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CREATIVE ELEMENT OF THE SYSTEM CIVILIZATION DEVELOPMENT STRUCTURE®

Pierwiastek twórczy w systemowej strukturze rozwoju cywilizacyjnego®

The article presents the concept of „creative element" in the process of civilization development, showing the relationships between development and system elements of the inventive triad. The author's attempt to interpret its essence in the process of solving inventive problems is illustrated on the example of an innovative solution in the field of fish processing machinery.

Key words: creative, system approach, innovation, development.

W artykule przedstawiono pojęcie „pierwiastek twórczy" w procesie rozwoju cywilizacyjnego, ukazując związki między rozwojem i elementami systemowymi triady wynalazczej. Autorską próbę interpretacji jego istoty, w procesie rozwiązywania problemów wynalazczych zobrazowano na przykładzie innowacyjnego rozwiązania w zakresie maszyn przetwórstwa rybnego.

Słowa kluczowe: pierwiastek twórczy, ujęcie systemowe, innowacje, rozwój.

INTRODUCTION

Civilizations arise and develop thanks to many people who have a stronger creative element. This applies in particular to two groups of people: social activists who create new ideas and engineers who create the material basis of every civilization with a long and arduous harnessing of natural forces to work for man. As L. Sprague de Camp writes in his beautiful book "Great and Small Artists of Civilization": sometimes they were inventors, and sometimes entrepreneurs, but the fact that they were able to create new concepts and put them into practice is important. They also had enough courage, stubbornness and energy to improve their inventions, bringing them to practical form and propagate them until they convince others of their usefulness [10]. These processes have been the basic imperative of human activity and work encoded in the human brain since the beginning, the goal of which was not always the conscious realization of everything.

The general truth is also the fact that the world is constantly evolving, that the place of simple activities is increasingly taken by complex, automated activities that require professional preparation. There are more and more predictions that the world will have knowledge, innovation and creativity at its core. Hence, we are observing a steady increase in demand for creative units. Around 1900, this demand was 1% of the population, in 2000 – 7.5%, and now – 10% of the population [7].

We shape our innovativeness within a specific situation and our level of agency in this area is largely determined by this situation. The relationship of the thinking process as a causative element in human activity is reflected in the oldest record and the word has become a body, which we also find in the Bible, similarly to other books of wisdom. The "word" is a product of thought, or an idea (from Greek) that inspires and shapes the emergence of abstract and consequently material beings. In solving inventive and broadly innovative problems, this creative thinking formulates the needs (goals) as well as the ways of achieving them (abstract beings), as well as the material structures of their implementation in the form of machines and devices. The purpose of the article, expressed in the title, falls under the above-mentioned problems, in which the most important role in solving the problems of civilization development of the world is assigned to the creative element. An important feature of the conducted considerations is the systemic approach to the conducted analyzes.

The contribution of the presented considerations consists primarily in the location of the creative element in an innovative system with the development of civilization and an indication that it gives direction to changes considered as progress. The conducted considerations were illustrated on the example of the author's solving of an innovative problem in the field of food processing equipment. The information provided can be used in knowledge management.

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SYSTEM INTERPRETATION OF THE CREATIVE ELEMENT

The term "creative element" (in the sense of the concept taken very broadly) was introduced into the circulation of the Austrian economist J. A. Schumpeter in 1912. Like the concept of innovation and destruction, he was associated with the concepts of the processes of formation of scientific discoveries, innovations and more broadly development, in the connotations of the element of novelty [9]. This concept is still a central problem in the area of knowledge called heuristics [2]. The roots of knowledge about inventiveness go back to the complex problems of analyzing the interrelationship of matter, energy and information. They are stuck in the attempts to identify the ways in which inventions arise in the processes of their creation, because they cannot arise in a different way when a system is created to look for the answer to the question how?

