



INCLUSIVENESS AS AN ATTRIBUTE OF DEVELOPMENT FROM THE ASPECT OF INTELLECTUAL PROPERTY PROTECTION

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ABSTRACT

The level of technology that constitutes the resources of individual countries is an important attribute of development. It is therefore necessary to create new solutions and to empower enterprises with new innovative technologies, preferably derived from endogenous sources. People who are well-educated and young are the most creative and their ideas constitute the beginning of the commercialization processes. The protection of intellectual property facilitates the implementation of these processes, whose outcomes include products that in many cases demonstrate the features of inclusiveness. This paper presents the importance of the actions of patent offices in areas related to the protection of intellectual property with regards to development that brings universal benefits.

1. Introduction

The concept of economic development includes not only growth measured by the size of national income, but also its effects that relate to the whole society. The so-called HDI-Human Development Index is a synthetic indicator of development which is applied by the United Nations (UN). Inclusiveness which is understood as the universality of benefits resulting from economic growth is an important element of assessment. Based on this assessment in 2017, Poland was listed as one of the 25 most-developed countries in the world [14, 15, 17].

Maintaining this high rank requires intensive actions within the economy, which, from an engineering perspective, involves the implementation of innovative products and technologies. It is linked with innovation understood as competences stimulating a creative approach to performing entrusted tasks through the modification of the prevailing ways of acting and application of the new ones [12].

The driving force of great changes is, and always has been, human creativity as a feature dominating the development of economic life. The systems supporting this creativity and its use lead to new technologies, branches of industry, prosperity and all other positive changes in the economy which can be identified with the concept of innovation [3].

In terms of supporting innovation, it is worth noting that in October 2007 the Council of Ministers accepted a resolution on the adoption of the Innovative Econo-

my Program, which is aimed primarily at entrepreneurs who intend to implement innovative projects which are related to research and development, modern technologies, investment of major significance for the economy, and the implementation and application of information and communication technologies.

The program was aimed at supporting broadly understood innovation not only in enterprises or business environment institutions, but also in scientific entities which provide research and development services to enterprises, as well as systemic support ensuring the development of the institutional environment of innovative enterprises. The program was aimed at actions within product, process, marketing and organization innovation; directly or indirectly contributing to the inception and development of innovative enterprises [14].

Another action supporting innovation involves creating the Innovation Council in 2017 and the initiation of the “Start in Poland” program. These very important actions are based on the idea that competitiveness of the economy depends mainly on investment in innovation that will become the engine of not only technological, but also social change. The importance of inclusiveness was also confirmed by the statement that innovation can be discussed in the context of large business and scientific ventures, but innovation is very important in everyday life of every citizen. Thus, it applies to inclusive products, i.e. according to the dictionary definition, intended for everyone [8, 16, 18].

The studies on this subject also included the statement that nineteen million smart phones are currently used in Poland for an average of about three hours a day. They are mainly used to look for information about innovations [19, 20].

It is not necessary to add that these three hours concern mainly young people of the digital Generation Y. These are the most oriented people towards the reception of innovative solutions, and at the same time the most creative, which may result in a large number of innovative ideas. This group of creative, young people should be provided with support in the process of developing, presenting and spreading their ideas which after the process of commercialization can have the chance of being transformed into innovations characterized by a significant level of inclusiveness.

2. Creativity and inclusiveness in the process of development

2.1. The importance of creativity

Creativity dates back to the beginnings of humanity and can be understood as a creative attitude and action that result in new ideas, solutions, concepts and associations. The human brain has enormous creative potential which should be developed and cultivated. It can be encouraged by a combination of actions that can stimulate creative activity simultaneously developing specific skills and predicting real areas for these actions. Methods supporting creating innovative products are, *inter alia*, an important element in this process. The creative process, in other words, the process of creation is conditioned by [9]:

- resources, otherwise knowledge, experience, access to information and sources of inspiration that a man has,
- learned ways of thinking and individual intellectual abilities of a man,
- a man's internal motivation to create.

