Tarptautinis verslas:
inovacijos, psichologija, ekonomika
2013, t. 4, Nr. 2 (7), p. 21–53

International Business:
Innovations, Psychology, Economics
2013, Vol. 4, No 2 (7), pp. 21–53

Parameters of the creative product and factors that determine it

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The article reviews scientific literature and determines essential criteria for describing a creative product. It also analyzes factors that determine creating a product and presents a model of the factors that determine a creative product.

The novelty and originality parameters are applied to the definition of a creative product. Also, additional criteria, such as the value, appropriateness, usefulness, applicability, etc. are introduced.

Creativity can be considered as the most important factor of a creative product. However, the systematic approach shows that there are more factors that determine both the creativity and creative activity outcome. We have found the outcome of creation to be determined by the creative potential (skills, experience, knowledge, imagination, intuition), the management of the creative process (goals, specific skills, emotions, will, disposition, self-esteem, methods), personal characteristics of the creator, the exuberance, "weight" and other parameters of a problem, the environment and operating conditions. A structural model of creative product determinants is compiled according to the above factors. There are eight main groups of various factors: creative potential, management of creative process, personal characteristics, human exuberance, different parameters of the problem, environment, and creating conditions. The level and quality (novelty, value, suitability, etc.) of a creative outcome depend on the influence the factors mentioned in the model has on the creator.

Key words: creative product, creativity, factors that determine creative product

Introduction

We live in the era of a rapid progress of science and quickly changing information technologies. Every day the new information technologies can change our world unrecognizably. Rapid changes have new challenges. The humanity has to face these changes and needs to overcome them. Otherwise, we can find ourselves on the threshold of global and catastrophic crisis whose results are difficult to predict.

Politicians, business people, scientists talk about the importance of creativity in the nowadays' world. Creativity is considered to be not only the engine of the progress, but also the most important economic resource of the 21st century (Florida, 2002). Guilford (1968), one of the most famous psychologists, notes that creativity is a key to a comprehensive education and the solution of the major problems of mankind. "Europe needs to boost its capacity for creativity and innovation for both social and economic reasons" (European Year of Creativity and Innovation, 2009).

Despite the fact that creativity is considered to be a very important factor in the progress of our times, many researchers claim that creativity alone is not enough for a man to create new products, to patent inventions, to solve problems, to invent new technologies or to develop other creative products. Scientists with a systematic approach in their models include motivation, personal characteristics of creator, interaction with other people, influence of the environment and other factors. Today, like never before, it is very important to know the factors that lead to the creation of a creative product.

In order to determine what factors lead to a creative product, we have to describe what we consider to be a creative product in the first place. Creativity is inextricably linked with the creative outcome of a creative personality a creative product. There are different definitions of creativity and creative product in scientific literature. Despite the increased interest in creativity studies over the last decades, "the question of *what is creativity* is often ignored or answered in too many different ways" (Kaufman, Beghetto, 2009, p. 1).

On the definition of what is a creative product depend not only theoretical models of creativity, but also the practice of creativity education. With this research, we seek to contribute to the debate about creativity and to bring more clarity in the theoretical modeling of creativity.

The aim of the research is to analyze the parameters of a creative product and the factors that determine a creative product.

The objectives of the research:

1. To overview the scientific literature and to identify the essential parameters that determine a creative product.
2. To identify and analyze the factors that determine acreative product.
3. To present a model of creative product factors, based on literature analysis.

1. Creative product

There is still a discussion going on in scientific literature about what kind of human product should be considered creative.

A product is an outcome of human (group of people or organization) activity which can be evaluated by certain criteria. There is no consensus about what criteria determine that a product is creative. Moreover, many of the criteria are not precisely defined, and this causes problems in evaluation.

1.1. Novelty and originality

Novelty or originality is a necessary condition for creative products. What is new is something that so far did not exist. Every day brings new things, technologies, ideas, theories, forms of artistic expressions, etc. But only a small part of these things are absolutely new because most things are modifications or transformations of what has already existed. The question is how much something needs to be changed that we could consider it to be a new thing.

Novelty was the most important criterion since the very beginning when creativity re-

searches started. For example, T. Ribot (1897, quote by Mouchiroud, Lubart, 2006) said: "It has been wrongly said that an invention is "a novel and important idea": only novelty is essential, it is the psychological mark ... thus invention has been mistakenly restricted to famous inventors" (p. 101–102).

C. Rogers (1954) claims that novelty comes from the uniqueness of individuals and context (for example, circumstances, events, humans). A. Koestler (1964) proves that new insights, new inventions or other kinds of novelty are created when a creator deliberately combines two thoughts, ideas or things which were previously unrelated.

Novelty and originality are the main requirements for a creation. Some people claim that anything what is created has to be absolutely new and something that has not been seen or heard before (Stein, 1953). Others say that to name something as creation, a product has to be new for the creator himself (Stewart, 1950; Thurstone, 1952).

During the second part of the 20th century the use of the concept "originality" increased. This is due to the fact that J. P. Guilford, E. P. Torrance and other authors started measuring originality in their creativity tests. Originality was measured by the frequency of an idea: if an idea came from the only participant of a study group, it was considered an original idea, and it was not original if it came from more than one participant. This criterion has a shortage because the very same idea can be original or not due to in what group of participants it is offered. Simonton (1999) thinks that originality must be defined within a certain socio-cultural group because something what is original in one society or culture maybe common in other societies or cultures.

Novelty and originality (separately or together) are present in all definitions of creativity that can be found in psychological literature in which creativity is considered to be a feature of a creative person.

Some of the researchers claim that novelty is a sufficient criterion to describe a creative product. This is the opinion of Koestler (1964), Gallagher, Weis (1979), Weisberg (2006) and others. However, most scientists (Amabile, 1996, Sternberg, Lubart, 1995, Kaufman, 2009 and many others) believe that one criterion is not enough, and there should be more parameters to measure a product.

1.2. Value, usefulness

Perhaps the most common criteria, along with novelty, can be generally described as value and usefulness. According to Boden (2009), "creativity is the generation of ideas that are both novel and valuable" (p. 351). Reis, Renzulli (2009) add that a creation must have not any kind but a social value. Mumford, Gustafson (1988) claim that creative products have to be novel and useful.

Antonietti, Cornoldi (2006) say: "...creativity concerns the possibility that human beings produce, either in a physical—material or in a cultural sense, something that did not exist before and that is appreciated by other people because of its practical, intellectual, or aesthetical value..." (p. 124). Bernstein and others claim that problem solving ideas have to be not only new but effective as well. Nickerson (2009) adds one more criterion – utility.

Very similar combinations with originality can also be found.

Some scientists understand that the application of these criteria is limited. Kaufman (2009) says that an inaccurate definition of creativity, perceiving it as something new and valuable, indeed is an inappropriate treatment.

Another problem is: how to measure the value and usefulness of creation? It is simple when there is an innovation in the production

and its value can be measured by economic efficiency or profit. But what about works of art which are not for sale at auctions and scientific production which has no practical application yet? And many of the patents are not yet installed, and perhaps will never be used. Hope (1996) wrote that since 1828 when a patent office was established, there were 4400 patents for mousetraps registered, and only 20 of them made any money and the most widely used spring trap was discovered in 1899.

Value and usefulness can obviously be measured not only in money, but the question of measurement must be solved in the first place. Another problem arises when dealing with destructive creations. Can we consider as a creative product the invention of weapons of mass destruction? And what about a terrorist attack, crude as never before?

1.3. Appropriateness, practicality

Creation must be appropriate, Amabile (1996) says. He writes: "Conceptually, we – and most of the field – still endorse the spirit of Morris Stein's (1953) definition of creativity as "the process which results in a novel work that is accepted as tenable or useful or satisfying by a group at some point in time." This definition combines two of the key elements of our own conceptual definition of creativity – novelty, and acceptability or appropriateness" (p. 37–38).

According to Lubart (1994), creativity can be defined as the capability to create new and original works that fit the requirements of the task. Preiser (2006) adds suitability among other criteria.

Others authors claim that a creative product must meet the criteria of practicality: creation has to be adaptive (Feist, 2009), functional or workable (Simonton, 2008), innovative (Kaufman, 2009), purposeful (Reis, Renzulli, 2009) or generative (Stokes, 1999).

The concepts of appropriateness and practicality seem to be simple and understandable, but sometimes it can be problematic to decide what is appropriate and what is not. Leonardo da Vinci created a new painting technique in order to paint "The Last Supper". Can this technique be called creative or not? The techniques of painting fresco that existed at the time were not suitable for the artist because he had to work fast and what was painted could not be changed in any way. Leonardo could not work that way. Sometimes he was looking at his frescoes for half of a day and left after making only a few brushstrokes. The technique that Leonardo created let him do the work the way he wanted. But very soon it proved to be unsuitable for the fresco to remain; they started disappearing while the artist was still alive. In other words, if a creative product is something new and practical, so the technique of Leonardo da Vinci, was not creative because it was neither appropriate nor practical. But such technique was suitable for da Vinci, and without it he would not have been able to create the famous fresco!

1.4. Other parameters

Some authors claim that, despite novelty and originality, creation has to be influential, meaningful, relevant, significant, or to have some impact in its field.

While speaking about everyday creativity, Richards (2010) says that there are two product criteria: first, originality (or relative rarity of a creation within a given reference group) and, second, meaningfulness (being comprehensible to others, not random or idiosyncratic, and thus being socially meaningful) (p. 189). Defining creativity, Gascon, Kaufman (2010) claim that, first, creativity must represent so-

mething different, new, or innovative. But it is not enough just to be different – creativity must also be appropriate to the task at hand. A creative response also must be useful and relevant (p. 241).