From antiquity to our time, the "creative element" is identified with the basic determinant of creativity, and its pedigree, essence and causative role (according to J. A. Schumpeter) lies in the unity of opposites [9]. The creative element enters all fields and is increasingly connecting with enterprises and business [2]. A creative act is a new activity, more efficient than the ones that perform the same or similar purpose. An intentional creative act is an intentional mental action towards increasing the understanding of the essence of things, increasing the chance of finding another creative problem. Innovation is a job that requires knowledge, often great ingenuity, appropriate predispositions, but above all it means hard purposeful work [3].

Nowadays, creativity has ceased to be reserved only for artistically talented people. Creativity does not mean that man must create painting, literary or musical works, although he can devote himself to these classes. Creativity can concern every area of human life. Currently, creativity appears as a need to change the world, hence the creative element is treated as a kind of inspiration that affects our mood, fulfillment and everyday life. This inspiration stimulates us to exceptional behavior in all areas of our lives [6].

Creativity is an element that underlies all innovative activities and we owe it to civilization and technical condemnation [1]. The main factor in this activity is that everything that exists−ages. In innovations, there is no direct relationship between cause and effect, there are many causes and many effects that are difficult to separate, and therefore requires a systemic approach. The borderline beyond which the systemic approach becomes closer to us than the domain-specific approach is the moment when we realize that instead of perceiving only the cause-and-effect relationship between the state of affairs and its consequences (or cause), we create such a relationship as a mental being and it's a "creative element".

In the system of innovative activities, the concept of "creative element" can and should be located as a bond connecting the three basic elements (scientific discoveries, inventions, innovations) that make up the inventive triad. It should be recalled here that in general the system (Greek systema) means a static, organized structure (minimum three elements) or a structured set of ideas, assumptions (goals) of concepts, methods and principles of generalization, classification, activities between which there are various types of mutual relations dependencies and relationships. Each of these elements of the system created here responds to specific needs −Fig. 1.

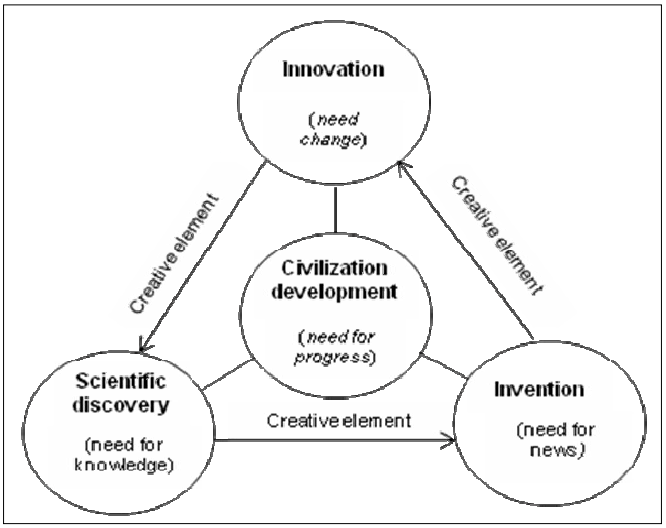

Fig. 1. The creative element as a bond forming the innovative system.

Rys. 1. Pierwiastek twórczy jako więź tworząca system innowacyjny.

Source: Own study

Źródło: Opracowanie własne

Scientific discoveries, innovations and development are treated here as collective names of „basic processes", dividing into three groups of the set of all unit processes that form them as a result of a kind of task integration. Scientific discoveries are the objective results of cognitive scientific cognition. Their use is the basis for creating inventions and innovations. Inventions and nowadays also innovations treated as synonyms are only a derivative of the occurrence of: a need, a mistake, or an accident (the phenomenon of an unexpected serendipity event) and their source is human thinking. The conceptual scope of inventions and innovations is different. Together, they fall into a group of 176 synonyms, referred to as „innovation," which means introducing something new. The transition from one element to another in each case requires mental activities of a creative nature, described in the above model with the term „creative element". There is a statement according to which the mere perception of the need and treating it as an inventive problem often carries the element of creativity, as well as its very solution, which is considered to create an unknown way of realizing the need (goal) that creates the process (abstract being) and consequently some material existence.

