

## EVALUATION SYSTEM FOR FACTORS AFFECTING CREATIVITY IN THE LITHUANIAN ARMED FORCES

Jurgita Raudeliūnienė<sup>1</sup>, Ieva Meidutė<sup>2</sup>, Giedrius Martinaitis<sup>3</sup>

<sup>1, 2</sup>*Department of Business Technologies, Vilnius Gediminas Technical University, Saulėtekio al. 11, LT-10223 Vilnius, Lithuania*

<sup>3</sup>*The General Jonas Zemaitis Military Academy of Lithuania, Šilo g. 5A, LT-10322 Vilnius, Lithuania*

*E-mails: <sup>1</sup>jurgita.raudeliuniene@vgtu.lt (corresponding author);*

*<sup>2</sup>ieva.meidute@vgtu.lt; <sup>3</sup>giedrius.martinaitis@mil.lt*

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**Abstract.** In a constantly changing environment, factors influencing creativity and approaches to evaluating them, considered controversial in the scientific literature and in practice, are also experiencing changes. Different authors evaluate and interpret factors affecting creativity differently. Consequently, the problem how to identify and evaluate which of the approaches fully reflects the situation arises. The present article deals with these problems by combining the approaches of different authors from the aspects of identification and evaluation of factors affecting creativity. The aim of the article is to develop an evaluation system for factors affecting creativity in the Lithuanian Armed Forces. In an attempt to identify and evaluate factors affecting creativity, expert and multi-criteria methods for evaluation were applied. A multi-level system for the evaluation of factors affecting creativity, that creates preconditions favourable for the identification of factors affecting creativity (by means of the method of determination of the significance of criteria), more objective evaluation of factors affecting creativity and development of suggestions for the stimulation of creativity, was suggested.

**Keywords:** creativity, factors affecting creativity, identification of factors affecting creativity, evaluation of factors affecting creativity.

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### 1. Introduction

Due to the process of Globalization and increase of organizations' dynamics and importance of knowledge management during the last decades, organizational success is closely connected with creativity and innovation; hence, nowadays economy is referred to as the knowledge and creativity economy. Recently, it was admitted that the maintenance of the long-term competitive advantages mostly depends on the level of creativity in organizations, whereas the motivation for creativity and the results of this activity

could be significant not just to individuals alone but also to organizations, certain regions and even countries. Although creativity is usually connected with business organizations, its development could also be useful for such public-sector organizations as, for example, the Lithuanian Armed Forces; therefore, in the Lithuanian Military Doctrine, the motivation for creative thinking is identified as one of the objectives. Organizations' managers and employees responsible for decisions in knowledge management, taking into consideration the importance of creativity for such processes as new product (or service) development and acquisition of long-term competitive advantages, determine a goal: to stimulate the creativity of certain employees and the whole organization in order to develop products (or services) that are hard for competitors to imitate. In order to achieve this goal, it is required both to have a good understanding of the phenomenon of creativity and manage to identify factors affecting creativity, as well as methods for evaluating them.

After recognizing creativity as a core factor affecting organizations' innovation and competitiveness, researchers and practitioners have paid a particular attention to the investigation of this sophisticated phenomenon in their studies. The studies have indicated that creativity is not an innate human quality but a developed human ability; therefore, in the scientific papers, a considerable attention is paid to the identification of factors affecting creativity. During these studies, a set of factors affecting creativity, which could be applied to stimulate creativity at different levels: individual, group, organizational, or country, was estimated. However, in recent scientific papers, the process of the identification of factors affecting creativity is emphasised more than the process of the identification of methods required for a comprehensive evaluation of interrelated factors affecting creativity. Consequently, organizations seeking to stimulate creativity are facing the problem of how to develop and select for the evaluation an expedient subset of factors affecting creativity, the implementation of which would lead to the effective results achieved in organizations' innovation development processes.

The object of the research, presented in the article, is the identification and evaluation of factors affecting creativity in the Lithuanian Armed Forces. The aim of the article is to present the system for evaluation of factors affecting creativity adapted to the Lithuanian Armed Forces. Presenting the problems connected with the phenomenon of creativity and its significance, and structuring the factors affecting creativity, theoretical methods of analysis, comparison and generalisation are applied. Expert and multi-criteria methods for evaluation are used for a comprehensive identification of creativity factors.

## **2. Evaluation of factors affecting creativity**

### **2.1. Theoretical evaluation aspects of factors affecting creativity**

The significance of creativity as an extraordinary human quality was noticed many years ago but, during a long period of time, it was regarded as an exceptional and highly rare ability acquired by birth; in other words, creativity was considered as a God-given talent.

During the 6<sup>th</sup> and 7<sup>th</sup> decades of the last century, the phenomenon of creativity was investigated by various scientists. Even in early studies, it was already estimated that creativity and genius are not mystical human qualities. Investigating the activity of creative geniuses, T. Edison has declared that geniuses' inventions are achieved by 99 per cent of perspiration and 1 per cent of inspiration (Titus 2007) and, by declaring that, he confirmed J. W. Goethe's saying that genius is innate diligence. According to the studies, it was found out that creativity as human quality can be developed and trained as the result of continuous practices and special techniques and methods applied. Hence, this phenomenon has become the object of studies of the researchers of various scientific fields.

