



“The common-pool resources” in the open innovation process

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Abstract

In this article the change in attitude to the innovation process is described. The growing importance of knowledge and information causes modifications both in the type of innovation and the innovation process. Linear or closed innovation models are no longer appropriate with respect to knowledge-based products. At present, scientific discovery becomes the first step to new product development. Costs of such an activity often make the product development impossible, because companies do not undertake too risky ventures. The open innovation process is a model of innovation that uses ‘common-pool resources’ like knowledge, in order to lower costs and risk of developing a new product. The pharmaceutical industry is a knowledge-based industry, and new drugs development is a costly and risky activity. It usually takes 15-20 years to introduce a new drug to the market. Only about 5% of new molecules discovered in the pre-discovery phase reach the market as a new drug. And the cost of a new drug development is more than 800 million USD. In order to lower the costs and risk of innovative activity pharmaceutical companies use the open innovation model. The results of such an activity are presented in the article.

Keywords: closed innovation model, open innovation model, common goods, knowledge, pharmaceutical industry
JEL D21, D83, O12, O31, L65

History: received 10 May 2014, revised 15 November 2014, accepted 18 November 2014

Introduction

Contemporary economies develop dynamically, e.g. due to the dominant role of the innovations. The innovation-based model of development implies enterprises to be innovation-oriented, both in their use and creation. The innovation process, in its traditional, linear sense, leads to the birth of new developments through the market mechanism, with respect to all market artifacts (with the private property dominance). The linear innovation model is carried in the form of triadic activities: basic research, applied research and experimental development. Enterprises R&D input (resources) and output (innovations) are private with economic consequences of the

state of things (see Kline, Rosenberg 1986). Meanwhile, one can observe the new challenges for business research activity, which, because of the risk and high costs, should be organized differently than linear-like innovation models. Market-allocated private resources, and the ‘industrial’ ethos of research, make traditional innovation models economically ineffective. Companies do not get involved in risky and costly innovation process without the prospect of investment return. Uncertainty of market applications of research output stops companies from getting involved in socially needed but economically questionable activity. A useful solution here seems to be ‘the open innovation process’ (see Chesbrough 2003), where uncertainty of research output’s market success is neutralized

by using common resources. The research constituting the base for socially useful products is realized in the form of the common-pool goods by creating scientific communication platforms, where public research results are available in open access mode.

The article is structured as follows. First, the origins of the change in the attitude to the innovation process development are described on the basis of literature. Then, the growing importance of knowledge and information is shown as the main purposes of such change. Next, the linear innovation model construction is criticized as being inadequate for the present conditions the companies operate in. The “open innovation model” is introduced as a model thanks to which companies can benefit reducing the risk and cost of discovery, by using ‘common-pool’ resources – knowledge, produced in public research institutions - outside the firm’s boundaries. The example the pharmaceutical industry is given to show the use of ‘open innovation’ in case of innovative drugs development.

The goal of the article is to show the change in innovation process organization due to the growing importance of knowledge as a common pool resource, as well as to show mechanisms of using ‘the commons’ with the purpose of creating socially useful value.

Changes in innovation models

The growing complexity of business environment makes scientists to redefine the term “innovation”. Competition, emergence and fast development of new technologies, especially information-based ones, are features of a new framework for the modern innovation landscape. Moreover, these changes go hand in hand with rapid societal change. The growing importance of information, knowledge as a key production factor, dominance of technological development and globalization of the world economy, have directly and indirectly affected conditions for functioning of innovative production systems. Theorists of innovation show different attitudes to the innovation process development. For example, Roy Rothwell described the development path of innovation as the five generations of innovation (Rothwell 1994). These generations are:

technology push, market pull, coupling of R&D and marketing, integrated business processes, system integration and networking. His “fifth-generation innovation” concept sees innovation as a multi-actor process, which requires high levels of integration at both intra- and inter-firm levels, and which is increasingly facilitated by IT-based networking. As Professor Joe Tidd from the Sussex University argues: “(...) Most innovation is messy, involving false starts, recycling between stages, dead ends, and jumps out of sequence (Tidd 2006: 3).” And that is why innovation models must evolve.

