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Original article

Innovations in sectors in the industrial approach

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ABSTRACT

The article presents the development of innovations from the perspective of specific sectors. Typologies of innovations in sectors have been indicated and the most important differences between them have been articulated. The article describes the sector dimensions in terms of innovation management. In addition, the influence of knowledge and technological possibilities on the development of innovations in particular sectors has been indicated. The article provides a description of individual entities, relations and institutions relevant for the implementation of innovations. The final section addresses the dynamics and transformation in sectors and indicates the possible political implications.

KEYWORDS

innovations, sectors, innovation management

Introduction

Innovations in various sectors vary appreciably. Indicators of sectors differentiation can be found in: features, sources of occurrence, entities involved, within the boundaries of processes and the way of organizing innovative activity. The article is based on the review of the subject literature and brief case studies. The aim of the work is to indicate the basic typology of the division of sectors with respect to the ways of implementing innovations, and to articulate the necessary elements that should be taken into consideration when planning innovative activities in sectors. In order to identify key variables affecting innovation, the issue should be viewed as a whole from the right perspective. Comparison of innovations in sectors indicates the existence of significant differences. It is also important to emphasize the major role of innovation in the dynamics and transformation of sectors.

1. Typologies of innovations in sectors

Innovativeness in sectors, in the context of economics, is manifested mainly through the following factors: intensity of R&D activity, market structure, coverage and profitability of R&D strategy, intensity of patenting activity or effectiveness of legal protection of patents. In order to fully understand the diversity of innovation in sectors, it is necessary to go beyond these factors and look at a sector from a further perspective. The literature on the subject highlights a certain division of sectors based on various dimensions according to the level of innovation and diffusion. The simplest and most frequently used (among others by the OECD and the EU) breakdown classifies sectors by the intensity of R&D activity. Sectors with high (e.g. pharmacology, electronics) and low (e.g. textiles) intensity of R&D activities have been indicated. Another approach is based on Schumpeter's work. The author points to differences in the structure of the market and the dynamics of industry in particular sectors. On this basis, two types of sectors have been distinguished. The first type sectors are characterized by the occurrence of creative destruction, the lack of technological barriers to enter a sector, and the influence of companies already operating and newly entering the sector on innovative activities. Creative destruction is expressed through the introduction of completely new ideas in business entities. As a result, new, significantly improved technologies replace previous ones. The machine industry and biotechnology can be given as an example of the first type sectors. Meanwhile, sectors of the second type are characterized by the occurrence of creative accumulation and large technological barriers to enter the sector. The second type puts large enterprises in a privileged position. Moreover, the characteristic feature of the second type sectors is the presence of only a few, general, major enterprises in a given market. An example is the semiconductor industry in the 1990s [1].

Another breakdown of innovativeness in sectors concerns the concept of technological conditions of innovation. Technological conditions relate to learning and gaining experience by a company. They apply to the company's process of solving problems in innovative activity, affect the company's technology implementation and learning model, shape specific behaviors and ways of organizing work, and influence basic processes in the company (including the dynamics of enterprise development) [2]. The technological conditions have been generalized and described in [3; 4] where it was noted that they depend on: possibilities and conditions of use, the degree of the accumulation of technological knowledge and the specificity of knowledge bases. It can be stated that technological possibilities manifest themselves through the probability of return on innovation investment. The probability level is proportional to the willingness to invest. This leads to a situation in which potential investors will often appear with breakthrough technological innovations. In addition, technological properties have a large impact on the innovative activity of enterprises. Technological knowledge is expressed through various levels of specification, complementarity and independence and can significantly differ between sectors. Technological conditions through their diversity create the shape of innovative sectoral activity. What is more, they can lead to innovations based on creative destruction or creative accumulation. It should be

emphasized that technological conditions are based on knowledge and technology. Both factors are of dynamic nature and change during the innovation process. Improving technologies and acquiring new knowledge results in more efficient and more efficient use of resources.