The period of studying is particularly important for the development of creativity, which may result from the process of acquiring knowledge and developing individual interests. However it is often a process that is stimulated by appropriate university classes that are part of the teaching process within bachelor's, engineering and master's programs. Another period conducive to students' inventiveness involves the doctoral studies.

In the course of studies young people conduct research using modern equipment, which makes it possible to develop new technologies, materials and constructions, for many of which patent applications are submitted.

During this period many bold ideas are created, the implementation of which is not possible due to the current state of technology development. This is their disadvantage, because they have no chance of being implemented. However, sometimes they become visions of

development and after many years it is possible to implement these solutions.

Creativity of employees with professional experience is, however, restricted by their awareness of limitations to possibilities of implementing new ideas.

It should be also noted that some inventions are generated without a formal relationship with science or professional work, and in such cases the commercialisation process is extremely rare [6]. As the research results show, independently of the origin, very few new solutions are used in practice. According to estimates, for every 333 ideas only 23 show unique features, from which 6 can be patented, and only two are the basis for products launched on the market, one of which achieves significant market success.

It does not mean that the others are useless [13]. According to the systemic approach, they often constitute the next level in research related to the development of science and the creation of new products [4].

2.2. The process of commercialization

The idea and concept of a new solution are the initial stages of the process of creating new products. They are generated in the minds of individuals or teams aided by the synergy effect. Once introduced on the market, *i.e.* after successful commercialization, they become innovations. Thus, commercialization is the process of feeding the market with new technologies, which is difficult and often accompanied by a high level of risk. Methods relating to the area of knowledge and innovation management are developed to mitigate the risk. They indicate specific stages of practice, where apart from technical features, already at the design stage, the requirements for practical application and marketing are taken into consideration. They are favourable to the commercialization of a new or upgraded product.

These methods are part of the area of management support and implementation of the principle of continuous improvement initiated and promoted by Deming [9, 10]. The commercialization process in the form of algorithm of actions from the idea to the creation of products is presented in Fig. 1.

The presented process was based on the nine-grade scale of the Technology Readiness Level (TRL) used in the European Union, including Poland [21].

This scale determines the states of product development in the consecutive stages defined as: fundamental research, industrial research (applied) and implementation work. Level 9 (the highest) indicates that the new solution is already in its final form, ready to be presented to recipients and to undertake intense market actions, related to its promotion and advertising.

In this process, it is often necessary to adjust the adopted concepts and assumptions, and to modify the design and the prototype. These actions have a repetitive nature, and its scope and time of duration as well as the degree of risk may vary depending on the analysed solution.