Another approach to the problem of innovation process development is based upon the work of prof. Henry Chesbrough in which he points out that the main difference between the innovation “from the past” an innovation “at present” is opening of the innovation process (Chesbrough 2003, 21-62, 93-112). He describes two modes of innovation: closed and the open. Chesbrough introduced the open innovation paradigm. He framed it in opposition to the closed innovation model. He also broke the traditional paradigm of internal innovation. His findings seem to show a more general trend in a clear way. Innovation is no longer only in the firm’s domain. The fact that knowledge has become a key production factor, which is of a symbolic (intangible) rather than material (tangible) nature, caused a great change in the attitude to the organization of the innovation process.

Closed innovation models

The main characteristic of the closed innovation model can be the phrase: successful innovation requires control (Herzog 2011: 19-23). In an orthodox meaning it states that a firm has to do everything by itself, starting from the idea of discovery, through development and production stage, to marketing, distribution, service, and financing. In this sense innovative projects have some limitations. They can only enter the innovation process at the very beginning. They are developed using only firm’s internal resources and competencies, and the only way they can exit the innovation process is commercialization via the firm’s own distribution channels (Herzog 2011: 22).

The rejected ideas or projects cancelled are stored and collected in firm's internal databases, unless innovation teams pick them up again later in another context (Chesbrough 2003: 93-112). As a result of such an inward-looking innovation model, many promising business ideas and technologies will never be exploited. The literature shows two main reasons of this situation: first, firms fear losing their intellectual property to other firms or organizations. Second, firms exist in an environment of scarcity and uncertainty (Wolpert 2002: 77-83). Scarce firm's resources and asymmetry of information dominate the decisions taken – firms do not exploit every new research outcome because of the lack of knowledge or lack of necessary resources.

A typical example of the closed innovation model is the linear model of innovation. This model has explicitly and implicitly dominated much of the theoretical debates, science and technology policy formulations. The linear model of innovation is a typical "innovation push" model constructed in early 1950s and used intensively until the mid-1970s. In the model, basic research produces theories and findings that are redefined in applied research, tested in development processes and after that commercialized as industrial innovations. Each level in the linear model produces outputs that are transferred to the next level as inputs. The flow of knowledge is also unidirectional, i.e., later stages do not provide inputs for earlier stages (Kline, Rosenberg 1986: 285). Moreover, costs of such an innovation model are huge, because it requires the emergence of specialized research teams, which consume a lot of input (money, time, etc.) and offer little output instead. It is also noteworthy that the traditionally created innovations can lose their innovative feature at the moment of their emergence, because of the linear innovation model construction. The new solution can lose its innovative features if it is constructed on the basis of the research conducted years ago. Business environment changes so quickly, that a couple of years delay between the first stage of innovation process (basic research) and the last one (innovation market entry) can change the market expectations with respect to the introduced innovation.

The linear innovation model was the first attempt to describe the innovative process cycle. Its limitations were obvious, but it took about 30 years to propose an explanation that would better describe the research realm. Kline and Rosenberg in their seminal work stated that in a nutshell the linear innovation model criticism claims that the model distorts the reality of innovation at least in few ways (Kline, Rosenberg 1986: 286-288). First, the linear innovation model is a model where information flows unidirectionally. There are no feedback paths either within development processes or from markets to development work. Second, the central process of innovation seems to be not science but design. A design is essential to initiating a technical innovation and redesigns are an essential part of the process. The problems of designing and development can also give rise to new scientific investigations – there is no one way street from science to development work and innovations. This is further emphasized by the fact that science is often dependent on technological products and processes for its advances. Third, the role of scientific research is more limited in innovation than the linear model assumes. Most innovations are carried out with already available knowledge, usually scientific in nature. Only when the available knowledge fails in problem-solving, there is a need for scientific research. Scientific research seems to have an important role when new radical innovations are created, like semiconductors or genetic engineering, but more common incremental or evolutionary innovations are made usually on the basis of available knowledge, whether scientific or product-related by origin. Many innovations are also based on the cumulative experience and learning occurring in production.

In the mid-1980s a new model of innovation was developed - a "chain-linked model" of innovation (Kline, Rosenberg 1986: 286-288). The model was supposed to deal with the linear innovation model's imperfections. It was noted that "pushing" innovation into the economy is as important as "pulling" it. Besides, this model shows the possibilities of using science for purposes other than the basic research. Science exists alongside development processes, as it is used at every stage

of such process, when needed. It proves instant coupling inside the innovation process, recycling of information. It is still a “closed innovation model” - all processes occur within a firm’s boundaries, but the science and its presence alongside all innovation stages shows the potential of using external resources and, in consequence - opening the innovation process. The “chain-linked innovation model” is definitely a forefront of the change in the attitude to innovation. It is noteworthy that gradual opening of the innovation process was possible thanks to the intangible nature of knowledge and its ability to diffuse, cheap storage and costless duplication.