According to Csikszentmihalyi (2009), one of the most important criteria of creativity is the contribution which a human brings to the field. The scientist also a dds that achange that does not affect the way we think, feel, or act will not be creative (Csikszentmihalyi, 2009, p. 316).

Sternberg, Kaufman, Pretz (2002) have created a model of propulsion according to which there can be eight types of creative products depending on the type of momentum they provide to the conceptual space of the field. Products can be: replication, redefinition, forward incrementation, advance forward incrementation, redirection, reconstruction / redirection, reinitiation, and synthesis.

Horowitz (2004) thinks that the creative problem solving is a solution which fully solves a problem, has no negative consequences, is effective (does not require much material and financial cost) and original (only few people can find such a solution).

Some researchers have requirements for aesthetics (Amabile, 1996), quality (Sternberg, Clinkenbeard, 2009), elaboration (Reis, Renzulli, 2009). Others think that creation must be elegant (Gascon, Kaufman, 2010), fully developed (Davidoff, 1987) or meet specific requirement (Mednick, 1962).

1.5. Combinations of criteria and their number

There is a different number of criteria in the definitions of creativity (if talking about human activity products). The numbers vary from one to four different criteria. A more frequent definition is of two criterions but one criteria, is made of a few criteria combined by the word "or".

If a product is covered by one of the criteria, usually it is a novelty (Ribot, 1897, quote by Mouchiroud, Lubart, 2006) or originality (Simoton, 1999). There are more than 30 different combinations with novelty and about 15 combinations with originality. Gascon, Kaufman (2010) apply four criteria (relevant, novel and original, elegant and generalizable) while Reis, Renzulli (2009) mention the requirements of elaboration, novelty, and social value.

The more criteria are applied for a product, the narrower is a field where products of human activity can be considered as creative. For example, if we will apply novelty and adaptive criteria to creation, as Feist (2009) offers, then the theory that explains physical and chemical processes in the depths of stars could not be considered as creative because it is not adapted to human activities, unless, of course, we will treat the term *adaptive* very widely. On the other hand, according to Freist (2009), the adaptive criterion is necessary in order to distinguish truly creative thinking from simply different or pathological thinking. If we claim that a creative product has to be new and valuable (Necka and others, 2006), then we cannot speak about the creativity of children or students, because it has no value, unless in this case the value will be considered as an important process of education and children's self-expression. If creation has to make some sort of impact on its field (Csikszentmihalyi, 2009), so the daily work is left beyond the limit, because usually it is not shown to anyone and gives satisfaction only to the creator and people from his environment.

Besemer and O'Quin (1999) defined creativity as the production of high-quality, original, and elegant solutions. If we follow such a definition, problem solutions that are not elegant, even if they are original and of high qual-

ity, cannot be creative. The question "What solution is elegant?" could be subject to another discussion. One evaluator can find a certain solution as elegant and the other as not elegant. Many criteria of creative products have such subjectivity.

In such a case, we are facing the dilemma: if there is only one criterion, its definition includes products of activity which are not creations, but if we apply more than one criterion, the outcomes of creative processes that are considered to be creations do not fit into the area of creation. There still remains an unsolved problem of how many and which criteria to apply.

1.6. Evaluation

Products are very often evaluated not according to certain parameters but simply under one creative option: a product is considered to be more or less creative.

Requirements for creations depend on the field the creator is working in: there are different requirements for scientific theories, technical improvement, creations of art or manufactures of applied arts. Evaluation also depends on the specificity of a problem, its complexity and novelty. If a problem is well known, so all its solutions are evaluated by comparing it to solutions that already exist. And if a problem is completely unknown, any of its solutions can be considered as very creative or nonsensical (unreal, useless) because there are no clear criteria of evaluation.

The value of a creation, its usefulness, realism, appropriateness, significance and other characteristics of a creative product depend on the cultural environment, traditions, customs, specific provisions of the era, prevailing paradigms, social environment, knowledge, availability of information, and on many others parameters. Evaluation can take place more than once, and a creation may be evaluated differently. Also, the evaluation can last for a long period of time. It changes depending on social processes, progress, the development of art and science, and other factors. More than once it has happened that creations considered to be not valuable after some time became extremely valuable, useful, and very creative (Runco, 1995).

More than one case is known when it took many years until the ideas that made a revolutionary breakthrough in science, technique, education or business where recognized by scientists and society. But it can also be *vice versa* – something that was considered to be a valuable creation can lose its value when more similar creations appear. Boden (2004) says that it is important to see the difference between the ideas that are new to the author and the ideas that are tested by time and have a lasting value. A promising creation is a creation which may be evaluated favourably in the future, although many of contemporaries see it as not valuable.

It is also very important who is evaluating a product. Evaluation is always subjective and depends on the education, sophistication, specialty, taste, age and social status of the assessor. Any creation is as coded pack of specific information, so its perception depends on the user's ability to decode this information (non-specialist will not understand a theory or will underestimate the depth of the novelty). It happens all the time that a group of persons (experts, specialists) see something as a work of highest quality, but most people do not recognize it as a creative product. It may happen the other way: specialists claim that products of mass culture are not recognized as artistically or culturally valuable, but rather as kitsch of commercial value.

Evaluation also depends on the user's motives, emotional status, sophistication, culture as well as on social provisions.

Any product will be worthless without users. The creator himself can be a user. The value of fakes, imitations, reproductions or copies depends not only on the value of the original product, but also on what kind of information the evaluator has and where did that information come from. Sometimes a businessman who manufactures and sells a product "becomes" its creator because users usually associate a product with the name of its distributor. If it is known that the author has spent much time and worked hard on his creation, it will be valued more than the ones who achieved the same result more easily and faster. A simple mass-produced object, under certain circumstances, may become very valuable (glass necklaces to the aborigines).

Products of creation in a specific field can be divided into certain levels. Altshuller (1986) divides technical solutions into five levels depending on how and to what extent they eliminate technical objections. Creations, according to their significance, can be significant only to its creator (children's creations), to a certain group of people (participants of a competition), or to society and humanity.

Many researchers divide creativity into little-c creativity and Big C creativity. Little-c creativity is children's works and daily creative products. The production of world-famous creators, which is significant to the development of culture, arts, science and technique, belongs to the Big C creativity group. Kaufman and Beghetto (2009) have suggested four types of creations: mini-c, little-c, Pro-c and Big C. Mini-c is related to personal aspects of creativity. Pro-c is between the little-c and the Big C. According to the Kaufman and Beghetto (2009, p. 5), "anyone who attains professional-level expertise in any creative area is likely to have attained Pro-c status".

1.7. Dependence on time

As mentioned before, evaluation changes over time. Ideas transferred from one generation to another can transform, get a new meaning and value. After some time original ideas can become banal. Altshuller (1985) has noticed that a new idea is not only ignored, but also initially rejected as totally inappropriate since its implementation requires a number of costs (is not effective at the moment), contradicts to traditions (considered as heretical and not acceptable in the cultural environment), incomprehensible (even a specialist cannot understand its eligibility and see it as completely ridiculous). So, every idea has to go through several stages of each aspect: originality, appropriateness, usefulness.

When a creation is presented in public, appears on the market or is published in scientific or any other press, its novelty reaches maximum. If a creation is far from being similar to the existing products, in this phase its appearance could lead to a shock or a negative reaction. The first works of impressionists and modernists by critics and public were not considered as works of art. First inventions were openly mocked at. Both Copernicus and Darwin delayed the publication of their theories, even if they were convinced that their theories were correct.

Stenberg and Kaufman (2010) claim that, contrary to what we believe, mostly very creative innovations are found in hostile. The more creative a contribution is, the more likely it is to engender resentment and opposition (Sternberg, Kaufman, 2010, p. 472).

In the first phase, any creation is mostly not acceptable because it seems to be unusual, weird and often not understandable. Later on, when it becomes more usual and specialists start to understand it, a lager group of users accepts it as well. Finally, a creation becomes

trite, template, and traditional. When new creations, more effective solutions or more innovative technologies appear in the same domain, the old creations can get no longer acceptable because they are considered outdated, false or low-efficient.

What was previously new will inevitably become old. The same happens with other parameters, too. That is why, in our opinion, there should be a parameter of time in the definitions of creativity. It is important when do we speak about novelty, value, efficiency, applicability, the impact on a field or apply other criteria because all of these criteria depend on the time that has passed from the moment a creation was created. The parameter of time can complicate the evaluation, because various parameters change over time differently. When a creation is new, its efficiency is very low; when it is no longer new, its efficiency highly increases, and when a long time passes since its creation it loses its efficiency again (Altshuller, 1985).

Generalization

Upon reviewing the scientific literature concerning creative products we can draw the following conclusions:

1. There are many definitions of creative product in the literature. The parameters of novelty or originality are used to define such products. Sometimes researchers restrict the scopes of new and original products by entering new criteria such as value, appropriateness, usefulness, applicability, and others.
2. Researchers apply one, two or more criteria to describe a creative product. The more parameters are entered, the narrower is the field of a creative product.
3. The evaluation of a product depends on time (under any criteria).
4. The evaluation is also subjective and depends on the evaluator's knowledge, education, etc.
5. According to the value of creativity or other criteria, creative products can be divided into different levels.

Not all researchers have clear definitions of what they consider creative products (Kaufman, Beghetto, 2009). The validity of a research suffers if a researcher does not define a creative product. That is why all researchers must clearly define what criteria they are applying to describe a creative product. Moreover, it is necessary to bear in mind that the evaluation depends on time and is subjective.