In the innovative context, the concept of „creative element" defined by J.A. Schumpeter as „the result of the struggle of opposites" („creativity and destruction are two faces of the same coin" [9]. In his arguments he was based on the basic laws of dialectics (And the law of dialectics according to Hegel). This is a principle for the very existence of any phenomenon. Dialectic in the earliest period of its development (from Heraclitus recognized as its precursor) is associated with the concept of contradiction. The dividing of what is one and learning about its contradictory parts is

included in the basics of dialectics, which does not seem to be easy to understand. Without the clarity of the goal (development), doing something just because it is good (e.g. invention) is not enough to achieve a high level of usability of the entire system. but they are so general that they are almost completely ignored. Clear sfo formulating intentions (what?) to be done allows to significantly improve actions on how to proceed (how?). The intention expressed with the question what? Does not have to be formulated in an elegant language and too detailed. In this way, you can get stuck in a maze of words and lose the context of the goal.

Two basic (observable in history) concepts of development (evolution of the world) are [8]:

a) development – as decreasing and increasing as repetition,
b) development – as a unity of opposites (a split) of what is one, on mutually exclusive opposites and mutual relations between them.

The authors in this article are in favor of this first concept of development.

In general (according to the dictionary definition) the term „development" means any long-term process of directional changes in which one can correctly distinguish the following stages of transformation (development phases) of a given object (system), showing a definite differentiation of that object in a given respect. The process of positive changes (progress) can be accepted as civilization development. An innovative system, the source of which is development, cannot be described by a static structure (triad or even cycle), because changes occur not only repetitive but also progressive. The correct model of such a (action) system is a spiral spinning upwards as a picture of the intensification of progress. This spiral is a picture of directional changes that are a derivative of the creative element's involvement in activities related to the improvement of our material reality.

In the most general terms, all human activities of a creative nature, leading to the replacement of the old with new, is nothing but the implementation of processes occurring in social life and production. All phenomena in nature are also processes. Everything that exists now and arising in the future has a procedural nature, because it could not arise otherwise than as a result of the implementation of processes. The basic definition of the process defines it as the ordered operation of interrelated activities that achieve the intended goals. The process can also be defined as work done as a result of the flow of matter, energy and information.

The process of creating development, which was visualized in the form of an action system in Fig. 2, determines its duration and the gradual expansion of progressive changes. It defines the concept of the act of inventing how mass, energy or information flows to achieve a specific purpose. To this was added the nature of the growth spiral, emphasizing that it is developmental (progressive). It reveals the purpose, directions of impacts and sequences of its factors, science and innovation in its widest range. Development is always the sum of the results of partial processes.

Development and its factors are continuous, just like the existence of a human being but the speed of this process is variable. The first and most basic feature of the applicability of the presented analysis is understanding the concept of development as an action system, i.e. a dynamic process consisting of three total elements: scientific discoveries, inventions and their implementations in the form of innovation.

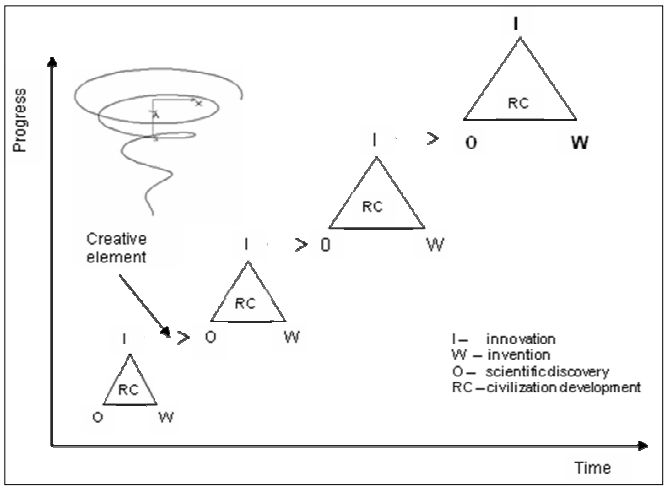

Fig. 2. Innovative system in terms of process.
Rys. 2. System innowacyjny w ujęciu procesowym.
Source: Own study
Źródło: Opracowanie własne

