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# **CREATIVE MANAGEMENT:**

**THEORETICAL FOUNDATIONS**

*Monograph*

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In a modern dynamic life new unpredictable events occurring more and more, overthrowing, either bringing success and prosperity or breaking a course of life and activity of many people, organizations, countries, regions. Our unreadiness to perceive random nonprogrammable events is caused by that the result of traditional education is ability to logically reflect and analyze the information. In order to work successfully under the conditions of increase of unpredictability and discrepancy of social and economic development, it is necessary besides infological paradigm of perception of the world around to master the paradigm of comprehension and creative work.

In this creative management there are ways and methods of switching over of training of managers, engineers, entrepreneurs to level of constructive creative thinking and activity by way of combination of logic and heuristicity.

The monograph meant for under- and postgraduate students, doctoral candidates, management instructors and practitioners of management in the economic sphere, engineering personnel, everybody who wants to work actively and purposefully for prosperity of one's organization and personality creative development. This is an original key to understanding of the present and vision of the future of a modern organization and socioeconomic development on the whole through activation of humane creative activity of the person.

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## Preface

Imagination is more important than knowledge.

*Albert Einstein*

At the beginning of the 21st century, according to experts in the field of scientific management, managers need to begin to think “outside the box,” generate and implement interesting ideas, that is, to think creatively as artists usually do. The notions of “creativity” and “creative work” are closely related.

Creativity — is the ability to generate new knowledge by expanding and transforming the vision of reality as the future that can systematically organize its activities, i.e., this is a creative construction. Creativity assumes a creative approach in designing new object properties using already existing elements (properties, relationships). The term “creativity” is closer to the original meaning of the word “constructiveness”.

Creativity is a wide-ranging topic, whose study is important for understanding mechanisms of development of both the individual and society. At the personal level, the manager needs creative attitude in the course of management process, the expert — when solving problems dealing with performing direct duties. At the cultural and educational level, creativity — is manifestation of new trends in art, scientific discoveries and social programs.

The urgency of introduction of creative management in the practice of enterprises and organizations is obvious. When the main method of competition is innovation, all employees need an unconventional approach, especially those at departments dealing with any type of innovations: technical and technological, organizational, those of range of goods, services, etc.

At present, the problem of determination, selection, and working-out appropriate efficient empirical research tools of creativity phenomenon in its various manifestations and at different levels of management of enterprises is foregrounded. It should not only learn to manifest and measure the creativity, but also create conditions for its development. Thus it is important to determine and work out optimal ways for an active support and development of creative individuals at enterprises and organizations.

The manual is aimed to reveal the essence of creative management as a constructive science of management activity. To apply this knowledge in practice, contemporary managers need to know well how to reveal management problems, to

state them as well as system analysis methods, solution search methods, which are often implicit and atypical.

The questions of management of creative solutions development at the enterprise are considered comprehensively and include the study of their stages and kinds.

The head needs to pick thoroughly the staff, to study and know the creative potential of each employee as well as that of a group or collective on the whole. Because of it, such issues as personality traits, creative act mechanism, kinds of creative thinking, connection between intelligence and creative abilities are considered in the manual. The essence and structure of creative potential, system of organizational conditions and factors affecting its formation and development are described.

For the manager to be able to fully reveal his abilities, internal and external incentives are required. Questions of creative work motivation are paid a special attention in the manual. An innovative leader must purposefully influence a group of creative employees' behavior, demonstrate original approaches to solution of problems and gradually change management culture and develop an innovative style. Considering the urgency of creative society formation, of determination of the ways for creative education conception formulation, managerial planning of creative training is considered in the manual.

# 1. Concept of creative management

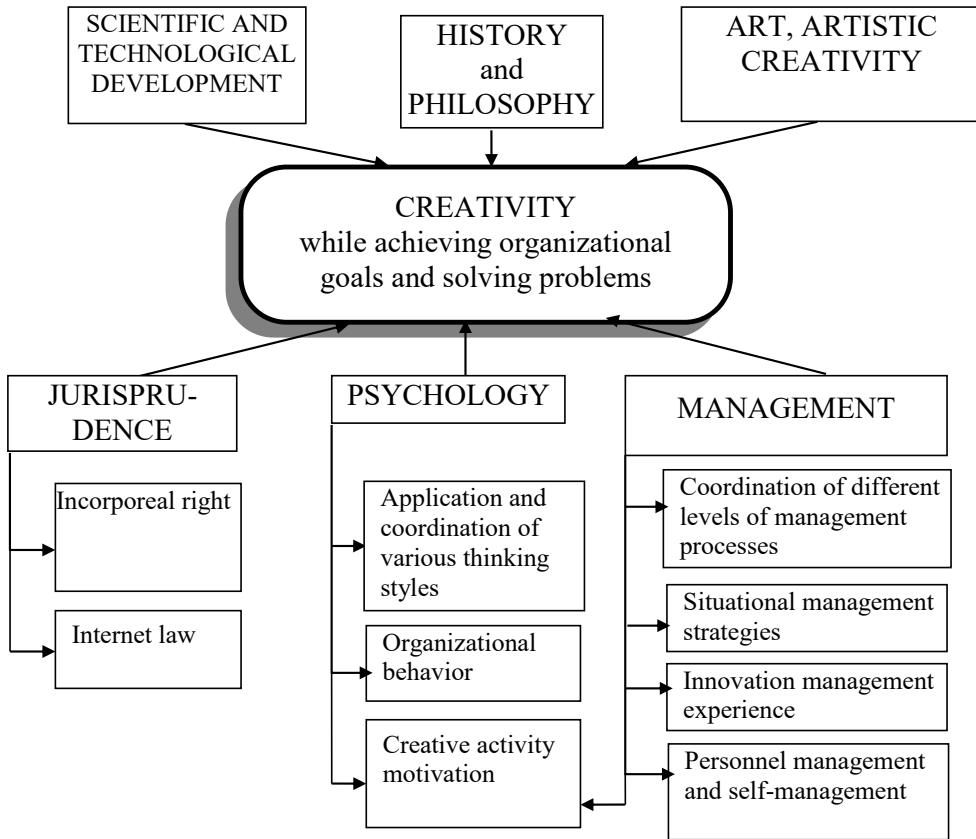
- 1.1. *Creative management as a science and kind of activity.*
- 1.2. *Essence of creative work, creativity.*
- 1.3. *Interrelation of ability, giftedness and creative work.*
- 1.4. *Urgency of introduction of creative management in the activity of enterprises and organizations.*

## 1.1. *Creative management as a science and kind of activity*

Creative management — is rather new concept, being a separate branch of management science and professional activity, aimed at the development of organizations under modern conditions. Theoretical and applied aspects of the discipline can be distinguished. The theory of creative management is at the interface of innovation management, theory of creativity (which has many varieties — theory of scientific and technical, artistic and applied creativity) and a number of other scientific disciplines (Fig. 1.1). The theory of creative management began to develop roughly from the mid-20th century and only recently started to be realized in well-founded applied use of this knowledge.

There are different approaches to definition of the essence and content of creative management in the scientific literature. Some authors emphasize that creative management is one of innovation management directions and deal mainly with new kinds of products. It includes technical, marketing problems connected with innovations. Creative management contains the whole set of principles, methods and forms of management of the creative process, innovative activity and of the staff involved in it.

Managers were encouraged to be active because of passing to a qualitatively new level of scientific sphere development: they became active participants in the research, started to create resource and investment base of creative activity. So, applied aspects are connected, first of all, with innovations, that is, processes of development, introduction and operation of productive and economic and socio-organizational potential of the organization [38]. Following a latent period, creative management, despite all difficulties of its formation, drew attention as actually existing field of knowledge. Its striking illustration is the introduction of the respective discipline in higher school educational process on the post-Soviet area (Russia, Ukraine) in the beginning of the 21st century. So, in Russia, the first presentation of creative management curriculum for economic and administrative institutes of higher learning took place in 1995.



**Fig. 1.1.** Creative management in the system of sciences

*The subject* of the discipline is creative process and mechanisms of its management. *The object* of creative management is the process of making management decisions by means of consecutive whole set of procedures, forming a general plan of creative process management. *The goal* of creative management — provision and keeping organization's competitive advantages by force of encouraging and promoting talents, personnel's creative potential, introduction of innovative management technologies.

*The objectives* of this branch of management are: creation of effective creative groups of employees, generation of original ideas and their realization in new products and/or technologies for modernization and improvement of management processes.

Creative management deals with such key areas of organization's activities as scientific, technical, personnel, production and marketing ones.

At the level of an ordinary production and commercial enterprise, creative management is a set of procedures, rules, principles, techniques, value orientations,



organizational forms, connections and economic relations in order to achieve unconventional results of effective activities. Similarly to the conventional perception of general management, the control system of creative processes at the enterprise consists of two subsystems: controlling (agent of management) and controlled (object of management). The control action mechanism includes gathering, processing and transfer of necessary information and making respective decisions.

However, it is necessary to understand the difference in interaction between the mentioned subsystems. If in traditional management, boundaries between the functions of object and agent of management have just begun to disappear (and even then not in all kinds of activity), then in creative management, a number of functions of an agent and object of management draw closer up to identification.

The goal of creative management — to coordinate the functioning and interaction of both internal and external structural elements of the creative process, to create a new organizational culture. The division of the area of innovation and creative management are found in A.I. Prigozhin's works [20, pp. 78–83], who specifies it by the following theses. From an organizational point of view, creative management problems consist in creation of temporary creative collectives to form a pool of new ideas, and innovation management concerns implementation of the most proper propositions and their commercialization. Creative management relies on *Creativistics* — a branch of knowledge about an efficient collective solution of creative problems, and innovation management — on *Innovatics* — a branch studying the formation of innovations and their distribution, as well as the ways to develop innovative solutions. And both branches only now found their realization in a well-founded application of this knowledge in practical activities of production organizations. Innovation management operates with an intellectual commodity as whole and indivisible, and conversely creative one — considers the given product, elementwise, as a complex entity. Management, connected with it by a new system of knowledge and skills, is divided into separate components, each of which is subjected to the study and comprehension in order to form right practical actions. Both innovative and creative management consider the same object, but innovative management — from the outer side, as a final completed object, and creative one — from the inner side, as a process of creation in dynamics.

Creative management implementation provides for:

- monitoring of the scope of activity and prediction of its development;
- development of ideas to be implemented in innovative activities plans;
- coordination of activities of all departments in this area;
- provision of an enterprise with skilled personnel and its motivation;
- creation of special design groups;

- evaluation of individual's creative potential (for the possibility of involving in creative tasks solution);
- creation of the atmosphere of creative work in the collective;
- formation of groups of analytical experts to estimate ideas and proposals in the sphere of innovation policy;
- defining heuristic methods and techniques (according to authors, heuristics is a branch of knowledge about person's efficient creative thinking) for effective performance of creative tasks by experts.

*Thus, **creative management at the enterprise** is a special organizational and management activity aimed at achieving high economic, social and environmental performance by activating a creative activity when innovations are introduced. It does not invent the methods of creative potential activation, and generates their composition and a rational sequence.*

At that, creative management borrows purposes and resource constraints from innovation management which ensures the functioning of a respective support system (infrastructure). The creative nature of activities is manifested to a greater extent in creative management than in innovation one, and conversely the purposiveness of activities — shows itself more in innovation management than in creative one.

The whole set of kinds of activity is formed in general management functions: definition of the mission and goals, planning, decision-making, organizing, motivation, and control. The composition of functions and management problems can be regulated depending on the level of a controlled system (economy on the whole, a branch of production, an organization, an enterprise or a separate project), as well as on internal and external conditions of its operation. Each general function is divided into specific ones related to peculiarities of the enterprise: definition of research purposes, creative work planning, rationalization activity motivation and so on.

Creative management studies psychological, managerial, sociological, economic, historical and cultural factors affecting the process of creative work.

Thus, creative management in the broader sense — this is a complex mechanism of interaction between controlling and controlled systems in order to create favorable conditions and opportunities for creative development and achieving an effective result by the organization.

### ***1.2. Essence of Creative Work, Creativity***

The concept of “creative work” is interpreted as a human activity aimed at the creation of principally new and previously unknown spiritual or material values (new works of art, scientific discoveries, engineering and technological, administrative or

other innovations etc.) [16]. Fantasy, imagination and unconventional thinking, mental content of which is to create an image of a final product (creativity outcome) are the necessary components of creative work.

*Creative work can be considered from two aspects: **psychological** and **philosophical**.*

Plato, an ancient Greek philosopher, was among the first who highlighted the concept of creative work, emphasizing its universal nature: “Any transition from non-existence to existence is creative work, and thus, creation of any works of art and crafts can be called creative work, and all those who made them — their creators” [29].

Fundamental changes took place with the onset of Christianity and the emergence of the concept of the creation (Lat. Creatio) of the world by God (God is the creator because he created the world); however the term was not used in respect to human activities.

At the Renaissance, by contrast, creativity imbued with the faith in infinite human capabilities was more and more recognized as an artistic action; there emerged an interest to an artist’s personality and to the act of creation itself (Fig. 1.2). The tendency to consider history as a result of human creativity becomes more and more evident [35].



**Fig. 1.2.** Raffaello Santi. Fresco  
*The School of Athens*

A Polish poet M.K. Sarbiewski (1595-1640) began to use the word with regard to poetry. However, such an idea of creative work was criticized for a long time because of the interpretation of the term as an act of creation from nothing. At the Age of Enlightenment, creative work was associated with the human ability to imagine. British empiricists (F. Bacon, T. Hobbes, J. Locke, D. Hume) interpreted creative work as some combination of existing elements. Thus, creative work

was much similar to invention.

In the XVIII century I. Kant became the author of another concept of creativity. He purposefully analyzed a creative activity in his teaching about a productive ability of imagination acting as a link between the mind and sensory experience.

***Immanuel Kant (1724-1804)**, the founder of the German classical philosophy. He claimed, inter alia, that a condition of cognition is universally valid a priori forms, ordering the chaos of sensations.*

Kant's doctrine was further developed by Schelling, who considered a creative ability in the unity of conscious and subconscious human activity. At the age of Romanticism, the view of an artist as a genius, creating by intuition, reached its climax when creative work of an artist and a philosopher was considered the highest form of human activity.

**Friedrich Wilhelm Joseph von Schelling (1775-1854).** *In his philosophical evolution, there are no precise boundaries between its stages that can be named "philosophy of nature" (natural philosophy), transcendental idealism, "identity philosophy" and "philosophy of revelation".*

In terms of idealistic philosophy of the end of the XIX and the beginning of the XX centuries, creative work is considered mostly as some sort of antithesis to mechanical and technical activity. At that, if the philosophy of life contrasts technical rationalism and creative natural origin, existentialism emphasizes spiritual and personal nature of creative work. In the philosophy of life, the most detailed concept of creative work was presented by H. Bergson (*Creative Evolution*, 1907): creative work as a continuous birth of the new is the essence of life. All reality is considered by the philosopher as "continuous growth and endless creative work" [11]. According to existentialists creative work is the most appropriate form of existence. N. Berdyaev (*The Meaning of the Creative Act*, 1916) considers the creative work as "an act of godlike freedom of a human being, revelation of the image of the Creator in him" [12].

**Nikolai Berdyaev (1874-1948)** — *Russian religious philosopher, one of the greatest philosophers of the twentieth century, the founder of Existentialism — the philosophy of existence, who made a significant impact in the development of art and literature. He initiated a philosophical direction of "personalism," which admits personality as the primary creative reality, and the whole world — as the manifestation of a creative activity of "a Supreme Person" — God.*

Philosophy of pragmatism as well as positivism, on the contrary, regards creative work as invention which purpose is to solve a problem caused by a given situation. Marxist philosophy defines creative work as "a human activity transforming both natural and social world in accordance with man and mankind's goals and needs based on the objective laws of reality" [24]. At the same time, creative work demands a fuller play to personal initiative, individual inclinations, ideas and fantasy.

In psychology, creativity is studied as a psychological process of creating something new and as a set of personality traits. At first creativity as a process was

analyzed based on self-reports of men of art and of science (description of “inspiration,” “throes of creation” and so on). An English scientist J. Wallace (1924) divided a creative process into 4 phases: preparation, incubation (of the idea), illumination and verification. The similar stages were also distinguished by H. Poincaré when describing the process of his several mathematical discoveries [34].

**Jules Henri Poincaré (1854-1912)** — *French mathematician, physicist, philosopher and theorist of science. President of the Paris Academy of Sciences. He is considered to be the last mathematician—universalist who was able to be in the know about all the mathematical results of his time.*

According to the scientist, a constructive process begins with setting a task, followed by unconscious cerebration, unexpected discovery of a lead, and finishes with processing of results.

Since the main links of the process (incubation and illumination) cannot be controlled consciously and volitionally, it gave rise to concepts that underlined a decisive role of subconscious and irrational factors in creative work. However, experimental psychology has proven that unconscious is present in conscious, intuitive and mental processes as well.

The aggregate of psychic attributes, characteristic of a creative personality, became an object of concrete scientific study once tests were invented along with methods of their processing and analysis. Scholars’ statistical studies examine relationship between education and work efficiency, between age and the dynamics of creative work. Methods to stimulate group creative work were developed.

The “Threshold hypothesis,” proposed by P. Torrance, became a popular model. He considers that the high degree of intelligence is a necessary, but not a sufficient condition for high creative abilities [5]. All in all, one can say about a positive relationship between creative abilities and intelligence, although this relationship will not become apparent if only people with the high level of intelligence are evaluated.

Other scholars studied relationship between emotions and a creative activity. Some researchers, one of them is H. Eysenck, consider that positive emotions not only activate associative thinking but also defocus attention, increasing the area to pick up the facts relating to the examined problem [7].

**Hans Jürgen Eysenck (1916-1997)** — *English scholar and psychologist, one of the leaders of biological psychology, creator of three factor model of personality, author of the EPQ.*

On the other hand, a number of researchers consider that negative emotions can increase creativity. For example, Arnold Ludwig when studying activities of 1005 eminent personalities of the 20th century, found a weak but meaningful connection between their depressions and creative achievements. According to

different approaches to the definition of creative work limits, two types of creative work were established: of an actor (art) and of a sage (science and engineering).

Creativity (Lat. creare — produce) is the latest term defining “person’s creative abilities characterized by the ability to produce essentially new ideas and being part of the structure of giftedness as an independent factor” [16]. According to Professor I. Miloslavsky (Moscow State University), the term “creative” defines creative work, which “not only puts forward ideas, but also a certain practical result is produced”. Thereby, he finds creativity as something similar to innovative activity.

F. Barron and D. Harrington, summing up the results of studies in the field of creativity, achieved from 1970 till 1980 [2], summarized the data on creativity as follows:

1. Creativity is an ability to adaptively respond to the need for new approaches and new products. This ability enables to realize something new in being, although the process itself may be of both conscious and subconscious nature; it is the ability to generate unusual ideas, to think out of the box, to find quick solutions to problematic situations.

2. Creation of a new creative product depends largely on a personality of a creator and on the strength of one’s internal motivation.

3. Special features of a constructive process, a creative product as well as a person are their originality, validity<sup>1</sup>, relevance to a task and suitability (aesthetic, environmental), optimality of a shape, correctness and originality at the moment.

4. Creative products can be very diverse in nature: new solution for a mathematical problem, discovery of a chemical process, creation of music, a painting or a poem, or of a new philosophical or religious system, of innovations in jurisprudence, fresh solutions of social issues.

Analyzing current studies of this phenomenon, we can conclude that until now there is still no definite answer to the question whether there is creativity as a phenomenon, whether it is a scientific construct or an independent process of creativity. And maybe creativity is a combination of other mental processes.

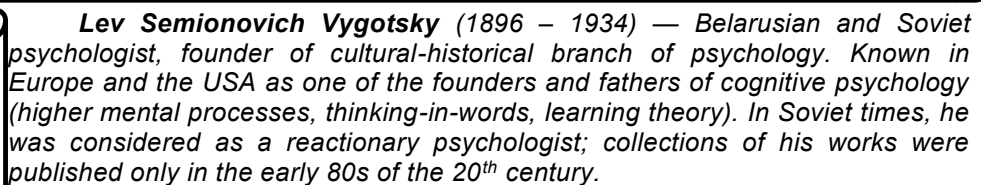
Creativity is an innate characteristic of a human being: due to it, man manifests himself, exercises social needs, and in due course satisfies his needs of achievements, of successes and self-expression. Thanks to the development of work skills, growth of experience, faced problems, and many other various situational, objective and subjective factors, creativity develops and shows itself differently throughout one’s life. One can say there is a relationship between behavior and creativity. Thanks to creative work, a person expresses one’s inner world and changes the external one, whereas products of creative work encourage him to further development.

We understand primary creativity as something new, differing from that what was before. Secondary creativity consists in creation of a specific object (carrying out

a complex multistep task, and so on) with addition of some distinctive features. It deals with those issues that have already occurred, have been realized before. For example, a director produces a performance based on a famous writer's classical work, but, nevertheless, he has his own vision, casts at his discretion and creates his own performance according to the traditional principles of performance creation (genre). Secondary creativity is considered in certain specific situation or circumstances, and the novelty in it is somewhat arbitrary.

However, a director can approach a production in a totally new way. It is a question of the birth of a unique conception, which no artist has ever seen, foreseen and used before. This can be considered as primary creativity.

L.Vygotsky, a well-known psychologist, studied person's creative essence from the cultural–historical point of view. He believed that due to an activity, the person study, “deciphers” products of culture, heritage of mankind, and acquires them in his own way. This process is the foundation and prerequisite of self-development. Every person has a unique inner world and shows creative potential in his own way [17].



**Lev Semionovich Vygotsky (1896 – 1934)** — *Belarusian and Soviet psychologist, founder of cultural-historical branch of psychology. Known in Europe and the USA as one of the founders and fathers of cognitive psychology (higher mental processes, thinking-in-words, learning theory). In Soviet times, he was considered as a reactionary psychologist; collections of his works were published only in the early 80s of the 20<sup>th</sup> century.*

For a visual comparison, Table 1.1 summarizes some scholars' views on creativity. G. Altshuller considered objective and subjective relations of constructive process in four aspects: philosophical, social, psychological and methodical. In philosophical terms — formalization can be spread only to a reproductive component and cannot be regarded as the key to understanding of that part of the constructive process, which is characterized by a productive component [8, 9]. In social terms — two forms of reflection of the need for a creative activity: social mandate, and need revealed by the subject. In psychological terms — two approaches: study of creator's psychology; research of the methods used by creators in made “products” of creative work.

The reasons of “psychological barriers” and inertia of thinking began to be considered as a result of the first approach:

- habit strength due to profession;
- fear to get into a different area of knowledge;
- influence of authority, titles/ranks;
- presence of specific terms;
- inability to reformulate the conditions of a problem.

**The essence of creativity from some scholars' viewpoint**

AUTHOR	CONTENT OF CREATIVITY
L. Vygotsky	Any activity that creates something new is a creative one. Creative work — необходимое условие существования, и всё вокруг обязано своим происхождением творческому процессу человека.
Ya. Ponomarev	Creativity consists of two main components: formal and dynamic aspect of <i>motivational tension</i> , manifested through active research activity, intellectual labor; <i>sensitivity</i> , i.e., the responsiveness to visceral displays of intellection.
A. Yakovleva	Creativity — is a realization of person's own individuality, and not a set of personal traits.
V. Molyako	Creative giftedness is innate static phenomenon, and habits and skills of creative solution of activity problems are formed already on its basis.
M. Poddyakov	Creative directedness consists of a number of components: needs and motives; formation of goals; emotional regulation; means of cognition and results.
E. Alfeeva, A. Matyushkin	Creativity is formed through the development of personal properties, talent and abilities.
V. Druzhinin	Creativity — this is the property which is realized only when there are favorable environmental conditions.
N. Hazratova	Creativity is first formed on the inner personal motivation level, and later — on the external behavioral and productive levels.
M. Gnatko	Creative work is an activity due to which the person produces new socially-significant material and spiritual values. Creativity is divided into potential (complex of respective inclinations), and actual creativity (respective abilities).
E. de Bono	Creativity is, on the one hand, a natural human property, and on the other hand, this is — the highest form of activity of the individual, which is embodied in products of creative work.
A. Maslow	Creativity — individual's creative abilities, realizing the need for self-actualization.
A.J. Rowe	Creativity is a reflection of our Creative Intelligence. It differs from what is normally considered General Intelligence. Creativity focuses on our desire to achieve something new or different.
G. Altshuller	Creative work is: the process of analysis and synthesis of new forms and images in the human brain; the reflection of objects and phenomena of an objective world, the cognition of goal, conditions and reasons for emergence and existence of these objects and phenomena.

Making the list of typical methods of finding solutions was the result of the second approach, and in methodological aspect — of methods of finding new engineering solutions and psychological tools.



Thanks to creativity, the person express oneself, changes own inner and external world. Thus, creativity is characterized through categories of personality's motivational orientation, of search and exploratory activity, the use of intuition in the process of elaboration and making a decision. The success when solving creative problems depends on the ability to manipulate ideas, images of objects and phenomena, as well as on "the personality's inner plan for action" [32].

Ya. Ponomarev, a psychologist, widely interpreting the concept of "creative work," defined this notion as "mechanism of productive development" and did not consider "novelty" as a decisive criterion of creative work [31].

The level of intelligence is of great importance, as well as the need for self-realization and the person's idea about his place in the society. Only such a personality is capable of creative activity, and the product of one's creative work serves as the final result of aspiration to unconventionally solve a certain problem. Considering this fact, a well-known American theorist *A. Maslow noted that getting an arts education is extremely important for formation of better human beings, because its purpose is to reveal the personality's potential from the humanistic point of view* [4].

A recreational or reproductive personality is an opposite of a creative personality. The system of motivation of the former is simpler (perhaps even more primitive), cognitive aspirations — are low, thereafter the products of one's own cognitive and practical activities are also not evaluated very critically by him. Therefore, the constructive process is a manifestation of individuality.

There is an opinion that creativity — an abstract (ideal) concept, since its presence does not provide for compulsory material embodiment. An idea as an intangible product can disappear without getting its further development for certain reasons. Sometimes, creativity can manifest itself only in interpersonal relations for its own presentation of unique individual traits [46].

A completely opposite view on creativity consists in that it is mainly manifested in the field of scientific and engineering developments. Giftedness is the most important factor of creative work. The results of activity of such a person are more original than those of other people. At the same time, new methods and ways of solving individual problems dealing with adapting to the situation and environment are a positive effect of creative giftedness [28].

To think creatively — it means to be interested in the invention of original ways of activity, to be motivated to change the world for the better, using your own "research strategies" for this [33]. Therefore, a humanistic, mental and ethical component of creative work is undoubtedly important.

Humanistic psychology claims that abilities, inclinations, and even talents can be developed with the help of special programs that, in turn, will allow creativity to be formed.

The complexity of studying the phenomenon of creativity, in particular, is that the mechanism of its formation and development cannot be formalized. For example, there is no typical behavior sample, no positive creative behavior, no conditions of its imitation, or unequivocal social approval.

Certainly, the external environment affects the development of creativity. M. Gnatko defines creative work as an activity due to which an individual produces new tangible and intangible values [18]. Creativity can be divided into innate (pre-socialized) and learned (actual, “socialized”) creativity. Here the problem arises of determining the regularities of actual creativity formation, and of transformation of innate inclinations into reality.

It is very good, if intelligence indicators, such as speed, agility, flexibility of thinking, are combined with originality. N. Hazratova, in her sociological studies, evaluated two main behavior parameters: the value of creativity products and the foundation of motivation. [43] She came to the conclusion that at first it is necessary to initiate a motivational mechanism, and then there will be changes in one’s behavior and waste products.

In people with a high level of creativity inherent such traits as the hope of success, affiliation (Lat. *ad-*, to *filius*, son) that is, aspiration to be together with people, empathy. Otherwise, the fear to be rejected and come to grief prevails.

E. de Bono emphasizes that creativity — is not a natural talent, but rather skills that can be learned. To achieve creativity, conservative statements and rules should be challenged. “When we keep to the beaten track, our thinking often misses hidden opportunities, which are located outside of it” [41].

So, creativity can be realized in any work and can be manifested in anyone, especially if multitude of ways for creativity to be realized is taken into account.

### ***1.3. Interrelation of ability, giftedness and creative work***

Psychological science is making fresh advances and is playing an ever growing role in solution of pressing problems of education, production, and human communication area. Psychological research of abilities, creative work and giftedness are important in our context because of modern needs of society which requires highly skilled, creative personalities who could solve actual problems of state and social construction. There are a number of studies devoted to the study of personality’s giftedness at different ages, mainly concerning adult individuals. The problematics of adolescents’ giftedness is less studied, although this human age — is one of the most sensitive periods for development of one’s general and creative abilities, as it is during this period of ontogenesis that thought processes change significantly, and personality’s active creative attitude to the reality and to oneself is formed.

The problematics of creative work — is the subject of study for many psychologists from different countries (D.B. Bogoyavlenskaya (check), E. Bono, J. Guilford, V. Druzhinin, S. Kostyuk, K.K. Platonov, Ya.A. Ponomarev, E. P. Torrance, A.N. Matyushkin, A.V. Morozov, D.V. Chernilevsky and others). Such scholars as N.S. Leites, V.A. Molyako, V.V. Rybalka, S.A. Sysoeva, A.V. Furman and others made a significant contribution to the development of subjects of intelligence, abilities, giftedness, creative thinking, and creative personality development.

The problem of abilities is studied from different positions and is developed in different ways. B. Teplov once pointed to three signs of abilities that are still recognized as classic ones, namely: 1) abilities mean individual psychological characteristics distinguishing one person from another; 2) not all individual differences are called abilities, but only those which deal with execution of activity or many kinds of it; 3) notion of “ability” is not reduced to knowledge, skills or habits this person has already acquired [40]. S.L. Rubinstein, as well as B. Teplov, understood by the abilities a complex synthetic formation of personality, which determines one’s ability to successfully perform any type of activity [37]. The scientist also did not reduce the abilities to knowledge, habits and skills, and had a dialectical approach to this problem: on the one hand, ability is the prerequisite to execute an action and, at the same time, to master knowledge and skills, and on the other hand — abilities are formed in the process of mastering them [37]. N.S. Leites notes that abilities are such personality traits on which the possibility to perform an activity and the degree of its success depend [22]. G.S. Kostyuk considered abilities as human nature manifestation, as complex synthetic personality structure, closely connected with complex of its qualities, particularly with knowledge, needs and interests [21]. K.K. Platonov in his understanding of abilities proceeds from their connection with personality structure, to which he attaches one’s “experience” (knowledge, habits, skills), “functional characteristics” (emotions, feelings, thinking, perception, will, memory), “biological conditionality” (properties of temperament), “directedness” [30]. Thus, abilities are mental properties of a socialized individual, being prerequisite for his successful performance of certain activities (acquisition of knowledge, habits and skills, their use in one’s work) as a conscious subject of everyday social life.

The term “intellectual giftedness” is synonymous with “mind,” “mental abilities,” “intelligence,” “giftedness,” “talent,” “intellectual abilities,” “cognitive sphere,” “cognitive capabilities.” Understanding of giftedness depends a lot on what importance is given to one or another kind of activity and what exactly is understood by “successful” performance of each of its

particular kinds. The essence of content of such notions as “giftedness” and “abilities” consists in that that man’s properties are considered in them from the point of view of those requirements, which one or another practical activity sets before him. Therefore, there is no reason for telling about giftedness in general, but only about giftedness in a particular activity or a sphere of human practice.

Scientists mainly consider giftedness from the following positions: as a qualitatively particular combination of abilities on which the possibility of bigger or lesser success in performance of a specific kind of activity depends (B. Teplov); as inherited qualities, being a prerequisite for the development of abilities (M.D. Levitov); as a natural fund of abilities that are anatomico-physiological inclinations (V.A. Krutetskiy). At the same time, giftedness — this is first of all a high level of development of human abilities, given him an opportunity to achieve special original successes in a certain area or segments of social activities. Hence, general giftedness is a wide range of possibilities making the foundation of personality’s successful acquisition of knowledge, skills, values and norms, and later on of achieving creative success in many kinds of professional practice [45], where general mental abilities form their basis. That is, such a system of individual psychological attributes ensures a relative ease and efficiency in operating knowledge, images, and meanings.

Scientists point out that giftedness is one of the least understandable phenomena of the human psyche, which is not confined to high intelligence, being undoubtedly one of the most important criteria in evaluation of this trait (quality) of the personality. It is noteworthy that in the psychological science, different authors’ definitions of the concept of “intelligence” have much in common. So, intelligence — this is: a) rather independent dynamic structure of cognitive characteristics emerging on the basis of the genetically fixed (and innate) anatomico-physiological properties of the brain and nervous system (inclinations), which is formed in interrelation with them (L.F. Burlachuk); b) an adaptative mechanism ensuring adequate human adaptation to surrounding reality (V. Molyako); c) personality trait, manifesting itself in the ability to accurately and deeply reflect in the mind objects and phenomena of objective reality in their essential connections and regularities, as well as in creative restructuring of experience (M.D. Levitov); d) the system of orientation to the essential dependences of the problems solved (P.Ya. Galperin); e) a plastic, and, at the same time, stable structural equilibrium of behavior (A.V. Petrovsky). And personality’s psychogeny depends on the same factors as many mental functions of the organism do, that is, on innate characteristics, on the one hand, and on the environment on the other hand; it is a special system of individuality development as a complex psychological phenomenon, reflecting

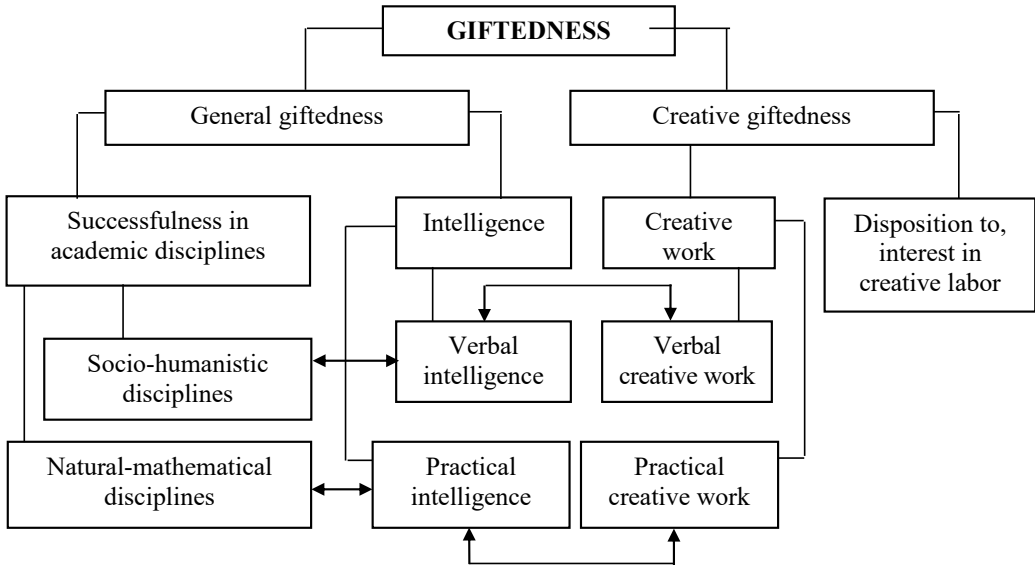
essential moments of complementarity of mental and intellectual processes, a peculiar combination of generalized and individual structures of human mental life. Manifestations of intelligence are varied and unstable. And nevertheless, “activation of all mental functions providing cognition of the world around in any act of thinking, memory, and imagination” is the dominant feature, with the help of which you can distinguish intelligence from other features of personality's behavior [42]. Therefore, intelligence — this is personality's ability to perform various operations of logical thinking conditioned by the level of development of other mental abilities (perception, memory, attention, etc.).