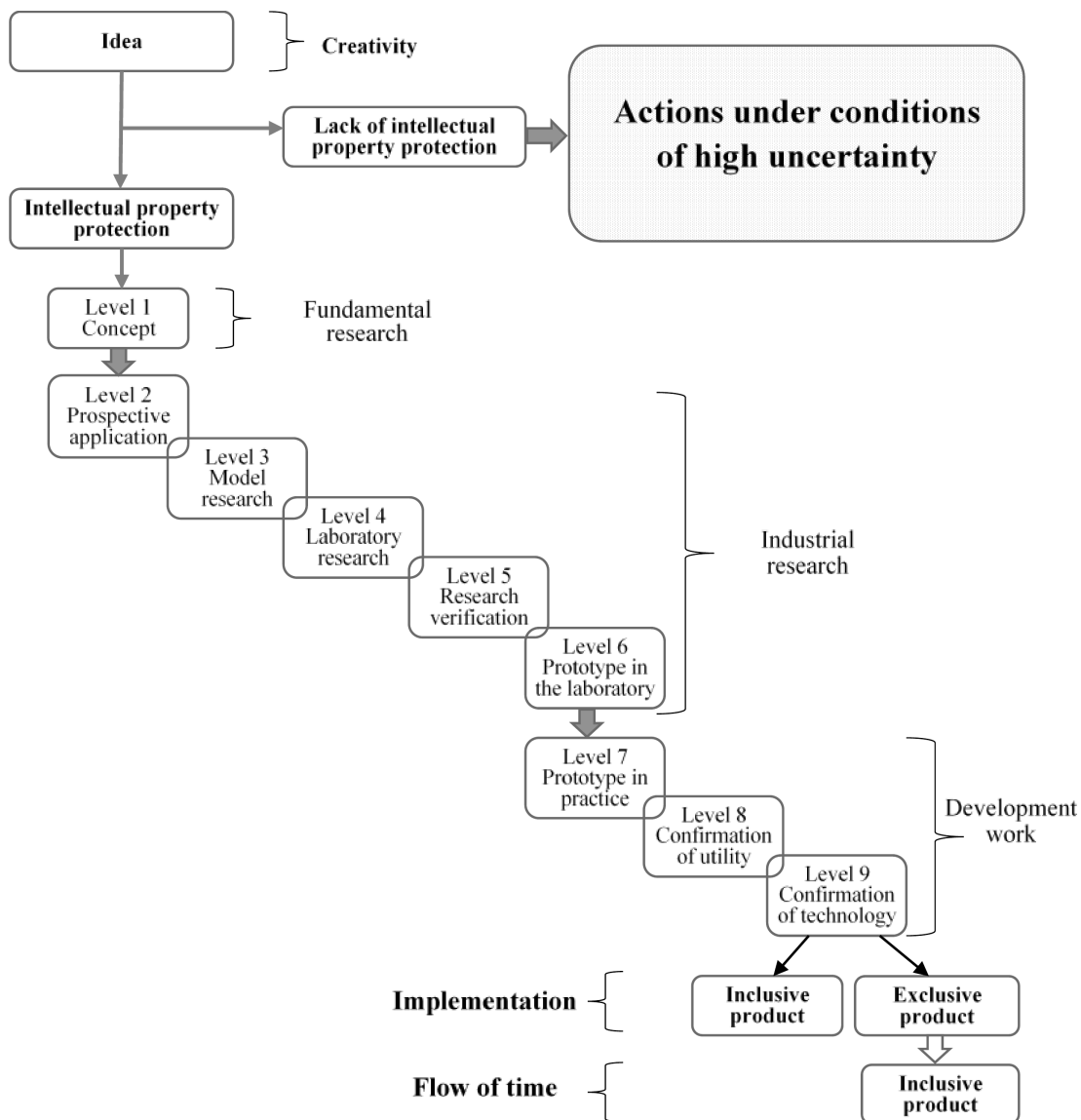


Fig. 1. The invention in the process of creating inclusive products. Source: the author's study on the basis of [8].

The idea for a new solution results from creativity, the process of creative thinking, which is often the effect of research in universities, science and research centres or in enterprises.

In the phase of creating the concept of a new solution it is important to analyse the state of the art (e.g. using patent databases) with the aim of examining the technological gap and analysing the demand for a new product, new technology. The information obtained as part of this research is used to specify the new idea, determine the strategy of protecting the intellectual property and the objectives and scope of research.

If the analysis of the state of the art confirms the novelty of the solution, the author makes the decision: to protect the solution within the scope of the industrial property rights or to ensure exclusiveness by keeping the new solution secret.

It is the know-how of an enterprise and it is often the source of competitive advantage. This path of development is used in the armaments industry. However,

despite the great effort put into secrecy in such a case the development of the product is carried out under conditions of high uncertainty.

By providing the exclusive rights, the patent offers legal protection against competition. However, it requires disclosing the essence of the invention. In the absence of a patent, partial disclosure follows the launch of the new solution.

Thus, many enterprises do not protect their solutions, inter alia, due to the rapid development of technology, which makes the lifecycle of a specific solution shorter than the procedure of obtaining a patent. Disclosing the research area in the patent indicates the ways of solving problems that the competition might learn.

At the first level of TRL, as part of fundamental research, the knowledge about the new product, new phenomena and interrelations between them are expanded. At the next level, as part of industrial research, the areas of application of research results are determined. They should be more specific, aimed at the possibility

of implementing the idea and using it in practice. Therefore, the objective is to prepare designs for new products and manufacturing processes, conduct research in laboratory conditions, build a prototype and verify the correctness of its operation.