Relations between increasingly developed systems, depicted by arrows, express the existence of so-called the element of creativity, without which no flow of matter, energy and information can arise. The consequence is the existence of a dynamic state of innovation system. The same must occur in lower-level innovation processes that create the summary concept of innovation. Innovation and inventiveness are derived from three types of successes: scientific, intellectual and market and they can reflect positive changes referred to as development. Its lack is defined by the concept of regression, which in earlier definitions was the concept of regressive development, marked with a minus sign. A scientific discovery, a beginner's triad of development, is usually a kind of achievement in achieving a cognitive goal, less often an application one. Its use in order to use the progressive idea: to live better, to create an invention / innovation, requires another two successes: intellectual, consisting in inventing something new – invention (derivative of developmental research) and further market, consisting in spreading this novelty in broad social practice, including development in food processing.

System thinking goes beyond individual events, it brings together events that appear to be distant and independent of each other. Systemicity is a method of both ordering and solving a problem, or designating procedures in which things and phenomena are treated comprehensively in their cause-and-effect relationships. In the system approach, new knowledge is the result of processing existing knowledge as an expression of a rational view of the situation. An important element of the system approach is the ability to present thoughts and relationships using diagrams and graphic models. Psychology of knowing this kind of information message considers the most effective way to understand phenomena and to find links between them as a way to create an invention. The following example contains elements that demonstrate the use of systematic skills to master the basics of the ability to apply the thinking of the inventor in practice (here in relation to food processing).

EXAMPLE OF USING A CREATIVE ELEMENT IN A SYSTEMIC APPROACH TO SOLVING AN INNOVATIVE PROBLEM

In the field literature in the field of food production engineering, there are few systemic approaches in presenting knowledge about methods to support inventiveness, especially based on real examples of its application. This is due to the fact that this approach, already widely used in practice, in science, the economy and social life, has a general, universal character, which allows the use of human action in every field, which requires adequate knowledge and considerable effort. Over the past few years, most articles on this issue have been found in this journal. In these textbooks and publications, the knowledge about the adaptation of systems theory to knowledge about inventiveness is not properly reflected. For many reasons, the development of the skills of their practical application, or the applicability of this knowledge, is definitely lagging behind the great advances in the theory of inventiveness (in its cognitive sense) [4]. As a result, in social consciousness, in which there is already an understanding of the value of skills and competences, we encounter the opposition of theory of practice. To the question of what separates already existing theories from their application in practice, there is an answer – an unusual difficulty in acquiring the skills to use them, which is due to the complexity and insufficient knowledge of the act itself of the creative process as a process of creating something new in the field of science and technology.

Therefore, this method can be used to shape and consolidate the ability to identify stages, select system elements of structures and the cause-effect relationships that connect them, but it does not always lead to the final goal – which is the invention. This is because newness cannot be determined before it is created, and the very process of its creation can be both spontaneous (the "Eureka" effect) and determined by the systematic approach. An example of such a system approach is the diagram shown in Fig. 3, specifying the procedural triad of innovative activities.

The procedural triad presented here is a general scheme that organizes inventive and innovative thinking, which leads to the answer to problem questions:

1. What?, Or for what? – resulting from the function definition.
2. How? – resulting from the adoption of a process or unit operation,
3. What? – the resulting determination of the material structure of the working body or a reaction chamber, carrying out a process or unit operation.