The understanding of creative work is characterized by a wide range of views: interpretation of creative work from a reflexological position as creation of something new in a situation when a problem-irritant causes the formation of a dominant around which past experience concentrates, which is required to make a decision (V.M. Bekhterev); as going beyond existing knowledge (D.B. Bogoyavlenskaya, A.N. Matyushkin, Z.M. Kalmykova and others); as interaction that leads to development (Ya.A. Ponomarev). Hence it is natural that creative work is considered in several aspects: as a product; as a constructive process; as creative abilities and characteristics of sensible course of creative activity.

While studying the phenomenon of creative giftedness, researchers analyze its various signs and forms of manifestation. A.N. Matyushkin, relying on the works of E.A. Golubeva, E.I. Ignatieva, V.A. Krutetskiy, I.V. Ravich-Scherbo, B.M. Teplov and others, substantiates a synthetic structure of creative giftedness, to which the dominant role of cognitive motivation, research creative activity (finding something new, statement and solution of a problem), possibilities of forecasting and predicting attainment of original solutions, ability to create ideal standards ensuring high aesthetic, moral and purely intellectual estimations are attached [26].

One of the initial positions in the study of creative giftedness is distinguishing it as a complex psychological system. This system includes at least the following components: a) inclinations defining high sensitivity of the subject to certain kinds of signals and characterizing increased psychomotor capabilities; b) highly intellectual abilities; c) capacity for creative work (finding new solutions to problems, original assessment of a situation and so on); d) disposition to achieve predicted results, which is connected with overcoming various barriers, difficulties of external and internal nature [27]. Besides, an important indicator of creative work is originality, which is primarily expressed in a creative style of a person, in the richness of one's individuality. At the same time, originality — this is a sort of key, opening scientific, aesthetic and moral values of the world [36]. And further, V.A. Molyako's conception [27] allows interpreting creative giftedness as a high development of man's creative abilities, promoting a successful solution of various problems.

We note (Fig. 1.3), in conclusion, that the manifestation of psychological characteristics of general and creative giftedness — this is a complex interconnected system formation, causing operation of mental processes that are naturally involved in integral course of intellectual (creative) activity of an adult.



**Fig. 1.3.** Kinds of giftedness, peculiarities and their components

The manifestation of general and creative giftedness of adolescents is a complex interconnected system formation, conditioning operation of mental processes that are organically included in a developing-situational course of purposeful mental and then creative activity as well. Psychological peculiarities of general and creative giftedness of teenage students are dialectically interrelated what is caused by a strong basic connection of verbal intelligence and verbal creative work, practical intelligence and practical creative work. The volume of knowledge of academic subjects (humanities, natural-mathematical sciences) and, accordingly, a high developing potential of the intelligence (verbal, practical) contribute to the manifestation of general teenagers' giftedness. And a high development of their verbal and/or practical creativity and presence of disposition and aspirations to creative activity proper stimulate their creative giftedness formation.

***1.4. Urgency of introduction of creative management in the activity of enterprises and organizations***

Creative management should be developed because under modern conditions, the issue of increasing the quality of management decisions is topical. Unacceptably

low quality of management decisions taken spontaneously, impulsively, without a thorough examination from positions of modern management, is one of the main causes of crisis in the economy. For a successful business management, it is necessary to meet a number of terms and conditions, in particular, the use of improved methods for preparation of information for managers. On the one hand, rational decision requires manager's personal professionalism, and on the other hand — decision as a product of administrative work should be the result of mobilization of employees' reserves and be based on full use of their creative potential, including its deeper levels. Improving the management of creative potential provides for its increase. However, despite the existence of different methods in scientific and technical creative work, or when developing new ideas in other fields, they are currently almost not used to improve management decisions in economic-organizing spheres. This is explained, above all, by more complex objects of analysis in comparison with that of engineering systems.

The urgency of introduction of creative management is also caused by the need for “emancipation” of the personality in the collective. It is no secret that school and family education is primarily aimed at suppressing uncommonness, originality. Creative management methods are used to fight against clichés, monotony.

Besides the issue of creation of a creative collective and its management, solving the problems of creative management to formulate tasks of artificial intelligence is of great importance.

It is necessary as to improve the efficiency of manager's individual actions as to learn to control a process of changes. This requires competence in such issues as leadership, training, and creativity. In recent years, cognitive and behavioral techniques of neurolinguistic programming began to be introduced for the development of personal and organizational learning strategies, communication skills and those of management, which in turn enable the process of management of innovations.

Management of creativity in the organization can be considered on both micro- and macrolevels. The microlevel is a level of personality, and macroaspects are methods to enhance creative interaction in a group, collective interaction to solve problems in an organization.

Managers' activities coordinate the work aimed at strengthening and better use of creative potential, intellectual abilities. Management, as a special kind of activity, has always used creative work. Firstly, it is used for development of solutions (even during daily meetings and sessions), secondly, during realization of motivational management function to induce subordinates to behave as it is necessary. Because of

ever increasing spread of “exclusivity” in management, we can tell that it approaches the sphere of art more and more. It can be expected that transition to a qualitatively new level of development of management will entail destruction of established stereotypes and emergence of peculiar unknown traits.

The development of abilities has always been a prerogative of learning activity, and now switched over to the theory and practice of management. Management of creative processes is a synthetic field of knowledge. Creative work is an integral concept for different and even contradictory processes, and management requires for a control object to be clearly defined, intelligible and specific. Herein lies the dilemma of creative management.

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## 2. Creative personality potential

*2.1. Concept and psychological structure of constructive creative personality potential. Personality traits.*

*2.2. Creative act mechanism.*

*2.3. Kinds of creative thinking. Creative work and human thinking models.*

### ***2.1. Concept and psychological structure of constructive creative personality potential. Personality traits***

Creative potential is a complex subsystem, which is closely intertwined with other structural components of the psyche, with elements determining creative processes. Creative potential is manifested in the personality's ability to set and meet new challenges in the sphere of one's activity, and to have an unconventional and independent approach to solving a particular case.

The ability to create is inherent not only in talented personalities in the area of science, technology, culture and arts. It can be stimulated and developed at each individual through purposeful measures, increasing the efficiency of productive human activity in various areas.

Researchers have different approaches to the evaluation of components of creative work: a) focus their attention on different components of creativity process; b) they pick one component as a priority; c) they construct a complex system of interacting processes. J. Guilford and E.P. Torrance describe creativity in terms of thinking, understanding creative thinking "a process of becoming sensitive to problems, deficiencies, gaps in knowledge, missing elements; making guesses, or formulating hypotheses about the deficiencies: testing and retesting these hypotheses and possibly modifying and retesting them; and finally communicating the results" [8].

According to J. Guilford creativity parameters include [14]:

- 1) ability to detect and state the problem;
- 2) ability to generate a large number of ideas;
- 3) flexibility — the ability to generate various ideas;
- 4) originality — the ability to respond to stimuli unconventionally, ability to give unconventional answers. This is achieved by certain kinds of flexibility, among which:

- \* semantic flexibility — ability to suggest a new usage of the object;
- \* image flexibility — ability to see new signs in the object.
- \* sponaneous flexibility — ability to generate various ideas in unregulated situations.

5) ability to improve the object by adding details;

6) ability to solve problems, i.e., the ability to analyze and synthesize.

E.P. Torrance, using special features of respondents' answers to tests items, proposed the following main parameters of creativity [5]:

- easiness, estimated by the speed of doing test tasks;
- flexibility, estimated as the number of transitions from one class of objects to another while giving responses;
- originality, estimated as the lowest frequency of this response relatively to a homogeneous group of respondents.

J. Guilford's conception provides for two varieties of thinking: convergent thinking — this is thinking, when all efforts are focused on finding the only right solution; divergent thinking — a “fan” search for a solution in all possible directions in order to consider as many options as possible that lead to original solutions [14]. He connects creativity to productivity, originality, uniqueness and selectivity.

O.I. Kulchitskaya attributes to creative thinking features:

- easiness and productivity of thinking — that is, how quickly an individual can create certain products of creative work: ideas, thoughts, images, etc.;
- flexibility — ability to pass quickly from one problem to another, or to combine them;
- originality — peculiarity of thinking, unusual approach to the problem, its new solution;
- accuracy (correspondence) — precision of the operations of thought on the issue, the choice of an adequate solution corresponding to the goal set [18].

I.A. Bartashnikova and A.A. Bartashnikov reveal the key indicators of creative thinking: speed, flexibility, originality, curiosity, boldness [6]. L.V. Khomik names such peculiarities of creative thinking as flexibility, speed and originality. [20] Each of the authors use different concepts to explain creative thinking, for example — parameters of creative thinking, peculiarities of creative thinking, indicators of creative thinking, signs of creative thinking, without giving them a specific interpretation. It can be assumed that in any case it is a matter of peculiarities of creative thinking.

E. de Bono believes that creative people have also “rebelliousness of spirit” [10].

In psychology, there is a concept of conformism — when an individual accepts rules of conduct of a group to which he belongs. Already since their schooldays, children with “cunning” inherent in them, learn schemes of approving behavior and get personal benefits from it: how to please a teacher and spend less time sitting with textbooks. Later, it is repeated at an institute of higher education, at work. However, there are also nonconformist rebels among them who challenge the public. It is they

who more often become creative personalities. As in order to swim against the tide, courage and vigor are required. This is, perhaps, the primary creativity. Then conformists pick up ideas, if the society decides that innovations are needed (secondary creativity), and nonconformists again depart from conventional frameworks and seek original solutions.

E. de Bono argues that the paradox arises of transition of creative potential from the rebels to the conformists. So, creative work does not belong solely to the oppositionists, or solely to the conformists. For example, on the one hand, it is difficult to characterize Japanese people as rebels and oppositionists. On the other hand, the Japanese management model stands on the fact that already schoolchildren are trained to develop creative skills and are instilled the idea that it is they who will be the world leaders. And as a result — Japanese managers became world leaders in quality management in the 1970s of the last century.

The complexity of a problem of a psychological study of creative work becomes clear if to consider the whole variety of special kinds of creative work, which can be distinguished by the subject of creative activity (scientific, technical, artistic, social, administrative, political, economic, educational, domestic); by age, cultural, national and other signs. Creative thinking occurs at such levels as the operational, objective, reflexive and personal. They form a system of constituents of cognitive activity. And man's search for creative problem solution is a movement of one's thought through hierarchically subordinate levels. The personal and reflective levels form the top of the hierarchy, and the objective and operational — the basis. They operate as a dynamic system in mentation.

A.N. Luk [20] singles out such typical qualities of the creative personality: willingness to take risks, impulsivity, inner-directedness, and an uneven progress in the study of different academic subjects, sense of humor, originality, cognitive scrupulosity, disbelieving in words, a critical view on such things that are considered "sacred," courage of ideas and thinking.

As a result of consideration of the features of the creative process, and the main signs of personality's creative work, the following basic traits characterizing a developed creative personality can be distinguished: depth and breadth of knowledge, the ability to apply them in different situations; established stable need for constant renewal and acquisition of new knowledge; a purposeful aspiration for the truth; the ability to penetrate deeply into the essence of a problem, to reveal connections between phenomena, that is, the capacity for analysis and synthesis, to work systematically on one's own; an irresistible impulse to self-improvement and self-realization; constructive criticism and self-criticism; the ability to give up outdated habits and views, to coordinate something new with a personal experience and that of others; scientific world outlook.

So, creativity is manifested in the speed, accuracy, flexibility, originality of thinking, rich imagination, disposition to high aesthetic values, level of detailed elaboration of a problem, display of persistence, purposefulness, resoluteness, diligence, and systematic character of work.

## ***2.2. Creative act mechanism***

For creativity to be activated, a special mental state should be created. The evolution of a scientific thought on the creative act mechanism gives rise to new ideas about creative work, creativity. Its non-motivation, spontaneity, disinterestedness are the fundamental differences of creative work. On the other hand, creativity — this is creative work that sets a specific goal, mainly in the socio-economic environment.

It is interesting to examine the creative act mechanism of artists. Almost all of them concurred with the lack of control of their creative process, the presence of a special state of consciousness, feeling to be guided from outside; only means and results of these processes were different. A. Blok (1880-1921), Russian poet, noted: “And everything is not mine already, but it is ours, and a connection with the world established.”

Some typical statements can be given. A. de Vigny, *Compte de* (1797-1863), French author, wrote: “I do not make my book, and it is made by itself. It is maturing and growing in my head like a large fruit”; V. Hugo (1802-1885), classic of a French prose, noted: “God dictated and I wrote.” Similar statements of well-known theologians could be found. So, Saint Augustine (354-430), diminishing the value of his own experience, said: “I do not think by myself, but my thoughts are thinking instead of me.” Michelangelo Buonarroti (1475-1564), outstanding Renaissance artist, was convinced that his art is guided by the Superior Mind — God: “If my heavy hammer in hard stones can form A human semblance, one and then another, Set moving by the agent who is holder Watcher and guide, its course is not its own”.

A number of the other features of creative work are associated with the leading role of the subconscious, its domination over the consciousness in the creative act; in particular, the effect of “impotence of the will” when inspiration comes. At the moment of creative work, of an uncontrolled activity of the psyche, a human being is totally unable to control the flow of images, freely reproduce images and experiences. The artist is not able to fill the gaps of creative fantasy. Images are generated and disappear spontaneously, aside from a certain plan (rationally created plan of work), more vivid and dynamic images replace less bright in the consciousness; that is, and the consciousness becomes a passive screen on which the human subconscious reflects itself.

The artist always feels anxiety when trying to explain the cause, source of one's fantasies. The "divine" and "demonic" versions of attribution of cause of creative work are the most common. And artists and writers adopted the versions, depending on their outlook. If G. G. Byron (1788-1824), English poet, believed that "demon" gets into the person, Michelangelo — that his hand is led by "God": "Fine painting approaches to God and merges with Him".

As a result of it one's authorship was even denied — because I am not the author, but it is God, devil, spirit, "inner voice" (according to P. Tchaikovsky (1840-1893), Russian composer, believed); a creator is aware of oneself as, for example, W.A. Mozart (1756-1791, Austrian composer), the tool of outside force, "I have nothing to do with it." The version of an impersonal source of the creative act passes through different eras and cultures. So, in the 20th century, it was revived in J. Brodsky's mind (1940-1996), Nobel laureate: "The poet is language's means for existence ... he writes not because he courts fame with posterity ... and because the language prompts, or simply dictates, the next line."

A lot of artists lost interest in their works after their publication. So, for example, F. Kafka (1883-1924), Austrian writer, willed his manuscripts to be burnt after his death, and R. Kipling (1865-1936), famous English writer, threw his "Recessional" in a trash can as if the published books ceased to exist for him.

The activity of the subconscious in creative process is connected with a special state of mind. The creative act often occurs in one's sleep, in a drunken state and anesthetized. Sometimes artists resorted to artificial stimulation: when R. Rolland (1866-1944), French author, was writing *Colas Breugnon*, he drank wine; F. von Schiller (1759-1805), German poet, took cold foot bathes to keep his creative inspiration; J.J. Rousseau (1712-1778), French thinker, poet and composer, got creative powers standing in the sun with his head uncovered; B. Prus (1847-1912), Polish writer had to smell strong perfume; an Englishman, J. Milton (1608 -1674) and a Russian, Pushkin (1799-1837) wrote their poems solely when lying on a sofa or couch. There were also more strong as well as sad addictions. So, for example, H. de Balzac (1799-1850), French classic and J.S. Bach (1685-1750), German composer, were avid coffee addicts, and G. G. Byron and an American, E.A. Poe (1809-1849), inventor of the detective genre in the literature, were accused of using drugs. J. Lennon (1940-1980), founder of *The Beatles* and J. Morrison (1943-1971), leader and vocalist of *The Doors* — idols of the 20th century — were drug addicts as well. By the way, the history of world rock culture is, unfortunately, associated with psychotropic drugs. The destruction of personality is opposite to creative work, although it is a way to turn to a direct contact with the nature too: a maleficent path back to "paradise" from "fall." But means and results of these processes are opposite.

It is a state of estrangement from one's own *Ego*, when there is no sense of personal initiative and merit in making of a creative product, that gives a feeling as if the person is a conduit of another's spirit, ideas, images, of sensations from the outside, and this experience has an unexpected effect: a creator begins to treat one's creations indifferently or, moreover, with disgust. At the same time, creative mechanisms, when performing purposeful mental activity, have an opposite effect namely — effect of efforts. The more efforts the person spends to achieve a creative goal, the greater emotional significance of the final result for him.

The point is evident that creativity — this is the ability to perform the work which is both pioneering (i.e. original, unexpected) and useful, that meets task requirements. This is a fundamental difference between creativity and purely creative activity. In this context, creative management should be considered as a constructive management.

Illogical behavior and thinking are sometimes useful too, as they encourage to the latest problem-solving procedures. The following example demonstrates that the intelligence and logical actions do not always lead to the best results. Creative thinking is a combination of logical thinking and chance.

*If you put bees and flies into a bottle and place it horizontally, with its bottom towards a window (as it was done by G. Sue — a specialist in the field of management), the bees will not find a way out, and the flies will quickly get free thanks to their swift inconsecutive movements.*

### **2.3. Kinds of creative thinking. Creative work and human thinking models**

The substantial proportion of able-bodied population does not show creativity for several good reasons. The lack of great responsibility in industrial relations is one of the psychological barriers. A creative idea is preceded by a lot of inner work as for the volume of processed information as for the energy spent. And it is historically established, that neither at school, institute of higher learning nor in a scientific laboratory, an average person is used to think constructively, that is the culture of thinking, formed for centuries, prevents creative directedness. The studies conducted in the United States [19] showed another profile of constructive thinking: only 20 percent of promising ideas come from professionals in a given field of knowledge, about 30 percent of the ideas are proposed by representatives of related professions, and a half of the ideas come from people who have little to do with a given trade.

In special literature, there are various approaches to the styles or models of creative thinking. The model of *information processes of human thinking* [29] is

constructed, similarly to the principle of trinity, using three components — conceptual apparatus (consciousness — “knows”), system of beliefs (reflection — “believes”), system of preferences (self-identification — “wants”: hence problem situations arise. The combination of these signs unambiguously defines the subject. At the intersection of these three components, one’s own conscious idea about oneself is formed (sufficient condition for object’s existence). The intersection of area of consciousness with that of advantages is a zone of problems (that what should be solved, but it is not quite clear how to do it). The intersection of the areas of consciousness and subconsciousness (believes) contains one’s own realized idea about the world — subject’s outlook. And finally, the intersection of the areas of subconsciousness and advantages reflects subject’s automatic skills [6, p. 10].

One of the properties of thinking — this is its duality (bilateralism). The conscious interacts with the subconscious. Morality, conscience (perceived by person’s heart, “guts”) are subconscious analogues of the world outlook. The conscious can be characterized by a degree of dynamism of thinking (ability to note and predict the lifetime of processes, objects) [26].

Besides the function of cognition and value system, the driving force of personality is the basic subject of analysis. This is a key factor underlying creativity. Our drives, ability to cope with difficulties and basic needs, combining with something that we consider useful, necessary or desirable, describe four basic styles of creative thinking. Each of the four types is described below [25].

*Intuitive type of thinking.* This style describes cunning and resourceful personalities and is typical of managers, actors and politicians. The intuitive style of creative thinking attaches particular importance to achievements, hard work and the ability to quickly find right answers; it focuses on results, use of common sense and of previous experience. (A. Rowe maybe wrong surname)

*Innovative type of thinking.* This style describes curious personalities, and is typical of scientists, engineers and inventors. The innovative style attaches great importance to accuracy, experimentation and precise analysis; it easily copes with difficulties.

*Imaginative type of thinking.* This type describes sincere personalities and is typical of artists, musicians, writers and leaders. The imaginative style is suitable to determine potential prospects; this style is also characterized by willingness to take risks not caring about traditions. In addition, the imaginative style is impartial and is often inclined to humor when suggesting ideas.

*An inspiring type of thinking.* This style describes dreamy personalities and is typical of educators, leaders and writers. The inspiring style has a positive impact focused on overcoming social needs and is characterized by willingness to self-sacrifice in order to achieve the objectives. This style is associated with changes that help others.



Creative personalities react in different ways to various situations, relying on the individual styles of creative thinking. For example, the intuitive style is characterized by a fast response to operational problems. On the other hand, innovative personalities trust large volumes of information and take time to examine and penetrate into a heart of the problem. People with the imaginative style use subjective estimate as a basis for decision-making. They rely on large volumes of information, and they require a significant amount of time to think, because they need to evaluate the options and possible consequences. There are people in whom the following train of thought is inherent: “On the one hand, we should do so, but on the other hand — actual benefit will be if we do in another way.” This way of reasoning requires time, but usually it leads to a better and more competent decision than decisions of those who act without thinking. These are the characteristics of the inspiring style. Such personalities are concerned about ensuring the welfare of others and are willing to self-sacrifice. The inspiring style is based on feelings or instincts, and such people are focused on work with other people to solve organizational or social problems.

Is it possible to consider with confidence one of these styles as the best one? Usually, it depends on the situation. In a critical situation, the intuitive style helps to quickly make right decisions, but when it comes to understanding the effects of certain problems in the future, the imaginative style, of course, will be more effective.

Creativity reflects the styles of special thinking, it depends on our cognition (ability to visualize and understand), memory (learnt reactions), and the ability to develop, reformulate, recombine or to invent new reactions to different situations, both within oneself (drive, willingness to take risks) and in interaction with the external environment. According to another point of view [16], there are three styles of creative thinking — these are kinaesthetic (focused mainly on physical sensations), visual (relies on visual perception) and verbal (focused on speech). Considering this, a communication barrier can be an obstacle to making a group creative decision. So, a visualist says to a verbalist or to a kinaesthetic: “I can not imagine what you meant?” The verbalist answers to this: “I have told you about it many times!” And the kinaesthetic replies: “I can not feel a heart of the problem” [16].

Thinking is a complex cognitive process that plays an important role in the activity of an executive. It is the process of reflection and cognition of phenomena of reality in their essential signs and relationships, and this process is socially conditioned and inextricably linked to the language. Thinking is formed on the basis of sensation and perception, but goes far beyond them. The characterization of thinking — this is a description of its basic properties, operations forming mentation, its forms, kinds, and main stages.

The basic *properties of* thinking are: an indissoluble connection with the language, generality, a social, mediate and problem nature.

The basic *mental operations* are: analysis, synthesis, generalization, abstraction, concretization, comparison, categorization and others.

The basic *forms of thinking*, according N. Revskaya, Russian psychologist, include concepts, reflections, conclusions [24, p. 112].

The basic *kinds of thinking*: visual active, representational, verbal.

The main stages of thought process:

1) emergence of a problem situation, person's awareness of it, the view of this situation as a problem;

2) mental search directed on analysis, comprehension, solution of the problem;

3) determining solution approach, emergence of the key idea favoring solution of the problem. The notion of insight is used to designate this moment in mental process, "functional solution";

4) concretization of general solution and its realization in the process.

In 1967 E. de Bono used the term "lateral thinking" to denote unconventional creative thinking, and now this term is officially recognized and recorded in dictionaries and encyclopedias, including the Oxford English Dictionary [9].

Because of lateral thinking, the person is capable of putting forth specific new proposals, unconventional views on things and events. Creative approach is always necessary there where nothing else can bring effective results. It includes a challenge to conservative, familiar things, urges to take risks. To have lateral thinking, it is necessary: a) to be an optimist; b) to be capable to change behavior patterns and stereotypes of thinking accumulated over a lifetime. It can be contrasted with logical thinking and compared with a sense of humor. The operating principle of lateral thinking is based on asymmetry of perception. In other words, the person departs from a beaten track, deliberately destroys a single scheme apart, and then ideas arise.

Regarding lateral thinking, the concept of "movement" is used in the sense of the work of the brain, which is the opposite of mental petrification. Such a movement assumes an activity, in an idea we are looking for something unknown in advance, we are inspired by the fact that we can create something that nobody has been able to do until now. The movement may be manifested in attempts to find answers to questions: What is interesting in this idea? Where will it lead? New ideas are often born as a result of errors of logic (as Columbus' discovery of America).

E. de Bono, for the implementation of lateral thinking, introduced the "po" concept, which means to consider an object on the other side of habitual judgments. Because of this technique, it is possible to switch to a new schema of perception of the world. For example, an absurd idea of square car wheels, a square shape of a hamburger, etc. Another similar technique — this is a topsy-turvy view: "Let sellers pay for clients' purchases"; "Employees should promote themselves." However, incentive ideas can be sensible or correspond to a common sense. The third way to

activate lateral thinking — to use random hints, for example, having read the first word in any book and link it to the problem under consideration. For example, it is necessary to improve a TV set and to combine this improvement with a random word “cheese.” It comes to mind it would not be a bad idea to make a screen with a lot of “holes,” that can be in some way connected with the ability to watch several programs at the same time. So, the random word can offer a new point of thinking, starting from which it is possible to generate an idea, which can hardly be achieved with the help of a logically consistent way of thinking. Lateral thought is aimed at finding new points of view. Creative thinking is simultaneously the gift of nature, character trait and skills. Certainly, some people are more capable of it, others — less, however the overwhelming majority can reach a certain level of it.

“The Disney method of creative thinking,” developed by Robert Dilts [16], is a specific application of modeling technique of the classic lateral thinking, which is successfully used in solving creative problems, although it is built on the basis of logic.

**Walt Disney** (1901-1966) — American cartoon artist, director, actor, scriptwriter and producer, founder of the company Walt Disney Productions, which has at present turned into the media empire The Walt Disney Company. The founder of the first in the history sound, as well as musical and feature-length cartoons. During his extremely busy working life, Walt Disney directed 111 films, and produced 576. Disney's merits in cinematography were awarded 26 Academy Awards and many other prizes and rewards.

W. Disney's ability to combine innovative creativity, a successful business strategy and attractiveness for the masses in his products allowed him to establish an empire in the area of entertainment industry that outlasted its creator for several decades. Disney became an embodiment of the ability to build success of one's company on creativity and turn fantasies into concrete and tangible results. One of his animators' words allow understanding deeper this crucial part of Disney's strategy: “... in fact, there were three Disneys: a dreamer, a realist and a critic. And it was impossible to predict in advance who of them would come to a meeting.”

The aforementioned description is penetration not only into Disney's strategy, but also into the process of creativity in general. Creativity as an aggregate process provides for coordination of three sub-processes: “dreamer,” “realist” and “critic.” The dreamer is unable to provide a clear form for the idea without the realist. The critic and the dreamer will get caught in an endless conflict without the realist. The dreamer and the realist are capable of functioning, but they will never reach perfection without the critic. The critic helps to evaluate and improve products of creativity. A humorous example: one boss was proud of his own innovative ideas, but

lacked the ability to look at them from the viewpoint of the realist and the critic. The employees of his company talked about him like this: “Every minute some idea occurs to him... sometimes even valuable one.” The point is that creativity inherently assumes a synthesis of processes. Creativity needs the dreamer to generate new ideas and goals, the realist — as a mean to transform the ideas into specific expressions; the critic acts as a filter and is an incentive to improve.

Each of these phases, of course, is an independent thinking strategy, and these strategies tend rather to clash with than to support each other. It is useful to examine in detail how in practice Disney used and coordinated his imagination (the dreamer), methodically turned these fantasies into a tangible form (the realist), and applied critical judgments (the critic).

One of the principles of lateral thinking is the awareness that cookie cutter thinking are harmful in the process of generating ideas. And using an element of chance, a game is of benefit. For example, James Clerk Maxwell, a distinguished mathematician and physicist, liked to play with cutlery at mealtimes. He knew that game was important, because, being a teenager he came to the discovery of the law of reflection of light by playing with pins and thread. Gradually, with the improvement of one’s own lateral thinking, a random combination of different things brings more and more results.

New ideas are not interesting by themselves; new ideas, that are economically sound, are valuable for the enterprise. Unfortunately, the criteria for drawing a conclusion about the suitability of a new idea are more often based on experience. Also, inert thinking is afraid of risk costs. It happens that only when competitors have already introduced some innovation and it has proved its viability, others venture to do the same. Hence, it can be concluded that many ideas have never been realized.

“The horse is here to stay but the automobile is only a novelty, a fad.”

*The President of the Michigan Savings Bank, 1903  
(advice to Henry Ford not to invest in the Ford Motor Co.)*

“Planes are interesting toys but of no military value.”

*Marshall F. Foch, French military strategist, 1911.*



“We don’t like their sound, and guitar music is on the way out.”

*Official rejection of Decca Records to Beatles.*



“There is no reason anyone would want a computer in their home.”  
*Kenneth Olson, founder and president of Digital Equipment Corp.  
1977.*

E. de Bono's Six Thinking Hats method [11] allows you to develop the skills of creative thinking. Its essence is that pretending that a hat of a certain color is put on, to change the style of thinking.

The main purpose of a green hat is a purposeful search for alternatives. It is necessary to go beyond the conventional, obvious. A blue hat stands for a comprehensive control; we get the ability to clearly see the plan of actions in a logical sequence. Wearing it is the best way to observe the process of reasoning. Figuratively, a person in the blue hat can be compared with a cab passenger who watches over a driver (after all, it is the passenger who has not only told a final address, but also indicated the route). This is useful, because a “creative chaos” often reigns during the discussion.

Black color — dark, unkind, that is, when wearing this color, an individual is pondering the idea in a critical way. Red color symbolizes anger, internal stress; thus having put a red hat, studies are made with the involvement of emotions. Yellow color is sunny, viable; thus the wearer of a yellow hat is filled with optimism, both hope and positive thinking live under it. White color is an objective, it does not give preferences. The thoughts, mixed on facts and figures, “are cooked” under the white hat.

E. de Bono suggests trying on each hat to learn thinking differently. Thus, lateral thinking is a special method for solution of complex problems on the basis of unconventional approach to the issue through mobilization of latent creative abilities.

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### **3. Creative thinking of the person as unity of intellectual and emotional activity**

*3.1. Creative activity and creative thinking of the personality.*

*3.2. Intelligence and creative work.*

*3.3. Interaction of static and dynamic intelligence.*

#### ***3.1. Creative activity and creative thinking of the personality***

It was already mentioned above that creative activity assumes the interaction of various and partly opposing components of the psyche and human activity, for example, such as logic and intuition, rational and irrational, destructive and constructive, and so on. The problematics of creative activity deals a lot with the categories of “reification and disobjectification,” which are in close meaningful unity. Their complementary and, simultaneously, mutually denying unity form the basis of integration of the personality’s creative activity. These categorical concepts are closely connected to fundamental sides of the human activity. So, putting a conception into an objective, materialized (tangible or sign and symbolic) form reflects the essence of the process of reification as a specific subject's ability to very embodiment, that is, the status making of social and cultural significance of the object. The process of abstracting is characterized by transformation of existing objective materialized forms (object-material or sign) to create a new product, and the related processes of change of sensual-objective structure of reality, as well as abstraction from numerous forms of expression of the object for the purpose of cognition of its essential signs. This is transition of human powers and abilities from the form of motion to that of object, when human essential powers are like crystallized, settled in products of intellectual and practical activity, and characteristics of the object become the property of the subject of realization of life, because of it strengths and abilities of the latter are filled with a specific content [19, p. 170]. Therefore, reification and abstracting reveal the dynamics of advancement of human culture which is continuously created, reproduced and exists as the creation of human spiritual and practical activity [21, p. 326].

This topic deals with the following issues:

- a) structure and content of the intellectual components, involved in the process of reification and abstracting;
- b) development of human knowledge from the intellectual and psychological viewpoint;
- c) determination of peculiarities and regularities of psychogeny in phylogeny;

d) analysis of the stages and peculiarities of intellectual activity in a process dynamics of reification-abstracting;

e) methodological substantiation of the procedure to facilitate the transition of thinking from a static to a dynamic stage of development.

The creation subject's activity as an integral wholeness encompasses two stages or two sides — process and crystallized, i.e., dynamic and static ones. At the first stage, the activity has a current form of making, and so everything in it is developing, moving and changing; its forms are changeable and poorly defined; at the second stage — activity products get their completeness, immutability, goal setting of the form (for example, ideas, theory, products, technologies, works of art, etc.). In any case, the dynamic and static sides of intellectual activity provide for the existence of two forms of intelligence — dynamic and static.

I.Z. Horn (1989) was the first who classified thinking by the dynamic principle of motion-change of structures of intelligence. He suggested the separation of intelligence into the fluid and crystallized [3], which are distinguishable by the degree of maturity, development of abstract-logical operations in the age-specific aspect. The fluid intelligence, in particular, is a pre-conceptual stage of thinking development; it is characterized by speed properties (for example, memory rate), as well as inductive thought forms and operating spatial images. Its progressive development continues from infancy until the end of adolescence, and then decreases in adulthood and, especially in old age [18, p. 295-296]. The crystallized intelligence has more advanced forms of abstract-logical activity and is based on advanced speech, knowledge and mental skills, accumulated over a long time. Its inherent ability is to establish logical connections, to analyze problems and to use the learned intellectual strategies for solution of everyday problems [18, p. 294].

### ***3.2. Intelligence and creative work***

The scientific community continues to debate about whether creative work and intelligence are the units of a single mental process. In the 1950s Joe Guilford in his works made attempts to establish the relationship between intelligence and creative work, and came to a conclusion that this relationship is rather questionable to consider these processes separately. He contrasted creativity and intelligence in science on the basis of his own theory of two kinds of thinking: convergent and divergent. The convergent thinking is directed towards the analysis of all available methods for solving the problem in order to choose the only correct one — this type of thinking underlies intelligence. The divergent thinking — this is thinking “which occurs simultaneously in many directions”: it is directed to generate a variety of different solutions of the problem, and it is this type of thinking that underlies creativity.