Creativity is a complicated and complex phenomenon; therefore, it is investigated and interpreted by various scientific disciplines, such as psychology, social psychology, sociology, adult education, organizational behaviour studies, knowledge management and etc. The reasons mentioned have resulted in the absence of a universal definition for creativity, and so authors have provided a variety of definitions in their works (Simon 2005; Watson 2007), describing creativity as, for example, a production of novel, useful ideas in various human activities; a process of persuasion, as people become creative in so far as they are able to persuade others to be recognized as creative; a process consisting of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements and etc., making guesses and formulating hypotheses about these deficiencies, measuring, testing, re-testing and possibly modifying these guesses and hypotheses and, finally, communicating the results.

Taking into consideration the variety of creativity concepts and theories, explaining it, all of these approaches and theories could be systematized. M. H. Chen has systematized and identified four approaches to creativity, namely the evolutionary approach, the cross-disciplinary science approach, the social system approach and the social network approach. The evolutionary approach to creativity identifies creativity as a social process which is characterized by volatility and certain selection process and is caused by human preferences, surrounding factors and socialization. According to the cross-disciplinary science approach, creativity is viewed as a complex phenomenon, extending the limits of psychological knowledge, which cannot be explained by a single discipline and, therefore, must be studied comprehensively, applying such disciplines as sociology, organizational theory, economic theory, metrology and social anthropology. Employing the disciplines mentioned, such aspects as environment, culture, experience, knowledge and skills must be taken into account. According to the social system approach, creativity, in social context, is considered as a result of the interaction between the following three subsystems: the field (various estimated rules and procedures), the sphere (all individuals following the prescribed rules and procedures), and the individual. Taking into consideration this approach, it is highly important to link creativity to individual, group and organizational levels that interact as one huge social system (Chen 2008).

In the discipline of Knowledge Management, creativity is connected with the process of knowledge development. The aim of this process is to develop new competencies, management tools, processes and products (services) in order to create greater value

for an organization and its clients. During the process of knowledge management, the organization must either make decisions or create knowledge within itself, or acquire knowledge outside itself; therefore, the potential for creativity is crucial (Probst *et al.* 2006).

Creativity is highly important for making strategic decisions (Savanevičienė, Gudonavičius 2007). It is recognized that the ability to create is mostly related to the acquisition of competitive advantages, whereas, according to T. Levitt, the future and the utility of business, and the maintenance of competitive advantages, depend on the degree of creativity in organizations (Titus 2007).

In order to systematize the value of creativity, it may be evaluated from technological, economic and cultural-artistic aspects. From the technological side creativity is inseparable from the process of the development of new products, ideas and technologies. In case of the economic aspect taken into consideration, creativity is important for turning these new ideas, products and technologies into new business or new industries, and thus leading to creating of a significant added value, in other words, leading to economic benefits. Cultural-artistic aspect of creativity refers to the ability to invent new art forms, concepts, designs and individual works of art (Suciu *et al.* 2009).

According to the form of display, the value of creativity could be divided into material and non-material. In case of material aspect involved, creative innovations are incorporated into material products. As a result, creativity is leading to inventing products that create new sensations (e.g., food), new styles and forms (e.g., fashion design) and new functions (e.g., new technical tools), and to stimulating new researches in the sectors, during which, innovations of a certain field are developed and applied to other fields of industry. From a non-material point, creativity plays an important role in the invention of new forms of expression (e.g., visual arts), new visions (e.g., new architecture and new urban structures) and new relations (e.g., social interaction between different professional and social groups) and affects life quality, that is related to social, cultural and economic sustainability and is dependent on such aspects as migration, tolerance and social interpersonal understanding (Suciu *et al.* 2009).

Creativity may be important to individuals alone, as well as to organizations, countries and regions. On the individual level, creativity is important, for it is the first step towards innovation at organizational level. For organizations, creativity is important because of value creation and acquisition of long-term competitive advantages with their further preservation. For regions and countries, creativity is important, for it leads to the added value creation, public welfare and country's or region's competitiveness.

In order to evaluate creativity, it is necessary to emphasize its value for public-sector organizations. The value of creativity for public-sector organizations should be measured by taking into account the target orientation of these organizations. According to the definition of public administration provided in Article 2, paragraph (1) of the Republic of Lithuania Law on Public Administration (Žin., 1999, No. 60-1945), the main mission of such organizations is aimed at implementing laws and other legal acts by making administrative decisions, controlling the implementation of laws and other regulatory

enactments, providing administrative services stipulated in laws, administering the provision of public services and carrying out the internal administration of entities of public administration. Taking into consideration the objectives mentioned, creativity could be useful to public sector organizations when making administrative decisions related to the improvement of quality of the provision of administrative services, in order to provide a new form of the existing services and create new services (e.g., the Single Window Principle), and ensuring the efficient internal administration of the organization.

It is highly important for the organizations seeking to motivate creativity of their employees to identify factors affecting creativity, in order to take these factors into consideration when developing reasonable decisions related to the organization's innovative activity.