2. Creativity and its systematic models

2.1. Creativity as an ability

Those who understand creativity not in a systematic approach are of the opinion that a creative product depends only on an individual's creativity which is regarded as his ability to produce something creative. Lumsden (2009) claims that creativity is a kind of capacity to think up something new that people find significant (p. 153), and Lubart (2009) says that creativity from the Western perspective can be defined as the ability to produce a work that is novel and appropriate (p. 339).

The very first model of psychological thinking was offered by associanists in the 20th century. They thought the cognitive experience to consist of many elements and their combinations to be ideas. Thinking was understood as making new combinations. New knowledge and experience appear when intermediate links are found among the elements that already exist. If associative links based on combinations of elements are distant from one another, the decision or idea is creative. This theory has its supporters up to this day. Neoassociants cre-

ate network models that are significant in the psychology of creativity.

Wallas (1926) treated creativity as a human ability to adapt quickly to the suddenly changing environment and to diverse cultural conditions. According to him, this ability has formed during the evolution. This concept is analyzed also in the context of modern science (Simonton, 1999).

In the middle of the 20th century, the provision that creativity as a cognitive ability differs from intellectual abilities was formed. Guiford (1959) introduced the concept of divergent thinking, according to which creativity, or creative thinking, is identical to the dimensions of divergent thinking such as the originality of thinking, flexibility and level of details. These parameters of creative thinking were started to be measured by special tests. Torrance (1987) extended the ideas of Guiford. He saw creativity as a solution to a problem and identified the following abilities: creation of hypotheses and assumptions, identification, of barriers, quick reaction to a problem, finding of missing information etc.

For a long time it has been thought that intelligence leads to operational success. This provision was denied by the American scientist Guilford (1968).

The connection between creativity and intelligence is not uniquely defined. There is no doubt that the creative process requires intellectual skills and abilities, but to accomplish complicated tasks the creator needs not only intellectual abilities (for example, intuition).

Torrance (1964) formulated the "threshold theory": if the intelligence quotient (IQ) is above 120, then the estimates of creativity and intelligence stand out. A high level of creativity requires the intelligence quotient to be above 120. When such IQ is reached, its further growth (let's say up to 150) has no influence on the potential of creativity. But if the IQ is very high (between 170 and 180), it hinders the creativity almost similar to the case when there is a lack of intelligence.

Studies of famous creators have shown what we call the "10-year rule". A decade of intensive work is required in order to switch from a novice to a master, i.e. to reach such a point of one's own evolution when it is possible to achieve a global recognition through one's work (Feldman, 2009). This rule explains why brilliant works are so rarely created. More than 10 years are spent in deliberate practice and the development of expert performance (Weisberg, 2009, p. 233). Some researchers look at creativity as at a dynamic process during which skills and abilities of a creative person are improved for a long time in order to achieve high results.

2.2. Systematic models

Many researchers claim that the concept of creativity cannot be reduced simply to cognitive abilities and that divergent thinking is not enough. It is established that a creative person must also have certain abilities, traits, and other characteristics. Some researchers also include motivation and other abilities that help to achieve success in life. The concept of creativity has become wider, and now it is treated in a holistic approach. Systematic models started to be developed.

In the fourth decade of the last century, the Russian scientist Vygotsky (1960) described a dialectical link between the internal and external processes of creativity. Creativity, according to Vygotsky, depends on the surrounding culture. On the other hand, the human's creativity changes creativity itself. The Mutual link between cognitive and creative processes taking place inside individuals and the interaction between the environment, creation, and culture is the basis of almost all modern systems or confluence theories.

Systems theories treat creativity as a mutual interaction between an individual and the outside world. Authors of such theories have a complex approach to the creative process: thinking processes in their models find themselves in the context of the external environment. Simonton (1988) wrote: "Creativity cannot be properly understood in isolation from the social context, for creativity is a special form of personal influence: the effective creator profoundly alters the thinking habits of other human beings" (p. 421). In many cases, creators of systemic models relate creativity or creative products with Big-C creation or the one that has a significant impact on culture, society or discipline, which include the product.

Creativity and other associated human mental phenomena over the last decades are analyzed in a complex context of personality, society, and culture. In the holistic approach, creativity is defined rather as a cognitive process which leads to the production of creative ideas. Holistic models include many factors of creative process.

Urban (1990) claims that a creative product depends on the interaction between the creative person, the creative process, and the problem. This model is called the 4P model (Problem – Person – Process – Product). According to Urban, a creative person has not only cognitive abilities but also a set of personality traits: the creative process involves not only the phases of creativity, but also various levels of obtaining and using information, convergent and divergent thinking: a problem is chosen quite freely while defining and providing ways to resolve it.

2.2.1. The Csikszentmihalyi and Gardner models

Perhaps the most systematic model is that by Csikszentmihalyi (1996, 2009). His model is made from three blocks: the person, the domain, and the field. The key question of creativity "What is creativity?" Csikszentmihalyi changed into "Where is creativity?". The researcher does not think that creativity is characteristic of humans or products, but sees it as an interaction between a person, a product, and the environment.

A man receives information from the culture in which he lives and transforms it, changes, and creates a new product. Such creation is conditioned by the creator's cognitive abilities, motives, experience, and other things. The creator is mostly influenced by the domain. It is a system of symbols: a scientific discipline, the artistic or other creative field, cultural traditions, rules, knowledge, and technologies. Creation is not possible without a specific knowledge of a field: a mathematician needs to know math, a chemist – chemistry, a composer needs to have a musical education and to be familiar with works of other composers.

The field includes people who can affect the structure of a domain. In the case of chemistry, such people may be chemistry teachers, high school teachers, workers of laboratories at chemical institutes, administrators, journal editors, reviewers, conference organizers, academy representatives, etc. If it is music, such people are composers, performers, the personnel of a record study, dealers, critics, as well as listeners.

Every field has its own rules. Creation will be considered as negligible or boring if it is not very innovative and similar to standards of the past. If it is very remarkable for its novelty, it can be not recognized as a creation. Very often, especially in arts, creations are recognized after the author's death. If a creator manages the balance between these two extremes, his creation is favourably accepted and becomes part of the domain. The domain and the field change over time, and when they do, once rejected creations can become well assessed and those who have long been "canonical" can lose their value or become forgotten.

The interaction between an individual, a domain and the field is complicated and may be different at different times, in different environments or in different areas of human activity.

Using the model of Csikszentmihalyi, Gardner (1993) presented his own conception of creativity. Gardner states that there are three core elements: a creating human being, an object or project on which this individual is working, and the other individuals who inhabit the world of the creative individual. In his theory of multiple intelligences, Gardner says that individuals are creative in a certain field of activity but not creative in general. Some people, of course, can be creative in several fields, but such universal creators as Leonardo da Vinci still remain to be an incredible exception. Da Vinci could successfully create in many fields. Gardner (1993, p. 33) wrote: "The creative individual is a person who regularly solves problems, fashions products, or defines new questions in a domain in a way that is initially considered novel but that ultimately becomes accepted in a particular culture setting".

Theoretical claims by Gardner were based on a deep life and work analysis of brilliant creators such as Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi. He noticed that the power of mind and the limits of intelligence activity manifestations of the above-mentioned creators were extremely high. It is possible that the intelligence, personal traits, and cognitive processes depend on the needs for creative products, on the pursued goals, and on the attempts. Other factors are also important for the process: "The language of the domain, the characteristics of the field at a particular time or the type of product necessary for the desired contribution – the potential elements of the system defining or controlling creativity become increasingly complex" (Starko, 2010, p. 68).

2.2.2. Other systematic models

Feldman (2009) lists seven dimensions of creativity: 1) cognitive process, 2) social/emotional process, 3) family aspects: growing up and current process, 4) education and preparation: formal and informal, 5) characteristics of the domain and field, 6) social/cultural contextual aspects, and 7) historical forces, events and trends (p. 171–172). Feldman (2009) submitted many complex interactions which occur in the creative process of a high level.

Sternberg and Lubart (1991) offered the investment theory of creativity: individuals must buy low and sell high to achieve creativity. Creative individuals invest in ideas that are not popular in society or totally unknown at a certain moment, and their value is low. Later, when such ideas become more known and their value increases, it is possible to "sell" them expensively. People who are trying to implement well-known ideas will not create a high-value product.

The investment theory describes six types of interacting recourses which influence the creativity process: intellectual processes, knowledge, intellectual style, personality, motivation, and the environment context.

The evolving-system approach by Gruber (1981) and other scientists covers a complex of provisions and viewpoints that allow to examine the creativity of a very creative person. Creativity in this system is examined as constantly evolving and affected by purpose, play, and chance. Moreover, creativity is considered to be a complex phenomenon when a creative person includes insights, projects, metaphors, etc. to his work. The third thing is that creative activity is interactive and influenced by the historical context, interpersonal links, and professional collaboration. This theory discloses many factors that influence the creative process, and the creator is treated as an individual interacting with the world with emotions,

aesthetics, and needs (Starko, 2005). Gruber (1981) believes that every individual with an extremely high creativity is unique.

The evolutionary model was offered by Simonton (1999). This scientist, on the basis of Darwin's theory of evolution, claims that lasting can be only the ideas that are able to adapt during the process of natural selection. Simonton also states that ideas are created thanks to random combinations of mental elements. The more combinations, the more creative the idea can be. Simonton has noticed that periods between big ideas are very long. This scientist explains that creators have to accumulate enough knowledge and experience before offering something really creative.