The typology proposed by Schumpeter and technological conditions transformed and evolved over time [1]. In the context of a product's life cycle, innovation based on creative destruction can turn into an innovation based on creative accumulation. The initial stages of sector development are characterized by rapid changes in technology and knowledge as well as by lack of or very low barriers to entry. This implies the actions of enterprises in an uncertain and dynamic environment. This favors companies that employ innovators. Then, the well-known models and diagrams: economies of scale, learning curve and barriers to entry (e.g. in the form of regulation) appear along with the development of the sector. They begin to play a significant role in the process of competitiveness together with financial resources. Therefore, large and monopolistic enterprises dominated in innovation [1]. In the next stage of the sector development characterized by wide access to knowledge, innovations based on creative accumulation can easily transform into innovations based on creative destruction. It is then possible to replace stable monopoly business groups with new ones applying modern technology or focusing on new needs [1; 5]. It supports the development of enterprises building their advantages with new ideas and innovations. Another typology of the division of innovations in sectors is based on the separation of technology suppliers and technology users. In the course of research on sectors, both groups were indicated, and then in [6] the analysis was extended and sectors were divided into: main – electronics, mechanics, pharmaceutics – generating the most innovations; side – metallurgy – playing the second role in innovativeness; usable – primarily services – mainly using technology.

The key differences between particular sectors come from sources of innovation and usability mechanisms. In [7], the classifications for innovation in four types of sectors are presented:

1) dominated by suppliers (textiles, services) – new technologies are included in new components and equipment, and the diffusion of innovation takes place through practice,
2) intensive (automotive, metallurgy) – it is believed that innovations are relevant and important, and their sources can be both internal (tacit knowledge, experience of qualified employees) as well as external (feedback on the user-producer line), moreover, innovations are patented and kept secret,
3) specialized suppliers (car equipment manufacturers) – innovations are to ensure improvement of efficiency and reliability, sources of innovation can be both internal (R&D) and external,
4) based on science (electronics, pharmacology) – a high percentage of process and product innovations, mainly internal innovations in the field of R&D realized at universities and public laboratories.

The aforementioned taxonomy of sectors in terms of innovativeness has been confirmed in later empirical studies. It helps to systematize enterprises and expose the strengths of regions or even whole countries.

2. Sectoral innovation systems

Sectors can also be analyzed from a multidimensional, integrated and dynamic perspective, leaving aside its differentiating factors. In this context, the structures of sectoral innovation systems are possible to identify. Such an approach allows for building a methodology for the analysis and comparison of sectors. From that point of view, the sector is perceived as a set of activities that merge with each other through product groups that satisfy existing or emerging demand and share common knowledge. Enterprises operating in one sector have both common and differentiating characteristics. The sectoral structure of the system divides the sector into three main dimensions:

1) knowledge and technology,
2) actors and cooperation networks,
3) regulations.

The first dimension includes a knowledge and technology base that can be distinguished in the sector. Moreover, this database is distinctive for a specific sector only. In the context of dynamic analysis, the emphasis on knowledge and technology manifests itself by examining the boundaries of the sector that change their shape smoothly over time.

The second dimension focuses on a sector as a whole consisting of different actors (organizations or individuals). Enterprises, other organizations (e.g. universities, government agencies, trade unions, etc.) and large structures within an organization (e.g. R&D department, production department, etc.) are included among actors operating in the sector. Entities have specific learning processes, competitors, beliefs, goals, organizational structures and behaviors. The mentioned elements mutually influence each other through communication, exchange, cooperation and management. In this respect, innovations should be perceived as a systematic process based on interactions between a wide range of actors aimed at generating and disseminating knowledge relevant to innovations and their commercialization.

The third dimension consists of norms, habits, rules, regulations, standards, etc. of different institutions. They affect actions and interactions of actors directly. The implemented regulations may be very rigorous, which strongly limits the diversity of innovation implementation. In addition, the legislators may have local or regional coverage.

Over time, a sectoral innovation system directed and powered by the common evolution of individual elements of the system is also subject to processes of transition and transformation. The concept of a sectoral innovation system complements other concepts of innovation presented in the literature [8]. Examples include: a national innovation system limited by state borders and focusing on the role of non-business entities [9; 10] conducting innovative activity, a regional innovation system with regional

boundaries [1], technological systems (focusing on common technology, not the sector) and a dispersed innovation system (focusing on specific innovation) [11]. It should be noted that a sectoral innovation system is not equivalent to a state system. A state system is confined with state borders, whereas a sectoral system may have a local, national or global dimension.

Both theoretical and analytical approaches to sectoral systems have their roots in the evolutionary theory. This theory emphasizes dynamic innovative processes and economic transformations. The most essential elements required for changes in economic systems to take place are learning and knowledge. The uncertain and dynamic environment, in which entities operate, implies the need to act in accordance with the theory of bounded rationality. Due to the diversity of experiences and competences, the performance and effectiveness of entities are not the same. The emphasis should also be placed on cognitive aspects (beliefs, convictions, expectations) that are determinants affecting the current activity of entities. Moreover, the creation of diversity (in terms of technology, production, enterprises and organization), replication (causing inertia of the system) and selection (reducing diversity in economic systems, inefficiency and ineffective use of resources) are of great importance. According to the evolutionary theory, advantage should be taken of the opportunities that link science and technology. The knowledge bases that underlie innovative activity are perceived in the same way.