Since there is no universal theory explaining the phenomenon of creativity, and there are numerous multiple approaches, different authors, in their works, mention different factors affecting creativity. Such variety of different factors mentioned makes it complicated to understand the phenomenon of creativity; therefore, it could be appropriate to take into account R. Ginevičius' observation that, when dealing with a complex phenomenon, the primary goal is not searching for relations between the factors describing it, but grouping them together according to certain characteristics (Ginevičius 2007).

There could be distinguished three main groups of factors affecting creativity: of the individual level, of the organizational level and of the external environment level. The first group consists of factors directly related to the individual's competencies (individual level competencies). The factors of the second group are related to the organization's competencies (organizational level competencies). Finally, the third group consists of factors related to the organization's external environment (external factors affecting creativity).

Since creativity is defined as the ability to create new knowledge, factors affecting creativity related to individual and organizational level competencies could be divided into the subgroups, according to the classification of competencies. This division is based on the fact that competence is usually defined as an attribute of knowledge or skills describing the employee's ability to perform certain tasks, or the organization's ability to carry out certain activities.

In their studies, J. Martinkienė and A. Stonienė distinguish the following competencies: personal, social, professional, managerial and methodological (Martinkienė 2009; Stonienė *et al.* 2009). Since creativity occurs at individual and organization levels, the above-mentioned competencies can also occur at individual and organizational levels. Personal competencies include: attitudes, personal values, the motivation for self-organization and reflection, and personal qualities (Jocienė 2007; Adamonienė, Ruibytė 2010).

Social competencies include the following abilities: to communicate, to state the opinion and express thoughts, to persuade, to motivate, to coordinate, to resolve conflicts, to work in team, and to be able to create a favourable environment (Jocienė 2007; Martinkienė 2009; Adamonienė, Ruibytė 2010).

Professional competencies include: special knowledge and abilities at a field of professional activity, process and technology skills, market and competitor's skills, production and service skills (Staliūnienė 2009).

Managerial competencies are related to the following abilities: to manage professional field and organization, to communicate effectively, to listen, to allocate tasks effectively, and to work in team (Martinkienė 2009; Butkevičienė, Vaidelytė 2009).

Methodological competencies are closely related to professional competencies, supplementing them, and are defined as: procedural skills, abilities to apply appropriate methods and techniques, when dealing with different contexts, and abilities to accomplish tasks regardless of their professional content (Jocienė 2007; Adamonienė, Ruibytė 2010).

Personal competencies (at individual level) are characterized by such factors affecting creativity as: motivation (Pierce *et al.* 2003; Titus 2007; Chang, Chiang 2008; Galia 2008; Zhou *et al.* 2008; Zabieliavičienė 2009), personal qualities (Raja, Johns 2010), acuteness (Laumenskaitė, Vasiliauskas 2006; Titus 2007), cognitive flexibility (Titus 2007), curiosity (lust for learning) (Choi *et al.* 2009), perseverance (Ganusauskaitė, Liesionis 2008; Choi *et al.* 2009), confidence (Ganusauskaitė, Liesionis 2008), openness (Homan *et al.* 2008; Jensen, Beckmann 2009), playfulness (Ganusauskaitė, Liesionis 2008), intellectual abilities (Karkockienė, Butkienė 2005; Kobe, Goller 2009), and creative abilities (Titus 2007; Choi *et al.* 2009).

Social competencies (at individual level) include such factors affecting creativity as communication skills, interpersonal understanding, cooperation skills, the ability to create an appropriate environment, resistance to criticism and failure, and the ability to learn (Jocienė 2007; Martinkienė 2009; Adamonienė, Ruibytė 2010).

Professional competencies (at individual level) include such factors affecting creativity as existing knowledge structure (Titus 2007) and work experience (Lorenz, Lundvall 2010).

Managerial competencies (at individual level) include the following factors affecting creativity: leadership experience (Chang, Chiang 2008), leadership characteristics (Ferrin *et al.* 2007; Choi *et al.* 2009), and leader's management style (Malovikas 2002; Watson 2007; Chang, Chiang 2008; Choi *et al.* 2009; Wang, Rode 2010).

Methodological competencies (at individual level) include the following factors affecting creativity: analytical thinking, individual work skills, teamwork skills, the ability to submit proposals, and decision-making skills (Jocienė 2007; Adamonienė, Ruibytė 2010).

According to scientists, personal competencies (at organizational level) are characterized by the following factors affecting creativity: task (work) characteristics (Watson 2007; Choi *et al.* 2009; Raja, Johns 2010), the workload (Verbeke *et al.* 2008), the organization's culture (Alves *et al.* 2007; Chang, Chiang 2008; Atkočiūnienė *et al.* 2009; Choi *et al.* 2009), the organization's environment (McFadzen, O'Loughlin 2000; Chang, Chiang 2008; Atkočiūnienė *et al.* 2009; Choi *et al.* 2009; Wang, Rode 2010), routine behaviour (Ohly *et al.* 2006; Alves *et al.* 2007), freedom of actions (Isaksen *et al.* 2001;

Choi *et al.* 2009), shared goals (Alves *et al.* 2007), shared values (Alves *et al.* 2007; Vveinhardt, Nikaitė 2008), the organization's motivation (Watson 2007), and the access to resources and technologies (McFadzen, O'Loughlin 2000; Isaksen *et al.* 2001; Zhou *et al.* 2008).