Simonton includes the socio-cultural context of "zeitgeist" into his model. He also considers personal characteristics to be very important. In this way, the model by Simonton, which explains scientific creativity, includes a confluence of logic, chance, genius, and Zeitgeist.

Amabile (1996), to her model of components, along with other components, added human's non-cognitive characteristics. She raised the question: what circumstances are favourable to creativity? The researcher has identified the social environment to be very important for the creative process. Amabile's innovative contribution to creativity researches was that she has considered in detail the importance of motivation to creativity. There are three components: domain-relevant skills, creativity-related processes, and task motivation.

Domain-relevant skills include factual knowledge about the domain, technical skills, or particular domain-related talents. Creativity-related processes include creative thinking and working skills: cognitive style, an implicit or explicit knowledge of means for generating novel ideas, and a conductive work style. The most important component of Amabile's model is motivation and more specifically – intrinsic motivation. Intrinsic motivation comes from the inside of a person and not from the outside.

Generalization

According to the reviewed scientific literature we can say that:

1. Creativity is treated very differently. It can be understood as the ability to create a creative product.
2. Creativity can be considered as the most important factor of a creative product. However, the systematic approach shows that there are more factors that determine both creativity and its outcome.
3. We reviewed the models by Csikszen tmihalyi (1996), Gardner (1993), Feldman (2009), Sternberg and Lubart (1991), Gruber (1981), Simonton (1999) and by Amabile (1996). Each of them reveal certain aspects and describe some factors that influence creativity outcomes.

3. Factors of creative process outcome

The questions "On what depends the creativity of a man-made product?" or "What factors determine the creation of a creative product?" are not clearly worded in the literature. Even not all authors of the systemic or holistic approach clearly identify the factors that determine the creation of a creative product. This is why it is very important to identify such factors.

If the assumption that a creative product is determined not only by creativity but also by other factors is correct, it is logical to think that the quality of human activity outcome depends on the size of the factors effecting the creative process, its intensiveness, the duration and in-

teraction of these factors. In this paragraph, we are going to overview these factors. And the quality, as we already know, consists of the type of level (little-c, Big-C or other), novelty, originality, value, usefulness, etc. In this paragraph, we are going to overview these factors.

What factors determine the outcome of the human creativity process? First of all, without any doubt, skills are necessary for creative activity. Experience, knowledge, and imagination are also necessary. Intuition is important in order to solve completely unknown problems. The totality of these characteristics is called the creative potential. The concept of the creative potential, in our opinion, is more accurate and more convenient than the concept of creativity which is explained in many different ways.

The question arises: is the creative potential enough for creating a high-level creation? The analysis of literature has shown that the outcome of any activity depends not only on the creative potential but also on many external factors and internal personal characteristics. Internal factors include process management, self-control, result evaluation, the creator's personal characteristics and human exuberance. The problem solved by the creator, various circumstances, the existing cultural, political and other situations in which the creator lives are all considered to be external factors.

Further, based on Beresnevičius (2011), we are going to take a brief look at the factors that determine the outcomes of creativity.

3.1. The creative potential

In his book "An Act of Creation", Kostler (1964) characterizes creative personalities as the ones who have a multiplier creative potential. Koestler assumes that the creativity of great scientists or artists is like some kind of energy which can be adapted to various works; it can be transformed from one form to another like, for example, steam pressure can be converted into electricity.

The creative potential is the human ability to perform a creative task or to create something new: to find a solution to the unknown problem, to come up with the idea of the unexpected, to imagine a new product, and so on. This potential includes a variety of skills, knowledge, certain personality characteristics and peculiarities of thinking. This potential includes not only creative abilities, but we shall call it creative, because the creative process and its result depend on it.

3.1.1. Abilities

Various creative thinking abilities are undoubtedly necessary for a creative problem solving. Some of the researchers and problem solving practitioners describe thinking in the notions of divergent, lateral, inventive, innovative, systematic inventive thinking and others.

Divergent thinking

Guilford (1959) offered a three-dimensional structural model of intelligence, in which he identified 150 different intellectual abilities. There are three main dimensions in the model: operations (how we think), content (what we think about), and products (a result of a specific operation with a specific content). Guilford (1959) named one of the five operations divergent productivity which, according to the author, is responsible for creative thinking. There is no doubt that the concept of divergent thinking is one of the most significant aspects in the field of creative thinking.

Divergent thinking has four dimensions:

1. Abundance of ideas (words, associations, expressions, images).
2. Flexibility (ability to move from one group of objects to another, to deviate from standard, conventional, frequent solutions, ideas or images).

3. Originality (ability to link distant elements, images, to provide nonstandard answers, new and unique ideas, nontraditional solutions).
4. Details (ability to convey a clear and detailed decision, to finish a work and to improve it).

Convergent thinking is a contrast of divergent thinking. People with convergent thinking try to find the only correct answer while people with divergent thinking offer a wide range of new and various ideas. Creative thinking is often perceived as a process of problem solving, which includes both divergent and convergent thinking skills (Urban, 1990).

Lateral thinking

The term of lateral thinking was proposed by E. de Bono. This is a unique thinking technique used in finding creative solutions. If we do not use lateral thinking, thinking will flow in normal furrows, just as rainwater runs down the slope through existing ditches. Going from usual thinking to lateral requires considerable effort. Different methods created by E. de Bono and provoking routine thinking facilitate the process of thinking transformation (E. de Bono, 1992).

Triarchic theory of intelligence

The triarchic theory of intelligence was formulated by Sternberg (1985). This theory has three parts: analytical, creative, and practical. Intelligent behaviour, according to the theory, is characterized by insight (ability to act effectively under new and un-experienced circumstances) and automaticity (ability to become productive, independent and automatic in the areas of thinking and problem solving).

Creativity also requires specific skills that form the basis of the creative potential. Only one specific ability is not enough for creative problem solving, because it requires the whole complex of abilities. We can say that a creator is a system of harmoniously functioning skills. And there are two important things in such a system – its components and the efficiency of their functioning.

3.1.2. Experience, knowledge

Creative work is impossible without some general and specific knowledge. Knowledge is necessary for scientists, for artists and for representatives of other spheres. If you don't know anything, it is impossible to define a problem and to find its solution. Specific knowledge helps to find a solution to a problem much faster.

For the assessment of work, knowledge is also necessary, because it is important to know what is done and to understand the specificity of the field, to be familiar with similar works, etc. Nowa days, creators must be aware of many fields.

Even if the importance of knowledge for creative work is obvious, according to Altshuller (1985), the author of Theory of Inventive Problem Solving, a large amount of knowledge hampers finding a creative solution to a problem or could even inhibit creativity. The bigger the amount of knowledge, the higher the thinking inertia, the more likely the solution to a problem will be standard and non-creative. During the creative process, all knowledge is transformed, modified, and a new kind of knowledge is created. According to Feldman (1989), creativity is "appropriate transformation of knowledge, where transformation is so significant that knowledge changes irreversibly" (p. 18).

3.1.3. Imagination

Imagination is a physical process by which new images in memory are created based on the rearrangement of available visual experience. According to the degree of activity, there are two

types of imagination – active and passive. Active imagination can be creative. i.e. create images that are realized later on. For this reason, this type of imagination is necessary for any creative activity and has an important role in it.

3.1.4. Intuition

Problems can be solved by means of logical operations and, if there is no logical reference point, by intuition. These two mutually contradictory processes are important in the creating process. Intuitive solution is a solution which cannot be explained logically and which comes out of nowhere. Intuitive solutions, ideas, assumptions and predictions appear suddenly and unexpectedly. All the solutions obtained in such a way are often unusual, odd, and nonstandard. Intuition is useful when there is little information, the problem seems to be totally unknown, and there are no analogues.

A. Bergson and Z. Froid considered intuition to be a source of creativity that comes from the depths of the subconscious. The proponents of this conception very often use terms such as inspiration, insight, enlightenment, thought leap (Koestler, 1964).

Generalization

The creative potential, as we can see, consists of four main components: 1) abilities, 2) experience and knowledge, 3) imagination, 4) intuition. If one of the components is missing, the potential is very small or functions inefficiently thus reducing the whole creative potential.

Although all the components are equally important, at certain moments one component works more intensively and for some time overshadows the influence of other components on the result. If a person is thinking intensively, his intuition is suppressed; and vice versa, if a person's intuition "is working", then logic "turns off". Creative imagination "sleeps" while using of experience, but experience is not necessary while performing various operations in imagination. Thus, we get two pairs of closely related components: logics–intuition and experience–imagination.

The core of the creative potential is formed of abilities. Three types of abilities are necessary for problem solving: analytical, creative, and practical (Sternberg, 1985). Analytical abilities are related to general and specific knowledge and skills and are necessary for understanding problematic situations in order to assess them, to define and to identify the reasons for such situations. Creative abilities, along with intuition and imagination, are used for finding a solution to a problem which can be implemented though practical skills, experience, and other abilities. A structural model of the creative potential is shown in Fig. 1. Abilities (located in

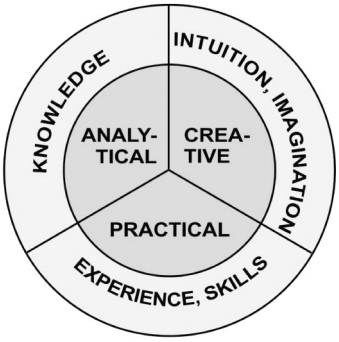

FIG. 1. **A structural model of the creative potential**

the middle) are surrounded by other components of the creative potential.

