live in with the plethora of technological solutions and the advancement of technology was the subject of interest of the film industry (Star Wars) and science fiction. We live in the era of technologies that have been first presented or described in these works of fiction. The security of the contemporary world largely depends on man. While uncontrolled natural disasters or equipment malfunctions can occur, it is man who is responsible for the positive use of modern technologies. The perfect equipment should be used for the benefit of man and mankind and the security and development of the world. Wireless communication, unmanned wheeled vehicles and other products will most certainly contribute to the development, determine the quality of life, and improve his efficiency, including for the disabled. One positive thought is that new technologies are no longer something foreign to Polish engineering solutions. However, they can also plunge the world into chaos and a reality that will be hard to control. Advanced devices can then become a serious threat. If misused, they can constitute a real threat to millions of people. Cybernetic wars, terrorist attacks, mass elimination of enemies for profit, subjugations of territories or other negative goals are no longer virtual, cinematic or literary threats. Thus, the introductory quote to this paper was by Stanisław Lem, written in 1957.

The most important challenge is to use modern technologies for peace, man's welfare, security and harmonious development. This also applies to the military domain.

New technologies, especially those used for military purposes, are of special importance in Poland, and enjoy special applications. Businesses operating in this field, especially those analyzed herein are characterized by their rich traditions and successes. They are benefiting from cooperation with leading R&D centers, which are recognized global companies, and are selling their products worldwide. At the same time, they constitute substantial support for the Polish Army. This is especially important when considering the ever-increasing challenges of the modern world and the unpredictability of the global security environment.

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THE STRATEGY OF THE ARMED FORCES BASED ON CORE COMPETENCIES

Aneta NOWAKOWSKA-KRYSTMAN

Abstract: The article presents the formulation of the strategy of the armed forces on the basis of the assumptions of resource-based view. As a result, the armed forces are perceived as a bundle of resources, capabilities and competencies which are used to create and implement the strategy which aims at the satisfaction of the beneficiaries' needs in terms of security provision. The competency is connected with the potential of the armed forces perceived in the scope of core competencies which are the effect of synergy between resources and capabilities. Thus, the formulation of the strategy of the armed forces is presented in a slightly different methodological approach.

Keywords: the armed forces, core competencies, capabilities, resources, value chain.

1 INTRODUCTION

Strategic approach in management, command and control or defence and its development are interrelated with institutional, information and structural changes of the globalized world. Changes observed in the environment are so surprising that even the boldest scenarios failed to anticipated such events. Thus, this article attempts to tackle the problem of internal environment, i.e. determinants which condition the success of the armed forces. The polemic character of the article stems from the assumption that these are resources, skills and competencies of the armed forces which determine the success, namely the assurance of national security and not turbulences and unpredictability of the environment. The armed forces are presented in the category of core competencies which are decisive for the development possibilities. Thus, it is assumed that strategies are formulated from the inside to the outside. This approach was developed on the basis of the assumptions of resource-based view which belongs to strategic management. This is a relatively new approach to the creation of an advantage.

From the point of view of resource-based strategy the analysis focuses on the potential of the armed forces. Thus, for the needs of this article it was assumed that the strategy of system development, which results from the strategy of national security[1], should be defined as the art and science of development, using, coordination and combining resources (tangible and intangible resources) to accomplish objectives which contribute to the assurance of national security (i.e. for beneficiaries and stakeholders) in the scope realized by the armed forces[2]. Thus, the implementation of the strategy is a process of looking for resources and their proper usage allows to achieve strategic objectives.

2 THE ESSENCE OF RESOURCE-BASED STRATEGY

Thus, what is a strategy? Strategy according to Public Governance is a concept of the choice of priority activities (national interests) which are valuable for *stakeholders*[3]. While, the main stakeholders are the citizens (Table 1). In order to accept the assumptions of resource-based view it is necessary to look at the realization of the objective through the prism of formulating the strategy as it is done by R. M. Grant which involves five stages[4]:

1) The analysis of resource base which belongs to the armed forces;

[1] The national defence strategy is a process – i.e. a sequence of activities undertaken by a country – which aim at the provision of national security in a long time-span taking into account different perspectives. It means that a country tries to sustain and develop national strength in order to counteract all threats in a given environment, having at the disposal certain internal potential as well as the necessary external support. A. Bodnar, *Decyzje polityczne. Elementy teorii.* Warsaw : 1985. p. 220; A. D. Chandler, *Strategy and Structure. Chapter in History of the American Industrial Enterprice*, Cambridge, Mass. 1992, p. 14.

[2] *Dictionary of Military and Associated Terms.* Joint Publication 1-02. Washington : D. C. 2001, p. 358.