Social competencies (at organizational level) include such factors affecting creativity as characteristics of the co-workers (Choi *et al.* 2009), interpersonal trust (Isaksen *et al.* 2001; Choi *et al.* 2009), risk tolerance (Isaksen *et al.* 2001; Choi *et al.* 2009), organizational support (encouragement) (Verbeke *et al.* 2008; Choi *et al.* 2009), and cooperation and discussions (Isaksen *et al.* 2001; Alves *et al.* 2007; Jensen, Beckmann 2009; Fliaster, Schloderer 2010).

Professional competencies (at organizational level) include such factors affecting creativity as professional coordination practice and the organization's knowledge of the latest developments and work methods (Staliūnienė 2009).

According to scientists, managerial competencies (at organizational level) include such factors affecting creativity as human resource management practice (Isaksen *et al.* 2001; Zhou *et al.* 2008), organizational flexibility (Raipa 2001; Alves *et al.* 2007), employee's participation in management (Huang 1997), evaluation system (Alves *et al.* 2007; Chang, Chiang 2008; Wang, Rode 2010), organizational structure (Isaksen *et al.* 2001; Alves *et al.* 2007; Chang, Chiang 2008), and organizational strategy (Alves *et al.* 2007; Melnikas, Smaliukienė 2007; Wang, Rode 2010).

Methodological competencies (at organizational level) include: the organization's ability to manage innovations, the ability to adapt to changing situations, the ability to organize work activities, project-management skills, the ability to create complex projects, and problem-solving skills (Jakubavičius *et al.* 2003; Watson 2007).

The third group of factors affecting creativity consists of factors related to the organization's external environment. According to the model of distribution of factors, suggested by J. Alves, external factors affecting creativity can be divided into two subgroups: factors related to the institutional support, and factors related to the sets of values and norms (Alves *et al.* 2007).

Factors related to the institutional support are: labour market mobility (Lorenz *et al.* 2010), education system (Lorenz, Lundvall 2010; Spencer 2011), innovations in residential areas (Walcott 2002; Sands, Reese 2008), economic diversity in residential areas (Desrochers, Leppälä 2010), university system (Florida 2005), cluster system (Schoales 2006; Jucevičius 2009), public investment in education and research, and tax incentives for scientists and their researches (Schoales 2006).

Factors related to the sets of values and norms are: public culture (Glaveanu 2010), tolerance (Sands, Reese 2008), local environment's tolerance, diversity and size of the residential area (Spencer 2011), revolutionary (major) changes (Livingstone *et al.* 2002), competition, and social mobility (Pruskus 2004; Simon 2005; Klimašauskienė 2007). Creativity is considered as a complicated and complex social phenomenon, as it is influenced by many interrelated factors acting in opposite directions. According to

V. Podvezko, multi-criteria methods for evaluation, that make the basis of quantitative evaluation of any complex phenomenon expressed by a number of criteria, have been effectively used for a comprehensive evaluation of complex quantities (Podvezko 2008). According to R. Ginevičius, multi-criteria evaluation of complex and complicated phenomena is usually carried out in the following steps: formulation of the research problem and statement of the research objects and aims; compilation of the list of factors affecting the considered phenomenon; formation of the system of the factors affecting the considered phenomenon; quantification (identification of the criteria) of factors affecting the considered phenomenon; formalization of factors affecting the considered phenomenon, and determination and normalization of the criteria values; selection of the model for determination of the significance of factors affecting the considered phenomenon, and determination of the significance of factors; selection of the method for joining the criteria into the integrated value; joining the criteria into the integrated value; decision-making concerning the improvement of the state of the considered phenomenon (Ginevičius, Podvezko 2005).

According to R. Ginevičius and V. Podvezko (2003), the aim of this method is: first, to determine partial criteria describing a particular phenomenon; next, to calculate their values and weights; and last, to join them into the integrated value, which integrates a set of partial criteria. The integrated value is calculated using the following formula:

$$R = \sum_{i=1}^n \omega_i \cdot R_i, \quad (1)$$

where  $\omega_i$  is the significance of partial criteria; and  $R_i$  is the normalized values of partial criteria.

As the influence of the particular criteria, describing the research object, on the considered phenomenon is different, it is highly important to determine the significance of the criteria. The methods for the determination of the significance of criteria could be divided into objective and subjective. In case if the subjective method of the determination of the significance of criteria is involved, criteria weights are evaluated by experts; and if the objective method is used, criteria weights are evaluated by means of mathematical calculations carried out on the basis of objective information (Podvezko 2008).