3.2. Management of the creative process

The Initiation of the creative process, planning, management, self-control, evaluation of the results are among the most important complexes of factors which not only determine the quality of the work, but serve as the key to some kind of result in the first place (there will not be any results if the creator decides that it is not worth to continue the process, that he is looking for a solution in the wrong place, that he won't be able to attain the goal, etc.). System of goals and objectives, motivation, different skills, emotions, will, provisions, interests, self-confidence, ideals, value orientations, methods, strategies, heuristics, etc. makes up this complex.

3.2.1. Goals, plans, tasks, aspirations

After researching biographies of many famous scientists, artists and inventors, Altshuller, and Vertkin (1994) have found that all these people set themselves ambitious and huge volume goals and made their detailed implementation plans in early adolescence. Implementation of ambitious, valuable goals and creative ideas is an essential attribute of a creative personality. Any creative activity is impossible without a goal. The most significant results are reached by those whose goals serve the humanity, life, goodness, and humanism.

Strong creative personalities are able to resist the other people's "pressure", to combine their own and other authoritative opinion and to choose the best path. Such personalities spend all their lives on seeking their own goals, controlling and adjusting their implementation plans.

When the goals of a creative personality do not match the expectations of its parents or other important people and social norms, such personality experiences the inner conflict. Such conflict causes psychological stress which can operate in two ways: either it can become a significant creative stimulus or make the creator to stop his work.

3.2.2. Motives

Motives are the incentives of activity, internal or environmental factors effecting human activity or its direction. Many researchers (Amabile, 1996; Shalley, 1991, and others) emphasize the importance of motivation in the creative process.

Motivation can be external and internal. External motives (reward, glory, desire to achieve the goal, etc.) are not related to the work. We mention internal motives when the creative process itself is pleasant and interesting and the result provides joy and satisfaction. Both forms of motivation are equally important. Amabile (1996) has determined that in-

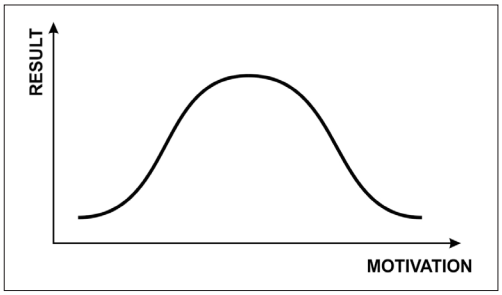

FIG. 2. **Graphical expression of the Yerkes–Dodson law**

ner motivation promotes creativity and external motivation inhibits it and, according to the researcher, internal motivation can be developed. Amabile highlights six different barriers that are harmful to creativity: 1) expected assessment, 2) supervision, 3) reward, 4) rivalry, competition, 5) limited choice, 6) external orientation (Amabile, 1996).

In 1908, Yerkes and Dodson discovered the law according to which the dependence of results on motivation (excitement, stress) is not linear. With increasing motivation, the results improve only to a certain limit, and when the limit is crossed the results deteriorate (Fig. 2).

The optimal level of motivation is not constant. It depends on the individual's subjective circumstances, work evaluation, and on the complexity of the problem. If the goal is serious, then the limit of motivation increases: there is a desire to overcome the challenge, to try your hands, i.e. enthusiasm appears. In other words, a rather serious challenge is motivating. If the challenge is too serious (too serious for a man to overcome it), there will be a disappointment, and if it is simple (significantly lower than the man's potential), it will lead to boredom and indifference (Csikszentmihalyi, 1996).

How motivation to create is developing?

Motivation derives from the needs of the creator. There are theories (R. Atkinson), that it is possible to divide people into those who have a strong motivation for Achievement and those who have a strong fear of failure. If the fear of failure dominates, the man is losing the hope to be successful, he stops creating. If the need of Achievement dominates, a person is able to create products.

In our study, we tried to develop A. Maslow's (2006) theory on the hierarchy of needs.

A. Maslow (2006) divided all needs of human beings into three levels:

1) existential needs;
2) needs of self-actualization;
3) transcendential needs.

The lower needs (he calls them deficit or D-needs) are the following: physiological, safety, needs for love and belong to a group, family, society, and self-esteem needs, needs to respect others and be respected by others (see Figure 3).

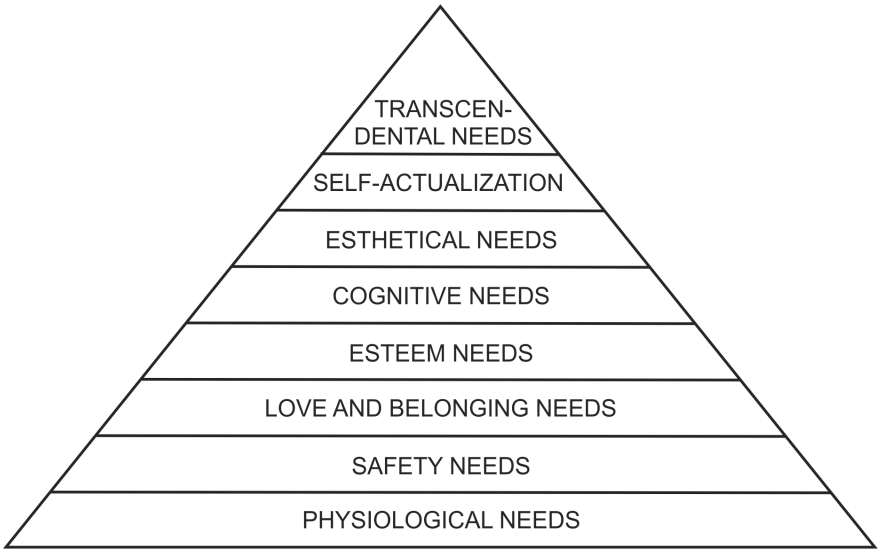

FIG. 3. **Hierarchy of needs according to A. Maslow (2006)**

If a person is not fulfilling his existential needs, he has a deficit. All these needs are survival needs like instincts. When a person is fulfilling his D-needs, he can reach a higher level of the hierarchy of needs, and this level is a bit different. Maslow called it Being needs or B-needs, or self-actualization needs.

When a person is fulfilling his D-needs, he stops to feel them again, but B-needs can become stronger when a person is fulfilling them. These needs are the desire "to become everything you are able to become", "to be all that you can be", to create everything you need to create, to be the fullest person, who is able to reach self-actualization.

Only upon reaching the level of self-actualization a person is able to create, and the more he is interested in creativity, in getting knowledge, understanding, learning and so on, the more he is seeking for more knowledge, more learning, more creativity, originality, he is more and more realizing himself, more creative, inventive, more original.

The third level of the hierarchy of needs A. Maslow calls transcendential needs, or meta-needs, which can be needs for meditation, needs to reach higher levels of consciousness, to reach the needs of Z-organization according to his Z-theory. These meta- needs are motivating a person toward peak experiences (see Figure 3).

Upon reaching the third level of the hierarchy of needs, human beings are able to create their own personality, consciousness.

In order to more deeply understand the needs of a creator, we further developed A. Maslow's (2006) theory on the hierarchy of needs and divided all needs of human beings into two levels (D. Beresnevičienė, 2005):

1) the needs "to have";
2) the needs "to be".

We took these definitions from Erik Fromm's (1992, 1993) theory.

When we are growing, we are moving from the needs "to have" (to have food, to have finances, a sexual partner, to have the leaders' role among friends, or in the family, or in the classroom or organization, "to have" recognition from others, or to "have" an activity, job where we can realize our abilities, wishes, interests, or "to have" everything we need to have) to the needs "to be" (see Figure 4).

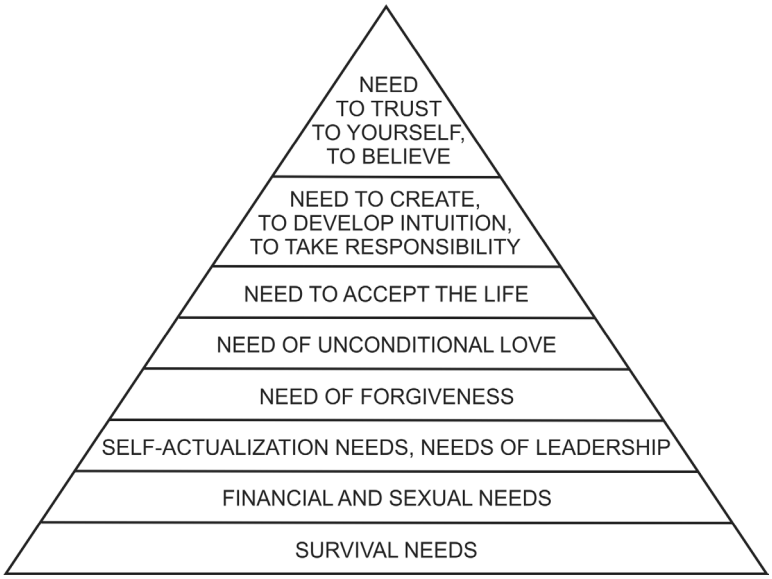

FIG. 4. **Hierarchy of needs according to D. Beresneviciene (2005)**

The needs "to be" are higher needs. They are similar to the meta-needs of Maslow's hierarchy of needs (see Figure 3).

Reaching the needs "to be", the person is developing and creating not only the products, but also his own personality through spiritual needs such as the need of forgiveness, the need of giving unconditional love, he creates his life fulfilling the need of accepting his life via the unconditional love to the Universe, to the human beings, he needs to create, to develop his intuition, to take responsibility, he needs to trust himself, his own feelings, insights, he needs to believe to someone bigger than he himself (needs to believe in God or the Universe, depending on his own philosophy of life).