[3] Identification of *stakeholders* is one of the most vital and popular methods of strategic analysis. *Stakeholders* are understood as organizations, groups in a country, which are somehow dependent on functioning, and in the analyzed case the armed forces, and/or exert influence (can influence) the country. The subjects directly or indirectly benefit from or bear the costs connected with their functioning. Thus, the military subsystem is linked to the interests, situations expected for the satisfaction of their needs and aspirations. The interests of *stakeholders* can be contradictory. Thus, a country must consider their needs and pressure to determine the hierarchy of importance. See: A. Nowakowska-Krystman, *Interesariusze systemu bezpieczeństwa i obronności państwa.* In: *Obronność w edukacji dla bezpieczeństwa*, eds. S. Olearczyk, Z. Piątek, Częstochowa 2014; I. Penc-Pietrzak, *Planowanie strategiczne w nowoczesnej firmie*, Warsaw : 2010, p. 139.

[4] GŁUSZEK, E.: Formułowanie strategii w nurcie zasobowym – ograniczenia i wyzwania. In: KRUPSKI, R. (ed.), *Zarządzanie strategiczne. Ujęcie zasobowe.* Wałbrzych : 2006, p. 78.

2) The assessment of the competencies of the armed forces, while the competencies of the armed forces are not assigned to a person but they are the effect of combining the resources;
3) The analysis of resources potential, including competency to generate benefits and values;
4) The choice of strategy;
5) The extension and improvement of resource base.

The components should be understood as:
– identification of resources and their assessment in the aspect of strengths and weaknesses. Resources can be analyzed according to the distinguished groups, i.e. tangible and intangible resources[5] or use M. E. Porter's Value Chain;
– identification of competencies where the possible starting point can be the recognition of strategically important services (products), processes of their creation as well as determination of beneficiaries' groups, i.e. the recipients of national defence service and the stakeholders, i.e. the groups of the environment the military subsystem (the armed forces)[6], and then a search for links between them and the areas where values are created, which constitute the value chain. Thus, any activity, the basic one or the auxiliary, should be carefully analyzed;
– the assessment of resources in the aspect of creating benefits and values, e.g. *Public Value*, which should take into consideration two elements: durability of the advantage over a threat) and the possibility of outbidding, takeover of the benefits generated by resources and competencies. Since, not every potential is valuable from the point of view of creating perm value. The market decides about such capacity, inter alia the possibility to use it in order to take a chance or neutralize the threats, protect against the purchase, takeover by threatening organizations. At the same time, it should be remembered that the value of resources and competencies is changeable in time and is characterized by a small amount. If a subsystem does not possess core resources and is not able to obtain them from a market, it is necessary to apply agreement on cooperation in order to safeguard the needs of beneficiaries and stakeholders of security. Thus, the assessment of

Table 1 The characteristics of public management model

Traits of organization's subsystems	New public service
Fundamental assumptions	The democracy theory, the concepts of the development of a public sphere based on knowledge
Dominating model of rationality and organizational behaviour	Political, economic and organizational rationality
The concept of public interest	Public interest is the result of social dialog on the shared values
Strategic stakeholders	Citizens
Understanding of the role of a country	Serving, helping through negotiations and brokering for the benefit of the citizens and social groups, the creation of public value
The mechanism of attaining the set goals	Creation of public and private coalitions as well as social agencies in order to satisfy the agreed needs
External responsibility	Multilayer, taking into consideration law, national values, political norms, professional standards, interests of the citizens
Decision rights	Rights which are justified by needs, connected with responsibility
Typical organizational structure	Structures which facilitate cooperation and leadership in external relations
Basic motivators having impact on administrators/managers and employees	The appointment of public service, possibility of acting for the benefit of the common good

Source: KOŻUCH, B.: *Zarządzanie publiczne.* Warsaw : 2004. pp. 79–80.

[5] NOWAKOWSKA-KRYSTMAN, A.: *Determinanty sukcesu systemu obronnego państwa w świetle teorii zasobowej.* Warsaw : 2014.
[6] Military subsystem, beside the civil subsystem and the control / management subsystem is the basis for the functioning of the national defence system.

potential is interrelated with the analysis of the environment[7];
– the choice of strategy which should best use core competencies and at the same time systematically strengthen them and protect them against depreciation;
– identification and filling out a resource gap, i.e. improvement and extension of potential.

Thus, what is the concept of formulating a strategy based on core competencies?

3 CORE COMPETENCIES

The second half of the 80s of the 20th century was the beginning of the development of a branch of management called the concept of resource-based view. As the name indicates, resource-based view assumes that an organization is a set of resources, capabilities, and learning (competencies) – thus, it is oriented inside an organization. Unlike other views, resource-based view assumes that resources are factors which are more important in the process of formulating a strategy than the state of situation in the environment. An organization (the armed forces) has a significant influence on its own resources, it can shape and control them to much bigger extent than with reference to the environment. Thus, the biggest contribution of the resource-based view to the development of strategic management is the analysis of the manner in which resources generate value, which results in a market advantage. The advantage is created on the basis of properly configured resources and capabilities into core competencies (complex resources).