At the level of development work, the prototype is verified in real conditions. Marketing research is carried out, market expectations are analysed and possibilities of satisfying them with the new product. The interest and its extensiveness on the part of the potential market are determined. The conclusions from these studies constitute important information in the decision making process on the continuation of activities and the practical application of the results of the research.

After completing development work, the process of implementing of the new solution on the market takes place. In the case of inclusive products, this is often a difficult and expensive process involving high risk (poor reception by the market). In the case of non-inclusive products – not intended for general use, implementation may be easier as it may result from contracts concluded at the earlier stages of product creation, and only with the course of time they become commercialized (e.g. the Internet – innovative technology developed for the needs of the army).

The algorithm for the development of new products shows the significance of creativity and its effects-ideas. They are the beginning of this process and constitute its most precious element. Therefore, one should strive to intensify the number of ideas, support the authors in the process of commercialization as only a small part of them will be successful on the market. Inventions are one of the sources of ideas, and their analysis allows us, with some probability, to indicate those which may be conducive to products commonly used by society, i.e. inclusive.

2.3. Intellectual property protection

The protection of intellectual property in the field of inventions is identified with patent offices. These institutions have full powers, and their decisions affect the activities of enterprises, and in particular the fate of people from the elite group of inventors. When analysing the core of operations of patent office, including the Patent Office of the Republic of Poland, these basic goals can be indicated:

- providing for creators in a financial sense;
- cataloguing data on the state of the art – reacting against redundancy;
- participating in the creation of patent law – promoting engineering ethics.

Providing for Creators in the Financial Sense

The protection of intellectual property implemented by granting patents is to some extent a limitation to the dissemination of products. Due to legal regulations, it is impossible to start production, even knowing the manufacturing method, which was disclosed in the patent specification, and having adequate resources. The patent owners have the right to do it and only they can derive financial benefits from the sale of the product. It is, therefore, a kind of limitation of inclusiveness and this argument is used by opponents of restrictions introduced by patent law.

Figure 2 shows a diagram of the development of a patented product. The owner of the rights allocates part of the sales resources to the development of a new or currently manufactured product. A system with positive feedback is created, ensuring continuous development through actions in subsequent loops (Fig. 3). A certain limitation of immediate inclusiveness occurs in this system, and commonplaceness applies to earlier versions of the product.

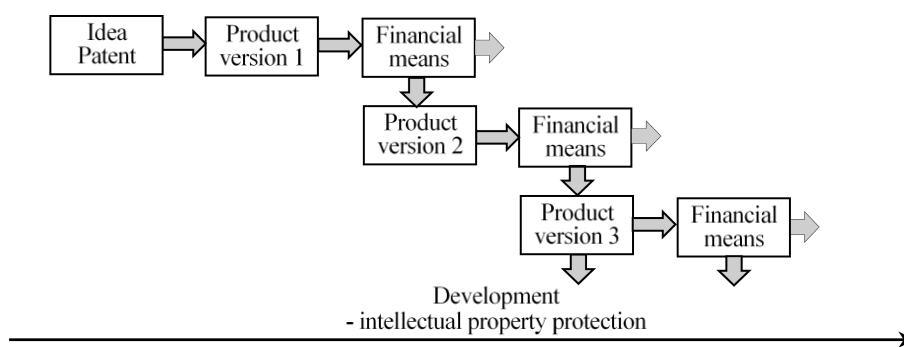


Fig. 2. Development of a product protected by a patent. Source: The author's study.

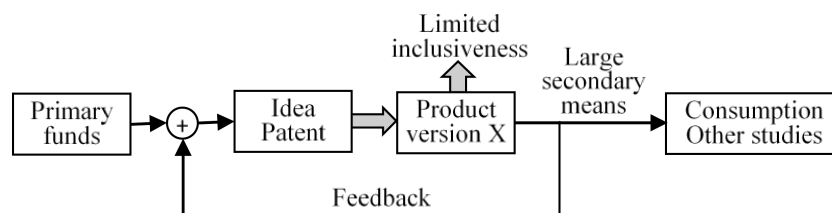


Fig. 3. System with positive feedback. Source: The author's study.