To achieve the goal of the existence of a technological device that performs a given function, solutions in these three subsystems should be found, and this requires the development of a total of 9 system components, located in two-way cause-and-effect relationships, through analysis, synthesis and inference processes. These subsystems, treated as autonomous systems, require an indication of their components selected so that there are causal relations between them. Following the model of the main system (Fig. 3), they can be presented in the form of material and formal system structures created to find a solution to the problem contained in each of the three questions defining them. The synthesis of the three subsystems presented, two of which reflect thought processes and the third real process, creates nine defined concepts of elements of these subsystem structures, and the arrows indicate the order of actions from general to detail, which is both a feature of the mental analysis process, but also of systematic.

An example (correspondingly (indirectly) of what constitutes the concept of a creative element in the solution of an inventive problem, in other words the way in which the concept is created, i.e. the emergence of a new way of operating the device used in food processing according to the invention, was the use of the scientific discovery presented in [4]. It was known about the differences in cutting force values depending on the type of fish body structure cut: skin, meat tissue and bones with the help of rotary disc knives. This was used to develop a new, innovative, machine-separated method of separating bone and skin from fish tissue, extended to raw materials from warm-blooded animals, causing revolutionary changes in their processing. The essence of this scientific discovery is shown in Fig. 4 in the form of a graph of changes in the value of these forces (occurrence of differences in cutting forces - emphasis of the authors), without which the method used (the essence of the invention) could not exist [5].

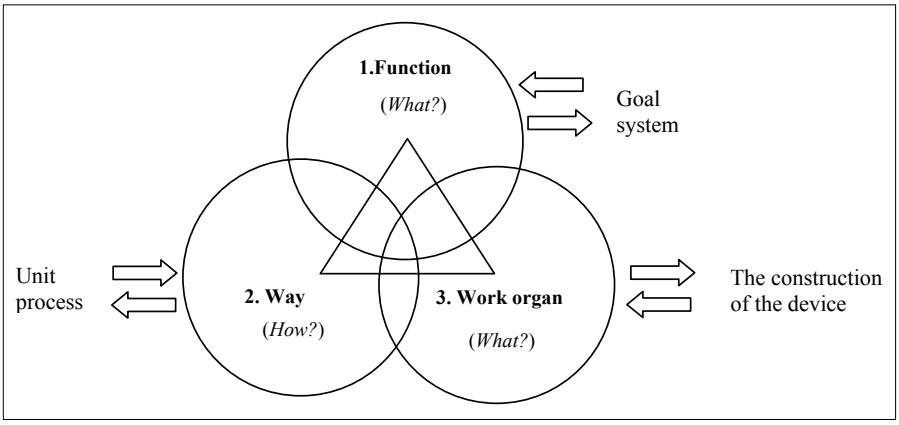

Fig. 3. Procedural triad of system approach in creating solutions regarding construction of working organs of technological devices (machines or apparatuses).

Rys. 3. Triada proceduralna podejścia systemowego w tworzeniu rozwiązań dotyczących konstrukcji organów roboczych urządzeń technologicznych (maszyn lub aparatów).

Source: Own study

Źródło: Opracowanie własne

The example shows the use of the discovery (maybe small, but still) to create the invention of the method and device for its implementation. What do we find at its base?–information about the fact of differences between the cutting forces of the constituent parts of the fish. The body of the fish has a structure