The main message stemming from the competencies theory is the idea of making use of a unique combination of resources in the process of forming an advantage on the market of providing security. Thus, what are those competencies of the armed forces?

The source of advantage should be looked for in the possessions of the armed forces (what is better at the disposal of the armed forces in comparison to the possessions of the allies or the organizations posing threat to them) and in the things they do (what are they better at). In the light of resource-based view it is possible to distinguish (in the armed forces) competencies which involve resources and capabilities[8].

The term 'resource' in the subject literature is defined depending on the needs of the publication: it can be understood as any factor of production at the disposal of an organization and used in the process of production, division, exchange and consumption[9]; according to another source these are economic goods accumulated at a given moment[10]; or understood as some quantity of something which was collected, accumulated in order to be used in the future. It is some kind of a reserve, inventory[11]. Another conceptualization suggests that a whole organization should be perceived as resource (its property, potential), and not particular assets. Thus, resources entail everything what is the strength or weakens of a given organization[12], while some of them can be treated as strategic resources[13]. J. B. Barney divides resources into physical, human and organizational ones. The first group includes: machines, appliances, location, access to resources. The second includes: employees (inter alia: professional staff, employees of the army, administrative employees) with their experience, abilities, relations, intelligence. The third one is: structure, internal systems of the armed forces. Grant, who was already mentioned in this work, extended the set by technology, financial resources and reputation. Thus, it is an extensive definition of resources which involve all assets, skills, processes, attributes, information and knowledge, which are controlled by an organization as well as make the realization of a strategy possible[14].

The division presented in this work shows a classic concept, i.e. the distinction of tangible and intangible resources. The tangible resources are placed at the lowest level of the hierarchy forming the advantage; they are characterized by the smallest value which depends on their skilful usage – since every organization has at the disposal numerous basic resources however, they are nothing without the capabilities of their mobilization and exploitation. Thus, the armed forces are not solely the portfolio of assets (tangible resources), but also

[7] As far as external support is concerned, it should be notices that the management of an organization does not require self-sufficiency of the organization. A country in the time of crisis or war can be supported by external resources, which is regulated by agreements assessed in the framework of rational capital. In this dimension it is necessary to pay attention to resource strategies as it is seen by Romanowska, M. who distinguishes here: errand boy, rich dilettante, business architect, the treasure owner. Romanowska, M. Dostosowanie strategii przedsiębiorstwa do jego zasobów. In: Krupski, R. (ed.), *Zarządzanie strategiczne. Ujęcie zasobowe.* Wałbrzych : 2006.

[8] URBANEK, G.: Kompetencje a wartość przedsiębiorstwa. Warsaw : 2011. p. 35. W. Czakon, *Istota i przejaw kompetencji relacyjnej.* In: KALETA, A., MOSZKOWICZ, K.: (eds.), *Zarządzanie strategiczne w badaniach teoretycznych i w praktyce.* Wrocław : 2008, p. 60.

[9] MAREK, S., (ed.), Elementy nauki o przedsiębiorstwie. Szczecin : 1999, p. 314.

[10] CABAN, W. (ed.): *Ekonomia. Podręcznik dla studiów licencjackich.*. Warsaw : 2001. p. 22.

[11] STEFANOWICZ, B.: *Informacja.* Warsaw : 2004, p. 78.

[12] FAZLAGIĆ, A. J.: *Zarządzanie wiedzą*, *„Poradnik gazety prawnej"* 2001, No. 34, p. 37.

[13] PENC, J.: *Leksykon biznesu.* Warsaw : 1997.

[14] URBANEK, G.: op. cit., pp. 23–24.

of skills. This point of view was proposed by R. Grant, where resources are 'inputs' in the process of creating national defence. Resources, themselves, are not productive, they are activated to create some value by capabilities. Thus, capabilities are understood as an individual and collective qualification to perform particular tasks, capability to implement resources in order to attain the desired effect. Since, resources are transformed into final products with the use of inter alia such factors as: the system of information management or motivation system. Capabilities are the derivative of specific abilities owned by the organization which result from complex interaction between the resources during a process[15]. Whereas a process is a complete sequence of activities which take place one after another in a given order and time as well as with proper duration, which constitutes a value for the beneficiary. A process refers to a certain organizational routine, a pattern of conduct. Thus, an organization should identify its key processes, manage them and properly support them financially.

The subject literature also provides distinction between: 1) individual and organizational capabilities as well as 2) technical and social. Individual capabilities (rather abilities) include: financial knowledge, service, marketing one or individual leadership skills to set the direction of performance, communication of vision, organization's mission or the motivation of employees. Organizational capabilities stem from the procedures of risk management, process management or resources management. They decide about the essence of the armed forces, their organizational culture, innovation or of the flexibility and fastness of operations.