3. Knowledge and technology in sectors

Knowledge is one of the most fundamental factors influencing innovative activity. The spread of knowledge (diffusion) does not occur automatically. The literature highlights significant differences in learning processes and knowledge bases depending on sectors. Knowledge in sectors varies in each sphere. In one area, knowledge may refer to a specific science or technology as the basis for innovation [1], while in another knowledge may describe users or demand for products from a specific sector. A characteristic feature of knowledge is the occurrence of different degrees of its use in economic practice [12]. Sources of knowledge may be both external and internal in relation to a sector. In both cases, high availability of knowledge may cause a drop in the concentration of industry. Higher internal availability of knowledge in a sector results in lower usefulness. Higher availability of knowledge enables competition to collect information about new products and processes. As a consequence of this process, the competition may imitate solutions of other companies. An access to external knowledge in relation to the sector refers to the possibility of obtaining information from outside the sector, e.g. about new technologies. Thus, the external environment in the form of, for example, universities or laboratories, may influence enterprises by means of knowledge and technology [12]. The possibilities and sources of acquiring advantages (opportunities) related to modern technology should also be emphasized. The technological strength can be achieved through work and research carried out at universities or advanced R&D activity or from external (in relation to the sector) sources, e.g. through the exchange of information with suppliers or consumers [1]. However, information from external sources may not always be easily used and trans-

formed into a finished product or process. It needs to be stressed that in the situation when external knowledge is available and easy to use (transformation), the probability of the emergence of innovation increases. By contrast, in the case when the integration of many capabilities and opportunities is necessary, the emergence of a concentrated industry dominated by large enterprises takes place [1].

Knowledge is expressed, among others, through the degree of accumulation. It describes the intensity of arising new ideas arise based on the current state of knowledge. The following types of knowledge accumulation can be distinguished:

1. Cognitive. The learning process and the current state of knowledge necessitate research and generate new questions and answers, which creates new knowledge.
2. Enterprises and their organizational possibilities. Enterprises generate the knowledge necessary to operate in a given sector. The state of desired knowledge and future achievable benefits are kept secret from the competition.
3. Feedback from the market. "Success breeds success" and, in a similar way, innovations bring revenues that can be reinvested in R&D activities, thus increasing the likelihood of implementing further innovations.

High cumulativeness affects the occurrence of high usefulness of innovation. Knowledge spills over into the entire industry, however, the phenomenon may also occur at the sector level or even locally. Cumulativeness at the level of an enterprise gives the advantage of priority and generates high concentration. By using the advantage of the first application of new knowledge, companies continue to work and implement incremental innovations.

The state of knowledge affects the shape of sector boundaries. The type and dynamics of demand strongly influence the process of sector transformation. The same applies to the relationship and complementarity of products and activities. They can be considered as both static and dynamic elements. In the first type they occur as input-output connections, while in the second type they are understood as interdependencies and feedback. They affect numerous factors in the sector (e.g. company strategies, structures, type of competition, etc.). Boundaries of sectors change more or less rapidly as a result of knowledge transformation, demand evolution and convergence, changes in enterprise learning and competitive activity.

4. Actors and cooperation networks

Sectors are built of various actors. The knowledge base, which is adequately rich, wide and multidisciplinary together with rapid technological changes encourage the creation of many different entities in the sector.

Enterprises are the main entities that create new knowledge through the adaptation and implementation of new technologies. Companies have specific organizational structures, procedures and organizational culture. It should be stressed that the process of learning and accumulating knowledge by enterprises continues uninterrupted throughout the enterprise's operations [1; 2; 13].