When determining criteria weights according to the scale of measurement of criteria weights, scales of measurement with various intervals (e.g., [0, 1], [0, 100], and etc.), ranks, points and per cents are used. The following scale of criteria significance measurement, with interval [0, 1], is used most commonly (Ginevičius, Podvezko 2005, 2008):

$$\sum_{i=1}^n \omega_i = 1. \quad (2)$$

Summing up the results of scientific research, it can be stated that creativity is a complicated and complex phenomenon that is affected by many interrelated factors. Factors affecting creativity have been identified in scientific papers, and may be divided into three groups according to their specific characteristics. The first and the second groups consist of factors directly related to individual and organizational level competencies.



The third group consists of factors related to the organization's external environment. Complex multi-criteria evaluation method is suitable for the evaluation of factors affecting creativity, as all factors cannot be expressed by a single evaluation criterion; but when this method is employed, the number of evaluation criteria is not restricted, that results in opportunity to evaluate the integrated partial criteria of both external and internal factors, determine the significance of certain criteria to evaluation results, and compare the values of the partial criteria with each other.

## **2.2. Identification of factors affecting creativity in the Lithuanian Armed Forces**

The identification of factors affecting creativity in the Lithuanian Armed Forces was carried out by employing the methods for expert and multi-criteria evaluation. These methods were used in order to identify the set of factors affecting creativity in the following two structural military units of the Lithuanian Armed Forces: the Air Defence Battalion of the Lithuanian Air Forces (hereinafter: ADB) and the Air Base of the Lithuanian Air Forces (hereinafter: AB).

ADB personnel consist of 214 soldiers, civil servants and employees, working under employment contracts (hereinafter: personnel). AB personnel consist of 428 employees. The above mentioned military units were selected for the research, because they are the only National Defence System units engaged in the execution of specific, characteristic only of them, missions, i.e., ADB's primary mission is the airspace defence, and AB's primary missions are air operations' execution and support, and keeping Šiauliai city's military airport fully functional. Due to the above-mentioned specificity of missions of the units and the fact that air defence specialists and air operation and support specialists are not trained at the National Defence System educational institutions, the efficiency of the process of knowledge formation, and creativity, as the main element of this process, are essential for both ADB and AB.

On the basis of the analysis of the scientific researches, the initial list of factors affecting creativity was compiled, with 77 factors affecting creativity subject to expert evaluation. A commission of 6 ADB and 6 AB experts, who were selected according to the following two criteria: relevance to the process of knowledge formation, and experience (not less than five years) at the process of knowledge formation, was formed. The interval [0, 1] was used in order to determine the criteria weights. Applying the method of the determination of the significance of the criteria, 43 of the 77 initial criteria were evaluated as negligible.

After the identification of factors affecting creativity has been carried out, it was estimated that the creativity of the organization members depends on individual level competencies, organizational level competencies and external factors (Table 1).

According to the experts, the following factors affecting creativity were considered as belonging to individual level: personal competencies (motivation, personal qualities, cognitive flexibility, perseverance, intellectual abilities, and creative abilities); social competencies (communication skills, interpersonal understanding, cooperation skills, and ability to create a favourable environment); professional competencies (work experience, professional knowledge, professional knowledge of the latest developments

**Table 1.** The identification of factors affecting creativity by applying the method of the determination of the significance of the criteria

Partial integrated criterion (third stage)	Partial integrated criterion (second stage)	Initial criterion	Criterion's weight
Individual level (0.57)	Individual level personal competencies (0.32)	Motivation	0.19
		Personal qualities	0.15
		Cognitive flexibility	0.15
		Perseverance	0.13
		Intellectual abilities	0.17
		Creative abilities	0.19
	Individual level social competencies (0.20)	Communication skills	0.27
		Interpersonal understanding	0.21
		Cooperation skills	0.24
		Ability to create a favourable environment	0.27
	Individual level professional competencies (0.21)	Work experience	0.26
		Professional knowledge	0.29
		Professional knowledge of the latest developments and professional techniques	0.24
		Foreign work experience	0.21
	Individual level managerial competencies (0.10)	Leadership experience	0.44
		Leader's management style	0.56
	Individual level methodological competencies (0.16)	Analytical thinking	0.27
		Teamwork skills	0.35
Decision-making skills		0.38	
Organizational level (0.33)	Organizational level personal competencies (0.30)	Organization's environment	0.33
		Organization's motivation	0.37
		Access to resources and technologies	0.30
	Organizational level social competencies (0.35)	Interpersonal trust	0.22
		Organizational support (encouragement)	0.25
		Cooperation	0.28
		Discussions	0.25
	Organizational level managerial competencies (0.16)	Evaluation system	0.53
		Organizational strategy	0.47
	Organizational level methodological competencies (0.19)	Project-management skills	0.41
Problem-solving skills		0.59	
External level (0.1)	External level factors related to institutional support (0.50)	Education system	0.50
		Public investment in education and research	0.50
	External level factors related to sets of values and norms (0.50)	Public culture	0.50
		Local environment's tolerance	0.50

and professional techniques, and foreign work experience); managerial competencies (leadership experience and leader's management style); and methodological competencies (analytical thinking, teamwork skills, and decision-making skills).

The following factors affecting creativity were considered as belonging to organizational level: personal competencies (organization's environment, motivation, and access to resources); social competencies (interpersonal trust, organizational support, cooperation, and discussions); managerial competencies (evaluation system and organizational strategy); and methodological competencies (project-management skills and problem-solving skills).