Others believe that creative work is the result of the same cognitive processes as intelligence and creative work is regarded as such only by its results (i.e., when the result reproduces something new).

Researchers as D. Wechsler, H. Eysenck, L. Thur, R. Stenberg consider intelligence and creativity as a single human capacity of a higher plane. V. Druzhinin has described this point of view as “reducing creativity to intelligence” [12]. In this context, the case in question is not simply that this is the only ability, but that creative work is the derivative of intelligence: high intelligence — high creative abilities, low intelligence — low creativity.

E. Torrance’s studies revealed a high positive correlation between IQ and creativity level [5]. The higher IQ, the greater the likelihood that the test subject may have the high performance on creativity tests (although those with highly developed intelligence may have low creativity results). E. Torrance proposed the Threshold Hypothesis: when IQ is lower than 115-120 scores — intelligence and creativity form a single factor; when IQ is higher than 120 — creative abilities and intelligence become independent factors. Thus, according to E. Torrance, creativity is creative abilities of individuals, having willingness to generate fundamentally new ideas, and is closely connected with giftedness. In addition, the scholar believed that creativity includes an increased sensitivity to problems, the lack or inconsistency of knowledge; as because of it, the search for solutions activates, as well as putting forth hypotheses, testing them, and nascency of something new.

Psychologists, who distinguish inborn and specific (learned) abilities, developed several models of intelligence, presented in Table 3.1.

One of the modern models of intelligence [20] considers it as a comprehensive whole of person’s mental (intellectual) experience and psychic mechanisms, ensuring accumulation, processing and use of one’s experience. On the mental level, three kinds of experience are distinguished:

1) *cognitive experience* — ensures storage, systematization and use of data; that is, by means of cognitive experience accumulation there is an efficient processing of current information;

2) *metacognitive experience* — self-regulates own intellectual activity and controls brainpower;

3) *intentional experience* — is the basis of individual intellectual abilities, giving a subjective preference to a particular subject area and for certain directions of search for solutions.

Currently, different tests of divergent thinking, personality questionnaires are used to measure creativity. There are at least three main approaches to the problem of creative abilities. They can be formulated as follows.

**Models of intelligence**

AUTHOR	NAME	Essence
C. Spearman	Two-factor theory of intelligence	The levels of development of cognitive process (attention, memory, perception and others) are interrelated. Intelligence consists of two main factors: <ul style="list-style-type: none"> <li>• general factor (G factor);</li> <li>• factor specific for each cognitive function (S factor).</li> </ul> G factor — this is intelligence proper, and S factor complies with it.
L. Thurstone	Multifactor model of intelligence	Intelligence consists of seven mental abilities: <ol style="list-style-type: none"> <li>1) S — spatial visualization;</li> <li>2) P — perceptual speed;</li> <li>3) N — number facility;</li> <li>4) V — verbal comprehension;</li> <li>5) F — verbal fluency;</li> <li>6) M — associative memory;</li> <li>7) R — reasoning.</li> </ol>
J. Guilford	Cubic model of intelligence (4x5x6 = 120 special abilities)	120 cognitive abilities highly specialized and independent from each other are distinguished. They depend on three main parameters of the intellectual activity: content (4 types), nature of intellectual operations (5 types) and products (6 kinds). The scholar has identified two types of thinking: divergent (creative) and convergent (logical).
R. Cattell	Theory of fluid and crystallized intelligence	It supports the existence of the general and special (partial) factors; it points out to two types of intelligence: crystallized (applied) and fluid (abstract). The first is a measure of mastering the culture of a society to which person belongs; the second describes the biologically-influenced ability of the individual's nervous system.
L.G.Humphreys	The model of general intellectual and educational factor	Approaching the Spearman's model. General psychological patterns of relationship when studying various aspects of intelligence — separation of the G factor — shows the existence of a general intelligence of an unquestionable psychological reality.

1. There are no creative abilities as such. Intellectual giftedness acts as a necessary but insufficient condition for creative activity of the personality. Incentives, values and personality traits play the main role in determining creative behavior [17]. The researchers attribute cognitive giftedness, sensitivity to problems, and independence in uncertain and complex situations to the creative personality's dominant traits. The personality's creative activity is conditioned by a certain psychic structure inherent in the creative type of personality, and creative work is a

situationally unstimulated activity, manifested in striving to go beyond a given problem. Pursuant to this approach, the creative type is inherent in all pioneers, regardless of their occupation: test pilots, artists, musicians, inventors [7].

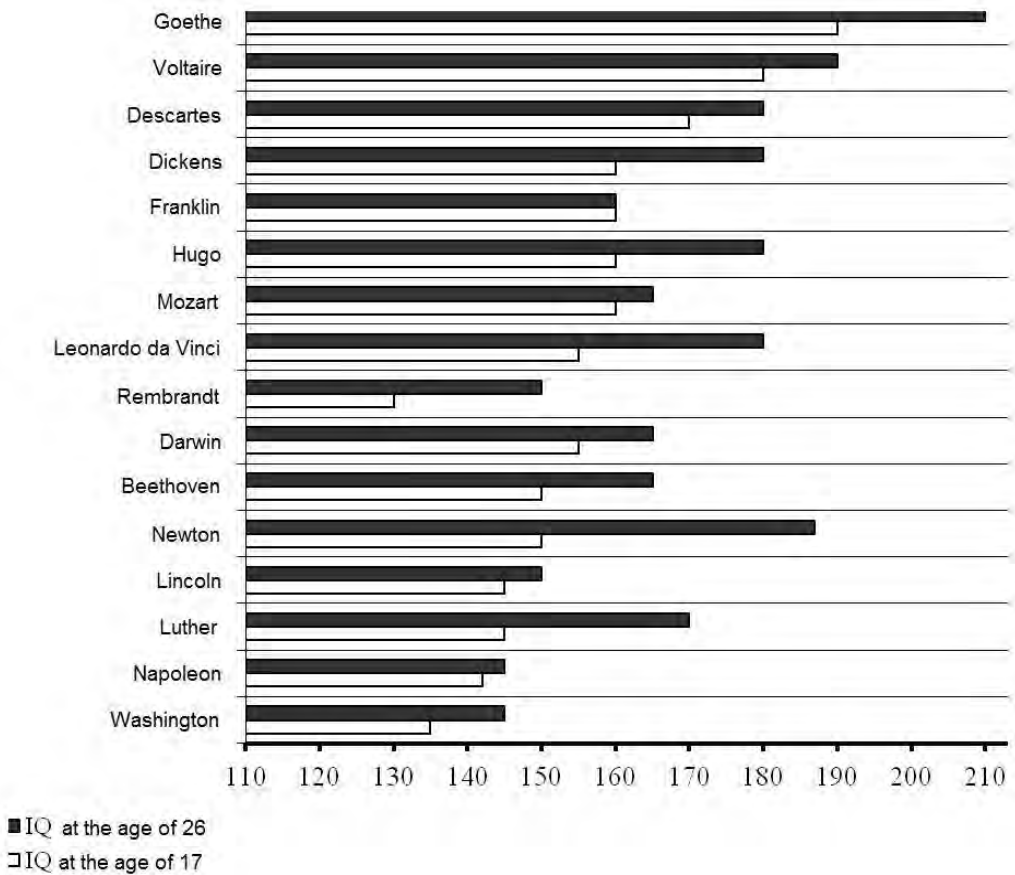
2. Creative ability (creativity) is a separate factor, independent of intelligence; however, there is little correlation between the level of intelligence and creativity level [8]. In accordance with E. Torrance's threshold hypothesis, considered at the beginning of this paragraph, creative ability becomes an independent value. Consequently, there are no creative people with low intelligence, but there are intellectuals with low creativity [5].

According to D. Pär-Kinsey's studies [9], there is a lower acceptable threshold of psychogeny for each profession. People with IQ below a certain level cannot master the profession, but if IQ is above this level, there is no direct relation between intelligence and the level of achievements. Personal values and character traits play the main role in determining successfulness of some work.

3. A high level of intellectual development presupposes a high level of creative abilities and vice versa. So, the phenomenon of constructive process as a specific form of mental activity is denied. Such experts in the area of intelligence, as D. Wechsler, R. Weisberg, H. Eysenck, L. Terman, R. Sternberg and others share this viewpoint. H. Eysenck, relying on a low but significant correlation between IQ and tests on divergent thinking by J. Guilford, expressed the view that creativity is a component of general intellectual giftedness. R. Weisberg argues that creative thinking is diagnosed by the quality of a product, not by the way it is got. Any cognitive process, from his point of view, is based on previous knowledge and causes their transformation in accordance with requirements of a problem. R. Sternberg's conception is more recent, according to which, intelligence is involved in both solution of new problems and in automation of established operations. In relation to the outside world, intellectual behavior can be expressed in adaptation, selection of the type of external environment or its transformation. If the person realizes the third type of relations, in so doing he shows creative behavior.

People, who like to reduce creative abilities to intelligence, support their view by the results of empirical studies, among which there is a classical work of L. Terman and C. Cox [14]. In 1926, they analyzed biographies of 282 Western European celebrities and tried to measure their IQ, using their achievements at the age from 17 to 26 (Fig. 3.1). In so doing, when evaluating not only intellectual, but also creative achievements were taken into account [15]. The researchers compared the age-related indicators of acquired knowledge and skills of well-known people with similar data of a sample of ordinary children. It turned out that celebrities' IQs were significantly above the average (158.9). Hence L. Terman concluded that geniuses — these are the people who, according to some testing, could be defined as

highly gifted already in early childhood. The total result of 800 Americans with high IQ: 67 books were published before reaching the age of 50 (21 — works of fiction, and 46 — monographs), 150 patents for inventions were obtained, 78 people got PhDs, 48 got MDs. 47 people were included in categories of “The Americans of the Year.” These figures are 30 times higher than those of the control sampling.



**Fig. 3.1.** IQ of famous people at the age of 17 and 26

As to the achievements, the results are not so unambiguous. None of the early intellectuals proved to be an exceptionally talented creator in science, literature, art; none of them made a significant contribution to world culture development (though there are such people among those with unmeasured intelligence).

Thus, the early intellectuals adapted to the society extremely well. Intelligence is not only an obstacle, but it is a prerequisite for achieving success in a democratic society. However, the high (and even superhigh) level of intelligence does not guarantee creative achievements: it is possible to be an intellectual, without ever becoming a creator.

### *3.3. Interaction of static and dynamic intelligence*

A. Gubenko offered to divide intelligence into the static and dynamic, on essentially different premises, unlike the division of thinking by the dynamic principle, discussed in the previous paragraph. First of all, three signs are assumed as the basis of division: a) mobility or rigidity of psycho-semantic cognitive structures (concepts, semantic fields and so on); b) fullness of overcoming a real being or awareness of it by thinking; c) historicity or non-historicity of the perception of objects of cognition (things and ideas) [22].

The dynamic intelligence in essence characterizes the formation of ideas, concepts and other intellectual forms, their comprehensive motility in search for something new in acts of creative mental activity. The following signs are inherent in it: 1) fluctuation and uncertainty of concepts and images, blurriness of boundaries of semantic denotations; 2) greater mobility and simultaneity of intellectual processes; 3) absence of platitudes and stereotypes; 4) informality, because of actualization of the intuitive and mental components of thinking [11, p. 11-14]); 5) blurriness of conceptions of reality within the cognitive experience; 6) deprivation of things and processes of their sensuous, manifested forms, mainly to find out the essence hidden behind them; 7) fluctuation of cognitive structures in the channel of psychosemantic stream, in which the concepts penetrate substantively and flow mutually into each other; 8) mixed boundaries between the possible and the real; 9) syncretism of cognizing the reality, which is characterized by the historical context; 10) intentionality, aimed at overcoming the boundaries of the given (reality, generated knowledge and experience).

But, in the static intelligence, focused on the already well-established cognitive structures and crystalline cognitive experience, are inherent such peculiarities: 1) concepts' stability, inability to move; 2) rigidity, inertia of topical flight; 3) focus on intellectual stereotypes; 4) prudence, reliance on the limited formal logic and everyday experience; 5) absolutization of the objective reality and the world of phenomena given in the experience and sensations; 6) refusal of the concepts of "possibility," "otherness," "dream," etc., which take thinking beyond the everyday reality; 7) constraint of imagination and fantasy; 8) particularity, fragmentariness of the perception of reality; 9) inability to look beyond system horizon, to see the future in fullness and integrity.

There is a contradiction between accumulated and vivid knowledge, and it is creative activity that is meant to solve it. The former one allow the person to orient oneself in various areas and not to re-create the already known, as they keep a certain amount of skills and habits that allow solving various problems, requiring cut-and-dried solutions or insignificant variable reorganization of already generated skills.

They also help to understand new facts and phenomena in tried and tested way — their identification with already developed schemes of understanding and perception patterns.

As was mentioned above, knowledge are needed for creative work. According to some authors, creative abilities can be manifested only when there is a certain level of knowledge. So, Hayes, (Hayes, 1989) in his study of 76 well-known composers, discovered that all of them had taken almost 10 years of music classes in order to create the first works, which were considered by experts as creative ones [2, p. 39]. Sometimes, knowledge can adversely affect constructive process expansion, however. Because of that, let's consider how such components of cumulative, static intelligence, as a high level of education, past experience, strong power of associating components of thinking and its functional fixity, influence creative work.

The functional fixity of thinking assumes rigid linkage of the object function to the object proper. For example, the function of a glass to serve as a vessel for water is perceived as the only possible one. Therefore, excessively fixed mindset will not be able to see other less familiar functions of the glass — to be a gurney for dough, a part of a makeshift xylophone and so on. An experiment with three candles, matches, thumbtacks and three cardboard boxes is a striking example of how prior knowledge can reduce the agility of thinking [16, pp. 40-41].

A study conducted by P. Frensch and R. Sternberg (Frensch & Sternberg, 1989) [1, pp. 157-188], suggests another situation of how knowledge can cause *mental rigidity*. In their experiment, novices and experts played in a bridge game with a computer program that was configured to a high level of difficulty. If changes in the game appearance caused a temporary reduction of its successfulness for both the experts and novices alike, the change of the game rules had a negative impact on the former, while the latter quickly adapted to the new rules.

D. Simonton, trying to find out whether in everyday life creative work is hindered by knowledge, used the bibliography method [4] to examine creative development of 192 great thinkers (Darwin, Freud, Monet and others). It was found that there was a nonlinear connection between the education level and the personality's creative "significance." So, the highest creative achievements are related to the average level of education, while its high and low levels correspond to the lower performance of creative achievements [16, pp. 41-42]. In any case, it is obvious, that too rigid and "close" links of semantic elements among each other make thinking rigid; as a result, a cumulated psychological inertia prevents the person from breaking the acquired connections and forming new ones in the process of creative work.

Or there is another danger — the agent's inability to harmonize the elements of experience into a single meaningful and coherent picture. In addition, S. Mednik in 1962 proved that people with relatively moderate conceptual associativity are more creative than those who have strong and weak associative abilities [16, p. 42].

Thus, too developed manifestations of the static, cumulative intelligence (rigid functional fixity, high associative ability, and reliance of consciousness on the past experience, high level of education and “overload” with knowledge) restrain the actualization and progress of the creative process, reducing flexibility of an idea and creativity of the personality.

### **Dynamic thinking conceptions**

The abstracting of cognitive forms, the process flow of traditional ideas about the world, which are typical of the culture of humankind (mainly European) during the Modern and Contemporary History, gradually spread to biological knowledge and ideas, political economy, sociology, physical ideas about space and time, and to many other things. In particular, in biology, Aristotelian and Linnaean static taxonomy of species of animals and of humans was replaced in the middle of the 19th century by the theory of evolution that grounded the emergence of living beings in their present embodiment of the form. In cognitive sciences, the traditional Aristotelian logical laws, emphasizing the rigidity and unambiguity of concepts and the linearity of their correlations, were changed by W.F. Hegel's laws of dialectics, according to which the concepts were divided within themselves (into themselves and their opposites), flow into one another and develop; in general, not only logic, but the whole reality, global objective reality as well started to be considered, after W.F.Hegel, as a dynamic, ever changeable whole. In physics, Newton's idea of space, as being a receptacle of things, and in no way connected with another fundamental attribute of matter — time, was changed by the influence of fundamentally new views of Einstein and Poincaré, expressed in the theory of relativity, based on the concept of a single space-time continuum. In the labor theory of value of Adam Smith and Karl Marx (political economy), the gold ceased to be considered the degree of wealth, and the living labor started to be considered as a mobile substance and the source of all goods and values created by man, both material and spiritual. Creative transformation of the world was proclaimed as the basis of human life. During this transformation, the object, reality, sensory reality were considered already not passively — as given and immobile, but actively, dynamically — at the moment, process and result of the subject's action. K. Marx substantiated the conception of practice, according to which, the decisive factor is an active object-practical activity of mankind aimed at

creative restructuring of the world. In the *Theses on Feuerbach*, he writes about it: “The main defect of all hitherto-existing materialism is that the object, actuality, sensuousness, are conceived only in the form of the object, or of contemplation, but not as human sensuous activity, practice, not subjectively.” Since then, human society started to be considered as a movable and dynamic phenomenon (Saint-Simon, Comte and others).

On the other hand, a Socratic dialogue was the ancient form of thinking processualization. Socrates is, probably, one of the first in the history of European culture who taught to comprehend the truth as a process, not as something predetermined in advance and given for good. Within the matrix of a dialogue, a new way of operating mental concepts and psycho-semantic structures formed as mobile, emerging phenomena [6, p. 139-145]. Actually, the Socratic dialogue gave rise to dialectic as a fundamental way of thinking and cognition of reality.

Both psychology and pedagogy face the task to create and improve the methodologies of psychogeny allowing transforming the crystalline, immobile experience in the general stream of the dynamic thinking. First of all it is a question of intellectual trainings and exercises aimed at restructuring the main areas of human experience and abstracting emotional and mental structures and the developed gestalts. The overcoming of the inertia of existing cognitive matrices, achieved at that, will contribute to upbringing of children’s and youth’s creative thinking and, at the same time, the removal of intelligent barriers on the way to actualize a creative psycho-semantic flow. To do this, the following stereotyped algorithmic modules of experience are subject to restructuring: verbal, ordinary and everyday, visual and aesthetic, social, cognitive, natural and physical, technical, and others. In so doing, it’s better to implement the restructuring of the algorithmic modules of the mentioned experience in the following ways: a) creation of imaginary virtual realities; b) search for the hidden new capabilities of objects and phenomena; c) cognition of the history, development and establishment of the latter; d) study of the history of technical, household and other objects (clothing, pencil and so on); e) a productive fantasy; f) overcoming of the functional fixity of thinking through the development of flexibility, originality and productivity of thought; g) semantic restructuring and reorganization of cognitive structures; h) bisociation, that is, the synthesis of new concepts and ideas by drawing together distant concepts and ideas.

W.F. Hegel, German philosopher, who was the first to develop the theory of disobjectification, pointed to the crucial meaning of disobjectification activity to form children’s cognitive processes. “The best, — he wrote — the child can do with a toy is to break it.” Hence the exceptional role of transformation arises as a way of cognition of object: because in order to get to the essence of a thing, it is necessary to



deconstruct its existing form, to reveal its deep objectification. Such disobjectification is also connected with a certain change in the nature of thinking towards departure from the rigid and frozen formal logical structures. So, frozen logical forms are transformed into “melted flow,” into a dynamically developing state. And the transformation occurs only temporarily and with one goal — “after having melt down” the former intellectual matrices, to “smelt” new concepts and ideas from them, and then properly commit an act of creating something new. After this, a psychomental product is structured again and gets stable traits; that is, it is crystallized from “freezing” psycho-semantic “flow,” where its elements are covered by new logical links and dependencies. At that, at one moment the dynamic, at another the static components of intelligence are activated, replacing each other at different stages of the personality’s creative activity (table 3.2).

Table 3.2

**Stages of movement and development of intelligence in the creative process of the personality**

Condition of intelligence	Crystallization 1	Melting	Crystallization 2	Melting
Kind of intelligence	Static	Dynamic	Static	Dynamic
Psycho-semantic structures and processes	Functional fixity of thinking, associations, cognitive patterns, well-established experience. <i>Quantization of semantics</i>	Bisociations, delimitation of associations, overcoming patterns, isolation of thinking from the functions and structures of the experience. <i>Continuity of semantics</i>	Functional fixity of thinking, associations, cognitive patterns, well-established experience. <i>Quantization of semantics</i>	Bisociations, delimitation of associations, overcoming patterns, isolation of thinking from the functions and structures of the experience. <i>Continuity of semantics</i>
Psycho-semantic carriers	Unambiguous monosemantic convolutions	Ambiguous polysemantic convolutions	Unambiguous monosemantic convolutions	Ambiguous polysemantic convolutions
Kinds of logic, cognitive processes	Formal binary logic. <i>Discursive thinking</i>	Intuitive many-valued logic. <i>Intuition, imagination and fantasy</i>	Formal binary logic. <i>Discursive thinking</i>	Intuitive many-valued logic. <i>Intuition, imagination and fantasy</i>
Result	Intellectual product 1 (idea, theory, invention and so on)	Psycho-semantic flow	Intellectual product 2 (idea, theory, invention and so on)	Psycho-semantic flow

The formal logical structures, such as ideas, judgments, inferences, symbols, formulas and others are the carriers of the static intelligence; they are distinct of precise certainty and unambiguity as the monosemantic convolution, the operation of which is based on the traditional laws of classical Aristotelian logic. But the dynamic intelligence carriers are always uncertain, polysemantic and unstructured, i.e., they are such psycho-semantic processes and units which are polysemous convolutions (see [11, pp. 52-53]). The peculiarity of the latter consists in that the traditional rules of formal logic (those of identity, contradiction, excluded middle etc.) are not observed in this context and are replaced by others — the rules of intuitive thinking [ibid, p.55].

The concept of polysemantic convolution, in our view, makes possible to understand adequately the intuitive phenomena in the person's life activity. Its content reflects not only the interference of several psycho-semantic meanings into one, but also provides for a unique or multiple correspondence between the symbol and the synthetic content, when not one, but several different meanings corresponds to the symbol, and, simultaneously, the same symbol corresponds to each of these meanings. Therefore it is a question of the situation when the logical law of identity is broken [13, p. 404]. At the same time, the aforementioned convolution may be the "stem cell", which gives rise to a class of phenomena associated with the creative forms of thinking as a whole. Indeed, such creative intellectual qualities as bisociative thinking, its agility, speed of ideation, productivity, etc., are based on the polysemanticity as a basic property of creative thinking. Hence, it is evident that the transition from the formal-logical to the intuitive and creative thinking — this is always a replacement of monosemantic convolution by the polysemantic, and then an overcoming such a state of semantics, which is typical of the formal logical thinking, when the semantic units are separated from each other and are involved in the dynamics of thinking alone, and the process itself is subject to the principle of quantization. In other words, during the transition to intuitive actions, a change of "phase state" of the psychosemantics occurs: substantive fields intersect and overlap, the boundaries between them disappear, contents begin to flow freely from one syntactic structure (word, symbol, image) to another; permanence, stability, self-identity of concepts and convolutions disappear, and the mentation and process of operating the named contents loses the features of quantization and becomes continual, continuous and organized by "everything in everything."

The speed of mental operations is growing in a dynamic way; the agility of thinking is dramatically increasing as well due to the overflow of meanings from one to another. Thus, the opportunities for search and mutations

of the specific meanings that are necessary to solve a creative problem are significantly expanding. The effect of continuity enables the emergence of the “relay effect” (V. Molyako), which, in essence, consists in the closure of a semantic circuit and in the emergence of a new idea; that, for its part, generates the uncertainty of semantics.

Thus, it is the effect of continuity is the psycho-semantic factor that promotes the formation of such traits of intuition as polysemanticity, uncertainty, high speed of mental actions, semantic flexibility, semes’ ability to mutate, overcoming the law of identity; as well as the ability of each seme to be polysemantic; that is, to include into its content substantive fields of many other, and, sometimes, even of all available semes relevant to a particular problem situation.

The aforementioned things indicate that the semantics of thinking operates in two phase states — the continuous and “quantum” (corpuscular). The former concerns the polysemantic convolutions and defines the psycho-substantive content of the intuitive phenomena of thinking; the latter contains rigidly fixed semantic structures (basically, concepts and monosemantic convolutions) and arranges the flow of discursive and logical mentations. The transition from the intuitive thinking to the formal logical one is associated with the transformation of the continual semantics into the quantum one. The reverse transition is accompanied by the transformation of the quantum semantics into the continual one. According to this algorithm of the change of the phase states of psychosemantics, the multiparametric dynamics of creative thinking becomes firmly established. It is presented in the form of a table, which records mutual transitions of various conditions and structures of intelligence in the integral unity of the static and dynamic aspects of the personality’s creative activity.

The thinker’s intelligence is able to withstand deconstruction and “melting” of intellectually logical structures without getting lost in the chaos of scraps of former removed logical paths and trains of associations and without losing the ability to build new, correct logical connections in stead of the former and removed. Not any intelligence can overcome such a load, but only “settled” intelligence with an advanced and flexible formal and logical mental apparatus. After experiencing the rough “concussion” of the psychosemantic connections, it has to be able to re-establish them, but this time under new ideological and hypothetical circumstances arising from the structureless “chaos” of the dynamic thinking. That is why the proposed below methods of the processualization of thinking are primarily designed for children and young people with the properly trained formally logical thinking. These schoolchildren mostly do well in most

subjects and are in the age when the abstract-logical thinking is already stable (in the formal operational stage, according to J. Piaget), i.e. roughly 14 years old, and sometimes — ages 11–12. In other words, they have an innate giftedness and special analytical skills.

We restrict ourselves to the essential characteristics of the methods of disobjectification of emotional and mental matrices and the processualisation of schoolchildren's thinking in various spheres of their everyday experience, proposed by A.Gubenko.

### **Methods of processualisation of thinking**

1. A. Gubenko's method of **“Semantization or Koreneslov (Etymological dictionary)”** foregrounds the verbal experience using the procedures of interpretation of words, revealing the meaning and significance of linguistic units. It consists of two parts: at the first one it is proposed to study the etymology of words by Russian philologist L. Uspensky's method (to propose hypothesis about the origin of some words, to establish their relationships); at the second part — to “play” with words and make puns and “words” (according to the stories by the famous Russian writer N. Leskov, whose neologisms successfully combine changing foreign words in Russian language with a deep and precise meaning, full of subtle humor (for example, “barometer” is transformed into “burometr (stormmeter)”); further, the task of producing their own neologisms is set, and, thus, to join in verbal creative work.

2. The method of **“Fantastic situations”** encourages ordinary and everyday experience of the personality to function, completeness of his understanding of the physical and technical phenomena. For example, imaginary physical laws and phenomena are proposed, using which it is necessary to argue their physical consequences for the world and the human life. (“Imagine that the gravity force on the Earth has decreased by 5 times. What changes would be observed in technology, human life etc?” “Imagine that the law of universal gravitation was replaced by that of universal repulsion, what would happen with the stars, planets, and our Earth? What changes would occur in our life?”).

3. The visual and aesthetic experience is reorganized with the help of **tasks using uncertainties, fantastic images** that do not have sharp contours and an accurate structure (stains, images of clouds, blurred pictures), which favor to a developing functioning of this particular experience of the personality. In particular, the method of “inkblotgraphy” assumes the “interpretation” of images got by drawing blots on the paper; they may be named, completed, used to make a fantastic story, to create non-existent characters and so on. In addition, the trainee is encouraged to invent new methods of visual arts, musical instruments, kinds of dwelling, and original architecture using exotic materials.

4. The method of “**Imaginary evolution**” contains the tasks of constructing any mental chains of the evolution of life under conditions of existence, which are different from those on the Earth. Let us say, on planets with a greater or lesser gravity force, or in those worlds where swimmers or birds are the key living creatures instead of terrestrial mammals...

5. The method of “**Adventures of Things**” is meant to show the process of formation of specific things and how they gradually got their modern appearance. This could be a history of footwear, paper clips, and a spade and of others, and as a result, the trainee is suggested to create a new modification of one or several things.

6. The method of “**History of Inventions**” shows the examples of modifications of man-made objects (wheel, lighter, etc.), simple and easy for the trainees to comprehend, which drive them at the independent disobjectification, restructuring and creative change of a particular object.

7. The method of “**Anthology of Mysterious Cases**” helps a researcher to enter into a state of mind, called removal, when familiar things and processes begin to seem unusual and mysterious. This requires disobjectification of the given, overcoming the pressure of usual perception stereotypes.

8. The method of “**Imaginary Story**” is meant to disobjectify the collective socio-historical experience and to develop a historical imagination by constructing possible historical events and tracing likely, but have not taken place in the history of mankind, consequences (for example, “What could be the course of historical development of the Russian Empire if the Decembrists Revolt on December 25, 1825, had won victory?”).

9. The method of “**Imaginary Society**” helps trainees to overcome the stereotypes of the collective social experience, as it involves the study and analysis of works of social science fiction; in particular, such as Herbert Wells’s novels and stories (*Men Like Gods*, *The Country of the Blind*), Ivan Yefremov (*Andromeda: A Space-Age Tale*, *The Bull’s Hour*), the Strugatsky brothers (*Hard to be a God*), J.R.R. Tolkien (*The Lord of the Rings*), J.K. Rowling (The Harry Potter books) and others. Next, the trainees are suggested to develop original group or individual projects of a future society that they defend before a group, as well as discuss and improve.

10. The method of “**Metamorphoses**” is intended to form the students’ understanding of the instability and interconnection of all phenomena of nature, and simultaneously, to overcome rigid gestalts of their perception and of everyday experience (what is a sunbeam, leaf of a plant, a drop of water, etc?).

11. The method of “**Let’s Change a Fairy Tale**” suggests reversing familiar plots of fairy tales, protagonists. This develops the agility of thinking, reveals the bent for literature, and forms the ability to overcome the established stereotypes.

12. The method of **“Development of the Agility of Thinking”** teaches to discover hidden, uncovered possibilities of objects and phenomena, to see their implicit properties, to use objects to a new purpose; and then it is used to overcome the functional fixity of the personality’s thinking (for example, it is told what new uses for an ordinary old stocking can be found, and then the task is set to propose its new “professions” by themselves).

13. The exercises called **“Find a Way Out of the Situation”** train the skills of finding hidden possibilities when solving problem situations, based on the ability to restructure the situation; to look at it, having set aside the standard patterns; to change the structural links of its elements overcoming the functional fixity of thinking; which are extremely important in complex crisis and extreme situations.

**Conclusion.** The creative intellectual activity of the person has been considered in the unity of the two kinds of intelligence — the dynamic and static. At that, the transition from the static to dynamic intelligence is made by disobjectification, restructuring and processualization of emotional and cognitive experience in its main areas, such as verbal, of ordinary and everyday, natural and physical, visual and aesthetic, social, technical and others.

The analysis of specific issues can be continued in the following directions: the study of the relationship of the dynamic intelligence with intuitive processes, the study of peculiarities of the interaction of a formal logical thinking and the static intelligence, the methods of disobjectification and the dynamization of the personality’s thinking.

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## 4. Head as creative management leader

4.1. *Head's mentation characteristics.*

4.2. *Innovative management style formation.*

4.3. *Leadership in decision-making processes.*

### 4.1. *Head's mentation characteristics*

The head should be creative management leader. General principles of psychological peculiarities of the head's thinking are the basis of his personal creative behavior. From the point of view of psychology, creative process is characterized by the presence of anticipatory reflection, probable prediction, and forecast of events (anticipation). Therefore, it is necessary for the leader to mobilize all his intellectual and psychological abilities to implement creative management practice.

To understand the distinctness of the creative process in management activity, it is necessary to take into account that the unique importance of intellectual process to ensure effective management activity is the peculiarity of the modern head's thinking. However, for example, unlike a scientific theoretician, the head's thinking is considered as practical thinking. To this end, scholars are working in the special direction, which is referred to as "psychology of practical managerial thinking." The works of the outstanding Soviet scholar S.L. Rubinstein [10] have become the general theoretical principles of this branch.

**Sergey L. Rubinstein (1889–1960)** — Russian psychologist and philosopher, one of the founders of the activity approach in psychology. He formulated the principle of the unity of consciousness and activity; developed the new methodological principles of psychological science; in particular, the principle of determinism ("external causes act through internal conditions").

B.M. Teplov [11] considers the peculiarities of the leader's practical thinking using the material dealing with activities of great military leaders and statesmen. The essence of practical thinking is that mentation occurs in order to solve practical problems and is realized concurrently with other functions of the head. That is why the practical activity itself sets tasks for practical thinking, and not the theory. The main goal of practical thinking is the ability to properly formulate problems and tasks, although there is still no qualitative method to determine practical thinking.

Acting in a specific role of arbiter of correctness of subordinates' actions, the head should determine the problem-solving criteria to be assessed. The *form of responsibility* for the outcome and the solution developing process is also specific for the head's practical thinking.



The subject's position for theoretical thinking is cognitive, and for practical thinking — initial and transforming. The practical thinking also differs in terms of dealing with the information about the problem. In the theoretical thinking, general, main traits are highlighted; in the practical thinking — details, particulars that often suggest the problem solving way. Taking into account the details sometimes is of crucial importance in praxis.

The next specific feature of the head's practical thinking is related to the content and conditions of management activity. As for its content, management practice requires mental operation with the information about the people, characterized by a high degree of complexity and secrecy to be perceived directly, and, therefore, difficult to “interpret” and explain unambiguously.

Uncertainty of the head's problems may occur because of some subjective reasons: complexity, lack or abundance of information. A combination of high level of systems thinking with an adequate development of his analytical sides is the professional requirement to the head.

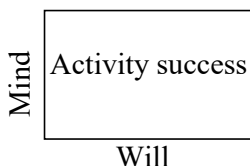
Management situations are characterized by dynamism, and the variability of situations requires an active productive mental work. The speed of their change imparts to management activity another specific feature — “shortage of time” regime (constant lack of time). Because of it, mental processing of practical thinking has to be high, and such thinking should be efficiently involved in situations, and switch rapidly from comprehension to actions. Due to the fact that a management decision is evaluated by its adequacy (quality) and timeliness, the features of memory organization and job-related experience are very important. The dynamics of thinking also depends on the speed of foregrounding information from the memory and the readiness of knowledge system to be used.