3.2.3. Abilities that are significant for managing the creative process

Sternberg (1985) in his triarchic theory of intelligence distinguishes the following components of process control: recognition of the existence a problem, understanding of a problem and selection of appropriate processes for its solution, the choice of strategy, the of mental representation, the allocation of mental recourses, control of the problem-solving workflow, the efficiency of the resulting decision. Planning, attention, and time allocation, activity analysis and other matter, depend on the above-mentioned skills. If the activity is poorly planned, then it affects the whole process. Sternberg (1997) has identified that subjects more successful in problem solving spend more time on planning, choice of strategy and encoding problems, and spend very little time on the process of problem solving itself.

3.2.4. Emotions, feelings

Emotions reflect human relationship with the environment at some point, and this is called situational experiences. The simplest form of emotions is the emotional tone of senses (vital factors caused by direct experiences that encourage any individual to retain or to remove these factors). An affect means especially strong emotions. It arises when an individual is unable to find a way from a critical situation. During an affect, the human consciousness narrows: attention focuses entirely on the circumstances that have caused an affect. That's why an individual facing a serious problem very often comes out with a standard solution or even stops looking for one.

3.2.5. Will

Will is necessary when the work is not admirable, boring, monotonous, and long-lasting. Characteristics of the human will may determine the intensity and duration of the creation process.

3.2.6. Dispositions (provisions, interests, and values)

Interests, curiosity, need for new knowledge, experience and impressions, desire to know what is new and of interest in the chosen field are very important for the development of creative activity. A man with a great interest mobilizes all his spiritual and physical strength for the work, can work long hours without getting tired and experience positive emotions. Interests can be very different, and they can appear and disappear. The influence of parents, friends or teachers is meaningful for the excitation of and maintaining the interests.

Creative interests sometimes are exclusively of priority and so strong that overshadow other priorities and needs of the creator himself or of someone who is related to the creator.

Creative persons stand out for their positive attitude to any challenges, crises or obstacles. They are even happy when facing serious problems and get satisfaction while solving them. Some of the attitudes are like personal

rules regulating the person's behaviour. Attitudes like "always finish what you have started", "keep the word", "start with the most difficult task", "to work every day for a certain number of hours" and similar are very helpful in creative work. However, the rules that grow into habits lead to ossification, and a person can become a hostage of his own habits. Inadequate provisions and the absence of rules in work organizing are harmful to productivity.

The consciously perceived attitude to creation, to the creator himself and his activities also have regulatory effects on the creative process. A positive attitude motivates and leads to action, while a negative attitude causes a psychological stress and inhibits the efficiency of a person. Such an attitude reflects what the creator brings to the world and what benefits (not necessarily material) does he get from his own activity. This attitude depends on how a person perceives himself as a creator, how he regards his activity, what is his approach to the problem, work, goals, circumstances and other things. This attitude is closely related to emotions, beliefs and expectations.

3.2.7. Self-esteem

From the way someone assesses his personal qualities, a person can accept or refuse to fulfil his own aspirations and to perform a task. According to A. Adler, creative work is a compensation for the inferiority complex. If person's self-esteem is low (a person sees himself as a looser), he plunges into researches, starts writing novels and poems, or starts a similar activity just to maintain his mental balance.

3.2.8. Self-confidence

One of the biggest threats to creative activity is the person's fears arising from the lack of self-confidence, fear to be humiliated, ridiculed and criticized. That's why things that allow the implementation of creative ideas include the courage to express themselves, the courage to present new ideas perhaps not acceptable to others, the courage to present one's own works in public. Self-confidence is essential for a creator, like the air is essential for combustion. The stronger belief in himself, the more ambitious goals the creator is ready to overcome. Self-confident persons are more independent, and there is no doubt that any creator has to be independent and confident in his own abilities.

3.2.9. Creative thinking techniques, strategies

We may also assign creating methods, problem-solving strategies, heuristics, mind tools, different algorithms and principles, organizing rules and other measures of creative thinking to the management. These measures are equally important in problem solving as it is important for a painter to know the rules of colour matching or perspective rendering.

Creative thinking techniques facilitate and accelerate the process of creation, help to avoid mistakes which can be made by inexperienced and not methodically working problem-solvers. The ability to apply creative methods or other measures is an important factor extending the abilities to overcome difficult tasks. It is like a leverage of mind which increases the creative potential. It is hard to imagine any carpenter without many different tools which help him in machining the material much faster and easier.

It is obvious that during the creation process a person always uses some methods but not always realizes that. The simplest method, "discovered" in the Stone Age, is the method of attempts and mistakes. In the 20th century, new psychological methods such as brainstorm, Synectics, morphological analysis, etc., were discovered. These methods, along with differ-

ent heuristics, laws of technical development and problem-solving algorithms based on systematic analysis, help in dealing with difficult scientific and technical challenges.

3.3. Personal characteristics

Psychologists name different characteristics of creators, so we are going to overview the characteristics of individuals that are related to creativity.

Perseverance

Creative persons are determined, have perseverance and a strong character. These characteristics are especially necessary while seeking long-range goals, when critical situations or a creative crisis occur, after failures, and when no one supports and everyone in the world seems to be against.

Diligence

Diligence is necessary in order to carry out large-scale works; it is related with a person's will, endurance, some emotions, temperament, and motives. Diligence can also compensate for the lack of creativity.

Endurance

This characteristic reflects human physical abilities and potential and is necessary when you have to work continuously for a long period of time. Endurance is the ability to mobilize and allocate one's strength.

Self-discipline

Many famous scientists and writers had their strict agendas, and this helped them to achieve great and monumental things. Set agendas could not be interrupted by anyone or anything.

Perfectionism and criticism

Demanding people to pay much attention to details, the completeness and perfection of the work, raising heavy demands to themselves and their work, often in derogation to perfectionism. Inside such people there always "lives" a strong critic seeing gaps everywhere and constantly unsatisfied.

Criticism helps to look critically at one'sown works, to withstand bad situations, to debate, to defend one's own ideas convincingly, to admit having made mistakes, and to learn from these mistakes.

Concentration of attention

The ability to concentrate attention on the subject of investigation for a long time is also an important characteristic of a creator. Creative persons are so engrossed in their activities that very often they even forget the basic needs such as eating or resting. Concentration of attention on a subject or activity depends on motivation, ability to manage mental processes, will and other personal characteristics. It has been noted that very creative people concentrate their attention only on significant and interesting things but don't pay any attention to anything beyond their scope of interests.

Csikszentmihalyi (1996) found the most important factors that determine the success of creative activity: ability to allocate attention, focus, and control.

Autonomy

Autonomy implies the ability to work and make decisions independently, despite the interests and opinion of other people, and despite their pressure. Such a person resists the suppressing environment and is capable to maintain the selected line of action.

Delay of reward

A long search for answers to difficult questions, not losing hope, the ability to wait for a reward for a long time – those are typical characteristics of successful and famous people, although extreme autonomy leads to stubbornness and ossification which threatens with the loss of flexibility.

Playfulness

Playfulness is a contrast to the strength of character. Creators often tend to be playful, childish, and spontaneous. These characteristics allow to find new, unexpected views or fresh ideas.

Sense of humour

It helps to remove psychological tension, allows taking a critical view of oneself and reducing the significance of any situation. All this together helps to overcome a creative crisis which often occurs in a creator's life.

Tolerance

Tolerance of uncertainties, polysemy, different approach or opinion, ability to accept non-standard, unrealistic or absurd ideas are undoubtedly important in finding new decisions or verifying old conceptions.

Emotional sensitivity

It is hard to imagine any creative activity without emotional sensitivity. It is known that creative males have more emotional and sensual openness and sensitivity, although there is a belief that such characteristics are more typical of female creators. Creative persons are rather fragile and often lack emotional balance.

Openness

Openness to new ideas, fantasy, figments, experiences, the diversity of inner feelings and a fresh point of view may contribute to the development of creativity.

Connection with the subconscious mind

Psychiatrists and psychotherapists, based on Z. Freud's theories, say that creative persons are different from the rest, because creative persons can employ their subconscious creative sources more easily (Helson, 1999).

Originality and non-conformism

Distinctness along with unusual behavior, failure to comply with rules and social norms, and unconventional thinking are perhaps the most important characteristics of a creative person. The influence of originality is so significant that it has even become a synonym of creativity. A creator goes where no one has been before or chooses the opposite direction than the majority.

Egocentricity

Some of the creators are more focused on themselves than on others and prefer individual work instead of working in a group. Such creators usually are more confident and seek to express themselves, their own ideas, feelings, and experiences.

3.4. Exuberance

Energy is necessary to realize creative ideas. Exuberance depends on the mood, physical and mental health, human strength and endurance. Physiological and emotional states are also important. If a creator is depressed, for example, or going through some bad events in his life, it can reduce his creative energy.

Recent researches (Conti, Amabile, 1999) have shown that highly creative persons are very energetic, and not only during the creative process, but also while implementing their ideas.

This feature is independent of character, which means that extremely creative persons may have different sets of characteristics, but they all have one common feature – exuberance.

3.5. Problem

To the problematic factor which has an influence on the result we may attribute the problematic situation, research targets, goals, object, activity, materials, exploratory aspects, etc. These are all elements of the problematic field in which the creator works. Scientists, artists or inventors can manipulate, transform, investigate or analyze these elements. Improperly selected exploratory tactics or poorly formulated goals can determine the final result.