In the absence of protection of property rights this type of loop does not exist (Fig. 4). The product in its first version gains followers, its copies appear, which radically reduces the amount of resources for further development of the product that are available to the author of the idea. In this case, the research and intellectual potential of the creative author is often limited, and sometimes it is related to his personal tragedy.

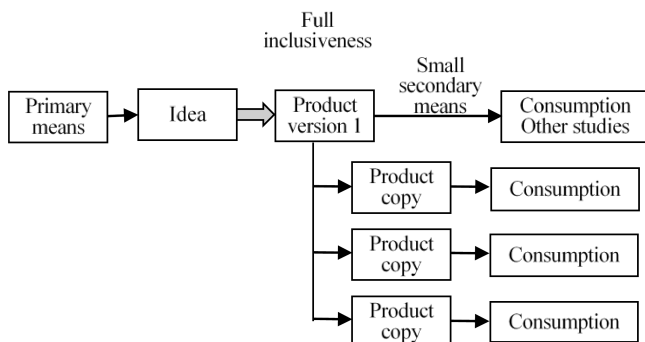


Fig. 4. Product development without patent protection. Source: the author's study.

As an example of the tragedy of a visionary and inventor one can refer to the fate of J. Gutenberg, the man considered to be the creator of the printing industry, whose contribution to the development of humanity was enormous. The story of the struggle over his wonderful invention is not commonly known. In 1436 J. Gutenberg invented the method of casting letters from metal, which eliminated numerous problems with printing in comparison to previously used wooden fonts.

The metal fonts were durable, they provided a clear reflection on the paper and were easily made. After many years of research, in 1452 Gutenberg began printing the Bible. It was the first book published in the world with a printing technique in the form of a volume. Unfortunately, Gutenberg soon fell into financial trouble and having been unable to pay his debts went soon bankrupt in 1455. Over the years, Gutenberg lived in extreme poverty off a small allowance received from one of his previous investors. This is a classic example of technological success based on a brilliant invention and financial failure. Perhaps the patent law operating in those days would have prevented this tragedy, and Gutenberg could have developed other no less inclusive solutions [22].

However, there exist many enterprises that develop by following a feedback scheme. A good example is the pharmaceutical industry which invests enormous resources in the development of new generations of medicines. The previous ones can be produced by other companies as generic medicines after the protection period. They are then much cheaper and therefore become universally available (inclusive). This kind of mechanism could not be possible without patent protection, which would result in a significant slowdown in development. Generally, it can be concluded that patent protection is conducive to development, which indirectly results in

widespread access to various types of products, and this access can be defined as inclusiveness.

Cataloguing data on the state of the art – counteracting redundancy

The work of a creative inventor can be compared to the work of an artist- creating something new. The reward for creative effort (apart from prospective financial benefits) is the recognition of priority by the global community. Sometimes, however, it is difficult to state clearly and assign the status of priority. It particularly concerns cases involving technical solutions. As an example, we can refer to inventors who contributed to the creation of the radio.

Guglielmo Marconi is commonly regarded as the inventor of the radio. Working in amateur conditions – and partly in secret from his father – in September 1895 he obtained radio communications for 1 km. In 1899, an attempt to transmit the signal through the English Channel was made. Later, in 1901 a message was passed over the Atlantic Ocean from Canada to England.

The Serbian engineer and inventor Nikola Tesla as well as the Russian physicist Aleksandr Popow were also the competitors for the title of the inventor of the radio.

Tesla designed a high-voltage coil that sends strong electromagnetic waves and began working on a device which could receive these waves. His patent for a device for transmitting and receiving electromagnetic waves was ready in 1900. However, Marconi beat him a few days earlier. Tesla fought with Marconi for a radio license, arguing that his invention, the patented coil, had been used without his consent, but the long litigation led Tesla to bankruptcy.