The entities influencing the innovation process in sectors include also consumers and suppliers. They differ from enterprises in types of relations with innovativeness, production and sales. Consumers and suppliers have specific properties, knowledge, competences and closer relations with producers [9; 14]. In a dynamic and innovative environment, it is the suppliers and consumers that have a big influence on shifting the boundaries of sectors. Another type of entities operating in sectors are organizations that are not enterprises (e.g. universities, government agencies, local government authorities). They support innovation and diffusion of technology, and their role varies depending on the sector in which they operate. In sectors with advanced technology, universities perform an important function in the spheres of basic research and human capital creation. In addition, they contribute to the emergence of start-ups or even innovations (e.g. in the biotechnology sector or computer science). From the perspective of consumers, government agencies and users, the role of demand is changing. From the point of view of a sector, demand is not perceived as the sum of collections of similar buyers or indivisible homogeneous consumers, but it consists of various entities that influence producers. Demand is created by individual consumers, enterprises and public institutions that are characterized by knowledge, learning and competence. The emergence and subsequent transformation of demand is a significant element affecting the dynamics and the evolution of sectors. Demand can also affect the change of sector boundaries, stimulating innovation and shaping the structure of enterprises.

Actors creating a sector are connected with each other through specific market and non-market relations. These relations can be looked at, among others, in the contexts of exchange, competition and management. However, it is worth considering them as cooperation in formal or informal terms, in particular as the following relations: enterprise-enterprise and enterprise-other entity. The scope of formal and informal relationships is very wide. Connection networks (relations) arise as a result of activity of diverse actors in an uncertain and dynamic environment. The created networks help to integrate the complementarity of knowledge, technological capabilities and the specialization of entities [See: 1; 8; 9].

It follows that each sector is characterized by specific types of relations and cooperation networks. These differences are the result of actors' actions in various environments (e.g. state of knowledge).

Differences are easy to note when comparing sectors: chemical, hardware (hardware), semiconductors and software.

Table 1. Comparison of sectors in the context of the innovation implementation model

Sector	Market model	Model of innovation implementation
Chemical	Centralized large enterprises	Creative accumulation
Hardware	Large enterprises	Creative accumulation and destruction
Semiconductors	Vertical integration of enterprises	Creative accumulation and destruction
Software	High specialization	Creative accumulation

Source: Own elaboration based on [1].

The chemical sector is dominated by centralized large enterprises, which are the main innovators. Nonetheless, innovations are implemented gradually. The competitive advantage is built due to large and expensive R&D departments, the use of economies of scale, the cumulative nature of knowledge and technology, and the possibilities of commercialization of ideas [1]. The innovation implementation model used in this sector is based on the scientific approach and knowledge, i.e. its accumulation. The development of new products and processes is based on the existing resource of knowledge and technological possibilities. The application of a synthetic dye that required work in R&D departments and universities is a good example of implementing an innovation based on such a model. At the beginning of the 1920s, the chemical sector changed its structure as a result of the use of polymers. In addition, the necessary knowledge in specific segments of a sector was so important that it contributed to the creation of direct relations between a company and a supplier. The accumulation of knowledge was followed by a deeper division of labor (specialization). Chemical enterprises were established as well as enterprises providing appropriate technology, which were strongly related to vertical relations. In addition, the role of industry and university cooperation increased.

The hardware sector developed in stages, which should be viewed from the perspective of actors and cooperation networks. The sector was dominated by the innovation model based on creative accumulation that favored large enterprises, which could develop technology and concentrate it due to large financial resources. Especially in the sixties and seventies of the twentieth century the sector was characterized by vertically integrated enterprises that produced subassemblies and then assembled computer systems. An example of such integration was International Business Machines Corporation.

IBM produced both computer parts (hardware) and created software. The invention of minicomputers was another breakthrough in the sector. In the effect of the implementation of a new class of computers, new enterprises, which specialized in the hardware production or software writing (the initial period of this activity it can be characterized as innovations of the type of creative destruction), were created. The invention of microcomputers brought similar results. Subsequently, the creation of various platforms (operating systems) resulted in a competition between individual large enterprises in the sector. As a consequence, the innovative activity took a decentralized form. Moreover, it is impossible to control a sector by one company. At present, the information exchange with a user plays an increasingly important role, which is made easier by the use of modern communication technology [1; 15].

In the case of the semiconductor sector, the difference resulting from the segment structure should be emphasized. Manufactured semiconductors were used in the next stage by vertically integrated enterprises. Entities participating in the semiconductor utilization process varied in the context of, inter alia, geographical location. The emergence of new enterprises in the sector was particularly important for the United States. In the initial phase of development, the semiconductor industry was based on sudden and radical changes (creative destruction). Large, vertically integrated enter-

prises were located in Japan and Europe [1; 16]. The economy in these countries is dependent on models of implementing innovations based on creative accumulation. The role of another entity, namely the armed forces, which in the USA had a big impact on the development of the economy, is worth noting. The military dominance was to be achieved by supporting innovative enterprises.