In another view, capabilities are divided into three types depending on the process they refer to. The first one concerns the capability of orientation from the inside to the outside, i.e. they respond to the external requirements. They include: logistics, management of human resources, the process of services creation. The second one is connected with external issues, i.e. the connection of an organization's internal processes with the environment's elements, in order to facilitate effective prediction of the requirements of the environment, establishing stable relations with partners, allies, armament corporations. Fastening capabilities are the third type, they aim at the integration of the earlier ones. They include: the development of a strategy; realization of orders; purchase of equipment[16]. Resources pertain to the things possessed by the armed forces, while capabilities and competencies to the things they do. (The ladder of formulating the potential of the armed forces on the basis of resources is presented on Figure 1).

At this point it is worth to pay attention to the concept of intangible resources, which are seen as a special source of value. In the subject literature there are many definitions and classifications of intangible resources. Thus, it is possible to encounter such terms as: intellectual capital, knowledge capital, invisible assets, intangible market assets, intellectual potential, intangible fixed assets, intangible assets, invisible assets. The assumed division results from the concept of a MERITUM project (*MEesuRing Intangibles To Understand and improve innovation Management*), which states that intangible resources include human resources, organizational/structural resources, relational capital[17].

In all armed forces the sets of resources and capabilities are similar. However, a skilful connection of the available resources allows to achieve additional quantitative and qualitative effects. Specific skills which facilitate the exploitation of resources in a more productive manner than in a different unit are called strategic assets [18].

Resources can be combined in different relations: intangible resources – tangible resources; intangible resources – intangible resources; tangible resources – tangible resources. Thus, many combinations of resources are possible. Only relatively small part of those relations distinguish the armed forces positively. It is worth to add that those processes can be perceived, however, most of them seem to be hidden, i.e. based on the exchange of information, knowledge among human resources. The processes are characterized by strong multilateral relations which integrate them into one coherent setup. Thus, it is difficult to distinguish the mentioned synergic relations, as well as it is difficult to copy them because they belong to a group of activities which are socially complex, so they become a permanent advantage[19]. Thus, capabilities pertain to: the ability to use resources, possibility of their implementation, level of their application, as well as to: fast and apt reaction to a change as well as proper combination of different types of resources. As a result, it is not only knowledge about what should be done and how but also conviction, intuition and definitely creativity are useful in the process of solving strategic problems[20].

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15 URBANEK, G.: op. cit., pp. 36 - 157.

16 URBANEK, G. op. cit., p. 37.

17 *Measuring Intangibles To Understand And Improve Innovation Management. Preliminary Results*. Available at: http://www.oecd.org/sti/ind/1947863.pdf (5.11.2015 r.).

18 OBŁÓJ, K.: *Strategia organizacji. W poszukiwaniu trwałej przewagi konkurencyjnej*. Warsaw : 2007. p. 127.

19 HUFF, A. S., FLOYD, S. W., HERMAN, H. D., TERJESEN, S.: *Zarządzanie strategiczne. Podejście zasobowe.* Warsaw : 2011. pp. 48–50.

20 GODZISZEWSKI, B.: *Zasobowe uwarunkowania strategii przedsiębiorstw.* Toruń : 2001. p. 69.

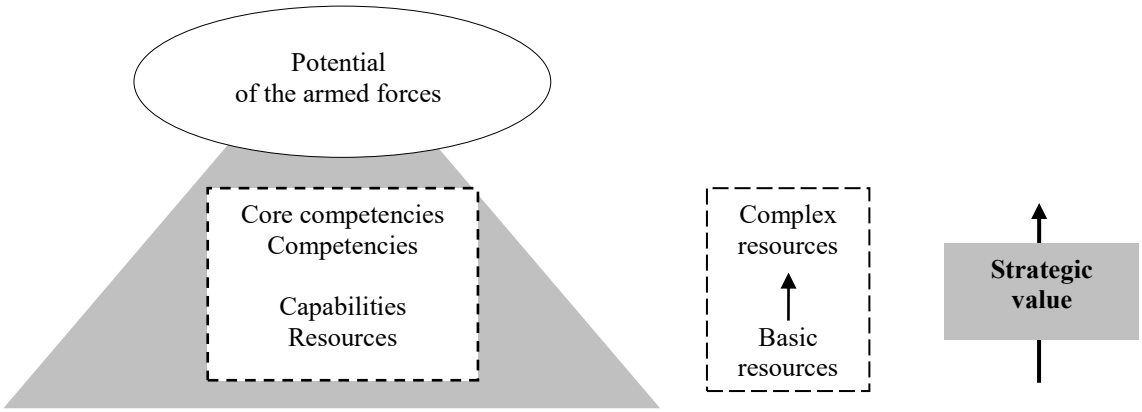

Fig. 1 Potential of military subsystem in the framework of the ladder of resources
Source: Own elaboration.