The commons in innovation – opening the innovation process

As mentioned above, opening of the innovation process is based mainly on intangible nature of knowledge and the development of digital technologies that improved, changed and instantly influence the firms’ internal processes as well as their networking. All these features, together with the rising cost of “closed innovation” models, make firms to look for a more effective and cheaper way to innovation. The solution might be the commons (or, more precisely knowledge as the common-pool resource) used in innovation process.

Garrett Hardin in his seminal work has first raised the issue of unavoidable necessity of using common-pool resources. The fact that only private property can ensure efficient solutions for economic problems can be simply proven in relation to Hardin’s considerations (Hardin 1968: 1244-1245). It is noteworthy that Hardin’s considerations were based on natural science, and that his conclusions were adapted to economics thereafter. The major defect of his theory is the assumption of the lack of regulation in ‘the commons’ issue. The commons, by Hardin, do not have the nature of joint-ownership resources, but rather of ‘no one’s goods’.

The sophistication of the commons issue has been better shown in work of Elinor Ostrom – especially in her most important book “Governing the Commons”. She proves that there

is more than one determined solution – opposite to the Hardin’s understanding of ‘tragedy’ in which there is always one result (Ostrom 1990: 15-16).²⁶ Ostrom’s great achievement was to explain how cooperation can actually manage resources sustainably – and often more effectively than the state or market. Empirical proof of Ostrom’s theoretical model gives a reason to claim that the commons can be efficient, but only when exact assumptions are fulfilled. The main problem is scarcity, which is the base for conflicts and competition between users of the commons. Thus, the issue is more associated with the commons of the tangible than with those of abstract (intangible) form. It is noteworthy that only physical (‘real’) goods are scarce. This is derived from the rarity of atoms. The world of symbols is more flexible, because symbols are not the subjects of physical goods limitations. “The commons” concept can be used in various situations, not necessarily in the common-pool area of tangible resources. Let us say that intellectual property can also be understood as some sort of the commons. This kind of property is not scarce, because it is made up not of atoms but of knowledge creating symbols. This difference causes consequences in resource management. It opens also a new area of studies connected to the institutional economics. One needs to understand that the intellectual property is in fact one of major decision making elements of economic entities. Apart from the scarcity problem, the commons constituted by intellectual property can give us a new understanding of common knowledge enclosed in private resources. Knowledge, opposite to rare goods, is free from scarcity. Moreover, it can be constantly replicated. So the question is how to manage intellectual property in order to receive the best results? In contemporary economics it is frequently encountered to use some ‘open’ strategy for profit. But it is also very important to remember what is the exact meaning of the term ‘profit’, and who benefits most.

²⁶ Notice that the Hardin use word ‘tragedy’ in meaning of unavoidable solution, that cannot be reversed or changed, because of the nature of people. He adheres to Adam Smith’s thesis about egoistic motives of human behavior.

“Openness” is a really new way of thinking about the commons in the aspect of using symbolic resources instead of physical ones. This concept is not precisely defined, but some guidance can be found in the literature of various science fields. The “open” conception is often used in order to clarify ambiguities in the new goods development process. There are at least three terms directly related to the concept of openness. The first one is the “open source” concept. It refers to the idea of software development in global partner production process (Czetwertyński 2012). The second one is “open development” associated with more general activities of the development process (Benkler, Nissenbaum 2006). David M. Waguespack and Lee Fleming indicate a key concept here, which exposes the developed project to the external entity comments and criticism. This solution is helpful, because it gives the opportunity to improve problematic issue or reveal unknown mistakes (Waguespack, Fleming 2009). The third term, “open innovation”, is for sure the most comprehensive approach to the discussed matters. Henry Chesbrough defines open innovation as “the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and expand the markets for external use of innovation (Chesbrough 2006: 1).” In this context open innovation is something opposite to the vertical integration model. Internal research and development that traditionally lead to internally developed products is replaced by the business model that utilizes internal and (even more important) external ideas to create new and unique value. In a certain sense open innovation constitutes an open system that resembles an open network of creators working on chosen issue.