The software sector is characterized by the existence of highly developed specialization in both global and local enterprises. The development of technology has led to the division of the sector into users, programmers and producers of specialized software [1]. The application of specialized programming languages corresponds to innovations based on creative accumulation. In addition, nowadays the use of tools for communication has made it possible to implement a remote work mode, which changes the shape of enterprises and the relationship in the discussed sector.

5. Regulations

All sectors are characterized by the fact that institutions severely impact the speed of technological change occurrence, the organization of innovative activities and the innovation implementation. They may occur as a result of both prudent and planned decisions and actions of enterprises or institutions or as unforeseen consequences of the interaction of entities. Formal and legal regulations are tools used by the institutions. These regulations may have coverage limited only to a given sector or cover a given region. Sector-institutions relationships are important and have different impacts on the sector.

Examples of regulations that have been empirically tested are patent systems, property rights or anti-trust regulations [1]. They evoke various effects and consequences in functional sectors of sectors. Appropriate regulations create an environment that encourages and favors the development of particular sectors. It should be stressed that the relationship between state institutions and sector enterprises is not always one-directional. A reverse relationship, i.e. from a sector to an institution, may appear. This is particularly noticeable when enterprises operating in a given sector are critical to the functioning of the state.

Table 2. Regulations in selected sectors

Sector	Impact of regulations
Pharmaceutical	Formalized, likely to block or delay the implementation of innovations
Software	Standardization
Machine tool industry	Local cooperation
Telecommunication	Standardization and liberalization

Source: Own elaboration based on [1].

With a view to showing differences in the impact of regulations on sectors, the following sectors: pharmaceutical, software, machine tool industry and telecommunication

can be compared. In the first case, the national health system and regulations influence the direction of technological changes. The key nature of the sector means that regulations may sometimes block or delay innovations. In the software sector, standards and intellectual property rights have a decisive influence. However, it should be emphasized, that the emergence of an open source model aimed at creating a new segment characterized by other models of distribution and cooperation, causes difficulties in controlling property rights, and hence competitiveness increases. While in the machine tool sector the internal and regional labor market and local institutions have a huge impact. The long-term financing of innovative enterprises and the possibility of building family businesses are based on trust and close relations at the regional level. In the telecommunication sector, regulations, standards and liberalization (privatization) are essential. The sector is strictly regulated to optimize the exchange.

6. Dynamics and transformations in sectors

The dynamics and transformation of sectors is the resultant of a joint impact of development (evolutionary) processes in sectors. Diversity creation may relate to products, technologies, enterprises, institutions as well as company strategies, R&D activities and innovations. The creation of new entities is particularly important from the perspective of sector dynamics. According to the research [17; 18], the impact of new enterprises varies depending on the sector they represent. Differences in types and intensity of appearance of new enterprises are strongly integrated with the knowledge base, diffusion and distribution of competences as well as activities of non-companies and institutions [1; 17-19]. The processes associated with the selection affect the reduction of the diversity of enterprises. This may result in the disappearance of ineffective or slower developing enterprises. Selection can be about product, business or technology. It should be added that some sectors operate in the non-market sphere, e.g. enterprises related to the armed forces or health services. Summing up, the selection process affects the development and limits the entities' diversity, range and mode of operation. The common evolution of processes taking place between particular elements, among others: knowledge, technology, entities and institutions, contributes to the emergence of changes in sectors. These processes were discussed in [1] and [20] where the authors focused on the interaction between technology, the structure of the industry, institutions and demand.

The development of technological capabilities and knowledge causes changes in organizational structures and in relations between entities. Generalizing both competition and market structure depend on the strategy of individual enterprises. Companies react to changes in the environment trying to better adapt to the existing situation and increase the chance of making a profit, i.e. survive in the market. The emergence of new products and clusters in sectors such as Internet-software-telecommunications or biotechnology-pharmacology is a key process in the transformation of sectors. It is in clusters that integration and the merger of previously separated knowledge and technologies play a major role. What is more, emerging new relationships between users,

consumers, enterprises and organizations has also a positive effect on the development of concentrating the space of a group of entities.

7. Political implications

Moreover, a malfunctioning system is identified as part of the innovation system. This involves identifying inappropriate or ineffective processes that are likely to lead to problems with e.g. performance. After the causes of a specific problem (e.g. poor technology transfer from a university to the industry) have been found, it is possible to identify a system of deficiencies. Only knowing its nature, politicians can influence or change organizations or institutions and interactions between them. Therefore, identification of problems should be supported by the analysis of their causes.