The appeal of Nikola Tesla regarding the radio patent in the US' highest court was successful after his death in 1943. Aleksandr Popow established radio communications and telegraphically delivered signals over 250 meters on March 24, 1896. However, he did not obtain any patents for his inventions [23].

Patent databases established by patent offices contain an enormous amount of information about inventions. Currently, these databases are electronic, which facilitates searching them and makes it possible to determine the state of the art in a selected area, and this is applied to the patentability study.

The resources contained in the databases should also be analyzed before undertaking research, which will allow the researcher to determine the current state of knowledge and prevent repetitions that would result in redundant solutions. Nowadays, many patent databases are available for free, and searching their resources is possible thanks to special Internet applications. It is the role of the patent office to care for the completeness of resources, and to create conditions that increase the effectiveness of exploration, which concerns, inter alia, problems related to national languages [11].

Participation in creating patent law – promoting engineering ethics

Patent law is a system of standards and rules of conduct in the environment of technical solutions inventors. By being issued a patent, the owner of a technical solution is granted the right to the exclusive use of the patented invention or inventions, for professional or commercial purposes. The patent law should protect the property of inventors and at the same time enable development and stimulate it. Its framework should prevent or at least reduce the probability of dishonest action. An example of this kind of action, possible due to a certain ambiguity of regulations, involved the issue of gene patents.

It seems obvious that genes understood as some kind of information coming from nature, the carrier of which is deoxyribonucleic acid (DNA), cannot have an owner but the sequence of genes determining every living being belongs exclusively to this being. However, in the 1990s, the American company Myriad Genetics patented the BRCA1 and BRCA2 genes, whose mutations may contribute to cancer. Research into these genes as part of medical diagnostics could only be performed using a special expensive test offered by Myriad Genetics [24].

In 2013 patents concerning these genes were annulled by US' Supreme Court. The justification states that naturally occurring DNA segments are the product of nature and do not qualify for patenting simply because they have been isolated. It is as if someone patented the air temperature as a feature describing the state of the atmosphere and allowed it to be measured only with the help of the expensive thermometer it produces.

For many years, up to 2013, Myriad genetics derived profits from having a patent, and many people had limited access to this test, which could have brought tragic outcomes.

This limited access to research can be discussed from the ethical perspective, which indicates another area of activities of a patent office – promoting engineering ethics. In line with its principles, scientific research, patent protection and subsequent commercialization of new solutions should take into account principles applied in a particular cultural circle.

This promotion of engineering ethics in connection with shaping the patent law in order to eliminate controversial actions in the currently highly technocratic world seems to be of special importance.

3. Supporting commercialization process

The task of commercialization is a complex process with a risk of failure at every stage. The connection between science and economic practice is conducive to reducing this risk. To a large extent, this applies to universities as sources of ideas in the process of commercialization [5]. The European Union, including Poland, conducts actions supporting the strengthening of uni-

versity structures responsible for the commercialization of technology and for fostering the creativity of young people. At the majority of Polish universities, there are units supporting the academic community in the process of intellectual property protection and technology transfer, that is, units operating at the interface between science and business. Their goal is to create a kind of buffer that combines the commercialization of knowledge, research and teaching at universities [7, 27].

The inventions designed at universities in Poland, which were created with students' contribution, mostly concern broadly understood engineering and biochemistry, renewable energy sources and medicine. At this point, one should mention the significance of transdisciplinarity so important for the development of inventions. Transdisciplinary knowledge is usually acquired through transformation, restructuring and the combination of knowledge from many disciplines (e.g. mechanics, biology, or construction of machines and devices) [1, 2].

Various competitions and exhibitions support young inventors and allow them to strengthen their motivation to conduct research. They are also a way of combining research and its outcomes with the offer for Polish industry. The objective of competitions and exhibitions that have been carried out for years is, therefore, to use in a more comprehensive way the potential of the representatives of the youngest generation of Polish science.