Intelligence, creativity, learning ability, reflectiveness, activeness, and self-regulation belong to *general abilities* that affect the efficiency of management activity. There is a particular curvilinear relationship of the success of management activity with the developmental level of the head's general abilities. This fact has been experimentally proved with regard to intelligence, reflectivity and creativity. Thus, poor learning ability is a negative factor of management activity. But, too high learning ability is not conducive to management efficiency as well. This fact can be explained, in particular, by that the aspiration to test right away (to use in practice) something that one has learned (experimentation), increases the riskiness of the activity and reduces its qualitative indicators.

*Special abilities* are proportional to the success of management activity. The more the special abilities developed, the higher, *ceteris paribus*, performance indicators. For example, the long-term memory (psychological basis of job-related experience) and the running memory (basis for the implementation of operational management

functions) are the objective conditions of efficiency of the head’s activity. The development of attention, of imagination similarly correlates with the successfulness, and, therefore, with strengthening of the status of creative process leader.

The ability to generate a wide variety of original ideas, to make simple concrete plans and promptly adjust them under the influence of changes, as well as to freely implement an approved plan, indicate the large intellectual potential of the head. The most important condition for the leadership effectiveness — is a proportional combination of the mind and will, which is reflected in the “Square Formula” (Fig. 4.1).



**Fig. 4.1.** “Square Formula” model of leadership effectiveness [9, p. 115]

The relationship of management and intelligence is obvious and of crucial importance. The creative process leader should have a high level of intelligence, which includes: perception, memory, attention, imagination. Intelligence, moreover, depends on the subject’s personality characteristics. Intellectual giftedness as a form of manifestation of intellectual abilities is differentiated into several types [9, p.123]:

*quick-witted* — with IQ of over 135 scores (the norm by Wechsler Intelligence Scale — 100-115);

*excellent students* — people with high levels of knowledge;

*competent* — people who have a large amount of professional knowledge and practical work experience;

*talented* — people with extraordinary intellectual achievements, which were recognized in socially significant forms;

*creative* — people who give birth to a lot of creative, original ideas, and feel the need to solve complex problems;

*wise* — people with extraordinary brainpower, related to the analysis and forecast of “everyday” life.

Let us note that according to the above differentiation, there are the differences between the creative, talented and wise types of intellectual giftedness.

The personality’s intellectual abilities usually include: creativity, learning ability, reflectivity (for example, subordinates’ imitation of the head). During the work, they are in indissoluble connection with an innate level of mental functions. However, already in 1960, American psychologist Ewin E. Ghiselli [9, p.240] proved the fact of the nonlinear dependence of the effectiveness of management activity on the level of intellectual abilities. Scholars try to find an explanation for the fact, why a smart head is not always automatically effective. The attempts to define a specific set of traits and mental abilities of an ideal head had a limited success. E.E. Ghiselli devoted more than

twenty years of his scientific effort to the study of this issue. Table 4.1 contains the data on the relative importance of thirteen various character traits and mental abilities to create the portrait of a perfect head. The *letters* mean: *A* — professional skills; *P* — personal characteristics; *M* — motivating factors. *The degree of importance*: 100 — very important feature; 0 — absolutely irrelevant in creating the image.

Table 4.1

**Scale of the head's important traits by E. Ghiselli**

TRAITS	IMPORTANCE
<i>A</i> Authoritarian inclinations	100
<i>M</i> Professional achievements	76
<i>A</i> Educational level	64
<i>M</i> Self-fulfillment	63
<i>P</i> Self-confidence	62
<i>P</i> Resoluteness	61
<i>M</i> No defendance need	54
<i>P</i> Working family origin	47
<i>A</i> Initiative	34
<i>M</i> No financial dependence	20
<i>M</i> Wish for power	12
<i>P</i> Maturity	5
<i>P</i> Physical skills	0

A leader with strongly pronounced authoritarian inclinations has less chance of success than a democratic one. Other important traits characterizing the head are professional achievements, mental abilities, self-confidence, self-fulfillment, and resoluteness.

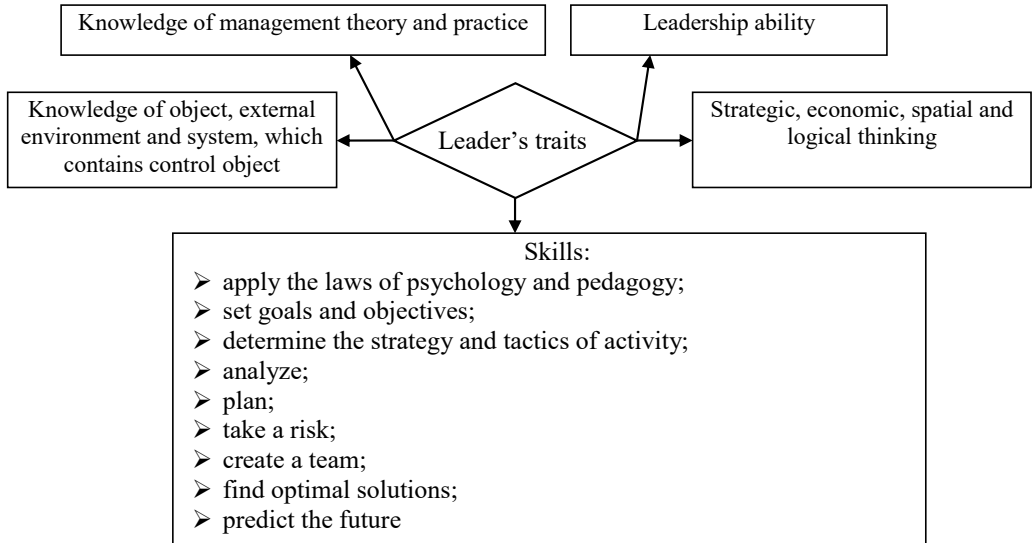
F. Fiedler contingency model [1, 2] is based on a multiplicity of the factors of the influence of the head's effective activity, such as the level of motivatedness, experience, and relations in the collective.

Fig. 4.2 summarizes the important traits of the creative management leader as an outcome of the mentioned features of the head's thinking.

**4.2. Innovative management style formation**

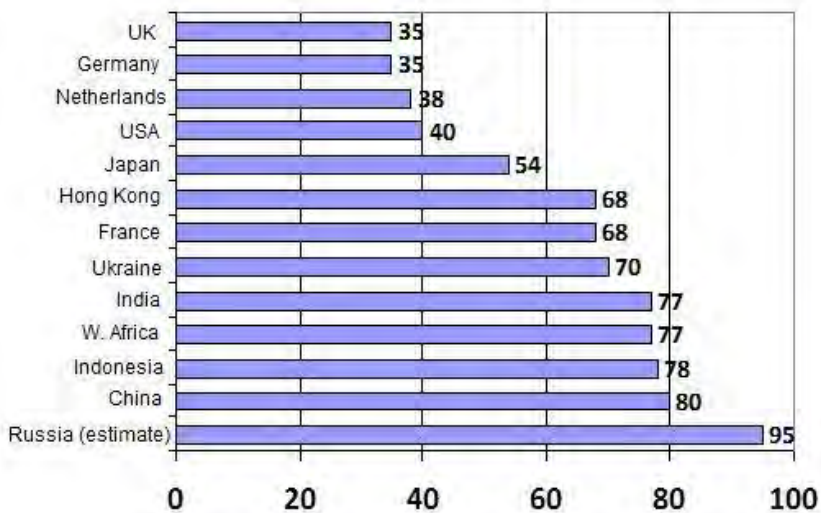
Management activity can be realized in many different ways — it is polyvariant and is manifested in the existence of several basic managerial styles. It is impossible to decide which of them the best is. Different styles assume the presence of different combinations of abilities. Individual differences determine the leadership style. Individual differences define managerial style. A certain style, selected by the head allows him to rely on the strengths of his individuality and ignore the weaknesses. In

the process of the evolution of a society, the management style has changed dramatically as follows from the data in Table 4.2.



**Fig. 4.2.** Requirements to the Creative Management Leader’s Qualities

To demonstrate the leader’s place in the creative process of management activity, we will consider the peculiarities of national mentality in Russia, Ukraine, the USA and other countries. In modern terminology [13] the term “power distance” is used, which describes “ordinary” people’s attitude to those in charge. Power distance differs significantly in countries with different cultural traditions (Fig. 4.3).



**Fig. 4.3.** Requirements to the personality of creative management leader [13, p. 17]

**The Evolution of Management Practice [5]**

FEATURES OF MANAGEMENT	PRE-SOVIET SOCIETY	SOVIET PERIOD	MARKET PERIOD
1	2	3	4
Leadership motivation			
Power	powerful autocracy	centralized management, suppression of democracy at the grass-roots level	separation of power and property
Responsibility	centralization of responsibility	puppet officials and honest ordinary performers	delegation of authority and strategic decision-making
Development			
Motivation towards achievements	dominance of stable state	lack of motivation	unrestricted
aspiration	poverty level reduction	employment in party organizations, collective well-being	to win
initiative	consideration of alternatives	to act solely within rules and directions	enterprise
HR	negligence of human factor	8 hour working day, emergency jobs	use of all potentialities
Way of life	life is struggle	they try to lead a regular life	they try to implement something new
Honesty and good faith			
Dualism of ethical norms	dishonesty in business relations, honesty in personal ones	double standards in any walk of life	“wild capitalism”, trust on a personal level to immediate environment
Use of connections	search for landowners’ affection	development of graft, corruption	big corruption, but aspiration to establish market relations
Self-confidence	from helplessness to bravado	from humiliation to gigantomania	from cynicism to populism

In the countries with a small power distance (the UK, Germany, Netherlands, U.S.A.) the subordinates are considerably independent of the head both in organizations and in a society. The upbringing starts with the family, where children are treated as equals, their personal independence is developed. In organizations the wage differentiation between the head and the subordinate is not very significant. Authoritarianism in management is not welcomed. There is a

significant dependence on the heads in the countries with a large power distance. Independent behavior is not encouraged in the family, and the same occurs in the workplace — the power is mostly centralized. The employees are accustomed to receive instructions from their superiors and not to engage in unauthorized actions. The specificity of power distance is also reflected in the decision-making process. Unfortunately, the chances to form a creative leader are small under the authoritarian management.

The head's creative ability is based on the ability to mobilize own intellectual qualities to meet the challenges of the enterprise. If we divide all heads in three categories — *bureaucrats* (act strictly by rules), *pioneers* (look for new ways of solution), and *analysts* (put in order the existing systems through a critical analysis and improvement), the head of the second category is likely to be the leader of the creative process.

The important specific quality of the creative leader is openness in cognition on which perception of something new depends; as well as the willingness to change one's views, initial opinion. Creativity is manifested in a creative attitude to the business, the ability to see the problem and to formulate new tasks for subordinates.

Creativity is manifested also in solution of already existing problems. The head should be able to offer an unconventional solution to the problem; it strengthens his professional and social authority. Creativity is necessary for performance of the expert and advisory function.

Polyolithism is typical of decision-making processes, that is, there are various forms of work with information that the head systematizes, and this is a difficult task. This ordering is based on the main feature of management decisions — their synthetic nature, it includes simultaneously the processes of individual and group selection. The change in the proportion between these processes changes the nature of interaction between the head and the group, this leads to changes in the group structural organization of collective decision participants. There are five main styles of organizing development and making management decisions [9, p.158].

1. *Autocratic level.* Decision-making processes are individually managed by the head, and he contraposes himself to the group. Sometimes the decisions are of dictatorial or voluntarist nature.

2. *Autonomous level.* The decisions are also made individually, but different from autocratic ones by their psychological content. The head strives to take into account the interests and opinions of the members of the group as much as possible, as he is aware of belonging to it.

3. *Locally collective level.* The decisions of this level are characterized by the following features:

- 1) decision is developed with the participation of other members of the group;
- 2) decision is developed in the course of interpersonal contacts, which gives them a special psychological peculiarity;
- 3) only a small part of the collective takes part in decisions;
- 4) head retains a dominant status in collective decisions that are made as hierarchically organized.

4. *Integrative and collective level.* Everyone is involved in the process of preparation and making the decisions of this level. Decisions show as much as possible the fact that they are made collectively. Decisions take the forms of referendums, conferences and meetings.

5. *Metacollective level.* Large organizational control system organized, for example, by a divisional principle, have many levels of hierarchy. The head is hierarchically higher in one's organization, and he is included in the overall management structure as a subordinate of a lower level.

The head cannot abuse those levels of organizing management decisions that do not form a reference group (autocratic, metacollective). However, in practice of domestic enterprises, the heads stick to an opposite tactic. They have quasi-need to make an independent decision, since it increases subjective self-assessment with respect to their own status; at that aspiration to strengthen their authority among subordinates by their competence prevails.

These facts are negative, since they do not reflect an overall logic of organizing the activities and its objectives. There is only a single positive reason for strengthening the head's role in the decision-making process: when the head "goes beyond" norms or standards, the need for innovative kind of solutions emerges. These — above-standard solutions that develop and improve an averaged, standard work method. They are typical of *the innovative management style*, of unconventional approach to realization of control functions.

In order to form an innovative management style, the leader needs to understand existing psychological mechanisms of decision-making in one's organization. The processes of making management decisions are divided throughout the whole decision-making cycle — from recognition and statement of the problem to its monitoring and adjustment. Their totality is a temporary structure of operations for development, making and implementation of management decisions. The processes of making management decisions include the main phenomena, typical of both individual and group selection. These processes are realized in the social and organizational aspects, and, therefore, a number of *socio-psychological phenomena* are observed in management process.

Since a final decision is made by the head, the following phenomena manifest in management: *subjectivity of choice*, “*lag effect*” — choosing the option that already proved its value; *the phenomenon of strengthening the first alternative*. *The effects of cognitive radicalism* could be manifested — understatement of the value and reliability of the most likely alternative, or, on the contrary — those of conservatism.

The mentioned phenomena occur in any group decisions, but collective ones are complicated by new phenomena. An unconditional trust in the leader (“*halo effect*”) belongs to the phenomena associated purely with the phenomenon of leadership. Under conditions of confrontation of the leader and the group, the opposite set to distrust the leader is formed.

The incompetence and weakness of the personal position of some group members cause them to adopt a peculiar stand, called “*fake unanimity*,” phenomenon that is, the demonstrative emphasis on consent with the majority or the leader. Accordingly, the opposite behavioral set — aspiration to emphasize one’s role, to distinguish oneself — provoked by the phenomenon of “*demonstrative disagreement*”.

The phenomenon of “*freezing the potential*” of the organization is the most common in hierarchically organized groups. As a mechanism of group organization, the hierarchy ensures its manageability and structuredness, but at the same time, it blocks the manifestation of the creative abilities of its members. The leader’s task — is to give to the group members an opportunity to show their abilities in the processes of solution that leads to “*unfreezing*” of organization potential.

The mechanism of the hierarchy can affect the nature of end results too. The groups more successfully solve clearly defined, deterministic plans than probabilistic, uncertain ones. The hierarchical groups’ decisions are characterized by less originality and more rigidity. In the hierarchical group, the head has much larger compensatory possibilities in relation to the group incompetence in decisions than the group with regard to the head. These patterns of relationship are referred to as “*asymmetry of competence compensation*”.

In the processes of management decisions, the general phenomena of “*group polarization*” and “*growth of judgments extremality*” in the group take place. In the first case, the group is divided into “*conservatives*” and “*radicals*” in the processes of group decision-making proper, and the radicals influence the most in their completion phases. In the second case, the degree of categoricalness of judgments/flatness and individual alternatives increases under the influence of the group. With the help of risky (extremist) judgments, the group members tend to obtain a higher group status, to aspire the role of a situational leader. It is in the problems of



decision-making where there are the largest objective opportunities to make such suggestions.

*The phenomenon of deliberate conflict escalation* lies in that that at the time of intentional buildup of tension, the situation arises, when interpersonal, emotional factors play the leading role during completion phases of decision-making, instead of purely constructive ones. The incompetence of certain members of the group, using a given situation as the defense and compensatory mechanism, is masked by such behavior. It is often used by the heads as well. The given phenomenon has an active influence on the decision-making process, and becomes one of its mechanisms.

All considered phenomena are included in the mechanism of elaboration of decisions, interconnected with each other; they can change their value, the degree of manifestation and directivity.

### ***4.3. Leadership in decision-making processes***

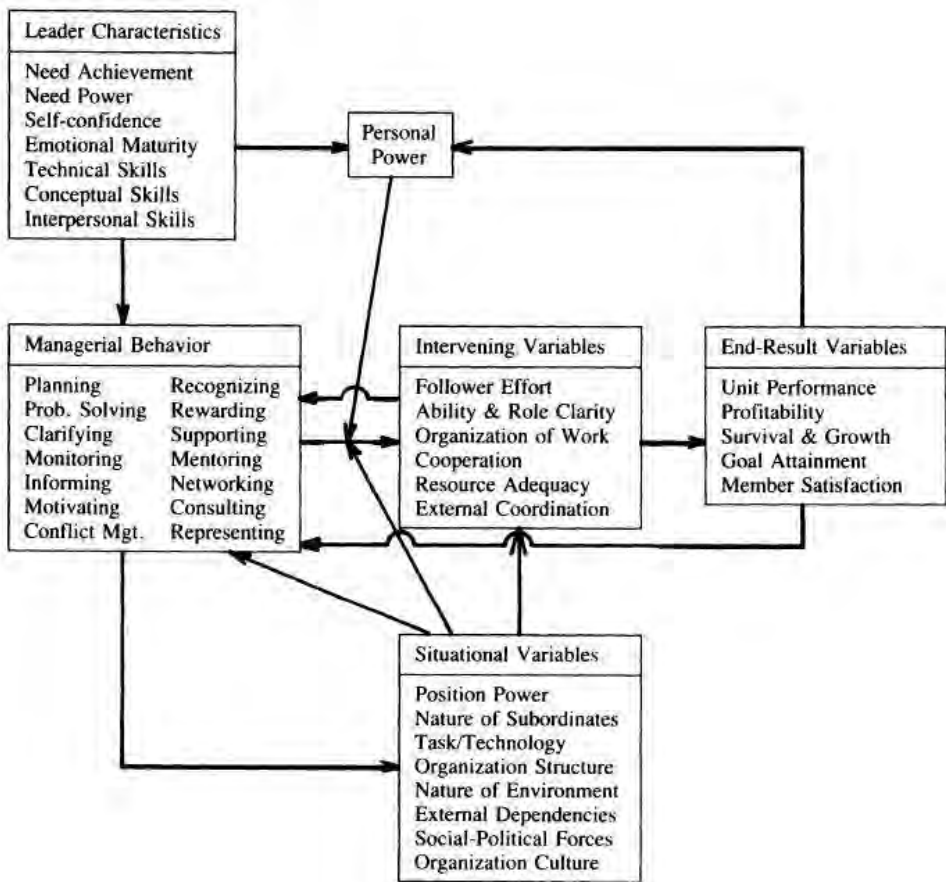
It is impossible to introduce any idea without the leader's participation. This person puts his energy, fights for the idea, while others focus on the short-term benefits of their own. It is such a person that is required to create conditions for creative work. But, the rank and file employee is more inclined to solve problems traditionally — by gathering information and its analysis.

When hiring employees, it is important to consider all these factors and select people who have the necessary intellectual abilities, experience and professional skills relevant to their duties (Fig. 4.4). The effectiveness of group activities is fairly dependent on the optimal ratio of leaders and managers. Successful organizational transformations 70–90 percent depend on the leaders, and only 10–30 percent — on the managers.

The differences between the leaders and the heads are in that that leadership is not limited to the position or the function (Table 4.3). Any member of the organization may become its undisputed leader, if he seeks to contribute to organizational effectiveness.

The members of the behavioral school of management (behaviorists) tried to reveal different types of leader behavior, resulting in increased efficiency of the group work. *The trait theory* is focused on revealing the personal properties that distinguish the leaders from the followers.

The belief that the leaders are born rather than made dominated at the turn of the twentieth century. Some people have innate traits that make them successful leaders.



**Fig. 4.4.** An Integrating Conceptual Framework [6]

*Table 4.3*

**Differences between the Leader and the Manager**

LEADER	MANAGER
Innovations	Administration
Development	Support
Enthusiasm	Control
Long-term outlook	Short-term outlook
Ask what and why	Ask how and when
Source	Initiative
Challenge the status quo	Accept the status quo
Perform proper work	Perform work properly

Hundreds of studies were conducted before World War II to reveal the traits of successful heads and the dozens of these properties were found. Ralph Stogdill

(1948) and Richard Man (1959) attempted to summarize and group all previously revealed leader qualities [8]. R. Stogdill identified 5 main characteristics of the leader:

- 1) intelligence or intellectual abilities;
- 2) dominance or advantage over others;
- 3) self-confidence;
- 4) activity and energy;
- 5) task relevant knowledge.

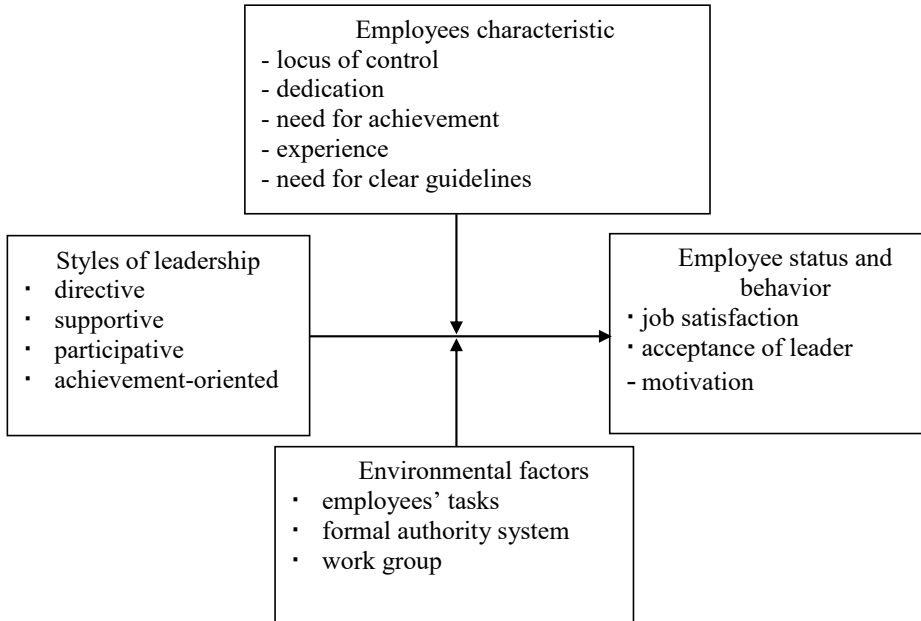
However, these five properties do not once and for all explain the nature of the leader emergence. Many people with these properties still remained the followers, not the leaders. R. Man suffered a similar disappointment. Among the leader's seven personal properties, which he revealed, the intelligence was the best predictor that its owner would be the leader, but it was not confirmed in practice. Despite this, the study of leader's qualities continued until the mid-1980s. An interesting result was obtained by Warren Bennis, the famous American consultant [7], who studied 90 successful leaders, and identified the following four groups of leadership qualities:

- 1) management of attention, or the ability to present the essence of the result, purpose or direction of movement (actions) so that to make them attractive for the followers;
- 2) management of importance, or the ability to communicate the importance of the created image, idea or vision for them to be understood and accepted by the followers;
- 3) management of trust, or the ability to organize ones activity with such a constancy and consistency to get the full confidence of the subordinates;
- 4) self-management, or the ability to know so good and timely recognize own strengths and weaknesses as skillfully involve other resources to compensate for the weaknesses, including other people's resources.

Bennis suggests the leaders to share one's power in the organization to create an environment in which people will feel the importance and the possibility to get to know what they are doing and that they are a part of this cause. The organizational environment created in this way should instill the strength and energy in people through workmanship. The further research revealed four groups of leader's qualities: physiological, psychological (emotional), mental (intellectual) and personal.

The modern period scholars claimed the existence of leaders focused on the collective relations and on production problems. The first ones focus their attention on creation of mutual respect and trust and concern about the group members' need. The structural leader organizes and determines what the group members should do to get the maximal result.

Robert House formulated the theory of leadership based on the explanation of the staff's behavior on the way towards the goal and benefit [3]. That is why this theory of leadership is called "Path – Goal." The model describes how the expectations affect the relations among employees at different leadership styles (Fig. 4.5)\*.



**Fig. 4.5.** Essence of Path–Goal theory [4]

The employees agree and follow the leader if perceive their activities as a source of satisfaction or the path to future prospects. In addition, the leader removes roadblocks that hinder achievement of goals, provide the guidance and support of necessary workers, rewards for achievement of the goals. The leaders can use one predominant style, or a combination thereof. F. Fiedler [1] interprets the leadership styles by the R. House's model as follows:

- **directive.** Providing the guidelines to employees about what should be done and how to do it, work scheduling, and maintaining the performance level;
- **supportive.** The constant concern for the welfare and needs of employees, openness in communication with employees as one's equals;
- **participative.** Consulting with employees and a serious consideration of their ideas in decision-making process;
- **achievement-oriented.** Encouraging employees to perform their tasks very skillfully, emphasizing a progressive experience and showing confidence in the staff.

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\*Locus of control is the concept in psychology that characterizes the personality trait to explain one's success or failures by the internal or external factors. The term was introduced by J. Rotter, social psychologist, in 1954.

The environmental factors influence the effectiveness of managerial style, complicating the activities or additionally motivating employees. Managers are recommended to change the style depending on the content of objectives and the characteristics of employees.

The process leader can successfully manage creative work. The creative management leader should have *three types of abilities inherent in the leader in any scope of activity: general, integrative and specific*. General abilities — those that are typical of the regular head; integrative ones correspond to the composition of general management functions (setting goals, planning, organizing, motivation, coordination and control). Specific functions of the creative management leader will be considered in detail.

The leader of creative process may have ordinary creative abilities. Very often, a person who has won fame as a creative person is the worst candidate for the role of organizer. Over the years, he used to work in a niche of his own talent, and is unable to manage the people. Such a person often causes the hostility of employees (generated by the inferiority complex). Often, talented people are not taken seriously. At the same time, they also can treat the ideas of others with arrogance. That is why the leader of the process should be a person who is motivated and interested in creative work, but not necessarily exclusively creative.

*Famous Soviet–American sculptor **Ernst Neizvestny** said about his creative work: “The vertical is God. The horizontal is Life. At the point of intersection — I, Michelangelo, Shakespeare and Kafka” [14].*

Energy and managerial abilities are the compulsory qualities of the creative process leader. Since creative work has a very wide range of application and is not limited to a specific professional orientation, there is no single right way to spread creative methods. Therefore, the process leader cannot sit on one's hands while events take their course. He is responsible for every step on the way of development.

The creative process leader should occupy a high place in the hierarchy of the organization, but at that have enough time and energy. It is necessary for creative value orientations to be accepted by the management; in addition, the process leader should be a sociable person, be able to establish links between various units of organization and individual people. He should have the gift of persuasion, be a good seller of ideas and have the sense of proportion.

The role of creative leader of the process is to be “guide” for employees. He directs their creative abilities. His ability to ask questions in order to better help the employees unlock their creative potential is one of the most important and valuable tools in the arsenal of the leader’s communication skills. This “Socratic” approach

gives the employees an opportunity to tell about new plans, ideas, potential problems and obstacles by themselves. The employee's self-openness leads to a much greater personal attachment in order to implement the decisions necessary to fulfil personal, professional and corporate tasks. A high level of cooperation and understanding while working as a team and increased efficiency of the employees are final positive results of leader's approach, described above.

The leader's most important function is to motivate communication by asking questions. When the question is asked, the channels of communication open and a verbal contact occurs. When managing creativity, the process leader can use the following types of questions:

a) questions aimed *at getting information*. While answering such questions, employees share their problems, that allow getting more objective picture of their satisfaction and dissatisfaction with certain events, phenomena and processes;

b) questions aimed *at disclosing motives and at understanding*. The leader should understand the goals and motives underlying the employees' views;

c) questions aimed *at providing information*. This type of question is very useful in order to tell about the care and benevolence of the organization with respect to its employees;

d) questions aimed *at drawing into a specific process*. As soon as there will be the mutual understanding between the leader and the employee, attempts to solve the problem should be continued. The employee's significant participation in the search for the solution stirs up his creative inclinations;

e) questions aimed *at checking understanding and interest*. They ensure "feedback," necessary for bilateral contacts;

f) questions aimed *at prompting the employee to think*. They demand to express the ideas and suggestions, which are able to add something important and valuable to the cause;

g) questions aimed *at reaching a harmony*. It is useless to continue the work if there is no mutual understanding. However, the employee's positive response habit should not be developed; frankly manipulative techniques can lead to a complete collapse of mutual trust;

h) questions aimed *at emphasizing the attention on the object*. While using the creative imagination, it is necessary to remember about the special object to solve the problem creatively;

i) questions aimed *at satisfying with the meaningful content of the work*. Having a clear vision and understanding of the situation, the employee will be able to choose new interesting direction to act.

The leader of the process cannot do without the team of like-minded people, and he should be able to keep them highly motivated. It seems that it is impossible to

combine all these characteristics in one person — so much one will be overloaded with work. Perhaps, a person may be suitable for this role that has attained a high status in his field, but has no ambitions with respect to the authority.

In a large organization, besides the process leader, it is expedient to ensure the presence of a manager of concepts. In a highly competitive environment, where high quality of goods or services is only the base level, the only way to achieve success is to transform the best concepts, developing into corporate strategy. In the near future, the concepts will become as topical as finance, raw materials, manpower and energy resources. The manager of concepts is responsible for gathering, generation and development of new concepts, thus this role is a key for the organization success.

In a small organization, the roles of the leader of creative process and the manager of concepts can be combined in the same person. In large organizations, the leader of the process works under the supervision and in close cooperation with the manager of concepts. The task of the manager of concepts is to encourage the development of new concepts. The task of the creative process leader is to see that all employees develop and use creative thinking skills.

So, the leadership in creative management is a multifaceted and complex activity to form an innovative cultural environment within the organization, which requires the manager's special qualities and personality characteristics.

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## 5. Methods for revealing problems and analyzing them

5.1. *Classification of problems.*

5.2. *Using complex systems theory in organization management.*

5.3. *Methods of statement and system analysis of management problems.*

### 5.1. *Classification of problems*

Three main types of problems are distinguished.

1. The problem of synthesis is considered “from the problem to the structure,” and called a direct problem:

$problems (p) \rightarrow goals (g) \rightarrow functions (f) \rightarrow structure (s)$

2. The reverse order of consideration of the system — “from the structure to the problem” is usually called an inverse problem.

$structure (s) \rightarrow functions (f) \rightarrow goals (g) \rightarrow problems (p)$

3. Optimization problems are the third type of problems.

Invention is a striking example of direct problems solution. In fact, all our life activity consists of solving the direct (problem-solving), or the inverse (situation analysis) problems. The more reliable and objective situation analysis, the more efficient will be the problem solution, and the less unexpected consequences of the solution will be. That is, the inverse problem solution (learning), without changing the properties of objects, creates the prerequisites for their changes in the future (for direct problem solution).

As a result of activity or as a result of comparing the desired and the possible, problem situation is formed. The situation is called the problem if it cannot be solved by existing means. There are four stages of awareness of the problem: vague feeling that something is wrong; awareness of the need; identification of the need; statement of the goal (state).

The goal of a direct problem is to find out the causes of the problem. The goal is a subjective image (abstract model) of non-existent, but desired state of the environment which would solve the problem. The hierarchy of objectives is a sort of guide in the synthetic process [5, p. 44].

The creation of the hierarchy of objectives of management of the organizational system is as follows:

- scenario development;
- goals formulation;
- generation of sub-goals;



- assessment of the importance of sub-goals;
- testing the feasibility of goals;
- tree of objectives derivation.

As a rule, the formulation of goals — is the most complex and labor-intensive process. This stage is implemented by using decomposition method what allows determining the composition of required conditions to achieve a predetermined goal. As a result is a hierarchical structure of the goal is got, i.e., a set of conditions that are necessary to achieve the chief goal. The goals of the lower hierarchy level are subordinate to the upper-level goals, and those of the upper level can not be achieved until the goals of the nearest lower level have been achieved. The outline obtained is the basis for the synthesis of functions, and then for the system structure as well. For each specific optimization problem, own methods of solution are found, which are changed with the lapse of time.

Creative management should be developed according to some rules. First of all, by the general derivative laws — the laws of dialectics. At the same time, the technological advance affects the needs of society and the development of nature. Three basic laws of dialectics are known: opposites interpenetrate; quantity changes to quality; negation of negation. In addition to the laws of dialectics, the systemacy is an important criterion for the feasibility of new ideas.

## ***5.2. Using complex systems theory in organization management***

The development of system views is characterized by a gradual transition from the simple to the complex — from structural concepts to the methods of functioning that determine the effectiveness of systems. According to this process, databases and knowledge bases should evolve that are constantly processed and reappraised.

The classification of the systems is based on quantitative and qualitative principle. The development of systems analysis and concepts of systems initially started in the field of mathematics. It began as the search for the methods of formalization of the processes of functioning of objects. In the modern conditions, there is a possibility to apply the system approach to solution of various technical, industrial, economic and social problems.

From the standpoint of a set of general characteristics [5], the systems are divided into:

- simple or complex (with regard to management practice)
- deterministic or random (probabilistic);
- static (functioning) or dynamic (evolutionary);
- single-purpose or multi-purpose.

The following rules of systems analysis are taken into account in creative management:

- principle of integrity (the properties of separate elements of the system cannot display the system attributes);
- possibility of structural and functional description of the system;
- multiplicity of system definition: construction of many different models, each of which describes only one side of the system;
- interdependence of the system and environment;
- systemasy of forecasting: interrelationship and hierarchy of forecasts of the object, environment and its elements;
- hierarchicness;
- correspondence of the resources to the goals of one hierarchy level.

The system remains equilibrium (stable) until a new problem situation arises. In order to evolve, the system should function continually and have a balanced ratio between the equilibrium (homeostatic) and nonequilibrium (contradictory) structures in the given system [5, p. 53].

The systems are analyzed in two ways: from the viewpoint of system structure, and that of its functions. So, in radio electronics, there is a separate description of system structure (block diagrams, functional and circuit diagrams) and of its functions (cyclogram, timing diagrams, and signal transformation algorithms in symbolic form). In psychology, there is the direction of research — behaviorism, in which mental phenomena are studied only from the functional point of view. The tendency to design languages, construct programs based on structural or functional description can also be traced in programming.