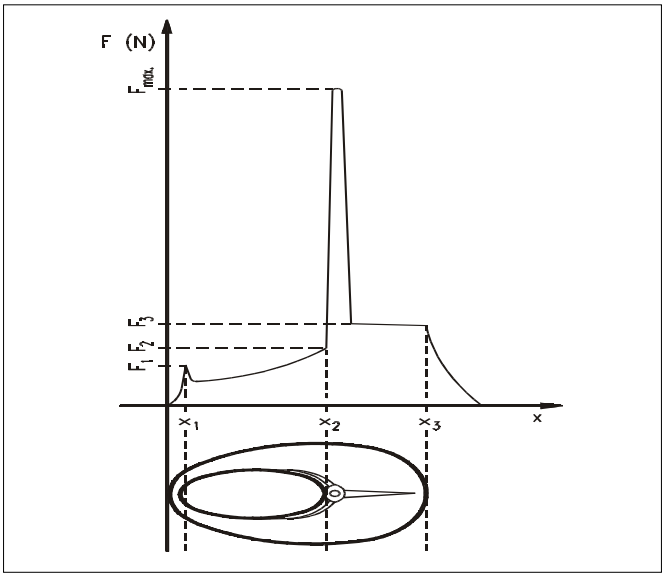

Fig. 4. Changes in the cutting forces on the head removing fish as the circular knife passes from the cut, skin, muscle tissue to the bones.

Rys. 4. Zmiany sił cięcia odgławiającego ryb w miarę przechodzenia noża tarczowego od cięcia, skóry, tkanki mięśniowej do kości.

Source: [Majewski, 2005]

Źródło: [Majewski, 2005]

composed of tissues of varying strength, which affects the amount of forces acting on the blade during cutting operations. Initially, the head removal operation showed a strong increase in cutting resistance due to the knife's impact on the tissue and its deformation. The cutting resistance reached the local maximum at point x1 under the stress associated with cutting the skin. After cutting the skin there was a rapid decrease in resistance, and after crossing point x2 there was a very strong increase in resistance, which was associated with cutting the spine (bone tissue). After cutting it, the cutting resistance did not return to the F2 value, but it set at a higher F3 level, which should be explained by the increased friction force. The largest increase in real cutting forces (from 6.3 to 139.7 N) occurred when cutting the spine. Such a strong (more than twenty-fold) increase in the forces acting on the blade was used to create a new way of working the demisting machine-previously not used type of cutting called "shaped", because it runs along the upper part of the fish gill cover.

The benefits of using it (compared to previously used head cutting with a flat cut perpendicular to the line of the spine) results from the recovery of meat behind the upper part of the gill cover. A clear difference in cutting forces when cutting the spine and other tissues is a key condition for the possibility of using contouring (the invented "disc" knife). This knife, together with the new design solution for transporting fish during the head removal operation, constitutes the working organ of the machine.

He inventive solution shown presents both a new way of working the machine and its working body (a new type of knife), but also a previously unused solution of the way of transporting fish during the heading operation and the structure for its implementation. The material expression of this structure are symmetrically pivoted rotating rollers, two on each side of the fish side, with movable pads from the action of the longitudinal force component, derived from the fish transferred in an oblique direction (along the cone forming the knife) and after the cessation of this returning force to the starting position under the action of the sector guide located on the non-working side of the rollers.

An example of the use of known differences in the size of unit cutting forces of various components of raw materials to create inventive solutions, shows the role of "differences" in the properties of raw materials as information from scientific discoveries in their creation, when we are able to combine and use their cause-effect relationships with phenomena enabling energy flow in the process transformation of agricultural raw materials.

SUMMARY

The above description of the elements present, the concepts used and, what is important, showing the sources, which turned out to be differences in the properties of fish, was only a practical example of illustrating the stages of inventive solutions. The synthesis of the concept of inventiveness is the ability to find the not always obvious cause and effect relationships: things, living and dead matter and energetic phenomena of nature, which are the subject of research in increasingly divided fields of science. In relation to inventiveness in the field of food production, the article of the authors in this magazine in issue 1 from 2019 is devoted. This article became the basis for reflection on the essence of the creative process in the context of dialectical development of the world?

Using the dialectical phenomenology method, it can be stated that the scientific thesis and proven by research (there is a difference in cutting forces) and its antithesis gave the answer to the questions: „what"?, „How" and „what"? And this (as a result of creative synthesis) led to implications in the form of the invention. From a methodological point of view, „creative element" is therefore a synthesis.