The industrial approach ensures identification of shortcomings and problems, the repair of which ought to be a political goal. The analysis should be based on system functions in such dimensions as knowledge, boundaries, diversity of entities and networks, institutions and transformations. Understanding processes that take place at different levels is a key condition for creating an optimal policy for a specific sector.

Furthermore, in this respect, sectors should be considered in the context of their multidimensionality (including geographic). Development at many levels: local, national, regional or global influences the perception of technological possibilities. When attention is focused only on one level, threats and opportunities that strongly affect the innovative behavior of individual enterprises may not be seen.

Summing up, traditional innovation policy appeared in response to the need to provide public funds for R&D activity, grants for innovation and positive incentives for enterprises to stimulate their innovativeness. Examples of such policies include: tax incentives for R&D activity, subsidies and patent systems. Increasing expenditures on public and private R&D activity will almost always be the effect of improving the innovation system organization in a sector. When analyzing innovations from the perspective of sectors, politicians use a tool to help understand differences in innovation systems and identify entities to be affected. This approach requires a much greater effort on the part of politicians [1]. Various tools used to analyze innovations in sectors will allow for the optimization of their management, which will positively affect growth and economic development.

8. Challenges

The sectors should be perceived considering their geographical boundaries. It should be borne in mind that state borders are not always the most appropriate for analyzing sectors in terms of their structure, entities or development. Sectors are often characterized by geographical focus, and they can also define the specialty of a given region. Route 128 (the sector of minicomputers) and Silicon Valley (sectors: PCs, software and electronics) best exemplify such a phenomenon [14]. Moreover, in the aspect of international economic integration, sectors mean as much or even more as national systems.

The differences between sectors are important and affect economies of countries. In general, states without well-functioning sectors will not operate well on the international market. The same applies to states trying to copy the success of world leaders by imitating selected elements of sectors without having appropriate entities, connections and institutions. By contrast, countries trying to specialize in subsectors (e.g. product or knowledge) that match their specific national characteristics are successful.

Conclusions

In summary, the following conclusions can be drawn:

1. The analysis of innovativeness can be carried out in sectors at various levels, including: knowledge and the learning process (acquisition of experience), technological capabilities, the structure (connection networks) and formal and legal regulations. In addition, the dynamics of innovation and the sharing of knowledge should be analyzed. In order to make it easier to find similarities in particular sectors, they should be compared in the appropriate dimensions.
2. Research should focus on relations, cause-and-effect relationships and interactions occurring between the variables that make up the sector. The basic relationships between elements of a sector, the emergence and operation of networks as well as processes leading to diversity and co-evolution should be analyzed.
3. Defining the type of sector in which the company operates in terms of the Schumpeter typology should start building an appropriate model of innovation implementation in a given enterprise. This will enable the application of right tools, and better understand the innovative activity. In addition, it will help to find threats and opportunities.
4. New research should focus on:
   – the extent and characteristics of the diversity of enterprises in a sector and related processes,
   – demand, in the dimensions of: creation, structure and innovation process,
   – networks in the dimensions of: formation, participants, structure and development,
   – co-development of various elements of a sector,
   – institutions, from the perspective of creation and role in a sector.

A full understanding of the determinants, properties and effects of innovations in sectors requires the integration of various types of analyzes (descriptive, quantitative, econometric and theoretical). Understanding the nature of innovation in sectors will make it easier to manage it optimally.

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Conflict of interests

The author declared no conflict of interests.

Author contributions

The author contributed to the interpretation of results and writing of the paper. The author read and approved the final manuscript.

Ethical statement

The research complies with all national and international ethical requirements.

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	Innowacje w sektorach w ujęciu branżowym
STRESZCZENIE	W artykule przedstawiono rozwój innowacji z perspektywy sektorów. Wskazano typologie innowacji w sektorach oraz wyartykułowano najważniejsze różnice między nimi. W pracy zawarto opis modelu sektora w ujęciu zarządzania innowacjami. Ponadto wskazano wpływ wiedzy i technologii na rozwój innowacji w poszczególnych sektorach. Artykuł zawiera opis poszczególnych podmiotów, relacji oraz instytucji istotnych z perspektywy wdrażania innowacji. W końcowej części opisano dynamikę oraz transformacje w sektorach oraz wskazano możliwe implikacje polityczne.
SŁOWA KLUCZOWE	innowacje, sektory, zarządzanie innowacjami

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