Within the system the elements and connections can be material, energy and informational. And they should be present in required quantities and ensure a certain quality.

The developed system is coordinated functionally, structurally and functionally and structurally. Coordination in the developing system is conducted by types:

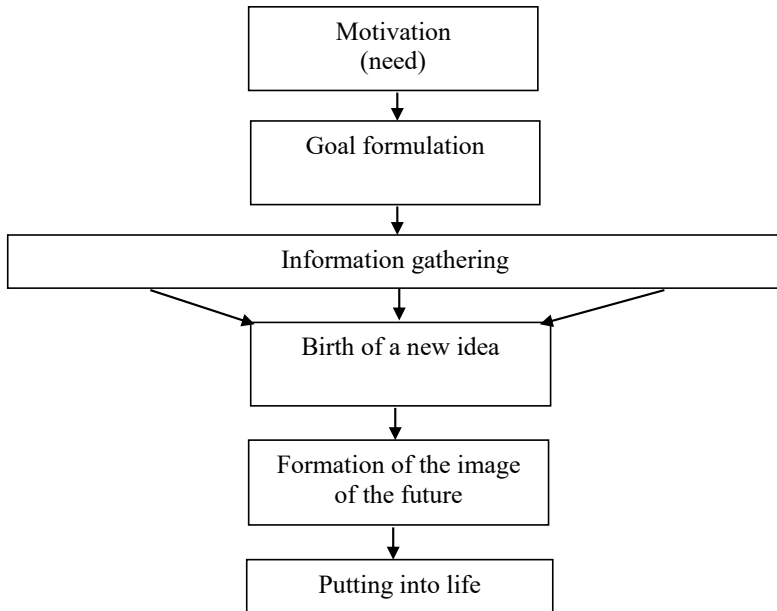
Functional coordination should minimize auxiliary and reduce main functions of the system activity. Structural coordination is coordinating elements with each other with the aid of connections, and formation of the system tree. Functional and structural coordination determines the conformity of the structure to the functions.

Systematicness, i.e., functionality of the system with a definite structure, ensures the chief goal, performs primary and auxiliary functions. The composition of the system includes internal subsystems and external environment. The efficiency depends not only on the system structure, but also on interrelations and direct and reverse impact. Systematicness requirements also include the account of historical system evolution, which is essential in predicting the research object development.

### 5.3. Methods of statement and system analysis of management problems

The problem can be considered as the question “how to achieve a specific goal?” Therefore, it is important to accurately determine the limits and the crux of the problem. It is necessary to consider whether the given circumstance is really a problem for us? Why it should be solved? Why do we need all this?

Creative work as a process of creation of a new product expresses a creative, transforming labor. A creative process is a sequence of stages, at each of them there is the search and selection of functions of the object and its structure (Fig. 5.1).



**Fig. 5.1.** Creative process stages

There is the search for already proved attractive entrepreneurial ideas in the following areas of entrepreneurial activity:

- manufacturing firm;
- mercantile business;
- financial institution;
- consulting agency (advisory services).

There are many methods of systems analysis of the problems; evaluating each idea by separate criteria, it is possible to get a cumulative result, which will help in selecting the optimum one. We will consider a cause and effect diagram and a value analysis below.

*Ishikawa diagram* (also called fishbone diagram, herringbone diagram, cause-and-effect diagram, or Fishikawa) was proposed by K. Ishikawa in 1952. The method is applied when designing and improving a product, it provides the system approach to determine the actual causes of the emergence of problems.

**Kaoru Ishikawa** (1915–1989) — Professor, Japanese management theorist, one of the developers of the new concept of organization of production, realized in Toyota Company. The diagram he proposed graphically reflects the work to improve the quality of production processes; it is the mean of visualization and organization of knowledge that in a systematic way facilitates understanding and final diagnostics of the problem.

The purpose of the method is to study, reflect and provide for techniques for searching true causes of the problem, under consideration, for its effective solution. The advantages of this tool is that the diagram allows systematizing in a simple and accessible way all potential causes of the considered problems, identify significant ones and gradually find root causes. According to the Pareto principle, among many potential causes (causal factors by K. Ishikawa), creating problems, only two or three are the most significant ones, thus it is the search for them that should be organized.

The Pareto principle (also known as the 80/20 rule, the law of the vital few, and the principle of factor sparsity) states that, for many events, 80 percent of consequences caused by 20 percent of the causes. This idea was applied in many areas. For example, 20 percent of villains commit 80 percent of crimes, 20 percent of drivers cause 80 percent of accidents, 20 percent of customers provide 80 percent of profits. The principle was discovered by Joseph M. Juran and named after the Italian economist Vilfredo Pareto, who noticed that 80 percent of property in Italy owned by 20% of the population.

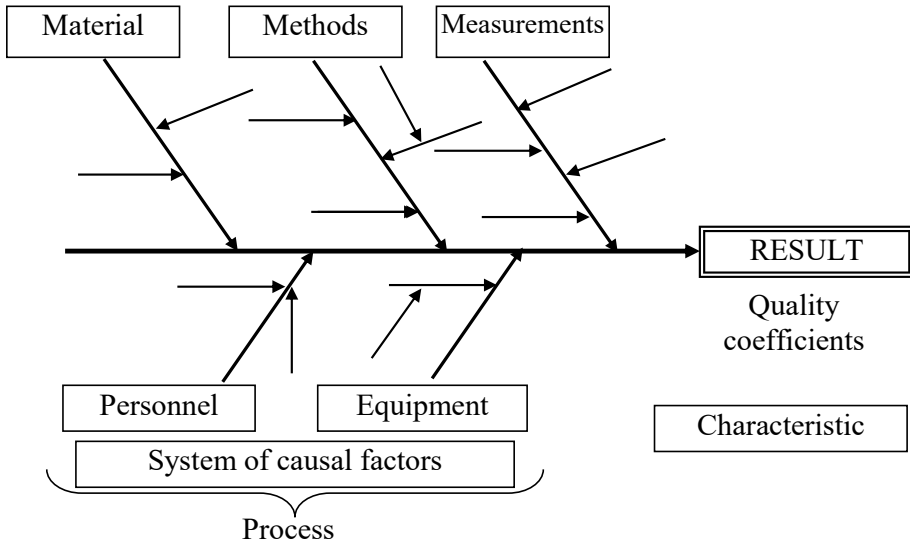
Analytical work is performed in the following stages:

- gathering and systematization of causes, directly or indirectly affecting the problem under investigation;
- grouping these causes into content and cause-effect blocks;
- ranking them within each block;
- diagram analysis;

Fig. 5.2 shows the diagram for solving the problem of improving products. From the figure, it becomes clear why it is called “fishbone.”

In order to create it, the participants of a meeting examine the problem, and draw the main horizontal arrow — “skeleton” — the result, which they want to achieve. In the process of analysis it is possible to determine a root cause of the problem if constantly answer the question “why?” During the discussion, the

important causes are depicted (the first level causes), influencing the problem — “big bones.” These causes are outlined and connected by inclined arrows with the “skeleton.”



**Fig. 5.2.** Conceptual Scheme of Ishikawa Diagram When Solving the Problem of Improving Products

Further, secondary causes (of the second level) are drawn that affect the causes (“big bones”), and those, in turn, are the consequence of the secondary causes. The secondary causes are recorded and arranged in the form of “medium bones” joined to the “big ones.” Causes of the third level, which influence the second level causes, are arranged in the form of “small bones” adjacent to “medium ones.” If the diagram lacks some causes, the arrows remain empty. During the analysis, as many factors should be revealed and recorded as possible, because this will lead to the search for the most effective way to solve the problem.

The Ishikawa diagram allows stimulating creative thinking; it allows showing the relationship between the causes and comparing their relative importance.

Method drawbacks:

- \* logical test of chain of causes is not considered, there are no reverse check rules — from the results to the root cause;

- \* if the problem is too complex, the diagram does not allow drawing the right conclusions.

The next method of systems analysis of management problems — *Activity Based Costing* (ABC) — a comprehensive, system study of the activity of an

enterprise, based on the interrelated examination of functions, characteristics, properties of the objects being created, of products and expenses to provide for these functions. The ABC methodology is used to determine the cost and other characteristics of products, services and customers; it is based on the use of functions and resources. The ABC methodology, developed as an operation-oriented alternative to traditional financial approaches, enables to:

- analyze the results and problems of the activity of an enterprise;
- define and make a general analysis of the cost price of business processes at the enterprise (marketing, output of products and rendering services, sales, quality management, servicing and after-sales service and so forth);
- make a comparative analysis and substantiation of choice of a rational variant of the techniques of business processes implementation;
- make a functional analysis related to the determination and substantiation of the functions performed by the structural units of an enterprise to ensure high quality of products and services;
- determine and analyze basic, additional and unnecessary functional expenses;
- form an adequate information about the effectiveness of the activities of centers of responsibility at an enterprise;
- make a comparative analysis of alternative options to reduce costs in production, sales and management by streamlining the functions of the structural units of an enterprise.

An important condition for the effective application of ABC is to stick to the following sequence of its stages: preparatory, informational, analytical, creative, research, and advisory nature.

The main objectives of *the preparatory stage* — choosing the object of analysis with respective feasibility study, defining tasks, terms and staffers, training specialists, preparing informational materials. At the same stage, the analysis plan is drawn up and discussed. A work group formulates the goal; it coordinates the methodology to solve specific problems.

*Informational stage* aims at gathering, sistematization and comprehensive study of information about the processes, expenses, and a structural model of the object.

The task of the *analytical stage* is to analyze the functions and costs on the whole by constituent elements. Its main purpose is suggesting ideas and alternate solutions to improve the object.

*Creative stage* is the most interesting and most important from the viewpoint of creative management; it includes the development of options to improve the object, discussion of the suggestions and selection of the most attractive ones as well as their systematization. To combine previous knowledge and experience is the most common method of generating ideas.

The rational options are selected during *the research stage*. They are preevaluated, together with the experts in each area of implementation, ranked and selected to be considered at the next *advisory* stage. It includes examination, giving advices, preparation of technical and economic calculations and time schedule of implementation.

ABC as a highly effective universal method to reduce costs is widely used today in such countries as the USA, Canada, Japan, the UK, and Germany. The scope of its application is much wider than it was at the time of the method creation (design, engineering procedures, construction objects, management processes). At the macroeconomic level, ABC is used as an auxiliary tool of management of the economy.

Unlike traditional financial approaches, the ABC methodology provides information in the form understandable for the enterprise personnel. Doing calculations using the ABC model allow obtaining a wealth of information for decision making. The received data allows substantiating and making decisions in the process of application of such methods of improving financial and economic activity of an enterprise as:

- Just-in-time (JIT) and KANBAN;
- Total Quality Management (TQM);
- Kaizen;
- Business Process Reengineering (BPR).

As a rule, ABC information is given as the system of cost and time parameters, indicators of labor intensiveness and of labor expenditures. The system of these indicators can be used both for current (day-to-day) management and for making strategic decisions.

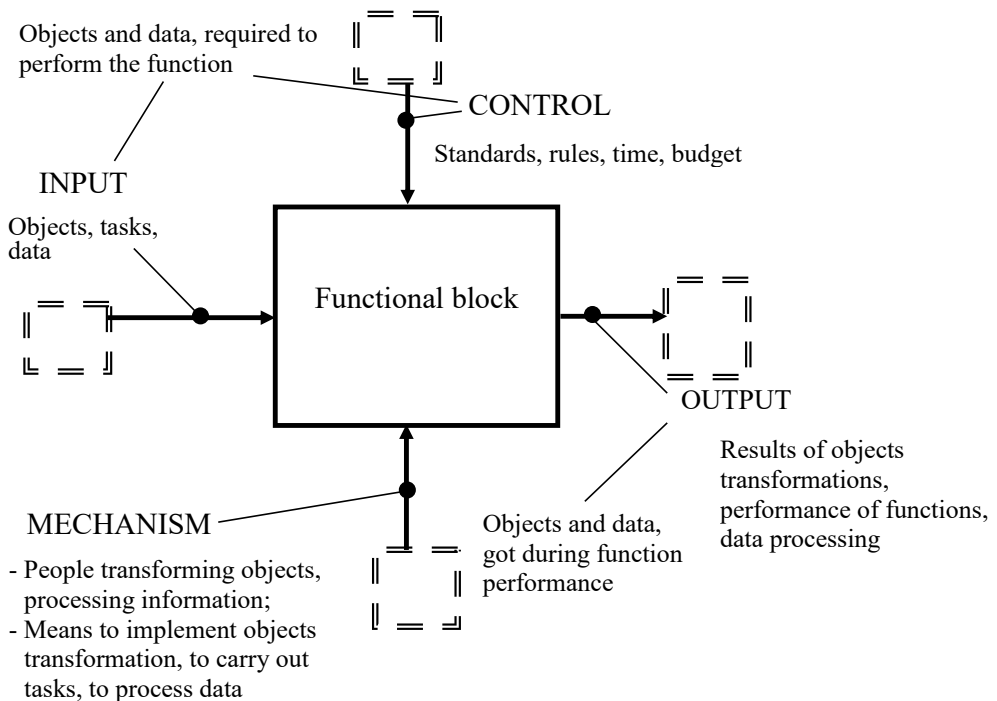
At the level of day-to-day management, information of the ABC model can be used to form advices about profit increase and enhancement of efficiency of the activity of an enterprise.

At the strategic level — this is the help in making decisions on the reorganization of an enterprise, change in the range of products and services, entering new markets, diversification and the like. ABC information shows how it is possible to reallocate resources to maximize strategic benefit; it helps to reveal the possibilities of those factors that have the greatest weight (quality, service, cost reduction, reduction in labour-output ratio), as well as to determine the best investment options.

The ABC method was further developed into the method of Activity-Based Management, (ABM). ABM is a method that includes cost management through the application of more accurate attribution of expenses for the processes, procedures, functions and products. The combined use of

ABC/ABM methods allows not only to accurately determine costs, but also to manage them.

Building ABC models is based on the use of methodological and technological relationship between IDEF0 (Integration Definition for Process Modelling) and ABC models. The connection of the methods of IDEF0 and ABC is in that that both methods consider the financial and economic activity of an enterprise as a set of functions performed in sequence, and the arcs of inputs, outputs, control and mechanisms of functions of IDEF0 model correspond to value objects and resources of the ABC model. Resources (expenses) in the ABC model are the input arcs, arcs of control and of mechanisms in the IDEF0 model (Fig. 5.3), products (cost objects) of the ABC model are the output arcs of the IDEF0 model, and the actions of the ABC method are the options in the IDEF0 model.



**Fig. 5.3.** Functional block and interface arcs of the IDEF0 model

At the low level, namely that of the functional block, the connection of the IDEF0 and ABC models is based on three principles:

1. The function is characterized by a number, is the cost or the time of performing this function.



2. The cost or time of the function without decomposition is determined by the model developer.

3. The cost or time of the function with decomposition is determined as the sum of costs (time) of all the subfunctions at the given level of decomposition.

Some software producers of CASE tools (for example, BPwin) have directly realized the connection of the methods of functional and cost modeling. It should be noted that in BPwin a simplified version of the ABC method was implemented. At the same time, in EasyABC software, the ABC method has been fully realized, but the software support of the relationship between the IDEF0 model and the ABC model is explicitly absent.

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## 6. Management of ideas

6.1. *Methods for searching creative ideas.*

6.2. *Theory of inventive problems solution.*

6.3. *Classification of typical ways of searching solutions.*

### 6.1. *Methods for searching creative ideas*

Creative problems solution is the prerequisite for the development of employees' creativity of thinking. The purpose of creative work in creative management consists in making an operative quality management decision. The list of basic methods of generating ideas suggested by scholars from different countries is given in Table 6.1.

Table 6.1

**Methods for searching ideas [10]**

Author	Method name	Year
1	2	3
United Kingdom		
E. Matchett	Fundamental design	1966
T. Eiloart	Control questions	1969
C. Jones	Functional innovation	1970
C. Jones	Removing mental blocks	1972
Germany		
F. Kunze	Method of catalog	1926
F. Hansen	Organizational concepts	1953
W. Gilde et al.	Conference of ideas	1970
J. Müller et al.	Systematische Heuristik (Systematic heuristics)	1970
H. Ebert, C. Thomas	Gebrauchswert-Kosten-Analyse (Value analysis)	1971
Russia		
Yu. Sobolev	Ekonomicheskiy analiz i poelementnaya otrabotka konstruktorskih resheniy (Economic analysis and elementwise development of design solutions)	1950
G. Altshuller	Algorithm of Inventive Problem Solving (ARIZ)	1956
M. Sereda	Method of directed thinking	1961
G. Bush	Semikratnyi poisk (Sevenfold search)	1964
V. Chavchanidze et al.	Heuristico-conceptual programming	1968
A. Polovinkin	Using the heuristic library	1969
V. Shubin	Systems and logical approach to solving inventive tasks	1972
G. Bush	Garlands of accidents and associations	1972

Table 6.1

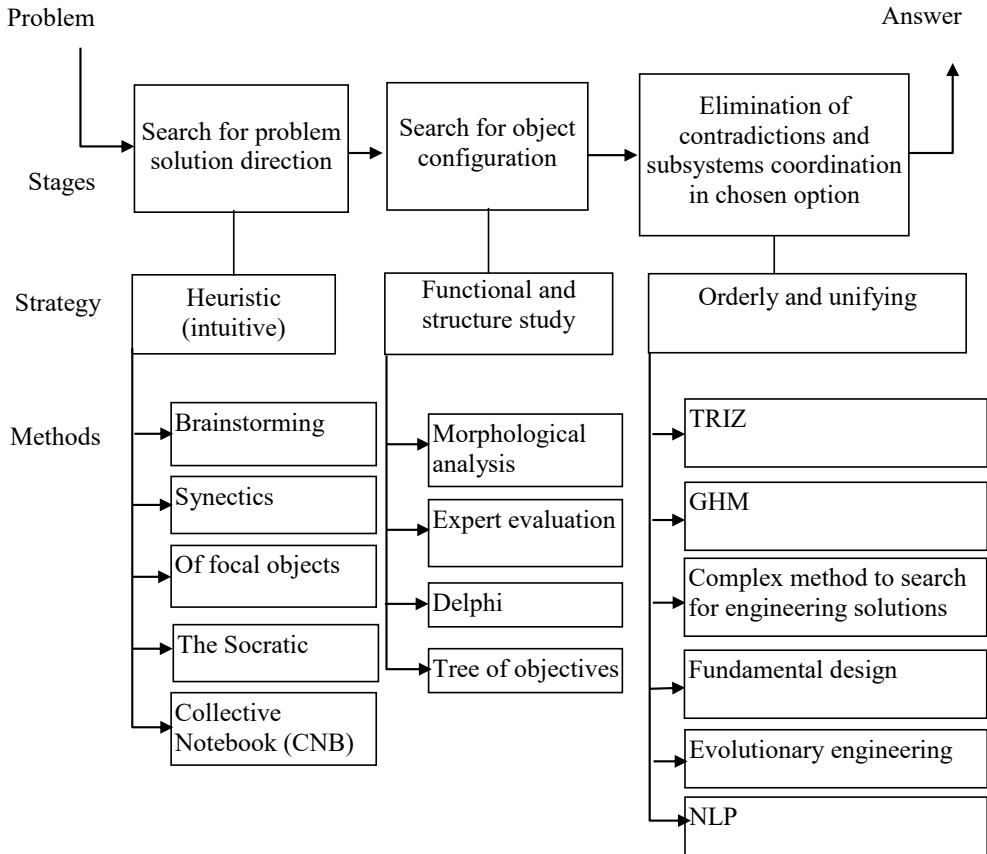
1	2	3
A. Polovinkin et al.	Generalized Heuristic Method (GHM)	1976
R. Povileiko	Decimal search matrices	1976
M. Zaripov et al.	Finding generalized ways on the basis of analysis of inventions descriptions	1978
G. Altshuller	Substance-Field Analysis	1978
A. Chus	Analysis of quality and of synthesis of engineering solutions	1979
V. Skomorohov	Axiomatic method of notions	1980
USA		
F. Zwicky	Morphological analysis	1942
W. Gordon	Synectics	1944
G. Pólya	The Socratic method	1945
L. Miles et al.	Value engineering	1947
R. Crawford	Slip writing method	1954
France		
A. Moles	Matrice de découverte (Matrix of discoveries)	1955
Y. Bouvin et al.	L'approche integree "Metra" ("Metra" integral Approach)	1972

Methods of searching for solutions are divided into three classes: heuristic, functional and structural study of objects; and combined algorithmic, action of the strategies of creative activity can be implemented within the frameworks of the methods aimed at increasing the efficiency, reliability and quality of the decisions obtained (Fig. 6.1). Currently, a large number of methods are known based on each of the strategies [10].

Heuristic methods (Gr. *εὐρίσκω* (eurisko) — find, discover) are based on the principle of a random search, and the most famous and popular of them is brainstorming, authored by Alex Osborn (United States, the 1940s). The main idea: collective search for ideas, separation of generation and critics in time.

In the process of generation, the expressed ideas are developed and modified by remote associations and analogies. The groups of 5–10 people are considered optimal ones. The purpose of this action is to develop the maximum number of various ideas — the more the ideas, the greater the likelihood of success.

It is considered normal if the group suggests up to 100 ideas for 90 minutes. The prerequisites of brainstorming are to create favorable conditions for overcoming psychological inertia and apprehensions to express meaningless ideas to be criticized; to attract a group of experts in various fields with the disposition to creative work.



**Fig. 6.1.** Types of problems, search strategies and search methods

Drawbacks of the method (and of all its variants):

- \* a huge number of ideas do not guarantee the appearance of “brilliant idea”;
- \* due to the lack of analytical stage, brainstorming produces bright, original ideas, but not always strategically correct solutions;
- \* this method is not meant to solve complex problems that require market research, special knowledge about the products or technical training.

*Reverse brainstorming* is a variant of the brainstorming. The search process for ideas has two stages. First, all possible shortcomings of the object are revealed. For the found shortcomings and weaknesses, the ways to eliminate them are suggested that is the meeting already goes on according to traditional plan of brainstorming. This method, reflecting the shortcomings more fully, allows us to find a larger number of new solutions both in the field of marketing, and in technical and technological aspects.

*Tenevaya mozgovaya ataka* (Shadow brainstorming) is a variant of brainstorming focused primarily on teaching and training of creative abilities. The method allows attracting to the collective creative work all participants of the process without restrictions. During the shadow brainstorming session, 5-7 people make a group of active generators of ideas, who act by the rules of conventional brainstorming. The rest form one or more “shadow cabinet” groups (competition among them may be organized). Generators of the “shadow cabinet” watch over active generators’ performance, recording the ideas and solutions they put forward, without expressing their suggestions aloud.

One of the variants of brainstorming is *635 Method*, which means: six participants, three suggestions, five passes around. The six participants makes at least three written suggestions to solve the problem within five minutes. The suggestions are passed around. As a result, 18 initial suggestions vary five times from the different points of view.

**Edward de Bono** (b. 1933) — Doctor of psychology, physiology and medicine. He showed that creativity is an essential characteristic of self-organizing information systems. His book titled *The Mechanism of the Mind* appeared 10 years earlier than areas of mathematics, dealing with chaos theory, nonlinear and self-organizing systems. He developed the concept and tools of lateral thinking.

According to E. de Bono [6], the concept of brainstorming was an attempt to create a more relaxed setting in which it is easier to generate ideas without fear to be criticized. However, it does not accustom to training serious skills of creative thinking. The misconception that true innovation is terrific and crazy thing became the result of brainstorming.

This method came into being under conditions when creative ideas lacked in the field of marketing; there it is quite justified, however, in the other areas, it does not always prove its value. In addition, brainstorming — a collective generation method, but not always a collective creative process is more effective than an individual one.

*Ship Council* (or “Meeting of Pirates”): a variant of brainstorming to solve the problem in the conditions of shortage of information and time. The authors of the method are W. Gilde, and C. Starke (East Germany, 1970). The rules for the implementation of the method stipulate that the sequence of statements is determined in advance from “cabin boy” to “captain,” that is, from the junior to the senior class. At that, each says only after the “captain” (moderator) addresses to him. Idea generation alternates with criticism (also after moderator’s command). Everyone must criticize, and then defend the selected ideas. At the conclusion of the work, the “captain” sums it up.

Charles Whiting (USA, 1926) is the author of the *Focal Objects* method (“Method of catalog,” “Method of random objects”): the method to search for new ideas by adding properties or attributes of random objects to the specified product. Shifting the properties of randomly selected objects to the one being improved is in the focus of transfer and therefore it is called focal. Unusual combinations may arise as a result of free associations. In the Soviet Union, H. Bush suggested a similar method and called it “Garlands of accidents and associations.” The advantage of both methods to generate ideas is the possibility to perceive the environment in an unconventional way.

*Synectics* (“συνεκτικού” in Greek — joining together of heterogeneous elements) method is proposed by W. Gordon (USA, 1976). It provides that the problem is considered by a group of about 9 people. The instructor manager acts as “client” of the enterprise, raises the problem, and explains its essence. And others offer solutions after a short joint meeting. The client analyzes this variant, speaks about its positive and negative aspects. Then the participants again confer with each other and offer another solution which is analyzed in the same way. The suggestions are put forward until an acceptable solution will be found.

*The Socratic Method* (list of questions, its developers — D. Pólya, A. Osborn, T. Eiloart) stipulates answers to the questions that may give an interesting idea about object modification. The method is effective when the developer has a rich imagination and is able to ignore the stereotypes. The exemplary list of questions is given below:

- \* Is it possible to find another way to use it?
  - \* Can it be adapted?
  - \* Is there anything similar? What to copy?
  - \* What can be changed (color, content, motion, smell, shape)?
  - \* Can (time, frequency, power, size) be increased?
  - \* Should more components be added?
  - \* Can it be reduced (made lower, shorter, and lighter)?
  - \* Can it be replaced by anything else? Should one ingredient be replaced?
- Should another material be chosen? Should another energy source be chosen?
- \* Can it be rearranged (another schedule, rhythm, order)?

*CNB Method* is a written form of recording ideas into the “notebook” which is located in a certain place (for example, in the waiting room at the secretary). Each employee can offer own variant of solution, and further, the most successful ones to be submitted to a general discussion.

*The method of decomposition:* the list of basic characteristics of the idea or object is made and each of them is considered separately in order to improve it. Each characteristic is considered and there are suggestions to alter it in a certain way.

Despite the fact that many ideas may “ripen,” the drawback of the heuristic methods is that there is no guarantee that the solution will be optimal.

A systematic search has fewer opportunities for creative ups, but this problem solving strategy allows embracing the experience to a larger extent, formalize ideas and make the functional and structural study of objects using modern means.

*Method of scenarios.* The scenario is a written description of the methods and ideas about the problem (analysis object). First, its content described the logical sequence of events, or the options of problem solutions; at that terms have to be used. Then the document containing the analysis of the problem and suggestions to resolve it or to develop the studied object became to be called the scenario. And every expert prepares a scenario individually and then coordinates it with the opinions of other experts and heads. Crafting a problem solving scenario, allows tracing the sequence of actions, in detail and in time, which must be made, helps to find out and take into account the critical and key moments that may arise during the decision-making process. The crafted scenario can be also used as a process model. If the scenario is meant to describe, it is recommended to involve a special combined group consisting of experts in different fields. With this, the scenario becomes versatile, it allows taking into account the aspects related to the course of the process, about which a decision should be made. The advantage of this method is the existence of quantitative technical and economic or statistical analysis with the preliminary findings and forecasts. A group of developers gets the access to the necessary database.

The systems analysis experts’ functions during the scenario implementation include:

- \* consulting to leading experts and business executives;
- \* determination of the regularities of system operation;
- \* analysis of external and internal factors;
- \* creation of a database (preferably automated), which will contribute to an effective solution.

Special software was developed In order to streamline the standard project management processes. Given a large number of variants, only the software of the most well-known manufacturers will be considered.

*TurboProject Professional* allows presenting the project graphically. Spreadsheets are issued by inquiry, their content is configured, and it is possible to divide the screen to view various types of diagrams. This is a convenient tool for creating complex structured projects represented as trees where each new “branching” shows the beginning of a new subproject, and “branches” indicate the relationship between them. The package allows getting the quick access to the information when editing, but it is difficult for beginners.

*Project Scheduler* — teaches how to create a new project step by step, and the prompt reference explains some details of program operation. All options are accessible and simple in use as much as possible; the screen is in the standard split format that allows seeing at once several windows — lists of resources, of problems, network diagrams, Gantt charts, and reports. All visual aids are well interconnected. Resource allocation is the key moment in management of projects, and here the work with expenses is especially important direction. It is suitable for complex projects, for work both with separate projects, and with a subroutine package. There is a function of grouping of projects to define interrelations or to integrate them for realisation of uniform operations. For beginners it is difficult to use.

*Microsoft Project* differs by a combination of capacity of functions with a convenient interface, supports the novice user and allows working with the program without additional training. It allows carrying out resource allocation, working in groups and distributing costs. It provides optional effort driven scheduling, when automatic time reduction necessary for the problem solution can be the result of increase in available resources. The manager controlling several separate projects, can note, that projects contain the elements connected with each other; problems of one depend on resources of another. The program allows inputting connections between design problems, having chosen the type of connection out of four possible ones: “finish to start,” “start to start,” “finish to finish” or “start to finish.” These connections are, as a matter of fact, hyperlinks and may turn out very useful along with a spectrum of Internet options.

As Microsoft software is the most widespread in the post-Soviet countries, we will consider more in detail the possibilities of Microsoft Project from the functional point of view. When planning the system of the description of properties of problems and their interrelations allows constructing the model as close to reality as possible, and flexible means of resource planning and equalization of overloads help to optimally distribute tasks among staffers. By existing techniques it is possible not only to calculate a project costs, but also to analyze possible ways to reduce them. During the control the automated aids of reports preparation, the developed system of information gathering from planners, enable to have reliable data on the project status. There is the option of repeated viewing of the previous stages (up to 10 iterations). Analytical function provides for application of intrinsics of the analysis of a current condition and development trends; it allows timely and promptly to interfere with a course of fulfilment of the project. Data import/export options (MS Excel, MS Access) ensure the use of external programs for the



additional analysis. Change management provides for forecasting of consequences of corrective influence on a current project and evaluation of its efficiency. The system allows not only to prepare final documents, to analyze the efficiency of project implementation, but also to save the project in archive for further use in whole or of its separate fragments. The distinctive feature of Microsoft Project from analogues is the realization of the concept of multi-project planning (up to 1000 projects can be combined) and ample opportunities in terms of group work organization.

*SureTrak Project Management* includes the module of project creation Project KickStart Wizard and option of creation of HTML publications for those who need to put their materials on the Internet. The project can be broken into components and tasks which fulfilment needs certain quantity of resource and time. At that SureTrak allows showing the user's own approach to project streamlining.

SureTrak supports Work BreakDown Structure (WBS) — hierarchical structure of distribution of the project which reflects the vertical scheme of detailed elaboration. Tasks are assigned unique identifiers what is especially useful for complex projects. The coding system allows making the analysis of prospects of development and progress of project execution from any POV. It is possible to create thesauruses of tasks identifiers. Another method of structuring — creation of sketches helping to accurately structure the project into blocks by different criteria with the subsequent division into smaller components. It is beneficial to use sketches then, when there is no complete information on the project.

*Time Line* contains unique options of exchange with databases, however, has fewer functions. It is applied at small projects, serving, in fact, as an organizer. The embedded system Guide Line ensures a continual schedule. Co-Pilot excludes possibility of errors, by checking logic of planning. Time Line offers rather powerful algorithms of work with resources, including aids of interdesign assignment and equalization of overloads of resources, flexible possibilities of specific schedules of resource management. For large projects the first step of planning is creation of hierarchical structure of the project which consists in construction of Work BreakDown Structure (WBS). The method of WBS divides the project into packages of detailed tasks for which it is easier to define time and cost parameters, to establish connections. Structure formation consists in consecutive division of project goals into blocks of tasks, up to the level of control and management of detailed tasks. Such tree structure allows breaking up total amount of project tasks into parts which implementation will be controlled and managed separately.

The project management system *Open Plan* includes tools of building project model and the analysis of a package of project tasks by the critical path method; flexible aids of resource planning, calculation, control and cost analysis of project on the basis of an actual output, the risk analysis by Monte Carlo method. When resources are attracted, there are two means to describe consumption of resources:

- \* to set the quantity of resources, used per day of work;

- \* to set total amount of resources during work period, having defined the nature of consumption function.

*Primavera Project Planner* allows keeping actual data about stages of project implementation, automatically to calculate a schedule and project equalization; to automatically enter the fact of fulfilment of tasks; to setup headings of reports and prototypes; to create codes of projects in groups; it has the advanced options of e-mailing.

Thus, projects management programs essentially differ by options, difficulty, interface, analysis methods. We believe, that Microsoft Project is the most suitable to solve creative management problems.

There are many *methods of expert evaluations*, in particular, — offered by Ukrainian scholars (V.M. Glushkov, G.M. Dobrov, E.S. Zharikov, E.I. Suimenko, E.M. Golovaha and so on). They include *methods of revealing thoughts by means of interview or questioning*. It is possible to question different categories of respondents: employees, business partners, end users and so forth. The questionnaire can direct thought in the given direction that is to serve as a kind of guide of ideas. The questions may deal with specific activity of an enterprise or to be general ones, let's say with design, finances, marketing. The so-called Osborn's checklist is widely used, which special feature is the availability of subtitles: "put to other uses," "adapt," "modify," "minify," "substitute," "rearrange," "combine," and so on. On the one hand, they help the respondent; however, on the other hand, they can restrain creative abilities owing to narrowing of sphere of survey. The choice of methods to conduct expert surveys, of ways to process the results depends on specific goals.

The method of expert evaluations can be considered for several reasons. If the object is studied in the conditions of limited information, reliability will decrease. Besides, some experts' opinions, essentially differing from those of the majority, are not always taken into account; it can lead to that that a reasonable idea "will be lost." The generalized group opinion is not always right. Therefore it is better to organize regular work with experts and to combine several methods.

The popular method of expert evaluation is *Delphi technique*\*, or of “the Delphic oracle.” At first it was used as an iterative way during brainstorming). However rather quickly the method began to be applied also as means to increase reliability of surveys, to estimate a tree of objectives, to develop scenarios. delphi technique advantages are: high reliability of results owing to feedback; multistage evaluation; possibility to get familiar with colleagues’ estimates between rounds. In advanced techniques experts are given weight coefficients of opinions significance which are defined by the results of the previous rounds. But the provided procedure of substantiation of one’s own opinion, differing from others, may cause the Asch Conformity Effect. Recent years the given method is combined with others (morphological, network, computer algorithmization). The efficiency of the Delphi method can be increased by its combination with a business game when the expert assumes the role of project manager or head of an organization.