The term “open innovation” has been primarily used with respect to the biotechnological companies and their attitude to the organization of their R&D activity. In contrast to the closed innovation model, the launch of an innovation project can be triggered by either internal or external idea and technology sources. Those ideas and technologies can enter the innovation process at any time by various means, such as technology in-licensing or venture investments. Besides going onto

market by using the firm’s own distribution channels, innovation projects can be commercialized in many other ways as well, such as through spinoff ventures or out-licensing (Chesbrough 2006: 12-13). As such, open innovation therefore applies to all three phases of the innovation process. Open innovation, however, is more than just using external ideas and technologies. It is a change in the way of use, management, employment, and also generation of intellectual property. Open Innovation is a holistic approach to innovation management as “systematically encouraging and exploring a wide range of internal and external sources for innovation opportunities, consciously integrating that exploration with firm capabilities and resources, and broadly exploiting those opportunities through multiple channels (Herzog 2011: 22).” The main differences between principles of the open and closed innovation are shown in Table 1.

Table 1. The comparison between open and closed innovation principles

Closed Innovation Principles	Open Innovation Principles
The smart people in the field work for us.	Not all the smart people in the field work for us. We need to work with smart people inside and outside the company.
To profit from R&D, we must discover it, develop it, and ship it ourselves.	External R&D can create significant value: internal R&D is needed to claim some portion of that value.
If we discover it ourselves, we will get it to the market first.	We don't have to originate the research to profit from it.
If we create the most and the best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our IP, so that our competitors don't profit from our ideas.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our business model.

Source: Chesbrough (2003); see also <http://www.openinnovation.eu/open-innovation/>

Examples of opening the process of innovation

Open innovation is a concept that shows a new approach to the relations between enterprises and scientists. It is a more participatory, more decentralized approach to innovation, based on the observation that nowadays useful knowledge is widely distributed between different actors (like universities, R&D institutions, enterprises), while enterprises usually do not innovate using only their own resources. There are numerous examples of using external resources in companies. The need of introducing the ‘open innovation process’ is related to the birth of a new mode of industries. These are the ones strongly based on scientific discoveries, like the chemical-, biotechnological-, nano technological- or pharmaceutical industry. The example of pharmaceutical industry is discussed in this article. The development of new drugs is a very expensive process saddled with high risk. It usually takes 15-20 years to introduce a new drug to the market. The new drug development pipeline contains the discovery and development phases. The discovery phase covers pre-discovery research, preclinical and clinical trials. The development phase consists of product development, product testing and registration. Only about 5% of new molecules discovered in the pre-discovery phase reach

the market as a new drug. And the cost of a new drug development is estimated from 800 million USD to even 2,600 million USD. In order to lower the costs and risk of innovative activity pharmaceutical companies use the open innovation model (see Mullard 2014). The opening of innovation process is dependent on the usage of knowledge as a key production factor. There are few ways to “open” innovation process with respect to the method of knowledge (information) transfer. One can divide them into three types of useful information flows. The first type of information comes from Academia. Information of this type is embodied in publications which represent the university research results. This type of research is mainly basic research. It is connected with a traditional profile of university’s activity. The second information stream comes from collaborative projects. In those partnerships public actors (universities, research institutes) meet private ones (pharmaceutical or other companies) in order to discover new areas of knowledge, solve problems of ‘stuck’, potentially innovative projects, and stimulate new growth areas by public finance support (Allarakhia 2011: 6). This sort of information is a result of private knowledge “release” and forwarding it to public institutions. An example is the Novartis Institutes for Biomedical Research (NIBR) an associate of about 300

members form different academic disciplines. The ‘research home’ created by NIBR gives the opportunity to solve still undeveloped technologies. This initiative is supported by private enterprises, universities and public sector. It also provides on-line platform with working papers, articles, and post docs (Allarakhia M. 2011).²⁷ Another form of such a collaboration in research is the NIH Roadmap Initiative in USA and its European counterpart – EU-OPENSOURCE (Roy et al. 2011: 131-133). This initiative resulted in the emergence of probe discovery in Academia (Austin et al. 2004), as well as high throughput screening (HTS) centers harbored in universities all over USA, and also compound libraries like PubChem (Roy et al. 2010).²⁸ Another example of open innovation networking is Open-Source Drug Discovery initiative (OSDD.net). It is a computerized platform that allows over 3,500 scientists around the world to collaborate on the discovery of new antibiotics for tuberculosis. The platform was launched in 2008 by India’s Council for Scientific and Industrial Research. It runs with 5 full-time employees and an annual budget of 2 million USD. In 2010, 830 volunteers joined hands to re-annotate 85% of the genome of *Mycobacterium tuberculosis* in 4 months (an effort equivalent to 300 man-years of effort). It has identified 18 novel targets and several drug leads, which are being tested by clinical research organizations in its network (Munoz 2011).