By nature, any creator is an active personality involved in public and professional life with his creative works. The desire to change the situation by a personal or collective effort into more convenient and more acceptable is one of the motivational stimuli. That's how a desire to create a scientific theory which could explain so far unexplained natural phenomena, to write an opera of a new genre, to improve the engineering equipment appears. It is not known how to achieve the desirable situation (otherwise there would have been copying instead of creating); that is why the barrier of "unknown" is always a hinder for the transition from the current situation to the desirable one. We call it a problem or problematic situation.

The desirable situation is a creator's goals, tasks and plans. The bigger the plans, the greater uncertainty separates the desirable situation from the current one, and more abilities and effort are necessary for the creative process, but at the same time a greater outcome can be achieved.

Many researchers emphasize the importance of problem framing, because its solution and outcome depend on it. It is quite difficult to frame a problem having without information and experience. The framing of a problem often depends on the subconscious or on a standard solution stored in the memory (thinking inertia). It is possible to avoid such mistakes by using the algorithmic problem-solving method.

3.6. The creative process

There will be no result if a person will not take any kind of actions, will not spend time on creating, i.e. if there will be no creating process. Creating process is a sequence of actions and the obtained result at the end of it. Creative work can be intellectual (performed by human imagination and mind) or physical (made by hand, employing tools, mechanisms, equipment). During the creative process, a creator for different reasons can decide to stop working or to start all over. Various internal and external factors stimulate or inhibit the creative process.

The result of the process depends on the time spent on the process, the actions taken by the creator, the distribution of the work into stages, barriers. The quantity and quality of all these factors have a very significant influence on the result of the creative process. The work and rest regime is also important.

Wallas (1926) was the first to present a model of the creative thinking process. After an analysis of research findings, he divided problem solving into five stages: 1. Preparation (definition of issue, observation, and study). 2. Incubation (laying the issue aside for a time). 3. Understanding (a person realizes that the solution is already close). 4. Illumination or insight (the moment when a new idea finally emerges). 5. Verification (checking it out).

In many publications, this model is simplified to four stages (understanding is treated as a sub-phase). There is a brief overview of all stages of the creative thinking process.

Not all researchers agree with Wallas (1926) about the stages of the creative process, although in principle their offers are only modifications of the Wallas model.

Kilgour (2006) divides the creative process into four stages as follows: 1. Definition of a problem. 2. Development of ideas. 3. An internal evaluation. 4. An expression of idea. Kilgour states that the final stage is very important because during the process the creator creates a lot of ideas and only a few of them recognizes as most appropriate; without this stage, the process of creative thinking will be incomprehensible.

In the model of creative psychological elements by Cropley (1999), there are six stages: 1. Information. 2. Incubation. 3. Insight. 4. Verification. 5. Communication. 6. Confirmation. The necessary skills and emotions are also given in this model.

In the Osborn–Parnes model of creative problem-solving (Davis, 1998), there are six stages: 1. Finding of goals (disorder): goals, wishes, challenges, and problem are identified. 2. Finding of facts (data collecting). 3. Finding the problem (the problem is formulated). 4. Finding the idea (creating of new ideas). 5. Finding the solution (development of ideas, evaluation). 6. Finding of adaptation (action plan).

3.7. The environment

The environment is a totality of social, cultural, psychological, ethical, physical and other factors. All these factors influence not only the creator, but also the creative process and its result. On the other hand, the creator, his actions and creation itself change the environment.

Office, laboratory and other facilities, workshop, living place, equipment, tools, external stimuli (light, sounds and odors) are all physical environmental factors that can be favourable or unfavourable for creating, promote or inhibit creativity and be suitable or inappropriate for work. Before starting any creative work, it is recommended to manage the environment in a way it would be as favorable for the upcoming work as possible. It has also to meet work and personal requirements.

We could also add different events, natural phenomena, chemical preparations and clues to the physical environmental factors. Different stimuli and incentives have a positive influence on the productivity of creative thinking.

Social environmental factors are as follows: the opinion of relatives, friends, members of a creative or some other group, of bosses, colleagues, certain specialists or society representatives, and actions of all the above-mentioned groups, if they can have an effect on the creator's mind, emotions or actions. The work of formal or informal groups and various other institutions can be also significant to a creator. The range of social environmental factors can be very wide – from cooperation and support to criticism and prohibition to do creative work. Not only surrounding people have an effect on creation, but even those who communicate with the creator through means of information.

The environment forms personal characteristics, develops or inhibits the creative potential, has an influence on the creative process and its management, and is directly related to the problem and operational conditions.

3.8. Conditions for creating

Conditions are like the spiritual field of society in which the creator is working. This spiritual field comprises the cultural, economic, political and other situations in the country, social processes, events, changes, financial, physical and other possibilities to create; rules, traditions from the past, customs, provisions of creative activity, the legal basis, the variety of written and verbal agreements; human experience, information, scientific knowledge, art funds, databases and other matters. The creator's education, possibilities, knowledge, the nature of the creative process, dissemination of creativity depend on these factors.

Generalization

We have found the outcome of creation to be determined by the creating potential (skills, experience, knowledge, imagination, intuition), management of the creating process (goals, specific skills, emotions, will, disposition, self-esteem, methods), personal characteristics of the creator, the exuberance, "weight" and other parameters of the problem, the environment and operating conditions.

4. A structural model of creative product determinants

In the previous paragraph, we have reviewed the most important factors that determine the result of creating. Their main groups include the creative potential, the management of the creative process, personal characteristics, exuberance, a problem, the creating process, the social and physical environments, and operating conditions. Each of these groups consists of more or less specific factors. Based on the above, the structural model of creative product determinants could be as shown in Fig. 5.

Different factors have a different influence on the creator and the creative process. Depending on the situation, work character, personal characteristics or the interaction among the factors, this influence significant or can be minimal, positive or negative.

If we would include only the most important factors, the formula of creative outcome could be as follows:

$$O = k \times CP \times t, \quad (1)$$

where:

O is the value of a creative result (efficiency of problem solving, originality, importance, usefulness and etc.);

k is the coefficient that depends on the inner and environmental factors that have an influence on the creator, creating process and the value of outcome;

CP is the creative potential – necessary skills, abilities, personal and other characteristics;

t is the time spent on creating and problem solving (time spent on the creative process).

Internal and external factors can also accelerate the creative process or to stop it at all, and they can determine the value of a creation itself. If one of the factors in formula (1) is equal or close to 0, we will not get any result or it will be very small. If one creative person, for example, will not spend any time on creating, he, of course, will not create anything. But if a not very skilled person will spend a lot of time on creating and will work with a big effort, he could achieve significant results.

Creative outcome can be not only direct (related to the product of the creative process), but also indirect. This means that even if the creator is not able to solve a problem, he gets experience, and his creative potential increas-

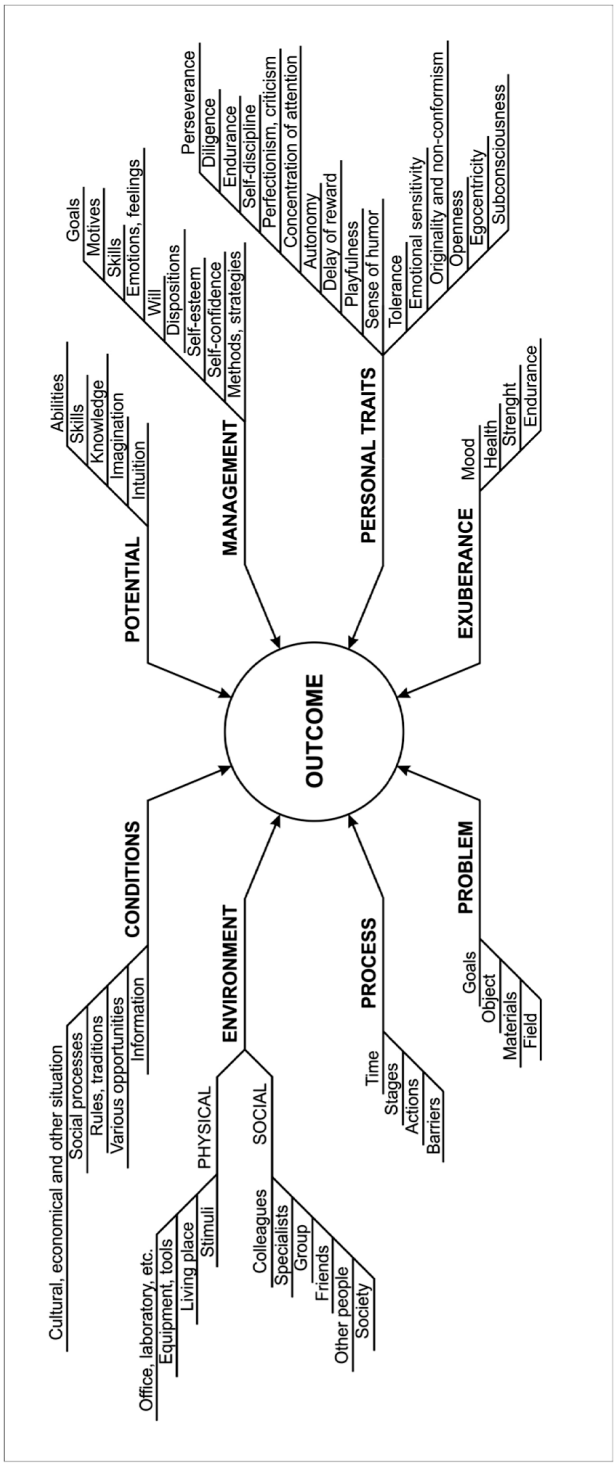

FIG. 5. **Structural model of creative product determinants**

es. When a person makes incorrect findings (gets frustrated in his own abilities) or the result of the process is bad (harmful to the nature or causes negative social consequences), we call it a negative outcome.