The Asch Conformity Effect — change of behavior or opinion of the person as a result of real or imaginary group pressure. In M. Sherif’s experiment (1937) in darkness a light source emerged on the screen, moved for several seconds and disappeared. At the first stage three people independently defined how far the light moved, and at the second — gave an agreed answer, considerably changing opinion towards average group norm. The results of answers experimentally proved people’s disposition to trust judgements of others more than themselves.

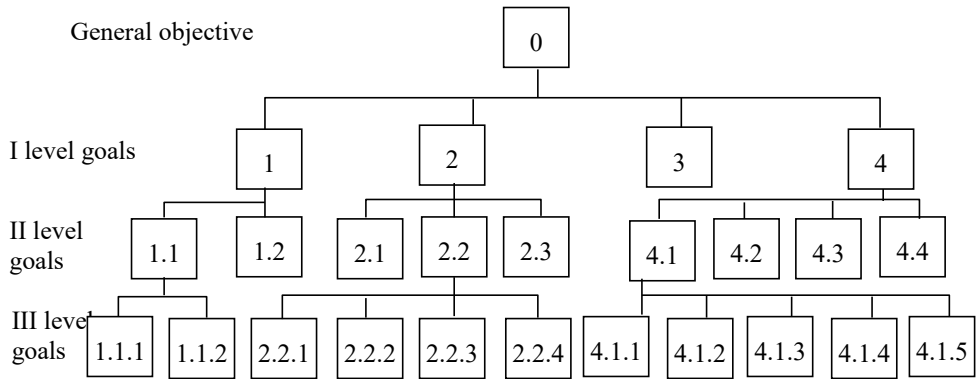
The method of the “*Hierarchy of Objectives*,” developed by W. Churchman, assumes availability of hierarchical structure (Fig. 6.2). The “hierarchy of objectives” can be defined, as “target frame» of the organisation, phenomenon or activity. When the method is used for developing and making management decision, it is called “decision tree,” such names as “problem tree,” “development tree,” “predication graph” are also known.

The “hierarchy of objectives” is a visual graphic representation of subordination and interrelation of goals, which shows distribution of the general objective or mission among subgoals, tasks and separate actions. The objective is an ideal notion about the nature of activity and object possibility (Fig. 6.3).

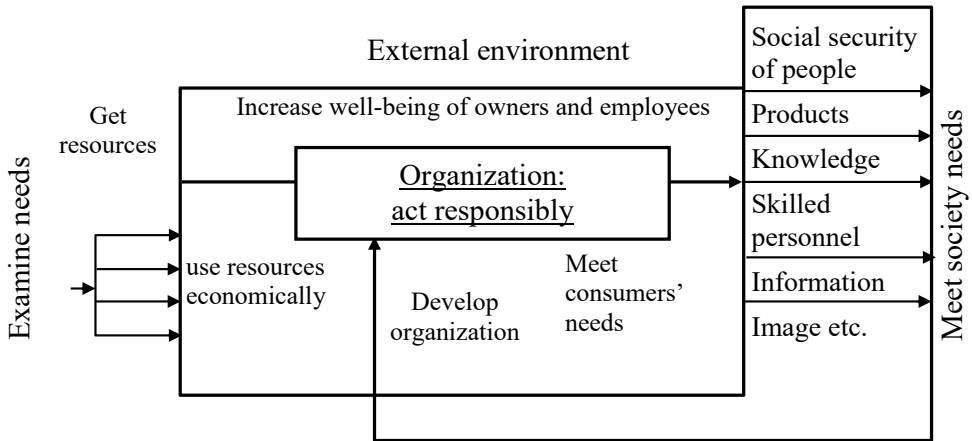
The main idea of “hierarchy of objectives” construction — decomposition (consolidation), that is system structure revelation, when it is divided into separate components by one sign. The decomposition is used for construction of “hierarchy of objectives” in order to connect the chief objective with the ways of its achievement, formulated as individual staffers’ tasks.

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\* Method emerged in the 1950-1960s to analyze US nuclear war plans (developed by RAND Corporation, Olaf Helmer, Norman Dalkey and Nicholas Rescher are considered its authors). Its distinctive features are no need of presence, multilevelness and anonymity.



**Fig. 6.2.** “Hierarchy of Objectives” of the organization



**Fig. 6.3.** Model of social organizational goals

There are no universal methods of “hierarchy of objectives” construction; ways depend on nature of the chief objective, chosen methodological approach, developer, set tasks and their interrelation. A horizontal coordination ensures the effective use of productive potential, a vertical one is used to coordinate directions of activity with the account of competitive advantages.

*Morphological analysis.* The term “morphology” (from Greek *μορφη* (*morphe*) — form, *λογία* (*logia*) — word, teaching) means the study of internal system structure. The idea of morphological style of thinking goes from Ancient Greek philosophers Aristotle and Platon (Fig. 6.4), and in the Middle Ages — from model of R.Lully’s mechanization of thinking.



**Raymond Lully** (1235-1315), Catalan philosopher and theologian. In the work "Ars magna" described attempts to mechanically simulate logical operations in "logical machine" he invented. Defined logic as "art and science, with the help of which truth and lie are recognized by mind and separated from each other. The main ideas were subsequently improved by G. Bruno (1548-1600) and G. Leibniz (1646-1716).



**Aristotle** (Ἀριστοτέλης; 384-322 BC) — great Ancient Greek philosopher, brilliant scientist with encyclopaedic knowledge. Went to Plato's philosophical school. Tutored Alexander the Great. Summarized the achievements of antique thought. The characteristic feature of his philosophy — fluctuations between materialism and idealism. The cognition of objectively existing nature occurs by sensations, ideas, and concepts. There is no true knowledge without feelings. He considered categories, that serve as the instrument of cognition of essence of things, as types of connections not only in concepts, but also as reflected connections between things and phenomena.

**Fig. 6.4.** Plato and Aristotle (right), central piece of Raphaello's fresco

**Plato** (Gr. Πλάτων; 427-347 (348) BC) — Ancient Greek thinker, along with Pythagoras and Socrates, is the founder of European philosophy; headed the philosophical school Academy. Thought over and recorded the project of ideal state system and ideal legislation (the Laws). The philosophical school, which he founded and opposed to sophistic and rhetorical schools, existed till the end of Antiquity. Thus Platonism preserved real achievements of ancient philosophy not only for the Western Middle Ages and Byzantium, but also for the Arabo-Muslim tradition, having ensured the unity of all European thought.

F. Zwicky, Swiss astronomer, developed *the method of the morphological analysis of complex problems* in the 30s of the 20<sup>th</sup> century and therefore it is also called — Zwicky's method. The scientist considered as starting points of morphological research:

- 1) interchangeable interest to all objects of morphological modelling;
- 2) elimination of restrictions and estimates, until the complete structure of the area under consideration will be got;
- 3) as precise statement of the problem as possible.

The method consists of the following stages:

1. Statement of the problem with conditions and restrictions.
2. Creating the structure of an object and its functions as the basis of problem solution.
3. Preparation of possible variants of realization separately by each sign (property).
4. Evaluation of all received alternate solutions of the problem.
5. Choice of the most apt alternate solution of the problem.

F. Zwicky also offered such methods of morphological modelling as regular cover of a field, negation and designing, those of morphological box, extreme situations, and generalization and so on. The main idea of the morphological approach — to find systematically the largest number of, and ideally — all possible alternate solutions of the set problem or of system implementation by combining basic structural elements of system or their signs. Thus the system or problem can be broken into parts by different ways and be considered in various aspects.

The versions of the morphological analysis are functional designing (R. Koller, Germany, and the 70s of 20<sup>th</sup> century) and morfologicheskaya klassifikatsiya (morphological classification) which was suggested by a Ukrainian scholar V. Odrin.

The *matrix of discoveries* (A. Moles, France, 1955) and decimal search matrices (R. Povileiko, USSR, 1976) consist in matrix compiling. All variables are written in a table and there are attempts to combine them in a new fashion. In a left column, objects of influence are written, and in a horizontal top row — possible ways of influence (changing actions). Then vacant cells are filled with possible means of influence on an object by certain variants of the given way. The advantages of the method are possibility to purposefully form both objects of influence and ways, and further to examine different variants systematically.

The class of the combined algorithmic methods is based on the strategy of logical search.

The problem solution search strategy is based on compiling n-dimensional matrix by signs of the object under consideration. Systems search is intended for systematic study of an object. Cells, on the crossing of rows and columns, reflect all possible realizations.

Systems methods differ only by implementation of research of structures and functions of objects and are among the methods of the mathematical analysis.

The class of the combined algorithmic methods includes

- theory of inventive problem solving (TRIZ) (G. Altshuller, USSR);
- GHM (O. Polovinkin, Russia);
- kompleksny metod poiska resheniy tehnicheskikh problem (comprehensive method of search for engineering problem solutions (B. Goldovsky);
- fundamental design (E. Matchett);

- evolutionary engineering (S. Pushkaryov);
- NLP (J. Grinder, R. Bandler).

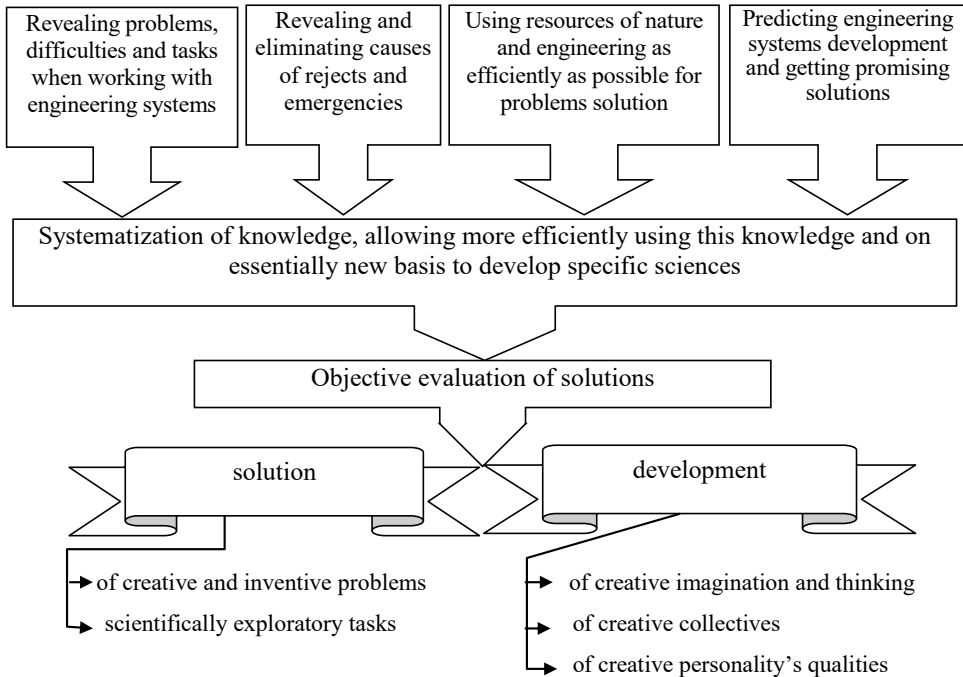
The search for solutions, by using these methods, is systematic and purposeful. Thus, the problem solution depends on the nature of a problem, degree of completeness and reliability of initial information, personal properties of the developer and especially on its capability to be guided skillfully in the information environment, on degree of grasp of methodology of cognition and creative work.

Besides the direct product of creative activity corresponding to the objective, the by-product emerges as well, which at the successful moment, can show itself as a prompt, that will lead to the intuitive solution.

Problems in the management organization are solved to a certain extent at integrated work with group of experts which includes researchers, developers and consulting experts. This group actually creates the coordination mechanism with which help contradictions among experts, investors, and consumers are smoothed out. The role of consulting experts, including industrial engineers, experts in organization of trade, marketers, experts in organization of finances, consists in meeting demands of production, consumers, after-sale service; necessary for successful production sales in the marketplace. For the expert body to be effective in its work there should be persons acting as the erudite, generator of ideas and critic. Without the generator and critic the erudite degenerates into a dogmatist, without the erudite and the generator of ideas the critic becomes a fruitless pessimist. The work will be inefficient if during organization regularities of collective creative work are ignored and methodical ways of activation of optimal solution search are not used.

## ***6.2. Theory of inventive problem solving***

The theory of inventive problem solving (TRIZ) was developed by Genrich Altshuller. The first work on TRIZ was published in 1956 [4]. The scientist was working over the given theory, in fact, all his life (1946–1998). TRIZ is put among analytical theories. The structurally functional method of the system analysis, considered in the previous issue, is the main component of TRIZ. The main point of TRIZ — revealing and use of laws, regularities and tendencies of technical systems evolution. Fig. 6.4 shows the basic functions of the theory which convincingly show the uniqueness of the given tool for search of unconventional ideas, revealings and solving many creative problems, selecting prospective directions of development of engineering, technology and decreasing expenses for their working out and production; for development of creative thinking, formation of creative personality and creative groups.



**Fig. 6.4.** TRIZ main functions

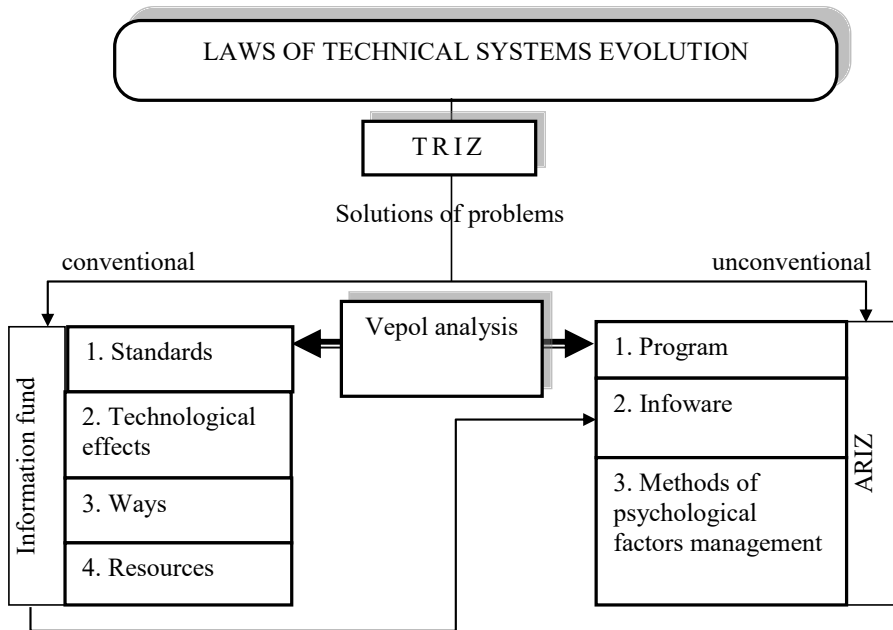
TRIZ is a system of ways, methods and algorithms of purposeful management of process of problems solution search. The ways are operators of transformation of initial engineering system (device) or initial technical process (method); they are rather “strong” to resolve contradictions. The way should be single (elementary) operation. The method is a system of operations assuming a certain order of their application. The method is based on one principle, postulate, and stays within the limits of these initial principles. TRIZ structure (Fig. 6.5) includes:

- 1) laws of engineering systems (ES) development;
- 2) ES information fund;
- 3) vepol analysis (structural substance-field analysis);
- 4) algorithm of inventive problems solving (ARIZ);
- 5) methods of creative imagination development.

The information fund consists of

- system of standard inventive problems solution (model solutions of a certain class of problems);
- technological effects (physical, chemical, biologic, mathematical, particularly, the most developed of them at present — geometrical) and tables of their use;
- ways to eliminate contradictions and tables of their use;
- resources of nature and engineering and ways to use them.





**Fig. 6.5.** TRIZ block diagram [8, p. 15]

ARIZ is rather accurate action program (for a direct problem) which is the program (sequence of actions) to reveal and resolute contradictions. ARIZ includes: program proper, infoware, feeding from the information fund (on Fig. 6.5 it is shown by an arrow), and methods of psychological factors management which are the constituent of methods of creative imagination development. Besides, ARIZ provides for the sections intended for task selection and estimation of the received solution.

The vepol analysis allows presenting structural model of initial system, revealing its properties, by means of special rules to transform problem model, thereby having received structure of the solution; this solution eliminates defects of the initial problem.

Dividing the system of standards into inventive problems solving problems and standards themselves is built on the basis of the vepol analysis of technical systems. Besides, the given analysis is included in ARIZ program (it is shown by arrows on Fig. 6.5).

Methods of creative imagination development allow lowering psychological inertia when solving creative problems. Recently, theories of development of creative personality and creative collectives became widespread. TRIZ purpose is formalization of a reproductive component of constructive process, the choice of the most effective tactics of search for solutions instead of trial and error tactics. TRIZ is

an attempt to create the tool for training “systems” thinking, to offer rules of organization of thinking according to the multiscreen scheme [12].

ARIZ is one of the scenarios of inventive problems solving, containing the following stages

- analysis of the problem and its models (two stages);
- defining an ideal end result and physical contradiction;
- analysis of optimal use of resources;
- searching for analogs in the knowledge base;
- adjustment of the task;
- analysis of received solution quality;
- checking actual problem solution for novelty.

The given algorithm is rather similar to the list of stages of the process of making complex decisions. At the first stage, restrictions and goals of the problem are considered with revealing a technical contradiction. As a result the model of the problem is got which analysis allows revealing conflict operating zone (second stage). At the third stage, the image of the ideal solution and “physical contradiction,” preventing its achievement is formed. At the fourth stage, systematic operations to increase resources and their optimum use are performed. In other words, stages 3 and 4 are the iterative structural-functional analysis-synthesis with orientation to a direct problem, or search for an optimum alternate solution.

Practical advance in TRIZ area is the use of knowledge banks (information fund) that allows solving problems more successfully in interrelation with environmental, social requirements and those of production process of technical objects. The information fund includes:

- ways to eliminate technical and physical contradictions;
- bank of regularities and trends of technical objects development;
- bank of methods of engineering creative work;
- bank of methods of activization of engineering creative work;
- bank of findings and physical effects (choice of principle of engineering solution functioning);
- bank of negative effects (results);
- bank of ways to transform technical objects;
- bank of methods of evaluation of cost-performance characteristics of objects, their workability and efficiency (revealing base object of the best world sample).

The information fund is constructed on classification and systematization principles. The bank of negative effects has become especially topical, as for the last decades many time distant consequences of environmental pollution emerged and an information component that creates potential threat to life existence on the Earth.

Thus, new thing in TRIZ is an interpretation of known system concepts to engineering and introduction of the new term “vepol.” The concepts of the technical and physical contradiction reflect the general law of evolution (unity and conflict of opposites) according to which the solution is found by the method of cycling structural-functional synthesis-analysis that is how it occurs in the life itself.

By means of TRIZ both known and unknown types of problems are solved. Known (standard) types of inventive problems are solved by using the information fund and unknown ones (original) — by using ARIZ. In process of accumulation of experience the class of known types of problems replenishes with solutions and is structured. At present TRIZ-based computer programs have been developed which provide an intelligent help to engineers and inventors in solving technological problems; they also ensure revealing and forecasting emergencies and undesirable phenomena.

We will consider more in detail separate sections of TRIZ which function is solution of problems (Table 6.2), having designated by figures the sequence (measure of significance) of an element for the given function. The elements, which for the given function are not executed, are noted with “-” sign.

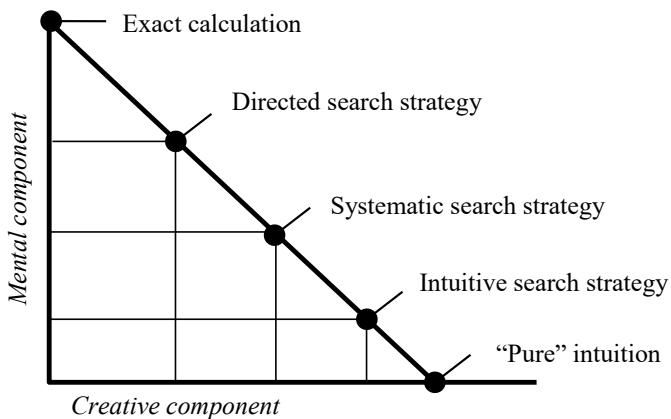
Table 6.2

**TRIZ functions and structure [8]**

FUNCTIONS	STRUCTURE												
	ES evolution laws	ARIZ	Vepol analysis	Information fund						Methods of creative work development			
				Standards	Technological effects				Examples	Resources	imagination	of personality	of collectives
					physical	chemical	biological	mathematical					
Forecasting engineering systems (ES) evolution	1	-	2	2	-	-	-	-	-	-	-	-	
Search for task	1		2	1	3	3	3	3	1	3	1		
Task selection	2	1	-	2	-	-	-	-	-	-	-	-	
Task fulfillment	2	1	2	1	2	2	2	2	2	2	3	-	
Evaluation of solution	1	2	2	1	-	-	-	-	-	-	-	-	
Creative imagination development	2	-	-	-	-	-	-	-	3	2	-	-	
Creative personality development	-	-	-	-	-	-	-	-	-	-	-	1	
Creative collectives development	-	-	-	-	-	-	-	-	-	-	-	-	

Now, methods of activation of thinking, typical directions of search for solutions (typical ways) and means of engineering solutions development started to be developed on the basis of statistical data. The literature about TRIZ covers literally all branches of knowledge: from general nature laws to human thinking. Features of problems ensure opportunities for revealing various strategy of creative activity. *Intuitive search* strategy is consecutive putting forward and verification of ideas, advancing hypotheses without proof of correctness of each put forward idea. *Systematic search* strategy assumes the formulation, definition of all possibilities within the limits of the set situation, check and elimination of false variants.

*Ordered directed search* strategy means the logical analysis of negative phenomenon causes. Usually when solving specific problems, combinations of various strategy or their components are used. At the lack of data at the initial stage intuitive methods are more relied on, more input allows attracting logical component (Fig. 6.6).



**Fig. 6.6.** Model of interrelations of creative activity strategy [10, P.74]

In the course of solution of creative problems the interrelation of logical and irrational emerges. Logic is used to formulate anticipations, plans, programs of solution; necessary input material and intermediate results for creative problem solution are accumulated. In this case the combination of creative work with scientific achievements, flexible adequate idea about creative work is decisive.

### **6.3. Classification of typical ways of searching solutions**

The main invention problem is stage-by-stage definition of the most probable zone of search for solution. The random set of methods (ways) is ineffective. Solution

searching process, depending on the complexity of problems, should be multilevel and with such definitions, as restriction, properties and relations. For methods to work in coordination, a respective classification of typical ways is required (Table 6.3).

Table 6.3

**Classification of Solution Searching Ways**

Top level sections	Subsections
Structural transformations (category of space and connections)	<ul style="list-style-type: none"> <li>▪ quantitative transformation of object parts;</li> <li>▪ qualitative object transformations;</li> <li>▪ selecting construction and material;</li> <li>▪ selecting a shape;</li> <li>▪ selecting a color;</li> <li>▪ dimensions;</li> <li>▪ choosing an intermediary.</li> </ul>
Functional transformations (category of time and sequence)	<ul style="list-style-type: none"> <li>▪ periodic sequence of states (discrete, harmonic);</li> <li>▪ nested loops (time calendar);</li> <li>▪ continuity of functioning;</li> <li>▪ pulsed, single actions;</li> <li>▪ rotation.</li> </ul>
Structural-functional transformations	<ul style="list-style-type: none"> <li>▪ weight;</li> <li>▪ universality;</li> <li>▪ selectiveness;</li> <li>▪ prompt change of parameters;</li> <li>▪ self-service;</li> <li>▪ feedback;</li> <li>▪ object lifetime;</li> <li>▪ economic technologies;</li> <li>▪ intensification of processes;</li> <li>▪ “vice versa” principle.</li> </ul>

Let's give several known ways presented by the aforementioned classification.

Structural transformations → *Quantitative object transformations*

– way of “grinding principle”

- a) to divide an object into independent parts;
- b) to make the object demountable;
- c) to increase automatization degree of the object.

– way of “carryover principle:” to separate an unnecessary part (property) from an object or single out a necessary part (property).

– way of “unification principle”:

- a) to unify homogeneous objects or those meant for related operations;
- b) to unify homogeneous or related operations in time.

– way of “universality principle”: an object performs several different functions, due to which there is no need in other objects.

– way of “cheap short life instead of expensive durability”: to replace an expensive object with a set of cheap ones, at that having lowered its quality (for example, durability).

Structural transformations → *Qualitative object transformations*

– way of “local quality principle”:

a) to pass from homogeneous structure of an object (or external environment, external action) to heterogeneous one;

b) different object parts should perform different functions;

c) each part of the object should be under conditions, most suitable for its operation.

Structural transformations → *Selecting construction and material*

– way of “using pneumo- and hydroconstruction” (to use gaseous or liquid parts of an object instead of hard ones)

– way of “using flexible shells and thin films” (instead of regular constructions or insulation).

– way of “using porous materials.”

– way of “homogeneity principle” (objects interacting with a given object, should be made of the same material or similar to it by properties).

– way of “using composites” (passing from homogeneous materials to composites).

Structural transformations → *Selecting a shape*

– way of “asymmetry principle” (passing from symmetric shape of an object to asymmetric one or increase in asymmetry degree).

– way of “matryoshka principle” (“Telescope”):

a) one object is placed in another one which, in turn, is in the third etc.;

b) one object goes through cavity in another object.

– way of “sphericity principle” (passing from rectilinear object parts to curvilinear ones, from flat surfaces to spherical ones, from a cube or a parallelepiped to globe constructions).

Structural transformations → *Selecting a color*

– way of “coloring change principle” (to change coloring or transparency degree, to use coloring additives or labeled atoms).

Structural transformations → *Selecting a dimension*

– way of “principle of transition to another dimension”:

a) problems, connected with moving or placing an object in one plane, are solved at transition to 3D space;

b) multistory arrangement of objects;

c) to incline an object, to put it “on the side,” to use a reverse of the given square.

Structural transformations → *Choosing an intermediary*

- way of “intermediary principle” (using intermediate objects).
- way of “copying principle” (to use instead of an inaccessible, complex, expensive, inconvenient or fragile object, its simplified and cheap or optical copies).

Functional transformations → *Periodic sequence of states (discrete, harmonic)*

- ways of “using mechanical oscillations” and “sampling action principle.”

Functional transformations → *Continuity of functioning:*

- ways of “efficiency continuity principle,” “overshoot principle”, “sphericity principle”, “prior counteraction principle,” “safety cushion in advance,” “antiweight principle.”

Structural-functional transformations → *Prompt change of parameters*

- ways of “dynamism (parameterization) principle,” “self-service principle.”

Structural-functional transformations → *Feedback*

- way of “principle of feedback.”

Structural-functional transformations → *Object lifetime*

- way of “principle of parts regeneration.”

Structural-functional transformations → *Economic technologies*

- ways of “mechanical system substitution,” “change of physicochemical object parameters.”

Structural-functional transformations → *Intensification of processes*

- ways: “phase transitions application,” “thermal dilatation application,” “using strong oxidants,” “inert atmosphere application.”

Structural-functional transformations → *“Vice versa” principle*

- way of “doing on the contrary”

a) instead of action which follows from statements of a problem to do on the contrary (for example not to cool an object, but to heat).

b) to make a part of moving object (or an external environment) motionless, and motionless — that which moves.

c) to turn an object “upside down.”

d) compression replaces tension and so forth.

Structural-functional transformations → *Conditional methods*

- ways of: “principle of partial or redundant solution,” “turning harm into good”:

a) to use harmful factors to get a positive effect;

b) to intensify a harmful factor until it will cease to be harmful.

If it is impossible to get 100 percent of necessary effect by applying these principles, it is necessary to try to receive “less” or “little more.” At that the problem may become essentially simpler.

Thus, it is clear from the given classification, that the ways of creative search for solutions can be divided into certain sections and subsections, but sometimes there are no ready ways to solve one or another problem at all. The inventor should consider typical ways only as a basis for decision-making which should be replenished independently and continuously. The available and widespread ways of search for solutions are *analogy, inversion, empathy, fantasy*.

It is possible to get ideas to be introduced by the similar solution from another area; hints arise from references or wildlife elements are capable to suggest an interesting idea (*bionics* studies and suggests to adapt natural mechanisms to be used in engineering area). For the analog approach to be used it is necessary to study main principles and design philosophy of the object under investigation. Then to transfer properties of a prototype to a required sphere, but to adjust, considering materials, technologies and other factors. For example, birds and fish have a special shape and nature of body surface for minimum resistance to reduce friction force during movement. Vehicles are designed with the account of these special features.

Although *analogy\** is extremely fruitful source of ideas, at the same time it cannot be used all the time. So, while designing a robot to test china, it was supposed, that it, like human, must take an object and knock, and to define quality of an item by its sound. However ultrasonic testing has been recognized as the most effective way of checking.

In business area it is a widespread practice when products are made by unknown enterprises which imitate well-known brands; however it is not always reasonable. It also happens, that a leading enterprise sells components to another, and the latter changes certain parameters or finds another way to use it.

The *inversion* method — opposite to analogy — see above the way of “doing on the contrary.” So, inverse things are a radio receiver and a transmitter. A treadmill, a swim trainer and an escalator were similarly invented. There are several kinds of inversions: functional, structural, parametric, spatial, that of connections.

The functional inversion consists in manufacturing a product with inverse function (attraction-repulsion, heating-cooling). For example, a grill oven was designed where food does not move, and hot air streams rotate around it.

The structural inversion deals with system components (a little—a lot, continuous—discrete, hierarchical—level). So, electronic equipment earlier consisted of

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\* *Analogy* (Gr. *αναλογία* — correspondance) — similarity, likeness of different objects, phenomena on the whole to specific properties, signs or relations.



set of blocks, and many elements were replaced by processor. Technical control means have been earlier designed with separate functions, and now they are created to be multitasking.

The parametric inversion is based on opposite parameters (long–short, hard–soft). For example, in medicine instead of heating, strong freezing is used for disinfection.

The following kind of the given method is inverse connections (connection — no connection, positive — negative). For example, telephone communication is constructed on this principle.

The spatial inversion is based on essential change of an object in space. The given way is used in design of household appliances (a mounted refrigerator, a washing machine with a different arrangement of a drum); when building skyscrapers.

Time inversion is based on changes of intervals, i.e, quickly – slowly, past – future. This category also includes the trend to replace analogue engineering by digital technique.

The *empathy* as a method to develop creative ideas is the projection of one's own personality into another person (they say to “put oneself into somebody's skin”). A designer identifies oneself with an object which develops. Thoughts about new functions or improvements may arise thanks to transformation.

Creativity and *fantasy* are very closely interconnected. The way of fantasy allows imagining unrealistic events, fancy solutions may prompt to something that can lead to a new actual result. For example, alternative kinds of energy (biofuel, biological waste decomposition) only recently were perceived as fantastic ones. Technical appliances and devices, controlled not by pressing buttons or handles, and vocal commands, do not surprise any more. Now possibilities of hazardous waste transportation to other planets are being studied.

Creativity turns out helpful when there is an urgent need in new ideas because without them there will be crisis. However, even if a situation is not so dramatic, ideas may bring new benefits and advantages. So, creativity is frequently required, when an object is improved (less resources consumed, ecological compatibility, and correction of different defects). Japanese employees are very active in this respect: on the average three hundred ideas in comparison with typical ten. It is therefore that the concept of total quality management (TQM) became widespread in Japan. On the other hand, the right solution may be found without using creative work, but only experience, new technology, rationality and logic.

Besides improvement, creativity is necessary when solving problems. It is useful to look at a problem from other point of view. The inventor at first states a problem, and then searches for a roadmap.

And one more sphere of application of creative thinking — creation of values and designing possibilities. Under modern conditions competition is more and more manifested not in price, and in higher skill, more perfect system of distribution, high reputation and creation of new value system.

Owing to intense tempo of life we have no time for pauses in the form of complex mental activity, but it does good, when we ponder over questions: it really it cannot be made differently, whether there are alternative options. This simple method induces to that that creative thinking becomes habitual and develops creative skills.

Focus — the element of creative work consisting in concentration on implicit aspects in problem statement, on that, what others do not pay attention to. And after all sometimes ideas simply “lie under one’s feet,” and nobody notices them.

Ability to choose an object and to muse — important acquired habit of creative thinking, and its absence sharply reduces creative work efficiency. People seldom use this way, because they have got used to pay attention to topical, serious problems. And when they are absent, there is nothing to react to. E. de Bono in *Six Thinking Hats* subdivides focus into two kinds: on sphere of action and on the goal [5]. He gives examples of use of the given way:

1. *Certain need or objective is clear.* The objective or problems are defined from the very beginning and there is a possibility of application of creative thinking. The problem can be selected independently or offered to be solved by another person.

2. *Review of habitual operations.* In this case there is no certain problem or issue, and there is an intention to review some operations or processes. These processes can be divided into zones of attention, which are small and convenient for consideration, and focus objects, to each of which unconventional thinking is by turns applied. It is possible to consider any existing process in that way. The focus type can be chosen at one’s own discretion — as focus on sphere of action as that on the goal.

3. *Idea-sensitive place.* The word “sensitive” means that in a given place a new idea will bring significant effect. We speak about a sensitive steering wheel, when the slightest turn of the wheel changes a driving direction of a car. The photosensitive film reacts to the slightest light. It is necessary to find the place which will sensitively react to change of ideas or conceptions. This search — operation which is valuable per se. When we manage to find something similar, we try to develop new ideas dealing with this sensitive sphere. Such action differs from “review” by that that in the previous case we did not feel a huge potential of a new idea. We paid attention to existing operation simply because it exists.

4. *Precision*. This case is close to a creative pause and simple focus. It belongs to the “investment” side of creative work. From time to time we can focus on something for no reason at all, simply because we want to do it, without any necessity to do it. We can concentrate on such things, to which another person would not pay attention, due to it.

Multiple objects of focus can be broken up into a number of smaller objects. For example, we require new ideas in bus service. Let’s break up this problem into the following: equipment, traffic control, schedule, market, “rush hours,” training of drivers, configuration of the buses, etc. When we divide the general focus into smaller elements, further it is possible to use a classic method of the linear analysis. But at that there is no need to adhere necessarily to strict division between separate types of focus — on the contrary, their crossing gives certain preferences.

Thus, management of ideas is comprehensively developed by theorists and practitioners in terms of methods and ways in search for optimal solutions. The manager has a lot to choose from the suggested methods when solving specific organizational or collective problems.