Literature shows numerous examples of new R&D structures within pharmaceutical companies that aim at fostering open innovation dialogue with academia. It is noteworthy that they represent mainly basic research needed for the pre-discovery or early discovery stage (Roy et al. 2010: 132). Examples are the Eli

Lilly-PD2 Initiative,²⁹ Merck-Sage Bionetworks,³⁰ GSK-caBIG Collaboration and Structural Genomic Consortium (Roy et al. 2010: 133-134).

The third source of knowledge inflow is a result of different agreements between specific business players. This last type constitutes the body between the open and close concept. It is noteworthy that results of such relations is more in the type of a “club good” than of a public domain. Still, the openness in this issue appears in diffusion of knowledge between competing firms. Examples are licensing, joint R&D agreements, corporate venture capital, joint ventures and acquisitions (Herzog 2011: 39).

Opening the innovation process in the biotech or pharmaceutical industry and using common knowledge resources does not imply free medications and not-for profit activity of these companies. The knowledge flow presented in the hereby article provides benefits to all participants – creating both the ‘knowledge – common-pool resource’ and the innovations. There are numerous examples of profitable collaboration between ‘actors’ of open innovation paradigm.

²⁷ Novartis Repository <http://oak.novartis.com> [20.02.2014]

²⁸ For example NIH through its Roadmap initiative set up a Molecular Libraries Program (MLP) to help mine human genome and to explore new ways to study the functions of genes and signaling pathways. MLPCN, Molecular Libraries Probe Production Centers Network, as part of the MLP, provides academic researchers with an opportunity to perform large scale compound screening for identification of small molecules that can be optimized as probes.

²⁹ <https://openinnovation.lilly.com/dd/> [20.02.2014]

³⁰ <http://sagebase.org/> [20.02.2014]

Table 2. Representative drugs originating from 'open' collaboration

Product	Indication	Licensee	Sales in 2011 (in millions)	Licensor
Copaxone	Multiple Sclerosis	Teva	\$ 3,570	Weizmann Institute
Rebif	Multiple Sclerosis	Merck-Serono	Eur 1,691	Weizmann Institute
Exelon	Alzheimer	Novartis	\$1,067	Hebrew University
Doxil/Caelyx	Cancer	Scheering-Plough	\$ 320	Hebrew University and Hadassah Hospital
Azilect	Parkinson	Teva	\$290	Technion Medical Scholl
Erbitux	Cancer	Merck-Serono	EUR 855	Weizmann Institut
Procrit	Anemia	Johnson&Johnson	\$4,300*	University of Chicago
Epogen	Anemia	Kirin	\$2,300*	University of Chicago
Neupogen	Neutropenia	Kirin&Hoffmann-La Roche	\$1,400*	Memorial Sloan Kettering
Remicade	Antiphlogistic	Schering-Plough&Tanabe	\$1,300*	University of Munich
Rituxan	Cancer	Genetech and Zenyaku Kogyo	\$1,200*	Stanford University
Humulin	Diabetes	Eli Lilly	\$1,000*	University of California
Betaseron	Multiple Sclerosis	Schering AG	\$800*	Stanford University
Altima	Antifolic acid agent for oncology	Eli-Lilly	Na	Princeton University
Campath	mAb for B cell CLL	Genzyme	Na	Univ of Cambridge, MRC
ELMIRON	Glycosaminoglycan for bladder pain	J&J	Na	Univ of California
FluMist	Nasal influenza vaccine spray	MedImmune	Na	Univ of Michigan
Gardasil	HPV vaccine for cervical cancer	Merck	Na	KU, National Cancer Inst
Kepivance	Keratinocyte GF for oral mucositis	Amgen	Na	National Cancer Inst, NIH
LEUSTATIN	Antineoplastic agent for hairy cell leukemia	J&J	Na	Scripps, Brigham Young
Myozyme	alpha-glucosidase for Pompe disease	Genzyme	Na	Recomb Erasmus Univ Medical Ctr
NATRECOR	Hu B-type natriuretic peptide for CHF	J&J	Na	Washington University /Clinical Research Institute of Montréal
Nizoral	Ketoconazole for dandruff treatment	J&J	Na	Univ of Tennessee
Pepcid	Combination antacid & H2 antagonists for heartburn	J&J/Merck	Na	Brigham and Women's Hospital
Prezista (TMC114)	Protease inhibitor for HIV	J&J	Na	Univ of Illinois
PRO-CRIT®/EPREX® epoetin alfa	Anemia	J&J	Na	Univ of Chicago
REMICADE®: anti-TNF mAb	Immune disorders	J&J	Na	NYU

*2002 sales

Source: Levy (2011); Edwards et al. (2003); Roy et al. (2010: 133).