The following factors affecting creativity were considered as belonging to external level: institutional support (education system and public investment in education and research); and sets of values and norms (public culture and local environment's tolerance).

### **3. Evaluation system for factors affecting creativity**

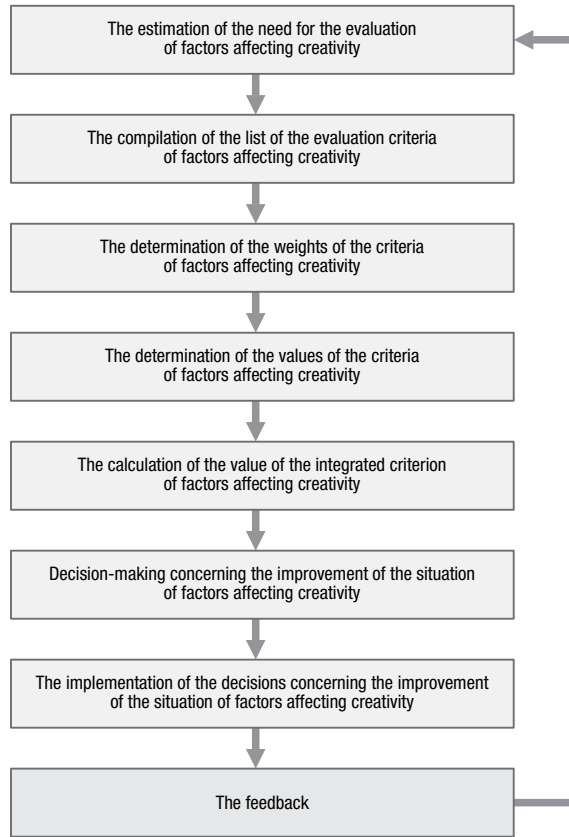
On the basis of carried out scientific and practical researches, a multi-level evaluation criteria system is suggested for evaluating factors affecting creativity. This evaluation system is based on the multifaceted approach, taking into account such quantitative and qualitative criteria that characterize factors affecting creativity comprehensively and precondition their evaluation in the Lithuanian Armed Forces. The evaluation criteria are grouped together in a form of a set of the initial criteria, according to their content and interrelation. The multi-level system is employed in order to achieve more objective and explicit evaluation and precondition the evaluation of the aspects of major factors affecting creativity on the basis of the hierarchical model. In order to maximize the application flexibility of the evaluation system in the Lithuanian Armed Forces, the experts have considered the specifics of the organization's activity, when estimating weights and values of the criteria.

The following sequence of the evaluation of factors affecting creativity is suggested: estimation of the need for the evaluation of factors affecting creativity; compilation of a list of the criteria; determination of the criteria weights and values; calculation of a value of the integrated criterion of the evaluation; and decision-making and implementation (Fig. 1).

*Estimating the Need for the Evaluation of Factors Affecting Creativity.* The need for the evaluation of factors affecting creativity appears when an organization states an objective to stimulate creativity at individual and organization levels.

*Compiling the List of the Evaluation Criteria of Factors Affecting Creativity.* In the process of analysing scientific literature and collaborating with experts, all essential factors affecting creativity are included into the list of factors affecting creativity. The criteria, added to the list, are grouped according to certain characteristics, and the structured hierarchical system of the criteria, subject to expert evaluation, is formed.

*Determining the Weights of the Evaluation Criteria of Factors Affecting Creativity.* The weights of criteria of factors affecting creativity are determined according to expert



**Fig. 1.** The sequence of the evaluation of factors affecting creativity

evaluation. The determination of the weights of the criteria illustrates the significance of each criterion in comparison to other criteria. In order to create preconditions favourable for more objective and explicit evaluation, the weights of the criteria must be differentiated according to the specifics of the organization's activity. The scale of measurement with interval  $[0, 1]$  is suggested to use when determining the weights of the criteria, i.e., the total value of the weights of the criteria of each stage should be equal to one. The weights of the criteria of the evaluation are determined for each level of the criteria, starting with the initial criteria of the evaluation.