Resource-based view also mentions the third component of an organization. i.e. organization's competencies. The competencies are a complex mixture of resources and capabilities, i.e. they are created by the linkage of resources and capabilities which are proper for the armed forces, which have to be mastered to provide the security market with certain tasks more effectively than an opponent. They are equated with the key factors of a success. Unlike resources they are invisible, they are not evaluated. Competencies can be given the value in themselves or they can increase the value of resources which they are connected with[46].

The formulation of core competencies is done in three stages which resemble a learning loop. The first one – is the routinization loop, in which an organization learns how to use standard resources by creating practice which, with the time passing, becomes specific skills which are observed in the environment of the armed forces. In the capability loop the efficient practice accompanied by organization's routine result in skills which are generalization and determine how the mentioned practices should be exploited in a given context. Thus, capabilities can be both mastered as well as created from the scratch. Only some of them are of core importance and they are moved to the strategic loop. Environment plays a significant role in the learning processes as it appoints the key factors. Learning which is observed in the strategic loop makes it possible to renew the processes of organizational capabilities which are the basis for a long-lasting success of a military subsystem[47]. Advantage can be simple, i.e. based on one or a few traits or complex which is based on a bigger set of variables. Most of the advantage gained on the possessed competencies can be estimated as small or big[48].

As it has been already notices, not all resources, capabilities and competencies are equally valuable – some of them facilitate the process of advantage gaining, some of them block the process. Those, which are characterized by certain traits become core competencies. Synergic effect which is observed due to the possessed resources and capabilities is perceived as core competencies[49]. C.K. Prahalad and G. Hamel presented the core competencies[50] in a form of a big tree (Figure 2), where:

- the trunk and the main limbs are key products, in our case – armed conflicts, peace and stabilization missions;
- smaller branches represent particular military units;
- leaves, flowers and fruit – these are final products (services) of military units, for example: reconnaissance, interconnection;
- the system of roots stands for competencies of the armed forces.

It is worth to emphasize that key products are a physical expression of the exploitation of competencies and the component of final products. Thus, referring to the discussed aspect, the key

[46] GŁUSZEK, E.: op. cit., p. 78; see: D.W. Hubbard, *Pomiar uniwersalny.* Warszawa : 2013.

[47] PENC-PIETRZAK, I.: op. cit., pp. 196–197.

[48] JAUCH, L. R., GLUCK, W.F.: *Business Policy and Strategic Management.* New York : 1988, p. 184.

[49] JASIŃSKA, A.: Wybrane elementy kapitału intelektualnego w świetle założeń koncepcji zasobowej. In: PRZYBYŁA, M. (ed.): *Zarządzanie – kontekst strategiczny, kulturowy i zasobowy.* Wrocław : 2007. pp. 257–260.

[50] Core competencies are treated by C. K. Prahalad and G. Hamel as a uniform resource, i.e. they do not distinguish tangible and intangible resources.

product takes the form of services and products of the armed forces and their objective is to provide national security – national defence. This is done by activities (final products) of varied subjects, inter alia of troops and sub-troops of the armed forces. It should be pointed that core competencies are the basis for the whole families of products and they can be used to create new products and new markets, i.e. new types of protection against novel, specific types of threats. A statement that – looking only at the final products – it is possible to miss the strength of a unit, as well as – looking only at leaves, flowers, and fruit – the strength of a tree is the quintessence of the 'tree'. A tree is the symbol of the whole armed forces, thus, the formulation of advantage should begin at the level of a subsystem, and not at the level of individual units, then combined operations will attain the anticipated effect. The vision and mission of an organization are the indicators of key capacities. In order to realize a vision, a system has to undertake diversified activity owing to which it gathers varied experiences which are the basis for core competencies. As a result, there emerge new ideas and ways of operation as well as new services for the assurance of security on new markets.