As shown in Table 2, the use of common pool resources with respect to the innovation creation can be a profitable activity. Open innovation often uses public-private partnerships as a solution that aims in fostering innovative activities. The role of innovative agents is played by public scientific institutions or universities. They create innovations as well as they owe the property rights to innovative solutions, thus they become licensors. As a consequence of that pharmaceutical companies become licensees.

Conclusion

The development of contemporary economies is to a large extent dependent on the development of knowledge. Costs of producing new knowledge, that would be vital to the economy, is high, and knowledge production investment returns are uncertain. In this situation closed innovation models, like linear innovation model, seem not to have much application value for contemporary enterprises. The characteristics of knowledge as a symbolic good - the possibility of its easy storage, its easy replication, high production cost of the first knowledge item, low replication cost - can be exploited thanks to computer technology. Thanks to the digitalization of symbolic goods the replication cost is close to zero, and the free access to knowledge creates the possibility of any modification and replenishment of the knowledge stored. These phenomena have been used in the open innovation process. As noted in this article, already the chain-linked-innovation model pointed to the necessity to use of knowledge alongside the whole innovation process. The open innovation idea has gone much further. Sharing the existing, private company's knowledge with other entities – giving free access to produced knowledge – is a profitable solution for both the firms' and other entities point of view. Each group of partners can bring new knowledge to the enterprise – universities, research institutes, researchers, clients and other firms. Universities are the entities that produce the knowledge in the form of publications – public basic research, and take part in different partnerships. Partnerships are also the base for creating the knowledge flow plat-

forms focused on specific industrial problems. Networking experts investigate the given problem and its possible solutions. There are many forms of this cooperation like public-private partnerships, outlicensing, outsourcing. The easy and digitalized circuit of available knowledge enables that process. It is possible mainly thanks to the symbolic character of knowledge, which empowers other resources in production process. Open innovation breaks the linear innovation model continuity and allows bringing the innovation (new idea) to every stage of innovation process. It also allows innovation to leave firm's boundaries on any stage of its creation. Open innovation means the disintegration of the innovation process. The examples of products being the results of opening the innovation process show how it is important for new, expensive technologies and products of a great social value to use knowledge as a common resource. It allows companies to lower the costs of new drugs. The drugs reach the market faster and they cost less as if they were produced in closed innovation model. And in this sense one can say that open innovation contributes to the objectives of sustainable development.

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Wspólne zasoby w modelu otwartej innowacji

Abstrakt:

Dynamiczny rozwój współczesnych gospodarek uwarunkowany jest przede wszystkim ich zdolnością do tworzenia innowacji. Liniowy proces innowacji prowadzi do powstania nowych rozwiązań dzięki funkcjonowaniu mechanizmu rynkowego. Skonstruowany jako triada działań: począwszy od sfery badań podstawowych, poprzez badania stosowane aż do rozwoju eksperymentalnego, w całości oddziałuje na rzadkie, prywatne zasoby i tworzy rzadkie, produkty (innowacje). Biorąc jednak pod uwagę ryzyko i wysoki koszt tworzenia innowacji, firmy coraz częściej rezygnują z liniowego modelu ich tworzenia na rzecz innych, mniej kosztownych i rozkładających ryzyko na większą liczbę uczestników. Przykładem może być tzw. „otwarta innowacja”, gdzie niepewność zwrotu inwestycji w działalność badawczą jest zmniejszana poprzez korzystanie z tzw. wspólnych zasobów.

Celem niniejszego artykułu jest ukazanie mechanizmu korzystania z wiedzy jako dobra wspólnego w celu tworzenia społecznie użytecznej wartości.

Słowa kluczowe : zamknięty model innowacji, otwarty model innowacji, dobra wspólne, wiedza, przemysł farmaceutyczny