It is in inventing, perceiving and inventing a new way of energy flow to do the work of cutting processed animal raw materials. The idea of the invention of the method of implementation arose in the human mind by noticing the non-obvious causal relationship of the properties of the raw material, more precisely the differences just mentioned, energy and need (purpose), treated as necessary three elements in the systemic approach, which is also a kind of triad as the development triad discussed earlier where the development element is the equivalent of a need (goal). If this relationship did not lead to an inventive thought – a method of machine cutting with separation of meat from bones – this process would still be carried out manually. The beginning of the inventive process of inventing a new, machine-based method did not appear until after a scientific discovery, seemingly small, but important for many processes in the food processing industry. In this example, it can be traced that the process of development of anything originates from the processes of cognition, science that creates knowledge and scientific discoveries, but the intermediate link without which no development could occur is inventiveness, a concept currently

dominated by innovation. Regardless of what it will be called, the root of these concepts lies the element of creativity. Each of us possesses it to a greater or lesser extent, the point is to want to use it to create social and technical progress.

PODSUMOWANIE

Przedstawiony wyżej opis występujących elementów, wykorzystywanych pojęć i co istotne, ukazania źródeł, jakimi okazały się różnice właściwości ryby, był tylko wziętym z praktyki przykładem zobrazowania etapów powstawania rozwiązań wynalazczych. Syntezę pojęcia wynalazczości stanowi bowiem umiejętność doszukiwania się nie zawsze oczywistych przyczynowo-skutkowych związków: rzeczy, materii ożywionej i martwej oraz energetycznych zjawisk przyrody, stanowiących przedmiot badań coraz bardziej dzielonych dziedzin nauki. W odniesieniu do wynalazczości w dziedzinie produkcji żywności poświęcono artykuł autorów w tymże czasopiśmie w numerze 1 z roku 2019. Artykuł ten stał się podstawą rozważań nad istotą procesu twórczego w kontekście dialektycznego rozwoju świata?

Stosując metodę fenomenologii dialektycznej można stwierdzić, że postawiona i udowodniona badaniami teza naukowa (jest różnica sił cięcia) i jej antyteza, dały odpowiedź na pytania: „co" ?„jak" i „czym"?, a to (w wyniku wystąpienia twórczej syntezy) doprowadziło do implikacji w postaci wynalazku. Z metodologicznego punktu widzenia „pierwiastek twórczy" jest więc syntezą.

Tkwi on w wymyśleniu, dostrzeżeniu, wynalezieniu nowego sposobu przepływu energii dla wykonania pracy cięcia obrabianych surowców pochodzenia zwierzęcego. Idea wynalazku sposobu realizacji powstała w ludzkim umyśle przez dostrzeżenie wcale nieoczywistego związku przyczynowo-skutkowego właściwości surowca, ściślej właśnie wymienionych różnic, energii i potrzeby (celu), traktowanych jako niezbędne trzy elementy w ujęciu systemowym, stanowiące również swego rodzaju triadę jak omawiana wcześniej triada rozwoju, gdzie element rozwoju jest odpowiednikiem potrzeby (celu). Jeśliby ten związek nie doprowadził do powstania myśli wynalazczej – sposobu maszynowego przecinania z rozdzieleniem mięsa od kości – to nadal ten proces wykonywany byłby ręcznie. Początek wynalazczego procesu wymyślania nowego, maszynowego sposobu zaistniał dopiero po dokonaniu odkrycia naukowego, wydawałoby się drobnego, ale istotnego dla wielu procesów w przemyśle przetwórstwa spożywczego. Na tym przykładzie można prześledzić, że proces rozwoju czegokolwiek bierze swój początek z procesów poznania, nauki, która tworzy wiedzę i odkrycia naukowe, ale pośrednim ogniwem bez którego żaden rozwój nie mógłby zaistnieć, jest wynalazczość, pojęcie zdominowane obecnie przez innowacyjność. Niezależnie jakkolwiek będzie to nazywane, u podstaw tych pojęć leży pierwiastek twórczości. Każdy z nas go posiada w większym lub mniejszym stopniu, chodzi o to, aby chcieć go wykorzystać tworząc postęp społeczny i techniczny.