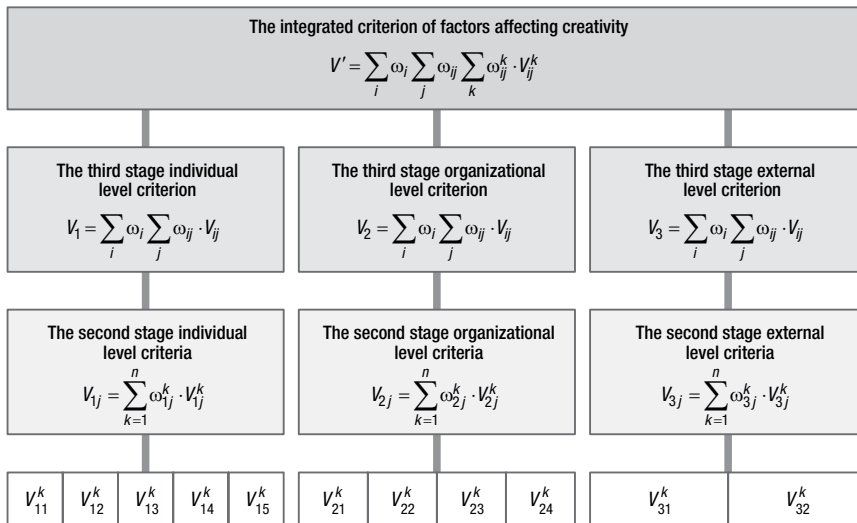
*Determining the Values of the Evaluation Criteria of Factors Affecting Creativity.* Factors affecting creativity are evaluated according to the initial quantitative and qualitative criteria. Qualitative criteria are measured by using a scale with the interval  $[1, 5]$ , where the value "1" of the evaluation criterion means "negative", "2" means "insufficient", "3" means "average", "4" means "good", and "5" means "high". Other criteria are measured quantitatively, by providing a ration and an average of the measured values, or expressed in absolute values. In order to illustrate the comparability of the criteria values (expressed in various units of measurement), they could be normalized by using a scale with

the interval [1, 5] (in which “1” means “risk”, “2” means “insufficient security”, “3” means “security”, “4” means “advantage”, and “5” means “leadership”), or by applying other methods for the normalization (adapted by Chlivickas, Raudeliūnienė 2007).

*Calculating the Value of the Integrated Criterion of Factors Affecting Creativity.* In order to calculate the integrated criterion  $V'$  of factors affecting creativity, a multi-level evaluation system is employed (Fig. 2) (adapted by Chlivickas, Raudeliūnienė 2007).

The following are the first stage criteria of the evaluation of factors affecting creativity:  $V_{11}^k$  – the initial criteria of individual level personal competencies;  $V_{12}^k$  – the initial criteria of individual level social competencies;  $V_{13}^k$  – the initial criteria of individual level professional competencies;  $V_{14}^k$  – the initial criteria of individual level managerial competencies;  $V_{15}^k$  – the initial criteria of individual level methodological competencies;  $V_{21}^k$  – the initial criteria of organizational level personal competencies;  $V_{22}^k$  – the initial criteria of organizational level social competencies;  $V_{23}^k$  – the initial criteria of organizational level managerial competencies;  $V_{24}^k$  – the initial criteria of organizational level methodological competencies;  $V_{31}^k$  – the initial criteria of external level related to institutional support;  $V_{32}^k$  – the initial criteria of external level related to the sets of values and norms.

The following are the partial integrated criteria (of the second stage) of the evaluation of factors affecting creativity:  $V_{11}$  – the partial criterion of individual level personal competencies;  $V_{12}$  – the partial criterion of individual level social competencies;  $V_{13}$  – the partial criterion of individual level professional competencies;  $V_{14}$  – the partial criterion of individual level managerial competencies;  $V_{15}$  – the partial criterion of individual level methodological competencies;  $V_{21}$  – the partial criterion of organizational level personal competencies;  $V_{22}$  – the partial criterion of organizational level social competencies;  $V_{23}$  – the partial criterion of organizational level managerial competencies;



**Fig. 2.** The sequence of estimating the integrated criterion of factors affecting creativity

$V_{24}$  – the partial criterion of organizational level methodological competencies;  $V_{31}$  – the partial criterion of external level related to institutional support;  $V_{32}$  – the partial criterion of external level related to the sets of values and norms.

The following are the partial integrated criteria (of the third stage) of the evaluation of factors affecting creativity:  $V_1$  – the partial criterion of individual level;  $V_2$  – the partial criterion of organizational level;  $V_3$  – the partial criterion of external level.

The integrated criterion  $V'$  of factors affecting creativity is equal to a total of the summation of the values of the initial (of the first stage) and the integrated partial criteria (of the second and the third stage) of factors affecting creativity,  $V_{ij}^k$ , multiplied by their weights:

$$V' = \sum_i \omega_i \sum_j \omega_{ij} \sum_k \omega_{ij}^k \cdot V_{ij}^k, \quad (3)$$

where  $\omega_i$  is the weight of the  $i$ -th partial integrated criterion (of the third stage);  $\omega_{ij}$  is the weight of the  $j$ -th partial integrated criterion (of the second stage);  $\omega_{ij}^k$  is the weight of the  $k$ -th initial criterion (of the first stage);  $V_{ij}^k$  is the value of the initial criterion;  $i, j, k$  refer to the indices of the criteria of the particular stages;  $i, j, k \in 1, 2, 3, \dots, n$ , where  $n$  stands for the number of the criteria of a particular stage; the total value of the weights of the criteria of each stage is equal to one:  $\sum_i \omega_i = \sum_j \omega_j = \sum_k \omega_{ij}^k = 1$ .