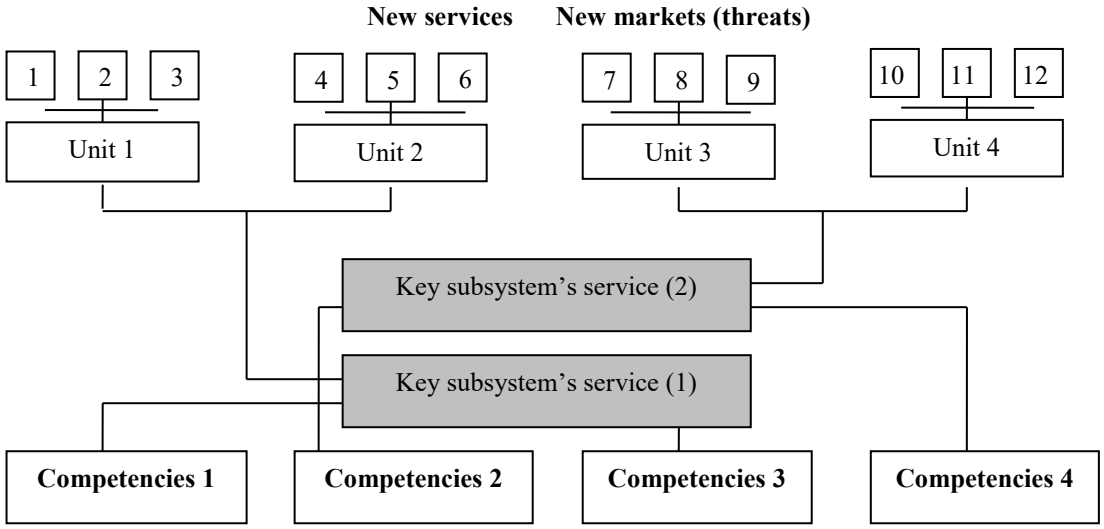

Fig. 2 Hamel's and Prahalad's competency tree of a military subsystem
Source: own elaboration on the basis of K. Obłój, *Strategia organizacji. W poszukiwaniu trwałej przewagi konkurencyjnej*, Warsaw : 2007, p. 136.

4 CORE COMPETENCIES AS A RESULT OF THE VALUE CHAIN

The potential of the armed forces can be analyzed not only by resources and capabilities and as a result by competencies but also by looking at it through the prism of the value chain (*Value Chain Analysis)*, where competencies are created as a result of coordination and integration of particular functions of M. E. Porter's value chain of an organization, i.e. a system of activities which create the added value[51]. The starting point is the assumption that the armed forces are a chain of subsequent stages of operation.

Basic activity is the essence, objective of the armed forces functioning. This results from the main process of the transformation of resources which are realized by a subsystem. Thus, they are directly connected with the processing of resources and the production of the final product, service and their delivery to beneficiaries, in the analyzed case they reflect a sequence of activities which show the way of services' rendering in the scope of security provision[52].

Auxiliary functions support basic activities. They are based on administration activities and those supporting the main activity. They involve the system strategic management/control, strategies which pertain to development as well as support

[51] PORTERA, M. E.: *Przewaga konkurencyjna: osiąganie i utrzymywanie lepszych wyników*. Gliwice : 2006.

[52] OBŁÓJ, K.:, *op. cit., p. 366;* Strategie organizacji, Zarządzanie firmą. Strategie, struktury, decyzje, tożsamość. Warsaw : 1995. p. 62.

strategies (the functional ones). The supporting activities assure the effectiveness of operation. The realization of the above functions can be presented in the following way:

1) basic functions include inter alia:
   - the analysis of the potential goals of an attack (e.g. objects, terrorist hiding places);
   - the choice or the attack's target;
   - the choice of the manner of attack's realization (e.g. if the attack is launched from the air, land, or the sea);
   - planning and simulation of options prepared on the basis of the gathered data (staff, financial, and resources review);
   - service productive operations – the preparation of operation and support teams, provision of the indispensable resources (e.g. explosives, means of their transportation) which are necessary to carry out the operation;
   - the provision of a service, i.e. a physical provision of the product – the operation;
   - withdrawal/evacuation from the place of the incident;

2) auxiliary (supporting) functions, which include inter alia: strategic management of a military subsystem, which involves its vision, development strategy (e.g. the one included in the NATO strategy, as well as the National Security Strategy of the Republic of Poland 2014[53]); functional strategies which include: human resources policy (recruitment, military training), technological strategies (political decisions concerning military equipment), financial strategies (political decisions on the governmental expenditure in relation to the GDP), strategies concerning communication with the external environment (inter alia: through the promotion of the defence by means of support given to schools with military classes).

It is worth to mention that a value can be created in different spheres of subsystem's functioning, both in the scope of basic functions as well as the auxiliary ones. Thus, the value chain illustrates adding of values in subsequent stages of service creation.

In the framework of this analysis, it is necessary to identify and properly allocate tangible and intangible resources into coordinated aspects of system operation so that the system represents the highest possible value. Value is the price which a country is ready to pay for providing security to the beneficiaries. Value (W) can also be expressed as the relation between the functions of a service (S) and the cost of its acquisition by a county, i.e. the price which a society must bear with relation to the title of its provision by military subsystem (T)[54], in accordance with the following formula W = S / T.