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## 7. Management of creative solutions development at enterprises

7.1. *Features of managerial creative solutions.*

7.2. *Solutions, based on experience and judgments.*

7.3. *Intuitive solutions.*

### 7.1. *Features of managerial creative solutions*

Decision-making process is one of the key sections of management, and decision-making methods — special direction based on the mathematical apparatus, the systems analysis, the theory of operations and other sciences. In creative management the solutions development function also defines efficiency and quality of the given activity on the whole. The rest of the functions can be considered as derivatives.

The “managerial decision” concept has the dual nature because it is simultaneously the function of management, and the process of realization of other functions (planning, organization, motivation, control). Because of it “managerial decision” function began to be named “binding function” [8]. Therefore the process of creative solutions development can be considered from the point of view of organizational normative and subjective and psychological aspects. The importance of managerial decision is revealed in its functions (Fig. 7.1); that is the feature of the given kind of activity is polyfunctionality. Let’s consider some functions.

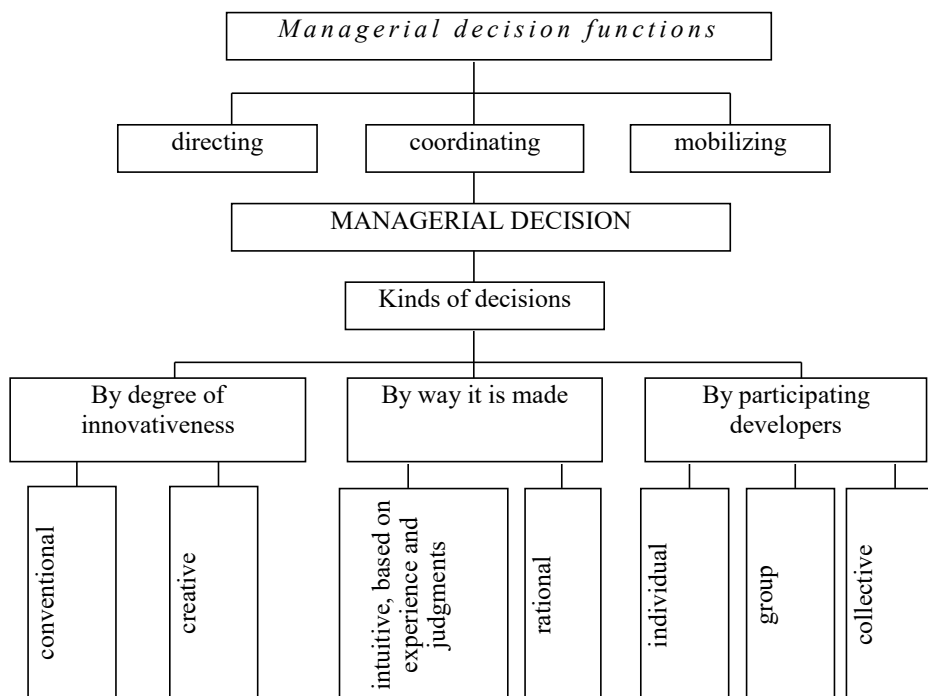
*Directing* function consists in guiding the activity of an organization and does according to its strategy and tactics.

Function of *coordination* — the managerial decision defines a place of each unit, employee during solving problems, coordinates their actions and necessary resources in time and space. Coordination helps to work smoothly, qualitatively.

*Motivating (stimulating)* function — activation of does to achieve organizational goals.

The *managerial decision* is a result of constructive process of employees (manager and collective) concerning directions, methods, and means of the way out [11]. Therefore participants should have a respective potential which would ensure realization of these tasks. One more feature of decision-making processes — their *polymorphism* (a large number of kinds and forms) favors that as well.

Managerial decision making processes along with objective factors also include additional system of factors of subject and intersubject (interpersonal) aspect.

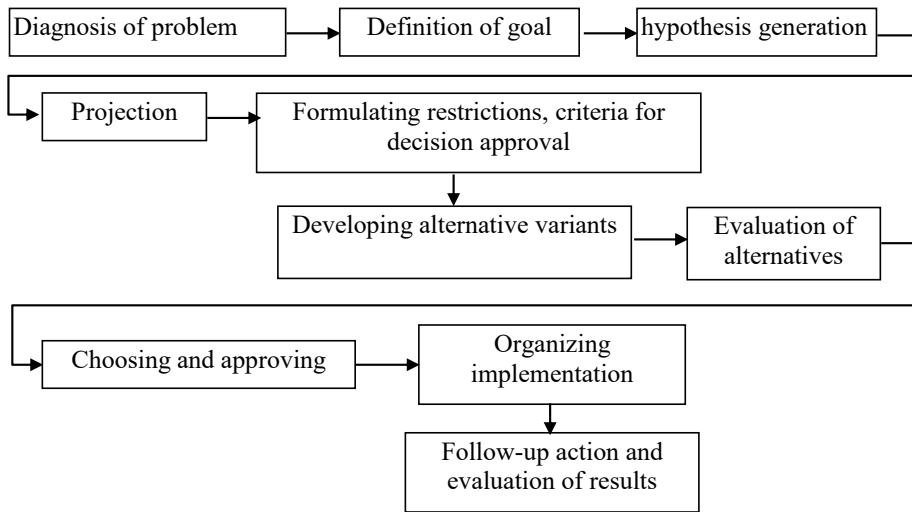


**Fig. 7.1.** Functions and kinds of managerial decisions

In management there are several generally similar algorithms of managerial decision making processes which differ only by details. The general sequence of stages of making and implementing a decision is presented on Fig. 7.2.

Projecting, according to the process approach, is a link between functions of defining goals and planning. By means of projecting, enterprise is managed not as reaction to external environment change, and as proactive adaptation to them in advance; the point of the given function consists in that. Such behavior began to be named proactive management [10, p.43]. Key factors of projecting of external environment changes are spheres of direct and indirect action. The first includes factors which directly influence the activity of an organization (manpower, suppliers, laws, consumers, competitors). The indirect action area — factors indirectly influencing the enterprise (state of the economy, scientific and technical achievements, political, legal, sociocultural and other factors).

For projection of research object development to be more reliable, it is necessary to study external environment properties: interrelation of factors, complexity, mobility, and uncertainty (according to available information).



**Fig. 7.2.** Algorithm of developing and implementing the managerial decision

To make a reasoned decision, it is possible to use a matrix of assumptions (Fig. 7.3) which allows arranging influence factors by importance of parameters. For this purpose controllability parameters are written across, and down — factors proper by degree of importance of impact. The importance is defined by degree of positive or negative effect on an object. The matrix visually represents, to what factors it is necessary to pay special attention, and what problems are unsolvable.

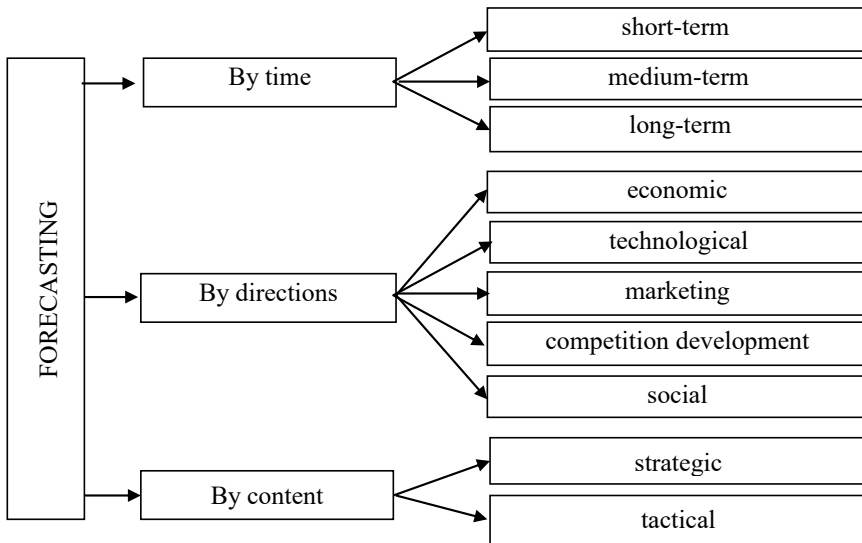
	Controlled	Uncontrolled
External		
Internal		

**Fig. 7.3.** General matrix of assumptions

The leader's creative thinking should include projection results to develop internal and external predictions (assumptions, hypotheses). Internal planned assumptions concern the volume of investments; change of technologies and of means of labor, organizational structure of management and so on. External assumptions deal with general environment of projection (economic, technological, political, social, demographic conditions), condition of commodity market and production factors (demand, supply, prices, competition, and cost of resources). External and internal projections can be formulated through qualitative — but better still — through quantity indicators (for example, in percentage of the current level).

Uncontrolled, but projected well assumptions include population changes, tax policy. Among controllable assumptions to which the manager should pay special attention, the most important are entry to new markets, intensification of scientific researches, and level of staff turnover.

A detailed classification of projections is presented on Fig. 7.4. Initial general assumptions are used as material for the following step of projecting — working out more detailed presumptions. Such work can be done by the head both alone and jointly (advisers, projection experts are involved).



**Fig. 7.4.** Classification of forecasting

Economic forecasting assumes evaluation of the future state of the economy on the whole or of specific organization. Technological forecast concerns new technologies development and respective economic consequences. Marketing forecasting deals with demand, segments of production consumers; this is the main type of projection for any organization activities. Competition development forecasting consists in assumptions about probable changes of strategy and tactics of competitors. Social forecasting is based on changes of society at large and people’s social attitudes in particular.

Usually not only informal, but also formal quantitative and qualitative methods are used for forecasting. The most known quantitative forecast methods are those of “time-series analysis” and causal modeling. The role of polyvariant forecasting increased because of computer engineering development (the method of scenarios was covered in topic 6 “Management of ideas”).

The procedure of solutions evaluation can become an important element of innovation process, allowing considering opinions of heads of units at early stages of development [2, 12]. Criteria of filtration of ideas during project development are constantly detailed and specified (Table 7.1).

*Table 7.1*

**Major project evaluation criteria**

Criteria group	Description
1	2
A. Criteria, dealing with goals, strategies, policy and values	<ol style="list-style-type: none"> <li>1. Project compatibility with current organizational strategy and its long-term plans.</li> <li>2. Possibility to change the strategy with taking project potential into account.</li> <li>3. Project conformity with ideas about a company.</li> <li>4. Project compliance with management’s attitude to risk.</li> <li>5. Project compliance with management’s attitude to innovations.</li> <li>6. Compliance of project time aspect with management’s demands.</li> </ol>
B. Market criteria	<ol style="list-style-type: none"> <li>1. Project compliance with accurately defined market needs.</li> <li>2. Total market capacity.</li> <li>3. Market share, which an enterprise can control.</li> <li>4. Product life cycle.</li> <li>5. Commercial success probability.</li> <li>6. Projected sales volume.</li> <li>7. Market planning terms.</li> <li>8. Impact on existing goods.</li> <li>9. Pricing and product perception by consumers.</li> <li>10. Competitive state.</li> <li>11. Product compliance with current distribution channels.</li> <li>12. Estimation of initial costs.</li> </ol>
C. Scientific and technical criteria	<ol style="list-style-type: none"> <li>1. Project compliance with strategy of research and research and development (R&amp;D.)</li> <li>2. Possibility to change the R&amp;D strategy with taking project potential into account.</li> <li>3. Project technical success probability.</li> <li>4. Cost and time of project development.</li> <li>5. Project novelty.</li> <li>6. Availability of scientific and technical resources for project fulfillment.</li> <li>7. Possibility of fulfilment of future R&amp;D on the basis of the given project and new technology.</li> <li>8. Influence on other projects.</li> </ol>
D. Financial criteria	<ol style="list-style-type: none"> <li>1. R&amp;D costs.</li> <li>2. Investment in production.</li> <li>3. Investment in marketing.</li> <li>4. Availability of finances at right points of time.</li> <li>5. Influence on other projects, requiring financial means.</li> </ol>



Table 7.1

1	2
	6. Time of achievement of a break-even point and the maximum negative value of the net cash flow. 7. Potential annual profit margin. 8. Expected rate of return. 9. Project compliance with investment efficiency criteria.
E. Productive criteria	1. New manufacturing methods. 2. Sufficient production personnel and its skill. 3. Project compliance with available production capacity. 4. Price and availability of materials. 5. Productions costs. 6. Additional capacity requirements.
F. Spillovers and environmental criteria	1. Possible harmful effects of products and technology. 2. Public opinion influence. 3. Current and prospective legislation. 4. Influence on employment rate.

The availability of financial resources for R&D project implementation depends on organization condition, which is defined by its activity, all expenses and profits. Therefore cash flows including during project implementation as well, should be evaluated as much accurate as possible. Such analysis can clarify the following.

- maximum value of negative cash flow does not exceed the volume of allocated financial resources. In this case financial restrictions will have little influence on project selection;

- required financial resources are on a limit of the expected volume of available funds. Then the risk of shortage of funds grows, and it is necessary to revise the development schedule, to shift the maximum of costs in time or to develop the extreme plan of replenishment of financial resources.

Each organization chooses the form and criteria of estimation independently. Rating estimations have a number of advantages

- ease of getting estimations of the project with diverse criteria;
- possibility to reduce subjective estimates and objective data to a single estimate;

- possibility, when selecting estimation criteria, to consider organization specific character.

Besides estimates by individual criteria, it is necessary to establish rating weight of groups of factors and separate factors, and further to reduce all estimates to the only one by the chosen technique (for example, in additive or multiplicative way).

Three basic kinds of scenarios are developed for enterprise economic development forecasting:

- optimistic — economic and social prospects will be favorable;
- realistic — prospects will remain the same;
- pessimistic — prospects will be unfavorable.

The polyvariant approach helps to combine accuracy of projections with their flexibility, variability under the influence of various factors.

Defining the structure of object or process means defining its *components composition*, as well as interrelations of these components. The main feature of managerial decisions is specific and stable components composition: decision purpose, its *information basis*, *rules* and *criteria* of choice, *strategy* of preparing and making the decision, *hypotheses* and *alternatives*.

The hypothesis is a scientific assumption put forward to explain any phenomena. This is just an assumption of that, what an original project is. The hypothesis is an assumption, which gives us simultaneously several advantages, it is a skeleton organizing the information in such a manner that we start to notice that was left beyond our field of vision before. The hypothesis also gives us direction of action since we should prove or disprove its conclusions.

Creative work matters a lot in constructing hypotheses. The science could move forward much faster, if not the opinion that the scientist or scholar should be just good analyst; this thought ignores significance of creative work in constructing hypotheses. Unfortunately, the serious dilemma is connected with hypotheses: without a hypothesis we flounder in the sea of facts, but after creation of a hypothesis it can interfere with estimation of real possibilities. The hypothesis must open new opportunities, but very often it, on the contrary, closes them. A manager, who constructed the hypothesis about the causes of reduction of demand for hamburgers, can cause more damage to business.

At the first stage of hypothesis existence we search for confirmation and proofs. But as soon as the hypothesis has affirmed, it is necessary to destroy it to move further. (It is so convincing and so well grounded, that we cannot possibly abandon it and only “drive” new data into its “Procrustean bed.” Therefore radical changes of scientific views occur so seldom and with such effort). Necessary data can be available long before scientists or scholars are able to look at them from a new point of view. Until then these data are emasculated by former hypotheses. Therefore, whatever smart this only hypothesis is, it is necessary to have several of them near at hand, to be able to look at a problem differently. It is necessary to put forward alternative and parallel hypotheses, assumptions and guesses, and it is possible to make it only by means of creative method.

When the person comes to work at a new organization, he has a short spell (approximately from 6 to 18 months) when it is possible to become the author of an original idea without difficulty. The first six month the employee has not found one's

feet yet (if only his work is not very simple). In 18 months the person has already completely joined local organizational culture and loses the novice's freshness of perception. These components act *as unity of objective and subjective* ones by their content. They are objective because they are the result of reflexion of real peculiarities of decision situation and are formed on their basis. They are subjective in the sense that they must be formulated by him who makes the decision, and not given as ready-made ones to the novice by other employees.

Each component represents the *unity of the normative and descriptive content*. All of them form under the influence of certain external factors: restrictions, orders, legal, technological and social standards and so forth. However any decision is virtually characterized by deviations from them.

Any of components represents the *unity of conscious and subconscious*. The significant part of the information, for example, is realized while solving, but still larger part of it is processed at extramental level, being shown in the phenomenon of intuitive guesses and solutions.

One more special feature of these components is that they represent the unity of *formal and substantial*. Though formally — by composition — only complete set of these components can ensure the choice, in each separate case “formal skeleton” is filled with different content, which depends on a specific situation.

At first the problem situation is defined, which can be solved by means of decision-making function. It is revealing the situation (diagnostics), defining its area, interrelations with other aspects of activity; describing the contents, key contradictions and stating the goals of the alleged solution.

The analysis of problem situation content consists of

- information analysis of the situation to reduce its uncertainty; controllability;
- defining “limiting factors” causing the problem;
- formulating solution criteria, which will underlie the selection of one of the alternates.

At the stage of formulating possible variants there is search for and generation of new possible ways to resolve the problem situation. The estimation of alternatives proceeds by the system of the formulated criteria and according to the main goal of activities. The choice of an alternative is the basic stage in the managerial decision process structure, since at the given stage the key step is taken — decision is made. Its major principle is maximization postulate that is the choice of alternative with largest integrated “utility.”

Frequently the made decision is to be implemented not by those those who developed it, this is the difference of the given stage from the previous ones. The implementation control can be current and final and, at last, the decision efficiency is estimated.

Decisions can be theoretically classified as programmed and unprogrammed. But these two “pure” types are now considered as a whole as continuum poles, and in management practice the combined decisions are most widespread.

H. Poincaré (1908) and H. Willis (1926) defined the following stages of creative decision making process [9]:

1. *Preparation*: problem stating and initial attempts of its solution, the conscious analysis of the problem by logic means. At that there is gathering and accumulation of information.

2. *Incubation*: diversion from the problem and switching of attention to another object. The subject stops conscious, connected with logical operations, work on the problem and activity starts at subconscious level.

3. *“Lucid moment.”* It is an intuitive penetration into the essence of the problem. This is a short-term stage of constructive process; the moment when the subconscious gives back (“prompts”) to the consciousness the problem solution. The given stage can be characterized by strong positive emotions, liveliness, inspiration, euphoria. From the point of view of psychology, the subconscious performs the task, set by the conscious, and now returns the ready-made solution. If the problem is difficult enough the consciousness is not able to analyze and control that what is going on, and the author may get direct access to the subconscious.

4. *Check of the validity of the solution by logic means*: correcting, editing, approval or disapproval. Then the following part of the task is developed, that is the initial stage is returned to.

## ***7.2. Solutions, based on experience and judgments***

The experience-based creative work essentially differs from that which emerges when the person is a little familiar with a problem. Incremental are innovations, based on the acquired experience. They are rather low-risk and are directed on consolidation of previously achieved success. Experience gives knowledge about a potential demand for an object. The idea, which once turned out successful, is strengthened, improved, modified and this way, for example, a wide range of one product is created. E. de Bono aptly calls another variant “son of Lassie” (the series about a clever collie, popular in the 1980s), that is creation of analog products protected from counterfeit copying by competitors [1].

The third variant of creative work based on acquired experience is recombining proved elements similarly to the principle of kids’ assembly kit. Such move of creative work is the most effective in marketing, however this way it is possible to get only additional revenue, but not essentially new ideas.

Professional experience is formed under the influence of the basic properties of long-term memory [10, p.110]. Forming owing to all professional and private life,

experience is organized and functions; this is a resultant phenomenon thanks to which long-term memory influences all aspects of management activity more effectively.

The main characteristics of professional experience are its volume and variety; the important feature is situational statefulness. The basic “units” of experience are integral management situations, faced earlier and being the most useful to the further activity; the information about the causes of emergence of certain situations and about effective methods to settle them. Therefore as basic “unit” of experience is considered not so much a situation, as a certain scenario (script). Script experience organisation dramatically increases its information capacity because “units” — scripts — extremely comprehensive and information-intensive.

Structuredness, order of experience is achieved due to typologization of the basic management situations. They are divided into usual (routine) and extreme; such which can be entrusted with others and demanding personal interference. There are other typologizations in the structure of professional experience as well.

Professional experience differentiation is defined by the following characteristics:

- number and variety of management situations, experience contains;
- degree of their typologization;
- variety of “behavioral repertoire” of the leader in different situations.

Besides, experience properties are.

The *integratedness of experience* is the degree of coordinatedness of its components; it is a derivative from the *differentiation*. It includes two basic aspects: to what extent components of experience are ordered and coordinated and in what measure they do not contradict one another and are united by common content and the head’s attitude. Differentiation and integration together give the generalized characteristic — degree of experience organization. High organization is the major condition for manifestation of the main property of operative memory in the leader’s activity — high mobilization readiness of the data, located in memory.

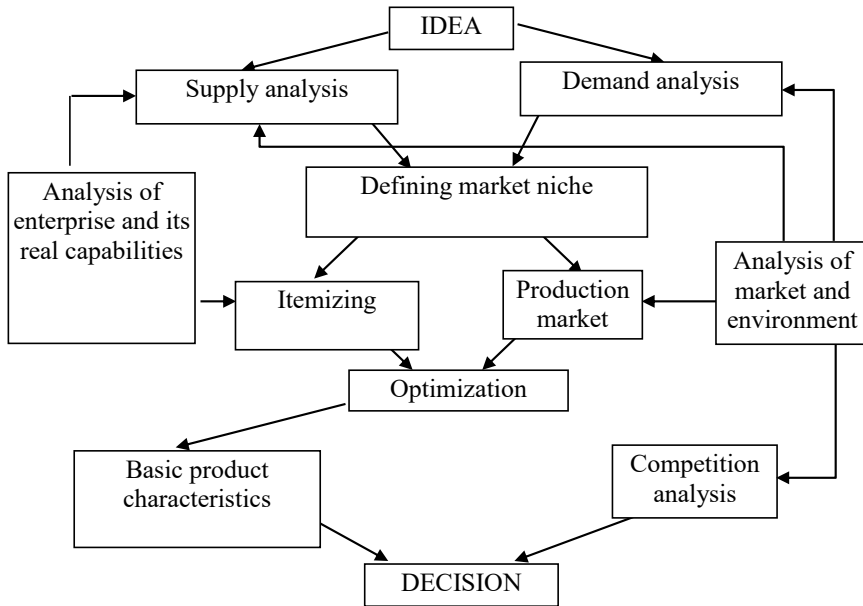
The *individualized nature* of experience. Experience is acquired as a result of own achievements and errors, therefore there is no universal structure of experience, a set of situations which need to be known. What is good for one person is unacceptable for another one.

The *selectivity* of experience is based on similar property of long-term memory. The important condition of experience formation is its constant enrichment but if it is only automatic summation of information there will be an information overload. Therefore the selection mechanism is built in the structure of professional experience (in many respects connected with forgetting).

The *productivity of experience* is the value characterizing the volume of knowledge, of skills, habits received as a result of previously acquired experience.

Because frequently marketers of an enterprise make decisions, based on experience and judgements, about evaluation of new kinds of production, let's consider techniques of such decision concerning new production output.

New production can have various forms: new application, new design, technical improvement, inventions etc. In most cases development and introduction of new production mean heavy expenses for the enterprise. That is why an innovative idea is examined in advance, forthcoming sales are projected. It is done by way of questioning and competition study. The decision-making process dealing with new production output is complex and long (Fig. 7.5).



**Fig. 7.5.** Process of new product development

It is important to take care of new production output as early as possible. For the enterprise to develop stably, new goods should be introduced into production when previous ones are at the stage of maturity. The phase zero, that is search and development of new production, must coincide in time with the first phase of previous production. But at this time the management's attention is riveted on products which bring considerable profits and therefore the enterprise increases its output. To ensure future well-being of the firm, it is necessary to create a department of strategic R&D planning which would develop long-term plans. Let's name several directions of strategy of the enterprise concerning new production output

- pioneer strategy, when the enterprise enters the market which, as a matter of fact, does not exist yet, risking to lose everything or receive high profits;
- copycat strategy, when the enterprise offers only reliable production — that which is at the stage of maturity at competitors;

- consistent differentiation strategy, typical of enterprises constantly improving existing products.

After goods introduction in production the marketing department must coordinate various phases to receive the maximum profit. It is necessary to remember, that the decision to limit current production output is as important as that about new output, especially if current production price is much higher. If it is not true at the beginning it is more difficult to make such decision. Such decision in many cases is difficult to make also because it demands certain sacrifices from the heads and causes dissatisfaction of a part of consumers (for example, deficiency of spare parts).

For stable development of the enterprise it is necessary to combine planning of new production with ceasing output of the previous one. Practice shows, that the range is considered successful, when

- 30-40% of products are at the stage of production volume expansion;
- 30-40% at the stage of maturity;
- 10-20% at the stage of introduction;
- the rest can be at the stage of preparation or slowing down.

The figures, in many respects, are simulated since they depend on specific production, branch, product life cycle and so forth.

When developing a new production the focus should be not on industrial problems, and on revealing prospective buyers' requirements and demand forecasting for 3–5 years. That is to create a product not only and not so much with supreme specification figures, and, first of all, the product which will be in demand tomorrow, i.e. the one of market novelty.

Practice shows, that the causes of new production failure lie, first of all, in erroneous definition of demand. That is why it is necessary to offer the product of market novelty, which

- opens up possibilities for the consumer to meet totally new requirement (pioneer product);
- rises to a new qualitative step known requirement satisfaction.

Because of that the enterprise has reasons to receive excess profits (above arithmetic mean return by branch) for some time. As the market is saturated the risk, connected with new production development, increases manyfold. On the average 8 out of 10 novelties do not get results.

The following stages are defined when planning new production output:

- 1) conception of new production;
- 2) idea evaluation;
- 3) cost analysis;
- 4) evaluation of project and prototype of new production;
- 5) market testing;

- 6) market segmentation;
- 7) forecasting new production sales at various market segments;
- 8) trial market sales;
- 9) mass manufacturing of new production.

The manufacturing enterprise certainly should frame the concept of a product which will be developed. In particular, it is necessary to provide for:

- description and quality of new production;
- features of its production and use;
- market segments new production is intended for;
- terms and conditions of warranty repair and after-sale service;
- description and kinds of services, related to new production (besides the previous).

The process of new production development starts with a comprehensive estimation and selection of a variant out of several novelties. The *rank correlation method* is used for this purpose. The method purpose consists in quantitative measurement of experts' opinion about defects or advantages of the prototype (project).

Using the rank correlation method for new production project demands to classify the major factors defining availability of the project by the following five groups:

- cost efficiency factors;
- market conditions indicators;
- factors ensuring high dynamism of sales;
- production and technical factors;
- factors of sales (Table 7.2);
- factors of after-sale service.

Each indicator is given a certain rank, depending on its importance in the system of the factors. In the simplest case, 2 is important, 1 — less important, 0 — not important, (-1) — small defect, (-2) — big defect. Further, experts evaluate by scores advantages or defects of the project from the point of view of each indicator. For example, applying (3; -3) scale, the group of 5 persons evaluated the project from the point of view of an anticipated profit and gave the following estimates:

1 expert	+ 3
2 expert	+ 2
3 expert	- 1
4 expert	- 1
5 expert	+ 2
Total:	+ 5
Average:	+ 1



## New product project evaluation

Factors, defining the availability of new product project, <i>i</i>	Factor rank <i>R<sub>i</sub></i>	Average expert estimate by scores (+, -) <i>m<sub>i</sub></i>	Total score <i>B</i>
<i>1. Cost efficiency factors</i>			
1.1. Sales income, tsd. \$.			
1.2. Calculated profitability, %			
1.3. Project payback period, yrs.			
1.4. Total of investments for scientific research, equipment changes and so on, tsd. \$.			
<i>2. Factors, describing market stability</i>			
2.1. Market capacity			
2.2. Prospective life cycle, yrs			
2.3. Patent protection level			
<i>3. Factors, providing for high dynamism of sales</i>			
3.1. Actual or potential competition			
3.2. Ad efficiency			
3.3. Customers' attitude to enterprise			
3.4. Ratio between supply and demand			
3.5. Export potential			
<i>4. Production and technical factors</i>			
4.1. Simplicity of design and technological solution			
4.2. Possibility of production at competitive price			
4.3. Availability of raw materials			
4.4. Possibility of waste use			
4.5. Possibility of use of installed equipment and technologies			
4.6. Availability of material resources and manpower			
4.7. Obsevanse of environmental cleanness of production			
<i>5. Factors of sales</i>			
5.1. Stability against seasonal demand fluctuations			
5.2. Ability of enterprise to provide for required level of service and after-sale service			
5.3. Ability of quick penetration of a given market			

We take into consideration a rank of the given factor  $+ 1 \times 2 = 2$ .

Similar procedure is used for all factors.

The availability of the project is defined by the total score according to the formula:

$$B = R_i \times m_i,$$

where  $B$  — sum of all expert estimates (scores);  $R_i$  — rank of given indicator;  $m_i$  — average expert estimate of a given indicator.

In our example the largest possible total estimate of  $B = (+ 3) \times 36 = + 108$ , the minimal one of  $B = (- 3) \times 36 = - 108$ . In this range the scale of development of projects is created. For example:

- project is unviable from  $(- 108)$  to  $(- 50)$ ;
- postpone the project to be reviewed in future from  $(- 35)$  to  $35$ ;
- approve the project with some adjustment from  $37$  to  $72$ ;
- project is viable from  $73$  and higher.

The importance of the given technique of choosing a new project for development consists in that despite presence of oppositely evaluated factors, the customer of the project is able to estimate the most important sides of the project and to concentrate on their achievement. The customer (manufacturer, seller) chooses the project of a new product which meets market requirements, as a rule at minimum expenses. Hence, the risk of introduction of production decreases, the enterprise consolidates positions; resources are rationally used.

### ***7.3. Intuitive solutions***

The intuitive method of solution development is one of the most difficult. From the point of view of psychology an instant illusion, a spontaneous train of thought, unconsciousness of process is typical of it. Intuition is related to both special features of thinking and general intellectual abilities and mechanisms, experience. The intuitive method of solution development is little-studied though it can be divided into two subkinds:

1) insight is look at an object from totally different standpoint. Such instinctive sensation happens extremely seldom.

2) pseudo-intuitive one — actually “matured” due to the previous experience. Let’s say, when the idea comes when sleeping, it indicates round-the-clock intense intellectual brainwork. The subconsciousness reorganizes experience and processes the information existing in memory.

The NLP model provides, that the information can get not to regular places in a program, and go another way, then creative idea is formed. Thus, an intuitive solution can be formed from long-term experience. It is necessary to note as well, that intuitive solutions are not always right, therefore it is erroneous to rely only on intuition, and it is better to deliberately develop creative style of thinking.

*Organizational factors of managerial decisions* at first sight do not come within the category of intuitive ones, however, owing to uncertainty and dynamism of environment where they are made; it makes sense to pay attention to the given issue.

Key parameters of internal and external organization environment are reflected by the concept of factors of managerial decisions. Set of these factors is remarkable for complexity and large variety what is caused by sociotechnical type of organizational systems and multiplicity of their interaction with external environment. In management theory conceptions about existence of *three integral parameters of environment* which affect performance of the given function most of all — uncertainty, complexity and dynamism of decision-making environment.

The main parameter — *uncertainty* — the insufficiency of relevant information in order to choose managerial alternatives — the information appropriate to the content of arising problems and necessary for reasonable solution development. There are many reasons of emergence of uncertainty, the main of them are considered to be: lack of information, its redundancy and its unreliability. *Complexity of decision-making environment* is caused by a large number of factors which need to be considered, their close interrelation, diversity and interdependence. The *dynamism of decision-making environment* means variability degree of intra- and extra-organizational factors, therefore any managerial decision should be diagnostic as well as prognostic.

These three integral parameters act synchronously, that impedes performance of the decision-making function. But at the same time these parameters, being expressed to a different degree in each specific situation, together give a complete picture of conditions of performance of this function.

Besides these general parameters there are also such important, specific social parameters — degree of organizational environment propensity towards conflict and personel readiness, involved in making and implementing the decision, to reach a consensus. Managerial decisions, considering these parameters, acquire a number of specific features, one of which — compromise nature. In general, while developing creative solution it is necessary to consider, that this process takes place not only under conditions of uncertainty, scarcity of resources, but also of conflicting criteria. For instance, the main objective of investment management is to provide for effective implementation of investments. Economic growth is ensured first of all by investing, that is it is necessary to spend in order to earn, and this is already a dilemma. There are more antipodal tasks of management such as:

- 1) ensuring profit maximization and financial stability;
- 2) ensuring minimization of risks, connected with unfavorable changes of investment market trends, and project implementation.

Therefore often management situations are complex and contradictory that makes them insoluble with the help of only rational, logical thinking. Solution developers should be capable to antinomous thinking, i.e. finding solution despite

antagonistic problem situations. Creative management of an enterprise, on the whole, also has other contradictory requirements and conditions:

- planned economic management and uncertainty of external conditions;
- stability and variability of processes and systems;
- preserving integrity of an organization and discretion of divisions (centralization and decentralization of management);
- can-do attitude and creative work in employees' activities;
- scientific approach and art of managerial decisions preparation.

Solution can be called successful when an accepted alternative is the best among all possible ones and ensures constructive overcoming of a problem situation when management activity efficiency can be maximized. When choosing from two or several acceptable alternatives sometimes it is difficult, sometimes impossible to define the best and the only one. Therefore a leader's personality factors can be involved in such cases. Other requirements include: validity, timeliness, realizability (feasibility), concreteness and regulatedness, rigidity and flexibility combination, observing the "limiting factor" principle in it.

So, when managing creative solutions development it is necessary to consider general requirements to statement; rules they are made and implemented, as well as personality factors of the head and staff.