REFERENCES

[1] **BOGDANIENKO J**. **2008.** W pogoni za nowoczesnością. Toruń: Wyd. UMK.

[2] **BRIDGES C. 2017.** In Your Creative Element. The Formula for Creative Successes in Business. Publisher: Kogan Page, London. WB.

[3] **DRUCKER P.F. 2004.** Natchnienie i fart, czyli innowacja i przedsiębiorczość. Warszawa: Wyd. Studio Emka.

[4] **DUTKIEWICZ D, B. SŁOWIŃSKI. 2019.** „Integracja systemowa wiedzy dziedzinowej w procesach innowacyjnych przemysłu produkcji żywności". Postępy Techniki Przetwórstwa Spożywczego 2: 98–105.

[5] **MAJEWSKI J. 2005.** Parametry maszynowego odgłowiania oraz zmienność pracy cięcia odgławiającego płoci w cyklu roboczym. Praca doktorska Akademii Rolniczej w Szczecinie (nie publikowana).

[6] **MICHALKO M. 2006.** Thikertoys: A Handbook of Creative-Thinking Techniques. Publisher: Berkeley, Calif. USA.

[7] **POPEK S.2016.**„Mechanizmy aktywności twórczej człowieka w świetle interakcyjnej teorii psychologicznej". Annales Iniversitatis Maria Curie-Skłodowska, Lublin-Polonia: Vol. XXIX 3, setio J: 7–32.

[8] **PRZYBYSŁAWSKI A. 2004**. Coincidentia oppositorum. Gdańsk: Wyd: Słowo/obraz terytoria.

REFERENCES

[1] **BOGDANIENKO J. 2008**. W pogoni za nowoczesnoscia. Torun: Wyd. UMK.

[2] **BRIDGES C. 2017**. In Your Creative Element. The Formula for Creative Successes in Business. Publisher: Kogan Page, London. WB.

[3] **DRUCKER P.F. 2004**. Natchnienie i fart, czyli innowacja i przedsiebiorczosc. Warszawa: Wyd. Studio Emka.

[4] **DUTKIEWICZ D, B. SLOWINSKI. 2019.**„Integracja systemowa wiedzy dziedzinowej w procesach innowacyjnych przemyslu produkcji zywnosci". Postepy Techniki Przetworstwa Spozywczego 2: 98–105.

[5] **MAJEWSKI J. 2005**. Parametry maszynowego odglowiania oraz zmiennosc pracy ciecia odglawiajacego ploci w cyklu roboczym. Praca doktorska Akademii Rolniczej w Szczecinie (nie publikowana).

[6] **MICHALKO M. 2006**. Thikertoys: A Handbook of Creative-Thinking Techniques. Publisher: Berkeley, Calif. USA.

[7] **POPEK S.2016**.„Mechanizmy aktywnosci tworczej czlowieka w swietle interakcyjnej teorii psychologicznej". Annales Iniversitatis Maria Curie-Sklodowska, Lublin-Polonia: Vol. XXIX 3, setio J: 7–32.

[8] **PRZYBYSLAWSKI A**. 2004. Coincidentia oppositorum. Gdansk: Wyd: Slowo/obraz terytoria.

[9] **SCHUMPETER J. 2009**. Kapitalizm, socjalizm, demokracja. Warszawa: Wyd. PWN.

[10] **SPRAGUE DE CAMP L. 1973**. Wielcy i mali twórcy cywilizacji. Warszawa: Wyd. Wiedza Powszechna.

[9] **SCHUMPETER J. 2009**. Kapitalizm, socjalizm, demokracja. Warszawa: Wyd. PWN.

[10] **SPRAGUE DE CAMP L. 1973**. Wielcy i mali twórcy cywilizacji. Warszawa: Wyd. Wiedza Powszechna.