The indicators of a success enumerated by Porter concern all activities distinguished by an organization, which create value and their interactions. He assumes that it is impossible to understand the source of advantage if we look at an organization only as a whole and not as a set of basic and auxiliary activities (Figure 3). An advantage can be achieved by creating a unique chain of values, by more efficient and cheaper operation than other do it. In order to recognize the elements of the armed forces as especially valuable they[55]:

- have to create a set of resources and skills within the armed forces, which together provide a unique competencies effect;
- usually require a cooperation of several key functional divisions (value chain);
- require other applications than in case of partners and/or competitors e.g. opponents as well as the possibility to switch to new products and markets in order to create strategic advantage;
- their basis (knowledge) has to be general enough so that the changes in the environment do not destroy them.

Thus, a strategy in this perspective means that the armed forces create core competencies in the process of their operation, i.e. during the process of implementing varied resources and skills. It is worth to remember about a hierarchical layout of the concepts of resources, capabilities, competencies, core competencies which stem from the strategic value and the difficulty of imitation (Figure 3).

[53] *Strategia Bezpieczeństwa Narodowego Rzeczpospolitej Polskiej*, Available at: https://www.bbn.gov.pl/ftp/SBN%20RP.pdf (6.11.2015)

[54] PENC-PIETRZAK, I.: op. cit., pp. 213-215.

[55] FAZLAGIĆ, A. J.: *Zarządzanie wiedzą*,.op. cit., pp. 11–42; idem, *Zarządzanie wiedzą w praktyce*, „Controling i Rachunkowość Zarządcza" 2001, 2., pp. 23–28; OBŁÓJ, K., op. cit.; PIERŚCIONEK, Z.: *Strategie rozwoju firmy*, Warsaw : 1998. pp. 21–24.

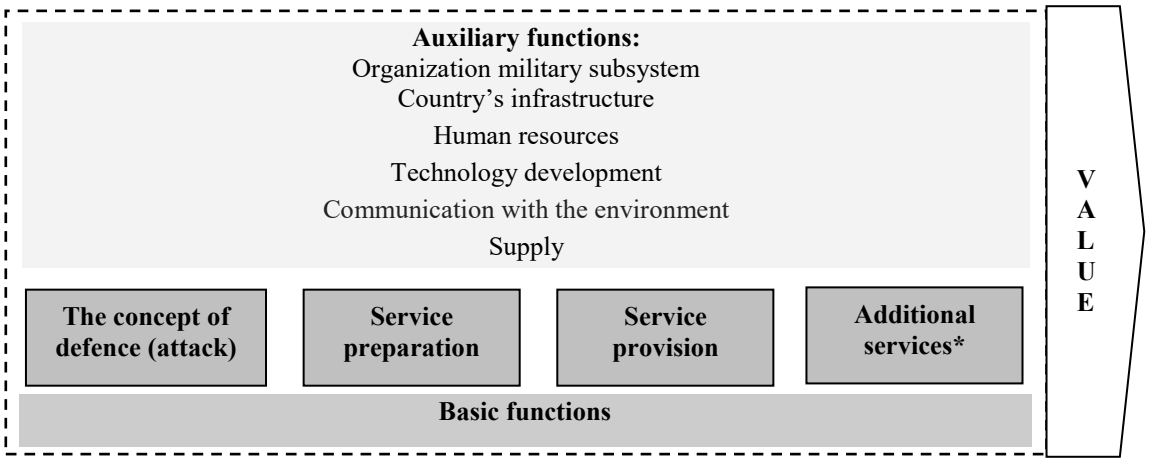

Fig. 3 Internal system of organization's activities
Legend: * additional services, inter alia provided by civil subsystem
Source: Own elaboration on the basis of M.E. Porter, *Przewaga konkurencyjna: osiąganie i utrzymywanie lepszych wyników.* Gliwice : 2006.