It is worth mentioning the Academic Incubators of Entrepreneurship, i.e. units created by universities aimed at supporting and developing the entrepreneurship of students or academics. They provide, inter alia, place, training and legal support. They can take the form of both pre-incubators and incubators. Incubators are also established outside universities, but they play similar roles.

It should be stated that in Poland there is a deficit of social respect for people who have the ability to create new solutions and implement them successfully. In particular, there is lack of systematic action aimed at building in the society the awareness of the significance of innovation and work performed by people who deal with it. One of the conditions necessary to increase the level of Poland's innovation is the social conviction that creative, young people are the engine of the social and economic development of the state [25].

A restricted access to appropriate funds, which in many cases closes the path of development for young and often exceptionally gifted people, is a serious limitation to the development of innovative products. These deficiencies are buffered by the activities of institutions such as the National Centre for Research and Development, which donates funds for research through competitions. However, radical improvement is only possible with the increased involvement of Polish industry into the research and development [26].

Another form of support involves the implementation of doctorates, including the commercialization process completed with implementation. PhD students re-

ceive financial support more easily. The university also receives co-financing, at the same time developing research excellence, opens to cooperation with business, and the entrepreneur can rely on discounts, often receiving innovative patents, which helps to achieve a competitive advantage.

4. Summary

The complexity of the surrounding reality stimulates the description and analysis of the process taking place in it. In accordance with the classification presented in the philosophy of science, the approach described as reductionism can be used for this purpose. According to this approach it is possible and appropriate to clarify and characterize the properties of a complex system by describing and explaining the behaviour of its parts. Holism is the opposite view, according to which all phenomena form integral systems which are subject to specific regularities. They cannot be deduced on the basis of knowledge about regularities which rule their components [4].

The paper presents a systemic approach, according to which the whole cannot be reduced to the sum of its components. It also makes an attempt to analyze the interrelations between commercialization-patents-inclusiveness. The three elements mutually influence one another supporting economic development as an added value (Fig. 5).

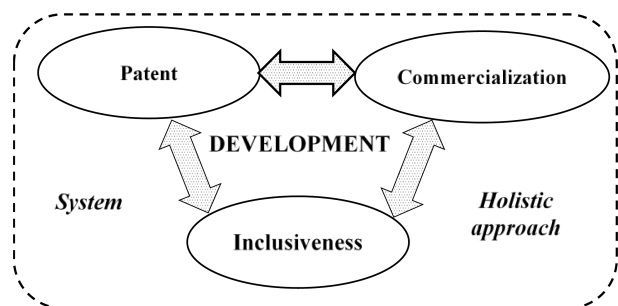


Fig. 5. Economic development loop. Source: the author's study.

Commercialization – the ability and willingness to create are revealed mainly in adolescence, when from the resources of knowledge and with the use of the uninhibited imagination, a man shapes his world of values and determines the direction of his aspirations. Therefore, inspiring and activating the creative thinking should be an important element of education and creative development, especially for young people and students. New technical solutions-inventions may be the effects of these actions. They have their origins in the minds of individual people or teams aided by the effect of synergy. Implemented viz. successfully commercialized become innovations.

Patent – developers of new technical solutions in order to protect their ideas apply to relevant patent offices to gain protection of their solutions in terms of

industrial property rights, and obtain a patent for an invention. Patent law and the possibility of protection create conditions for commercialization of ideas and research outcomes, which results in the opportunities for further research and commercialization processes. The protection of intellectual property can be a factor promoting engineering ethics as an important element of humanization.

Inclusiveness – universality as the opposite of elitism is the closure of the development loop shown in Fig. 5. The patented and subsequently commercialized research results should be widely available. In the opposite case, economic oligarchies may arise, which results in a large diversification of society in economic terms. In the long run, it is not conducive to a widespread participation in actions that begin with creativity and end with the commercialization of innovative products. As the example shows, this can only be beneficial in a short period of time.

Thus, it seems right that inclusiveness is an important attribute of development, in which creativity, innovation and commercialization are the key elements, effective and successful only in the environment with well-functioning intellectual property protection.

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