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## 8. Bases of motivation towards creative work

8.1. *Head's creative approach to employees' motivation.*

8.2. *Motivation of creative problem solution, of generation and implementation of new ideas.*

8.3. *Creative work as powerful motivation mean.*

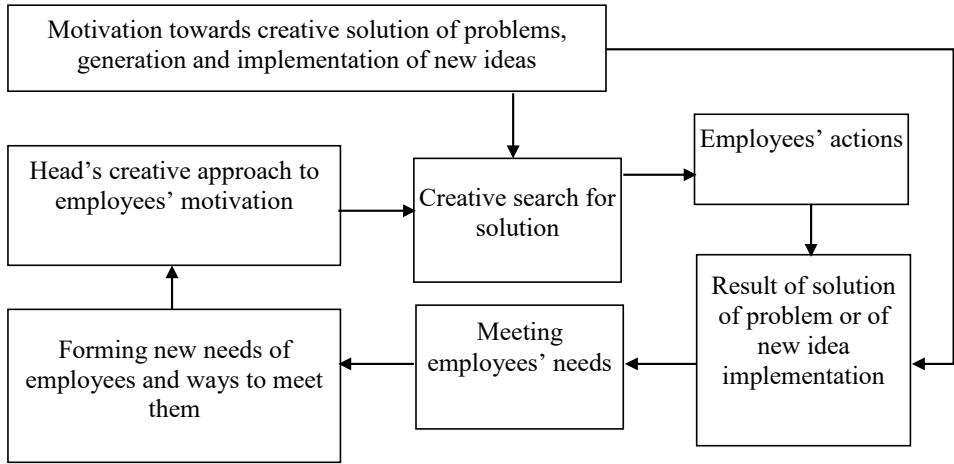
### 8.1. *Head's creative approach to employees' motivation*

One of the major functions of management is to motivate employees. Undoubtedly, the person's role as a subject in enterprise and business operation is huge. However, in the conditions of hierarchy of management, prompting to creative work is complicated by a number of factors: increase in time and "cost" of solution development, conservatism and lag, blocking of an individual contribution to managerial decision. Degree of staff's freedom is in inverse proportion to hierarchy and rigidity of a control system, and motivation to creativity is proportional to degree of freedom, trust and an actual range of employee's powers. To remove many interfering phenomena the head should direct mentation on solution which can be introduced promptly and effectively. Decisions are implemented by staffers, therefore they should carry "motivational charge" [9, p. 150], be clear, reasonable, correspond to the purposes of both staffers and leaders.

A. Schopenhauer (1788-1860), German philosopher, was the first who in his article "Four principles of the sufficient reason" used the term "motivation" following which the given term began to be used to explain the reasons of people's behavior. Motivation is a set of internal and external driving forces inducing to activity, setting limits and forms of activity and directing this activity to achievement of certain goals. In management this psychological phenomenon is used to reveal of leverages of employees' behavior, i.e. for the purpose of realization of their motivation. Motivation is the kind of management activity directed on prompting oneself and other organization employees to activity, ensuring achievement of certain goals.

**Arthur Schopenhauer** (1788–1860), German philosopher, one of the most known thinkers of irrationalism, misanthrope. Was attracted to German romanticism, keen on mysticism, highly praised Immanuel Kant's main works, calling them "the most important phenomenon, which philosophy ever knew for two millenia," appreciated philosophical ideas of Buddhism, of the Upanishads, as well as of Epictetus, Cicero and others. Criticised his contemporaries Hegel and Fichte. Called the existing world, contrary to sophistical, in his own expression, Leibniz's insinuation, — "worst of the possible worlds," for what got a nickname "philosopher of pessimism."

Problems of motivation and stimulation of effective activity of employees demand the head's creative approach which consists in a reasonable combination of material and moral stimuli (Fig. 8.1).



**Fig. 8.1.** Manifestations of creativity when performing “motivation” function of management

Difficulty consists in that that when choosing stimuli to consider individual qualities of people, their orientation, along with problems of corporate culture formation and strengthening of a moral climate of collective (sometimes employees get a deserved raise, but this fact is not perceived by their colleagues, as a result conflict situations arise in a collective).

To prompt employees a manager should do so that their needs for self-realization are met which will lead to synergetic creative effect which will “work” on an organization and its prestige.

The motivation of achievement of target goals and strategy largely depends on principles and control organization. Problems, demanding a creative approach, include completeness and periodicity of control and special features of organizing an effective control by management levels. The problem of how to make the control the tool for improvement, instead of a whip for punishment is equally important issue.

In the conditions of instability or uncertainty of conditions of environment it is necessary to switch over to adaptive structures which can organize themselves, get adjusted. They have already found an application in automation and robotic technology. There is certain adaptation in economic systems too when something is reconstructed when conditions are changed, but it should already be a question of adaptation process to become continuous. It becomes possible at automation and informatization of processes in productive and economic systems. The manager must consider staff’s potential, its professionalism, firmness and readiness for changes.

The considered contradiction is closely related to that between stability (steadiness) and variability (controllability). Stability tells about harmony of relations inside and outside of an enterprise; however it does not ensure success at dramatic change of operation conditions. The problem is that property of variability demands such mechanisms which are not appropriate to a stable structure. At the same time, without provision of some level of stability or steadiness, it is impossible to reach the necessary variability. It is known, that in technology contradictions between steadiness and variability are resolved by way of compromise or system reorganization (depending on conditions or priority requirements), at that the structure itself becomes dynamic in space and time coordinates (example of this principle is the variable wing configuration during takeoff, flight and landing). The problem of combining integrity of an organization and freedom of divisions becomes aggravated under conditions of instability and uncertainty, those of crisis. Giving to divisions only measured, certain economic freedom increases viability of an organization, preserving its integrity. The head's skill consists in defining degree of this freedom and keeping possibility of management.

It is possible to take into account special features of centralization and decentralization of management when motivating staff proceeding from the fact that a big company can pass to divisional type of relations, introduction of flat structures.

The problem of ensuring and supporting motivation faces a dilemma of a combination of diligence and creative work of staff. Endeavor and persistence of employees are necessary for strict fulfilment of accepted tasks (plans, strategies), and creative work — during search for effective ways of work. Performing and creative abilities seldom “go together” in one employee, and a manager's task is to find a reasonable parity between undisciplinable “free artists,” and “willing horses” who honestly pull a cart of routine work.

The manager's task consists as well in that that to treat ambitious creative personalities with understanding, to develop employees capable of creative work and to create for them conditions for creative activity realization. Experience shows that this problem is solvable, and the award for “patience” is innovations in sphere of management and business. Simultaneously the manager is obliged to take care of that staffers do not start suddenly to “create” there where it is necessary just to work and accurately to carry out instructions. The combination of a scientific approach and art in preparation of decisions are typical of business, and the problem consists in that each approach has found its place. Fulfilment of tasks is impossible disregarding the human factor, therefore one can not do without art, without working out and application of an arsenal of motivational means when organizing creative work and achieving a set goal.

N. Revskaya notes two approaches to motivation function performance: complex-methodical and adaptationally organizational [9, p. 67]. The former consists of four basic groups of methods directed on strengthening of motivational potential of work:

- 1) economic methods;
- 2) target method;
- 3) method of design and redesign of works (labor enrichment);
- 4) “participative method” (method of involvement of employees in management practice).

Economic methods are based on a system of basic principles of organization of material remuneration for the work:

- communications and consent between staffers and the management concerning common rules of stimulation system organization;
- justice of estimation of work results;
- creation of atmosphere of cooperation, instead of competition;
- work guarantee.

Besides, common rules of material motivation provide the size of bonus at least 30 percent of one’s salary, dramatic growth of efficiency of economic methods at their combination with socio-psychological measures (for example, bonus given publicly) and occurrence of errors of “distant material benefits” (so, the size of deduction for the pension fund does not affect current motivation).

The *target method* is based on two important psychological regularities:

- 1) giving to goals a precise form, clear verbal and/or graphic statement that leads to motivation increase;
- 2) complex goals have larger motivating force, than easily achievable since the complex goal increases the person’s self-appraisal of one’s capabilities and of significance. And the goals should be accurately measured, designate results, exact terms of work, that in creative work it is often difficult to do.

The head can apply *a method of design* and redesign of works (labor enrichment). Such a method positively changes the person’s attitude to his work, increases motivation and efficiency of labor. Improving contents and organization of work consists in using as large variety of motivational factors as possible and removal of hygienic (according to F. Herzberg). To define, that work really corresponds to the given criteria is possible, if it has:

- 1) responsibility for results;
- 2) confidence in that an employee does an important work;
- 3) control of resources;
- 4) feedback from a boss;
- 5) control of working conditions;
- 6) possibility of professional growth.



As a matter of fact, work of a highly-skilled expert is partly creative work. According to J. Hackman and G. Oldham [1], only the work which has the following special features can be considered as high-skill one: variety, completeness, significance, originality, psychological comfort, possibility of personal and professional growth, absence of antimotivators.

Participatism is a method of attraction of employees to process of labor organization and its management. A staffer turns from a passive object of administrative effects into an active participant — an agent of management. At that creative activity, initiative what is called in psychology as phenomenon of “defrosting of potential of the subject of work” is liberated. As the general ideology participatism is used in the Japanese model of management.

The main traits of participatism:

- 1) employee’s vote at solving problems;
- 2) search for consent;
- 3) use of individual and collective wisdom;
- 4) joint decision making;
- 5) delegation of rights;
- 6) revealing problems and defining actions;
- 7) creating conditions and directions;
- 8) cooperation improvement mechanism.

The adaptationally organizational approach to performance of motivation function consists in that the system of motivation support is spread depending on the basic phases of labor activity — from employment and novice’s professional adaptation to the end of his career.

## ***8.2. Motivation of creative problem solution, of generation and implementation of new ideas***

A specific complex system of motivation is inherent in creative activity of innovators, after all the given category of people requires self-realization with the help of highly intellectual activity accompanied mainly by positive emotions. To ensure proper motivation of employees towards creative work it is necessary, that activity of engineers and technicians, experts and highly skilled employees was integral, i.e. it had beginning, continuation and achievement of an expected result. It is important for a manager to regularly evaluate employee’s labor, to emphasize the importance of entrusted and done work. At that it is important for a manager (head) to be a creative person himself. Initiative is motivated by such a style of the head which ensures feedback from an employee; an open dialogue continues. Feedback importance is obvious — people should know how well they do their work. The

manager is an important source of a similar feedback, however it is better, when employees supervise the quality of own work (personal feedback).

For creative activity activation a variety of habits and skills matters a lot, and variety level is individual for each employee. If work is monotonous and routine, an employee suffers, feels nervous, or on the contrary — becomes withdrawn and sinks into depression. Unlike it when work demands diverse actions and provides for the use of various habits and talents, sensation of “fullness” of life emerges, as well as desire to improve and show creative abilities in labor activity. An employee will be proud, that has done the work so as nobody else. The work, not using employee’s valuable habits, does not cause necessity for the further training, perfection.

For the purpose of creative work encouragement at an enterprise it is possible to apply such methods, as development of democracy and expansion of authorities of skilled personnel in decision making, rationalization of labor organization and introduction of the flexible modes of operation, organization of competitions of rationalizers and innovators; creation of an interactive educational environment where employees can pass on knowledge, experience, as well as favorable general conditions for getting and mastering of new knowledge; keeping of a corresponding social-psychological climate in a collective.

If the level of management is high at an enterprise so-called “knowledge spiral” is formed — the concept of growth and expansion of knowledge which are applied in various scopes of activity. For this purpose innovation culture should be developed in a collective that is to promote efficiency work urgency, importance of such an attitude to work.

This problem is solved to a certain extent by a method presented in O. Figovskiy’s article [17], which allows increasing considerably efficiency of educational process in terms of expansion of an interdisciplinary outlook and of systems thinking development. The method is based on the principle of two-dimensional training. A vertical component of a curriculum is constructed on the basis of logical structurization of a teaching material within a studied subject area where previous themes are foundation for subsequent ones. An educational process goes sequentially vertically upwards, i.e. from easy things to difficult ones. Within the limits of a horizontal component for each of the themes its place is defined in existing interdisciplinary space (knowledge system) and examples of its engineering use at its own and other subject areas are given. Let’s give simple examples of the implementation of two-dimensional training model.

Example 1. Physics. Electrical engineering. Ohm’s law. Basic concepts formed in previous topics are: electromotive force, electrical resistance, electric current (electrical engineering), inverse proportional dependence (mathematics). A vertical component of training: explaining physical essence of the law and solving problems

dealing with finding of unknown value from a triad of parameters (voltage, resistance or current). A horizontal component of training includes:

a) a list and synopsis of practical problems based on the theory of linear electric circuits and demanding the use of Ohm's law for their solution (calculating cross-section of wires and magnet wires of electric machines, selecting electric fuses, calculating heating coils, calculating multipliers and shunt circuits for measuring chains and so forth);

b) formulating and explaining analog laws (isomorphisms) with mutual semantic and mathematical model

- Ohm's law for magnetic circuit;
- Ohm's law for pneumatic and hydraulic circuits;
- Ohm's law for chain and belt gears (drives);
- Ohm's law for railway vehicles and so forth.

c) presenting Ohm's law for an electric circuit as a particular case of realization of the general law of impact of driving force on physical entities;

d) formulating a conclusion of the general law of impact of driving force on physical entities (interdisciplinary definition of Ohm's law): "Result of impact of driving force on any physical entity (body or particle) is in direct proportion to magnitude of this force and is in inverse relation to resistance this object faces when moving";

e) defining driving forces: directed mechanical, torque moment; hydraulic, pneumatic (gas), osmotic and light pressures, electromotive force (emf), magnetomotive force (mmf) and others;

f) defining kinds of resistances: electrical, aero- and hydrodynamic, rolling and sliding friction, reluctance and so on;

g) defining opposite forces and their difference from resistances.

Example 2. algebra fundamentals. Problem 1. From town A to town B two automobiles left simultaneously towards each other. One of the automobiles can travel a distance between these towns for "a" hours, and the other — for "b" hours. How long will it take until they meet? Basic concepts: measures of length and distance, time, speed. Solution:  $t = a \times b / (a + b)$ .

Problem 2. Two house painters, having started to work simultaneously, must paint premises. One of them can do the whole work for "a" hours, and the other — for "b" hours. How long will it take for them to complete their work? Basic concepts: measures of area, time, labor productivity.

Solution:  $t = a \times b / (a + b)$ .

Problem 3. Two electrical resistances (resistors) are connected in parallel. One of them has resistance of "a" ohms, and the other — "b" ohms. What is their total resistance? Basic concepts: resistance, conductivity. Solution:  $r = a \times b / (a + b)$ .

First of all, schoolchildren or students have to solve these problems independently. Then they must explain why the problems dealing with mechanics, economics and electrical engineering, have the same solution (single mathematical model). Further it is possible to summarize, with an active participation of trainees, that similar problems with the same mathematical model can be formulated for many other subject areas, and all of them can be united by single definition: “If two (or more) productive factors, having joined in a process simultaneously, work to achieve a joint end result, time of achievement of this result is equal to reciprocal of sum of their productivities”.

The important thing in realization of didactic potential of the given problems is explanation of two opposite concepts: productivity and resistance. Productivity of a car is its speed that is a traveled mileage for time unit. Labor productivity is a volume of the work done for time unit. Resistor productivity is its conductivity (value, reciprocal to resistance), as the parameter, determining amount of current passing through it. Further it is necessary to list and explain the essence of semantically related, when mathematical models are realized, parameters: labor productivity, manufacturing equipment productivity, that of electric current, of magnetic flux, of heat flux, of air flow, of hydraulic flow, of traffic, of data flow and others. Road resistance is a set of factors (friction, aerodynamic resistance) which must be overcome and which prevent an automobile to move at a velocity of light. By conditions of Problem 1 “a” and “b” values — road resistances for if they were equal to zero then cars would cover the distance between towns instantly. Resistance (obstructive factors) to production process (Problem 2, “a” and “b” values) is its limited technological possibilities, lack of organization of production and doers, adverse working conditions, tiredness, disgust at the work and others. If there are no factors of resistance to production process the end result is obtained immediately. Resistor resistance (Problem 3, “a” and “b” values) is a property of a material of which it is made to block the passage of electrons. If there is no electrical resistance in the electric circuit, containing a source of electromotive force, the current is equal to infinity. Thus, if they say about achievement of some result for a certain time then it is a question of value, having resistance dimension. At that it is necessary to tell, that electrical resistance magnitude, in turn, is connected with time factor. It is numerically equal to a time period during which an electric charge of 1 coulomb will pass through the resistor with certain resistance at applied constant electromotive force of 1 Volt.

The two-dimensional didactics, as well as the given examples of its implementation, activates thinking, brings a trainee beyond frameworks of a studied subject and allows making associative relation to existing system of knowledge in its various variations and angles. The suggestion to infer the general case of Ohm's law

for a bicycle chain or to formulate Newton's first law in psychology interpretation will stir up interest of the student with developed thinking, accustomed to interdisciplinary perception of subjects being studied, instead of negative emotions. It is such “uninhibited” students who become innovation engineers needed everywhere where it is necessary to solve “unsolvable” problems. One of such organizations is DARPA — Defense Advanced Research Projects Agency (USA). This structure needs staffers with developed creative imagination and unconventional style of engineering thinking in order to:

- create a suit providing protection against enemy fire and bad weather, promoting healing of wounds and many times increasing human capabilities;
- make a soldier and technology invisible to the enemy in all bands of electromagnetic spectrum and at the same time to see the enemy in all bands at once;
- look beyond the horizon, as well as through water, ground and wall;
- create a flying car and a flying submarine, as well as a drone flying for months or years etc.

Creative abilities which modern system of engineering education should develop and teach are necessary to solve similar problems. Essential changes in its methodological basis are required for this purpose.

The idea of multidimensionality in training is not something new. Already René Descartes, known French mathematician, philosopher, physicist and physiologist, in his aphorisms noted: “All sciences are so connected between themselves, that it is easier to study all of them at once, rather than any one of them separately from all other.” And one more: “Statements of wise men can be reduced to very small number of the general rules.” It means, that there is some, rather small, quantity of elements of system of knowledge which in various combinations and interrelations can form considerably larger quantity of subsystems (subject areas). Elements of system of knowledge include laws, theorems, axioms, rules, principles, and effects, mathematical and semantic models. Separate disciplines consist of them as from bricks. The same elements of system of knowledge as unaltered or modified can enter into different subsystems — subject areas. This is also confirmed by the isomorphism principle, based on that numerous groups of phenomena and processes, various by nature and identical by properties and character, have identical formally mathematical descriptions. The method of the two-dimensional training is based on this system property, which major principle is the associative binding of a studied material and performed tasks to other subject areas and to solution of practical problems within the limits of studied discipline.

The method of two-dimensional didactics essentially expands a professional outlook of schoolchildren and students and to considerable extent defines their professional mobility in future activity. Professional mobility is an expert’s

ability and readiness to rather quickly and successfully adapt to new technological conditions by mastering new technics and technologies, acquiring lacking knowledge and skills, as well as ability to switch over to another kind of activity. Professional mobility assumes high level of generalized professional knowledge based on interdisciplinary ideas and practical applicability of mathematical models, physical, chemical, biological and informational laws, rules, principles and effects. In the conditions of rapid change of technics and technologies professional mobility is an important component of engineer's qualifying structure (model).

High educational level, as well as formed power of apprehension allow solving eventually one or another problem, but by no means guarantee the absence of system errors in its solution which later should be corrected. If a developer or a group of developers are guided only by an individual or group experience of system engineering then errors, which can affect viability of a developed project, are inevitable. Individual experience far from always considers all possible influencing factors in various conditions of their manifestations which should be taken into consideration when designing. It is important because a set of considered factors defines not only qualitative criteria of a designed system, but also consequences of its subsequent introduction. Positive and negative experience of engineering design development and their implementation has allowed creating unified approaches for support of life cycle of designed systems from its concept and development to manufacture, operation and disposal. These approaches named system engineering, allow developing complex science intensive systems in the presence of many restraints: constructional, technological, economic, and ergonomic, of safety, of reliability, of electromagnetic compatibility, climatic, environmental and so forth. System engineering is a holistic approach, focused on a designed product, which is responsible for creation and implementation of processes which cover various engineering disciplines and ensure satisfaction of needs of customers and direct users of a product. Such an approach is made owing to the use of methods of achievement of high quality and reliability, cost efficiency and conformity to a schedule of a project or a program throughout all system life cycle.

A degree of influence of the work on hand on the enterprise status, clients' satisfaction, public opinion — all that the management should acknowledge and stimulate with material and/or moral means individually (considering motivational structure of each employee).

The idea of importance is closely connected with doer's system of values. A work can be interesting and fascinating, but people will remain unsatisfied until they will feel, that their work is important and it need to be done.

For creative personalities the work content should have traits of autonomy or group autonomy when a group of 5–7 people works on a problem. Autonomy characterizes, how much work provides for freedom and independence of an employee. Therefore the authoritative management style in creative collective is almost unacceptable. If there is a total control, very accurate and unequivocal performance of instructions is required, decisions are taken by other people then an expert will hardly give a qualitative result. An idea generator is mainly an individualist, thus for him it is important to create an atmosphere where he will feel that it is he who makes decisions, and quality of performance of work depends on correctness of these decisions. It is necessary to emphasize, that autonomy, as well as variety level — an individual thing, for any employee there is an optimum level of autonomy which gives him real sense of personal responsibility and does not lead to stresses.

It is necessary to try to complicate assignments from time to time. The sensation of novelty “turns on” an employee, therefore as a psychological leverage acts the method which is called “challenge.” The work adjusted according to these regularities ensures inner satisfaction. This is a very powerful motivational factor which stimulates qualitative performance of work, and under the law of rise of requirements, stimulates to do more difficult work.

Complexity, value, independence and necessity — here are the important factors of creative work motivation. Work, which meets them, provides for high quality of performance of a task and adds feeling of satisfaction. It creates sensation of a personal contribution to enterprise activity, gives to employees feeling of participation. Only such work enables the person to satisfy social needs and that for self-expression.

### ***8.3. Creative work as powerful motivation mean***

Motivation to creative work means, that the person is ready to spend time to search for the best way of action, investigates other possibilities, aspires to explain unclear things, tries to find new ideas, — and all that not for remuneration, and as satisfaction of requirement for search activity.

Concentration on a problem acts as an important source of creative work. Creative work is big motivator as stirs up employees’ interest in what they do [3], gives hope of valuable idea birth, accomplishes, and makes life more joyful and more interesting. Creative work serves as a frame at a team work. All these aspects of creative work are often not connected with actual result of creative effort, however creative effort is important per se and it should be encouraged. If to remunerate the person only for an actual result, he will be less interested in a creative attitude to a

problem. On the other hand, sufficient efforts will produce a result sooner or later. By and large, when there is a necessity to think, always necessity for creative thinking arises, however usually it is not typical of the person to search for new possibilities without emergency.

There is an opinion, that the person is mainly inert until someone “will catch up or overtake,” that is it is useful for the head to organize the work of a collective with competition elements. A stimulating effect to creative work of employees can be achieved by specially created conflict (of ideas, of approaches, of directions), however it is a dangerous step as there is always a risk for a creative conflict to turn into a destructive one, therefore the head must be aware of the level of own possibilities and authority to manage such a delicate matter. However internally a creative person “turns on” himself if necessary conditions are created for him and there are no obstacles.

The culture of transaction of business and management are now being transformed from a principle “it is ok, that now everything is quiet” (reactive thinking) to heuristic thinking when creative work becomes an absolute must. It is expedient to create opportunities for a creative attitude to problems irrespective of, how much at a given stage employee’s capability to creative thinking manifested itself. One of the main rules of motivation should be replacement of set of failure by that of success. Actual conditions of daily work: overloads, increase in responsibilities negatively affect creative activity. Therefore a manager should give a moral support to creative employees.

The concept of “creative” thinking is almost identical to “heuristic,” “variable,” “divergent” thinking. These are various aspects of the same process, these are components of creative thinking which overlap, but each component has its certain specificity. Division lines are indistinct as it is typical of mental processes (it is impossible to single out precisely, where exactly memory operates and where mentation occurs). Creativity is more connected with imagination, fantasy, but divergence — with logic, as well as with width of sphere which can be embraced in the course of creative work. Differences can be demonstrated by comparison of human brain activity with machine intelligence. PC is capable to perform a lot of complex functions and assists during the solution development process; however it is not able to perform functions of creative work and selective perception.

Creativity can be understood as an ability to use differently the information at fast pace, ability which reflects an individual’s property to create new concepts and to form new habits [6]. Besides, creativity assumes independent search for solution of a problem, and not only use of those, given “from outside.” It can be shown during delegation of authorities from the highest level of management to the lowest one.



Table 8.1 presents ways of thinking and personality's qualities which a creative manager should support and develop in his employees.

The head needs to be aware of that creative thinking manifestations are possible then when bold statements are not forbidden. Quite often an author himself rejects interesting ideas because of fears to be not perceived, not understood, and because of pressure of authorities, of authoritative opinions (of the head, of general scientific thought opponents). Original novations motivator is also heuristicity of thinking, i.e. openness, disposition to generalizations, constructiveness, quick advancement of ideas, and generation of a plan.

*Table 8.1*

**Creative personality components**

WAY OF THINKING	FACTORS	DESCRIPTION
1	2	3
Creativity	promptness	<ul style="list-style-type: none"> <li>- variety of emergence of ideas, associations, connections;</li> <li>- ability to quickly orient oneself in changing and new conditions, using knowledge which lead to rational and productive work, applying and adjusting them to existing conditions[14]</li> </ul>
	flexibility	<ul style="list-style-type: none"> <li>- quick passing from one concept (way of thinking) to another;</li> <li>- ability to give up inefficient obsolete ways of solution;</li> <li>- quick attention switch</li> </ul>
	originality	<ul style="list-style-type: none"> <li>- originality of approaches to solution of problems;</li> <li>- unconventional nature of thinking, deviations from adopted standards, skill to get rid of stereotypes</li> </ul>
	integrative nature	<ul style="list-style-type: none"> <li>- combination of various associative relations;</li> <li>- ability to connect a concept from different (sometimes rather distant) areas and promptly use them</li> </ul>
	imagination, fantasy	<ul style="list-style-type: none"> <li>- ability to create in one's imagination constructions from known objects, modified or new objects</li> </ul>
Divergence	breadth	<ul style="list-style-type: none"> <li>- spreading intellectual faculties for specific topic to another area;</li> <li>- readiness to perceive ideas of others, even if they mismatch ones' own view</li> </ul>
	productivity	<ul style="list-style-type: none"> <li>- generation of various ideas in one direction</li> </ul>
	generality	<ul style="list-style-type: none"> <li>- ability to pass independently from private cases to general pattern and/or conclusions</li> </ul>
	variability	<ul style="list-style-type: none"> <li>- skill to work at new and changing conditions, ability to consider an object in various ways, by varying its qualitative and quantitative characteristics</li> </ul>

Table 8.1

1	2	3
Heuristicity	intuitiveness	<ul style="list-style-type: none"> <li>- ability to rely on guess when solving;</li> <li>- ability to comprehend the truth without proofs, by way of former insufficiently conscious experience;</li> <li>- ability to “see” a solution, even if its theory is absent yet</li> </ul>
	individuality	<ul style="list-style-type: none"> <li>- personality style of thinking and activity in sequence of solution stages;</li> <li>- independence in choice of methods, tactics, strategy</li> </ul>
	structuredness	- solving by means of separation of main stages and key moments with necessary substantiation and explanation
	predictability	- ability to predict possible results of activity in its beginning and before beginning
Efficiency	speed	- prompt solution of problem without quality loss
	convergency	<ul style="list-style-type: none"> <li>- finding the only correct composition of semiotic area elements, pertaining to a given problem [8];</li> <li>- synthesis with critical thinking elements (as for selection of the most effective combinations) without creative thinking inhibition when defining tactics of solving creative problems</li> </ul>
	attentiveness	- finding “by-products” of solution process, which can turn out not less important than main product
	self-development	<ul style="list-style-type: none"> <li>- ability to intellectual self-enrichment;</li> <li>- ability to accumulate, to be used subsequently, ways, methods which have been worked out when solving a certain problem</li> </ul>
Creative activity	initiative	<ul style="list-style-type: none"> <li>- interest, desire to work, to comprehend, to create new;</li> <li>- ability to pass on own inspiration to others</li> </ul>
	self-organization	<ul style="list-style-type: none"> <li>- high level of reflection development;</li> <li>- developed habits of self-planning, self-control, self-regulation (self-management)</li> </ul>
	self-motivation	<ul style="list-style-type: none"> <li>- ability to carry out creative activity;</li> <li>- independent opposition to complications</li> </ul>
	mobilization of own creative abilities	<ul style="list-style-type: none"> <li>- ability to stable preservation of optimal working parameters;</li> <li>- ability to bring own creative abilities to active state;</li> <li>- using existing experience of work on creative problems</li> </ul>

The breadth of thinking is vividly manifested when an employee is capable to not just answer “correctly,” but to look into another employee’s suggestion, which can be an interesting variant of correct answer or view a certain aspect of a problem from that angle, from which the given employee has not considered it yet [15]. Exaggeration (hyperaxiomatization) of own creative ways and results

can lead to anaxiomatization (disregard, depreciation) of ways and achievements of others [10]. Such an employee will believe, that only his hypotheses, ideas are correct, and those being at variance with them are wrong. Heuristicity of thinking differs by development of new strategy, and its components are intuition and algorithmization.

Creative activity is ability to independently work, using own potential for creative work, creative inspiration, based on high level of interest. The creative personality is characterized by that his cognitive need is impossible to satisfy [7]. Cognitive need is based on activity, requirement for process of mental activity per se, on pleasure from brain work.

Creative thinking manifestations differ by activity (active — passive), systematic character of revealing of activity (regularly — occasionally), emotional overtone (vividly positive, positive, indifferent, negative). Creative thinking is based on rather high level of development of creative and mental abilities.

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## **Be grown enough to behave childishly** (instead of conclusion)\*

There are children playing in the streets  
who could solve some of my top problems in physics,  
because they have modes of sensory perception  
that I lost long ago.

*Robert Oppenheimer*

Steve Jobs was deeply amazed. Being the General director of Apple he has given a serious task to a young fledgling design team Hovey-Kelley enabling to create a weighty reputation. Apple itself was known for an elegant design, however young designers have brought something to Jobs to be approved that reminded of a creation of five-year-old kids. The design consisted of various junk: ball from a deodorant, a part from a refrigerator, a shift lever and a plastic plate from a mall — fastened with a sticky tape and rubber bands.

David Kelley and his colleagues were grown-ups, running business; however they played for days on end like kids. They held different objects and craftwork materials in their hands all the time and enjoyed it tremendously. And still they had to present the upshot of the work to Jobs with his incredibly high standards.

In the early 80s the design of goods was formal — structures were depicted as detailed drawings being the bases for a subsequent production. It was a long-term and complex process, very adult and very serious. Kelley did not want to work like this. He believed such a process to be too slow and restraining. He wanted to toy with any materials, being at hand, quickly creating prototypes. As a result he got rather rough structures yet able to visualize his ideas.

S. Jobs has immediately realized what this mixture of bits was. It was a new revolutionary computer mouse, one of the most complex and, at that, feasible technical devices ever made. Previous version mice were able to move only up-down and from side to side; had a great deal of small details and were expensive to manufacture. The key principle of Kelley's model — combination of freely moving ball (of a deodorant in his case) with an optical and electronic system — began to be used in many subsequent generations of mice. Soon millions of these devices have been produced. Because of this success Hovey-Kelley

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\* According to R. Jadrinsk. <https://ogrik.ru/b/rod-dzhadkins/iskusstvo-kreativnogo-myshleniya/18671/budte-dostatochno-zrelymi-chtoby-postupat-po-detski/29>.

flourished little by little and turned into IDEO, well-known international company dealing with design consulting.

How to induce grown-ups to treat the game seriously? When delivering lectures Rod Judkins frequently repeats an experiment invented by a famous researcher of creative work issues Bob McKim, who was active in the 1970s (and exerted great influence on IDEO). He gives to every participant a pen and a sheet of paper and asks to draw a next sitting person and then to exchange drawings. This exercise always causes an awkward laughter and repeated excuses. The experiment visually proves that people are much afraid to be blamed. We are ashamed to show our ideas to others and apprehension deprives us of reasonable adventurousness. Let's compare this with kids' reaction being involved in the same activity. They show total lack of embarrassment and show their work to anybody without any problem. When kids are in a safe environment they play much more comfortably. The same is true for adults as well.

R. Judkins believes that his key role as a university instructor and a creative consultant is to create a situation when people feel rather confident in order to begin to play. It is playing principle that let people develop. If at the organization there are complaints that enough ideas cannot be generated and it lags behind competitors, this occurs because employees are afraid. They care what their boss or colleague will think about it; they are afraid to do something «wrong».

In the 1940s artists spiritually close to Jean Dubuffet, established a movement for getting back to play values. J. Dubuffet was fascinated by the sense of freedom in children's creative work apparently worthless and primitive. J. Dubuffet, however, saw freshness and easiness in it. He copied not only the style of children's art but also natural naïve approach inherent in kids. The painter realized: despite of all advantages of maturity it is inclined to forget about the one of the most important creativity components — game. J. Dubuffet has decided in his work to get back to the way of children's thinking unrestricted by anything. His paintings were filled with life, wild energy and ingenuity of the child. He worked with an impartial joy attempting to try everything and being fascinated by all around him. Despite of critics' reproaches that «any five-year-old kid can draw it» with time J. Dubuffet acquired an international reputation and his place in the history of art. Children's way of thinking helped him to remain young both emotionally and mentally even in the middle age.

A company faced the problem of «burnout» of heads asked R. Judkins to help and to save the best managers from mental distress. Stress made the company

to lose a lot of millions because of lost productivity. Busy schedules, strict deadlines and responsibility have caused that that work ceased to bring pleasure to people. The scholar asked to list kinds of activity that brought pleasure to them and then to tell how much time they take. Heads have found out that the majority of pleasant activities takes the whole day or even more. In other words they did not occupy themselves with pleasant matters since they could not find time for it. When these kinds of activity were broken down so that they fit into short mini-breaks of less than 30 minutes, employees got an opportunity to relax during the day. Stress level has dramatically decreased, productivity has grown, and, what is more important, they have started to feel that they live a full life both at work and at home.

It is possible to blame a society, culture, schools, parents or someone else, however on the whole this statement is fair: our freedom to behave childishly is buried somewhere deep and despondency substitutes it. We are afraid to make a mistake, to be ridiculed or blamed. Fear makes us to step back and gives no chance to new ways to derive pleasure.

Future belongs to those who are able to play. Creativity inside a person originates from a child instead of an adult. A kid is free and does not know what he cannot or must not do. He has not understood yet what it is that works and what does not, and adults repeat that that has worked last time. Whatever you do, do it as if for the first time. Kids do not know such a notion as «last time». Every time is the first one for them. They explore the world without rules and biases. This ability is lost somewhere on the way to maturity. Schools teach us something and then examine. In life people at first are subjected to examinations and learn something as a result of them. And this is the most effective way of learning. Not least creativity.

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# **CREATIVE MANAGEMENT:**

## **THEORETICAL FOUNDATIONS**

*Monograph*

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