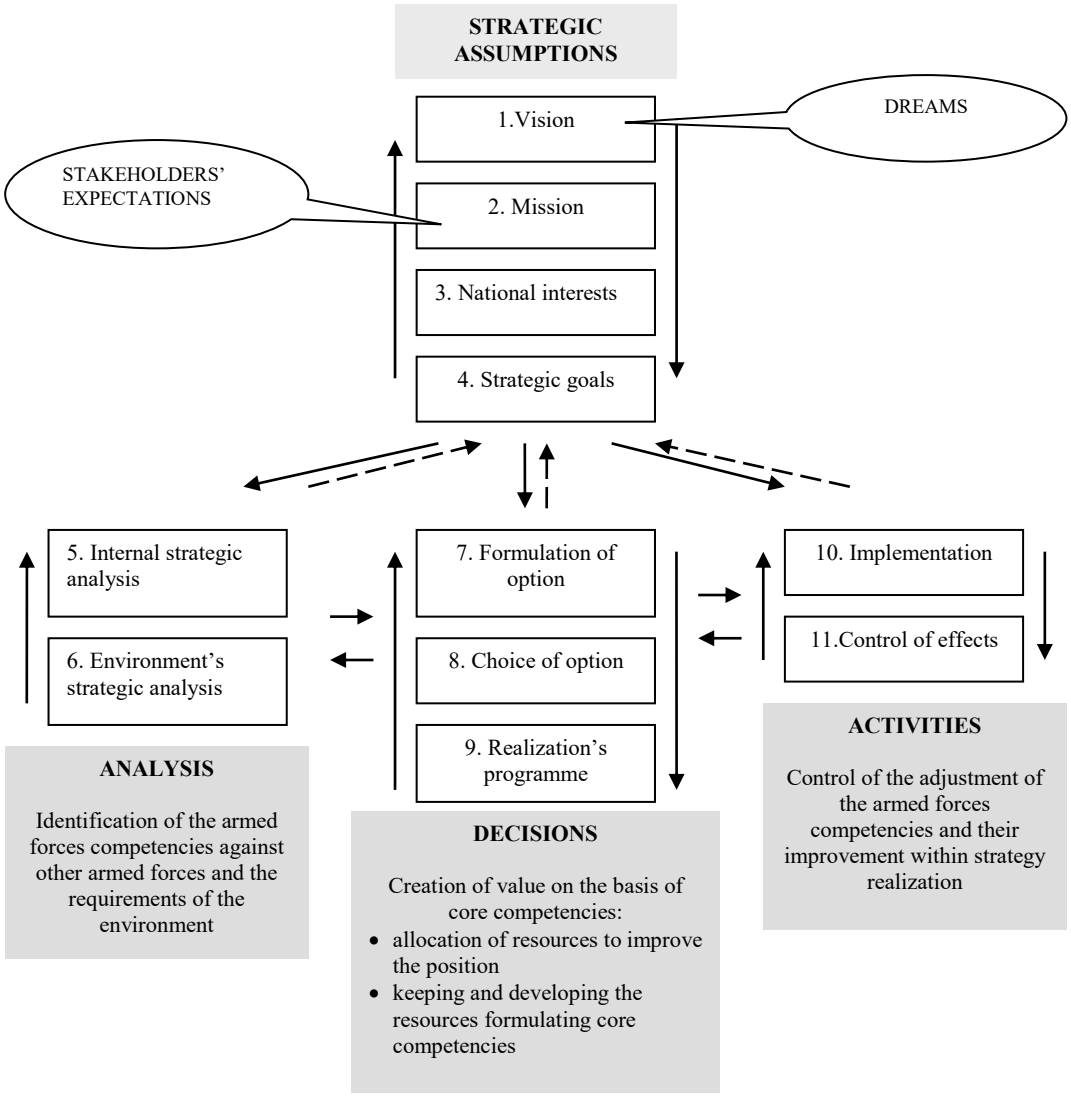

Fig. 4 New procedure of strategic management
Source: Own elaboration on the basis of A. Kaleta, *Strategia przedsiębiorstwa.* Wrocław : 2004, p. 80.

5 CONCLUSION

According to the assumptions of resource-based view, it has been assumed that the armed forces are a beam of resources, capabilities and competencies which are fished out in the process of tasks' realization (with the use of the value chain), which are used in the creation and implementation of a strategy, with the goal to satisfy the needs of beneficiaries in the scope of security provision[56]. With its use, it is possible to explain how the armed forces which operate in a given environment gain and sustain their position and value. The three basic assumptions can be expressed by the following statements[57]:

1) In order to understand the sources of the armed forces' success, it is necessary to comprehend a configuration of unique resources and capabilities;
2) There is an attempt to explain what traits of resources and competencies are particularly important;
3) It is assumed that between resources and intentions there have to be dynamic tensions, which can be observed with the use of value chain.

Of course the assumption that an advantage is formulated exclusively on the basis of internal factors is a simplification of the reality. However, if core competencies result from the clash with reality, they stem from allied operations, common trainings, they are not isolated factors of a success. Still, the elaboration of a strategy should take into account all streams[58]. The article puts emphasis on the one which should be a starting point, namely the resource concept. Thus, the formulation of a strategy should take the form presented on Figure 4.

[56] KOCH, R.: *Słownik zarządzania i finansów. Narzędzia, terminy, techniki od A do Z*, Kraków 1997.

[57] OBŁÓJ, K.: op. cit., pp. 85–91.

[58] The streams of strategic management:
- classical direction which entails the 60s and 70s of the 20th century;
- in the 80s and 90s prevailed evolutionary, procedural and systemic perspectives;
- there was a parallel development of a direction which focused on competitive positioning and the structure of sectors;
- in the 90s there was a focus on the extension of resource-based view;
- presently strategic dynamics is analyzed.

It is worth to emphasize that the evolutionary character of strategic management is not entirely historical, since all streams have supporters up to the present day.

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