*Decision-making Concerning the Improvement of the Situation of Factors Affecting Creativity.* When forming a decision-subset, the largest gap between the maximum possible values of the initial criteria of the evaluation of factors affecting creativity and the measured values of the initial criteria of the evaluation of factors affecting creativity, is taken into account (adapted by Chlivickas, Raudeliūnienė 2007):

$$A_i = (N_i \cdot \omega_{ij}^k) - (N_i^* \cdot \omega_{ij}^k), \quad (4)$$

where  $A_i$  is the largest gap between the values of the possible largest and measured initial criteria;  $N_i$  is the normalized value of the  $i$ -th initial criterion;  $N_i^*$  is the possible largest normalized value of the  $i$ -th initial criterion;  $\omega_{ij}^k$  is the weight of the  $i$ -th initial criterion of the evaluation. The estimated gap is seen as areas to be resolved; in order to eliminate them, a decision-subset is formed from the existing one.

*Implementing the Decisions Concerning the Improvement of the Situation of Factors Affecting Creativity.* The resources required for the improvement of the system of factors affecting creativity are identified and provided; and the measures, required for the improvement of the system of the factors, are implemented.

*Feedback.* The efficiency of the measures employed to the improvement of the system of factors affecting creativity, and a possible application of further measures, are identified.

The proposed system for the evaluation of factors affecting creativity is characterized by a complex evaluation, and creates preconditions to identify the strengths and weaknesses of factors affecting creativity and make decisions based on this identification.

## 4. Conclusions

Creativity is a key element in the development of knowledge that motivates organizations to generate new ideas, develop solutions and implement more effective processes and procedures.

Creativity is a complicated and complex phenomenon which is being studied by various branches of science. Numerous approaches dealing with factors affecting creativity interpret those factors differently and pay little attention to the evaluation of them. As a result, the problem of identifying the approach which would reflect the real situation more explicitly and comprehensively appears. In order to resolve this problem, expert and multi-criteria methods for evaluation were employed.

On the basis of the scientific researches, factors affecting creativity were divided into the following three groups: of the individual level, of the organizational level and of the external level. The groups of the individual and the organizational level consist of factors related to individual and organizational competencies. The group of the external level includes factors affecting creativity related to the institutional support, and to the sets of values and norms.

The identification of factors affecting creativity was carried out at the Air Defence Battalion of the Lithuanian Air Forces and the Air Base of the Lithuanian Air Forces. Applying the method of the determination of the significance of criteria, 43 of the 77 initial criteria were evaluated as negligible.

The system for the evaluation of factors affecting creativity, that would allow military units of the Lithuanian Armed Forces, public- and private-sector organizations, regions and countries to evaluate the factors affecting creativity, was prepared.

The multi-level system for the evaluation of factors affecting creativity, which could be applied for achieving more objective and explicit evaluation, was suggested in order not only to identify factors affecting creativity, but also to evaluate them comprehensively, determine their strengths and weaknesses and, on the basis of this evaluation, make decisions stimulating the creativity.

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## **KŪRYBIŠKUMĄ VEIKIANČIŲ VEIKSNIŲ VERTINIMO SISTEMA LIETUVOS KARIUOMENĖJE**

**J. Raudeliūnienė, I. Meidutė, G. Martinaitis**

Santrauka

Nuolat kintančioje aplinkoje keičiasi kūrybiškumą veikiančios veiksniai ir jų vertinimo būdai, kurie mokslinėje literatūroje bei praktikoje vertinami kontroversiškai. Įvairūs autoriai skirtingai vertina ir interpretuoja kūrybiškumą skatinančius veiksnius. Todėl kyla problema – kaip identifikuoti ir įvertinti, kuris požiūris tiksliau ir išsamiau atspindi bei perteikia tikrovę. Šios problemos nagrinėjamos jungiant skirtingų autorių pozicijas kūrybiškumą skatinančių veiksnių identifikavimo ir vertinimo aspektais. Straipsnio tikslas – suformuoti kūrybiškumą veikiančių veiksnių vertinimo sistemą Lietuvos kariuomenėje. Šiems veiksniams identifikuoti ir vertinti taikyti ekspertiniai, daugiakriteriniai vertinimo metodai. Pasiūlyta daugiapakopė kūrybiškumą skatinančių veiksnių vertinimo sistema, sudaranti prielaidas identifikuoti (reikšmingumo nustatymo metodu) bei objektyviau juos įvertinti, formuoti siūlymus skatinti kūrybiškumą.

**Reikšminiai žodžiai:** kūrybiškumas, kūrybiškumą veikiančios veiksniai, kūrybiškumą veikiančių veiksnių identifikavimas, kūrybiškumą veikiančių veiksnių vertinimas.

**Jurgita RAUDELĪŪNIENĖ.** Assoc. Prof., Dr of social sciences (management and administration), Vilnius Gediminas Technical University, Faculty of Business Management, Department of Business Technologies. Her research interests are related with knowledge management, formation and evaluation of competitive strategic decisions.

**Ieva MEIDUTĖ.** Assoc. Prof., Dr of technological sciences (transport engineering), Vilnius Gediminas Technical University, Faculty of Business Management, Department of Business Technologies. Her research interests are related with business processes management, logistics and supply chain management.

**Giedrius MARTINAITIS.** Master of management and business administration, The General Jonas Zemaitis Military Academy of Lithuania. He is an S2 security officer at the Air Defence Battalion of the Lithuanian Air Forces. His research interests are related with evaluation of factors affecting creativity.