Leonardo da Vinci is considered to be one of the greatest geniuses throughout human history; however, he is not among the 100 most influential people (Hart, 1992). Why? There can be many reasons. Some of his works were destroyed, some of them were forgotten, and some were not understood by his contemporaries. Besides, Leonardo da Vinci often changed the direction of his researches without completing what had been started… Charles Darwin acted the ether way. According to Koestler (1964), Charles Darwin and Mikołaj Kopernik were people of one idea. They spent many years and devoted all their effort and skills to creating only one theory.

Hoffmann and Dukas (1972) present Einstein's words: "I have no special gift. I am only passionately curious" (p. 7). For Einstein, it took a decade of intense studies and thinking until he finally created his theory of relativity. Gardner (1993) claims that Einstein could think focused for hours and could study one topic for weeks, months or even several years. If Einstein assessed his abilities objectively, we can assume that his famous theory emerged largely thanks to concentrated thinking and not because he was a genius. Of course, nobody doubts Einstein's abilities, but maybe the titanic scientific work, which he mainly carried out in his mind, lead him to the genial outcome.

In his comprehensive study, Weisberg (2006) revealed that the factors that led Watson and Crick to the discovery of the DNA structure was not their magical intuition, extraordinary abilities or exceptional creativity, but continuity in creative thinking (they built their work on previous researches), a set of coincidences, a good-quality photo, even just a random choice of the theoretical model from several possible (just a lucky guess!), etc. Not only Watson's and Crick's abilities, but also many other factors at the same time led to the discovery of the epoch.

Very often, ideas are taken over as in relay. For example, Kopernik from the famous ancient teacher Aristarchus (310–230 B. C.) took over the idea of the heliocentric system, which states that the Sun is in the centre of the Universe. Aristarchus also thought that the Earth rotates on its axis. This idea, by the way, came from Heraclitus (544–483 B. C.). If the continuity of works and ideas would not exist, it would be impossible to solve complicated scientific and technical problems. Altshuller (1985) states that it can happen that an engineer with limited abilities can make significant inventions if only he can use the earlier works properly.

The outcome of creativity may be determined by the characteristics of a creative person. Jack London, for example, wrote hundreds of short stories and over 50 books, but he was rejected over 600 times before publishing his first story (Kraus, 2002, p. 152). Maybe today we would not know Jack London if he would gave up after he had been rejected 590 times.

It is well known that the heyday of arts during the Renaissance mainly occurred because of grants of patrons, and the implementation of Leonardo da Vinci's sculpture project was stopped because of the French military invasion to Milan. Maybe it would not be realized also for other reasons (technical problems, an ambitious target: the sculpture of a horse was 7 meters high), but the creating conditions, historical, cultural and social circumstances, as we have mentioned before, have a significant influence on the outcome of creation, or it can

stop the whole project, as it happened in this particular case.

According to the above-mentioned facts and literature analysis, we can assume that creativity outcome depends on a combination of various factors, the creative potential of a person and the time spent on creating (in this case, multiplication is rather symbolic than mathematical).

The coefficient k (formula 1) can be expressed as

$$k = M \times PC \times En \times Pr \times Ev \times C, \quad (2)$$

where:

M – management,
PC– personal characteristics,
En – energy,
Pr – a problem,
Ev – physical and social environment,
C – conditions for creating.

Thus, we should rewrite formula (1) as follows:

$$O = M \times PC \times En \times Pr \times Ev \times C \times CP \times t. \quad (3)$$

If we would change the sets of factors with all creating determinants which we have discussed in this paragraph, we could get a formula with more than 60 multipliers. So, there is no wonder that significant creative events are rare.

Most of the factors in formula (3) have to be optimal. Otherwise, their influence on the outcome will not be maximum. A big factor can be less influential than a small one. It is also possible that the influence of the majority factors could be similar to that in the case of motivation.

The influence on the result depends not on the size of a factor, but on its influence on the creator; therefore, the dependence of factors should be expressed as

$$O = f(F_1) \times f(F_2) \times ... \times f(F_n), \quad (4)$$

where:

F_n – factor n,
$f(F_n)$ – influence (impact) of factor n.

However, even this formula is not accurate, because the outcome is determined by the interaction of factor effects and not by the totality of factor effects. One effect can inhibit or enhance the effects of other factors, so the final formula is

$$O = I[f(F_1), f(F_2), ..., f(F_n)], \quad (5)$$

where:

I – interaction of all factor effects.

Formula (5) can explain cases when the effect of one factor is equal to 0, but the result still exists.

Some factors from the same or a different group can unite into associations and operate in a certain direction. Other associations can operate in an opposite direction. Some of the factors may have a causative relation; this means that one factor can determine another (inhibit or enhance it).

Depending on factor size and its contribution to human thinking, condition or behavior, there can be several variations:

1. One dominant factor. If the impact of most factors varies around a similar level, but one is above the average, this will be the dominant factor. Other factors will be insignificant, like in a film with one main actor. It is like the central axis or the stem of a tree. The best results (not necessarily creative ones) can be produced when there is a dominant factor. And quite likely there will be no result.

2. Two dominant factors. If the impact of two factors is almost the same and they act in opposite directions, and if all the rest factors are insignificant, the creator could be torn apart. If the creator is a strong personality, a dynamic equilibrium is possible. In such a case, only one factor at a time is dominant, but the creative process goes forward, though with significant complications.
3. All of the factors are more or less equal. In this case, the creative process is stable. The impact of factors depends on the situation or the procedural stage.

The structural model of creative product factors is only theoretical. More detailed researches are necessary to prove this model. More detailed researches could reveal how and in what way different factors and their interactions impact a creative personality and the creative process upon which the quality of a work depends.

Generalization

The structural model of creative product determinants is made according to the discussed factors. There are eight main groups of various factors: the creative potential, management of the creative process, personal characteristics, human exuberance, different parameters of the problem, environment, and creating conditions. The kevel and quality (novelty, value, suitability, etc.) of the creative outcome depends on the influence the factors mentioned in the model have on the creator.

Conclusions

In this research, we have briefly overviewed the scientific literature and examined the substantive parameters and factors that determine the creativity of a product. We have also presented a structural model of creative product factors. Summarizing the research, we can draw the following conclusions:

1. There are different criteria in the scientific literature, applied to a creative product: novelty, originality, value, usefulness, appropriateness, efficiency, impact on the area, and others.
2. Based on creativity, complexity and materiality, there are different levels of creative products. The evaluation of a work is subjective and depends on many factors.
3. Creativity is the main factor for getting a creative product, although systemic models and the analysis of literature show that creativity is a necessary but insufficient condition for it.
4. According to our structural model, there are eight groups of factors (creative potential, management of the creative process, personal characteristics, human exuberance, different parameters of the problem, environment, and creating conditions) which lead to the creation of a creative product. The level and quality (novelty, value, suitability, etc.) of the creative outcome depend on what influence the factors mentioned in a model have on the creator.
5. More detailed researches could improve this theoretical model and reveal how and in what way different factors and their interactions impact a creative personality and the creative process upon which the quality of a work depends.

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Kūrybiško produkto parametrai ir jį nusakantys veiksniai

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Santrauka

Mokslo studijoje apžvelgiama mokslinė literatūra ir nustatomi esminiai kūrybišką produktą nusakantys kriterijai. Taip pat analizuojami kūrybiško produkto sukūrimą lemiantys veiksniai ir pateikiamas kūrybišką produktą lemiančių veiksnių modelis.

Kūrybiško produkto apibrėžimui taikomi naujumo ar originalumo parametrai arba įvedami papildomi kriterijai: vertingumas, tinkamumas, naudingumas, pritaikomumas ar kiti reikalavimai. Kūrybiškumas studijoje yra traktuojamas kaip vienas pagrindinių veiksnių, apsprendžiančių kūrybišką produktą. Sisteminis požiūris atskleidžia, jog yra ir

daugiau veiksnių, kurie nulemia tiek kūrybiškumą, tiek kūrybinės veiklos rezultatą. Nustatėme, kad kūrybos rezultatą lemia kūrybinis potencialas (gebėjimai, patirtis, žinios, vaizduotė, intuicija), kūrybos proceso valdymas (tikslai, motyvai, specialūs gebėjimai, emocijos, valia, dispozicijos, savivertė, taikomi metodai ir kt.), asmeninės kūrėjo savybės, žmogaus energingumas, problemos „svoris“ ir kiti jos parametrai, aplinka ir veiklos sąlygos. Remiantis aptartais veiksniais sudarytas struktūrinis kūrybišką produktą lemiančių veiksnių modelis, kuriame esminį vaidmenį vaidina 8 veiksnių grupės: kūrybinis potencialas, kūrybos proceso valdymas, asmeninės kūrėjo savybės, žmogaus energingumas, įvairūs problemos parametrai, kūrybos procesas, aplinka ir veiklos sąlygos. Kūrybos rezultatui turi įtakos ne pačių veiksnių dydis, bet veiksnių poveikis kūrėjui ir kūrybos procesui. Rezultato kokybė priklauso ir nuo veiksnių sąveikos.

Pagrindiniai žodžiai: kūrybiškas produktas, kūrybiškumas, kūrybišką produktą lemiantys veiksniai.

Įteikta / Submitted: 2013-10-01
Priimta / Accepted: 2013-10-21