Innovations and Innovations of the Future in Selected Companies

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The key factor enabling the development of modern enterprises is innovation resulting mainly from new technologies. Scientific literature has distinguished various types of innovation, such as product, process, marketing and organizational, and at the same time, their sources: endogenous or exogenous, including domestic or foreign. Current innovations must be accompanied by actions aimed at defining innovations of the future, which cover a wide range of disciplines, such as information and communication technologies, renewable energy, medicine, education or transport. Own research conducted in the construction sector indicates the predominance of organizational innovations and planned innovations of the future related mainly to renewable energy, information and communication technologies and logistics. Further research on innovations of the future is necessary for a better understanding of innovation processes and their potential impact on social and economic changes. Consistent development of innovation strategies will be particularly important, including analysis of the impact of various factors on the level of innovation, which should contribute to building sustainable and more efficient economies.

Keywords: innovations, future innovations, new technologies, construction

INTRODUCTION

The modern economy is based on innovations, which are a key factor enabling the development of enterprises. According to various definitions, innovation can be called the introduction of a new product, service, process or organizational method that will generate changes in organizations. These changes are necessary for progress at the level of a country, region or individual entity. Scientific literature distinguishes various types of innovations, such as product, process, marketing and organizational innovations, as well as creative or imitative-adaptive innovations. The sources of innovation can be internal or external, including domestic or foreign. The innovative approach is crucial for the future of the economy, especially in the context of the development of new technologies that support the low-emission economy. Innovations of the future cover a wide range of fields, such as information and communication technologies, renewable energy, education, medicine and transport.

The article aimed to determine the expected areas of future innovation in construction companies from the Wielkopolska province. The survey and graphic methods were adopted as the main research methods. The subject of the research was the innovations of the future, and the subject was construction companies. To achieve the research goal, the following research problems were adopted:

1. What types of innovations are implemented by construction companies in Greater Poland?
2. What are the areas of planned future innovation?
3. What types of future innovations are planned in the surveyed entities?

The empirical basis for our research was regional measurements in the Wielkopolska province carried out in 2023. The research conducted in the construction sector indicates the predominance of organizational innovations and planned innovations of the future related mainly to renewable energy, information and communication technologies and logistics. Further investments in research and development will be necessary to maintain the competitiveness of the construction industry and to meet changing market needs.

INNOVATION AND INNOVATIVE ENTERPRISE

The development of the modern economy takes place thanks to financial capital, environmental resources, and human capital, and also thanks to the innovative activities of companies that generate and implement changes in organizations, based on research using new technologies. Progress is the most important factor enabling changes at the level of a country, region or individual entity.

According to M. Kożuch, innovation will be the implementation in economic practice of a significantly improved or new product, service, process or new organizational method [Kożuch, 2018, p. 66]. The very concept of innovation means creating something new [Radomska, 2015, p. 65]. The creator of the theory of innovation is J. Schumpeter, who related this concept to the introduction of a new product, a new production method, a new solution in the field of sales and to the change of organization [Schumpeter, 1960, p. 104]. This author clearly distinguished the entrepreneur and the inventor, claiming that the invention is of no importance until it is used in practice. In his opinion, innovation means the introduction of a new solution to practice.

According to WM Grudzewski and IK Hejduk, innovation can be any thought, behaviour or thing that is new, i.e. different from the existing ones [Grudzewski, Heiduk, 2000, p. 139]. J. Baruk, on the other hand, believes that an innovation is a deliberately designed change concerning a product, work organization management or production methods, such that has been applied for the first time in a given enterprise to achieve socio-economic benefits [Baruk, 2002, pp. 54-55]. Innovation can also mean an original solution to a problem that will enable achieving a competitive advantage in the market [Godecki, Mamica, 2014, p. 13].

The above definitions indicate the following types of innovation: product, process, marketing and organizational, and in terms of originality of changes: creative or imitative-adaptive innovations; moreover, about the reason for the occurrence of innovations, we can distinguish: demand-side and supply-side innovations [Penc, 2012, pp. 142-143].

Product innovation means introducing a new product or a new service to the market. In the scope of services, it will be the introduction of significant improvements in the way they are provided, the introduction of new services or the addition of modernized functions to existing ones [Baczko, 2018, p. 234].

Process innovation refers to production methods, as well as the distribution of products and services. These innovations include new and significantly improved techniques, devices, software in supply, accounting, IT services and improvements in maintenance work [Mazur-Wierzbicka, 2015, p. 100]. Organizational innovations consist in implementing new organizational methods in the principles of the company's operation, for example, the introduction of knowledge management, as well as in the principles of the organization of the workplace and relations with the environment. Organizational innovations should be the result of strategic decisions of the management staff [Pypłacz, 2017, pp. 22-23].

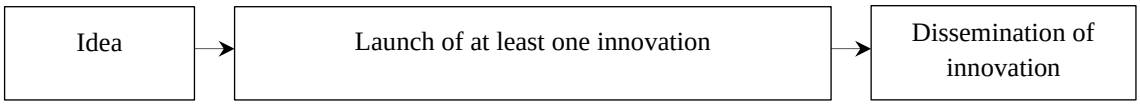
Marketing innovations consist in implementing a new marketing strategy that differs significantly from the one used so far (changes in *product design*, packaging, promotion, pricing and product distribution). These innovations aim to meet customer needs better in terms of quality or price, introduce new principles of product positioning, and open new sales markets [Sławińska, 2015, p. 163].

For this study, the following definition of innovation was adopted: "implementation in business practice of an improved or new product, service, process or new organizational method". Another concept that requires explanation is the sources of innovation. These can be divided into internal (endogenous) and external (exogenous) sources, as well as domestic and foreign sources [Radomska, 2015, p. 68].

Endogenous sources are mainly the company's work, such as invention projects and marketing research. Exogenous sources of innovation are research and development solutions created by public research institutions, as well as universities and business entities that engage in this activity in addition to the basic one (industrial enterprises with their research centre) [Rojek, 2021, p. 89].

Foreign external sources of innovation are solutions originating from research and development institutions that deal with knowledge transfer and import of machines and technological lines [Baran, Kłos 2007, p. 316]. Such sources of innovation include: licenses and know-how, solutions contributed within *a joint venture*, strategic alliance, franchise, production contract, *outsourcing*, and participation in research and development projects [Janasz, Kozioł 2007, p. 29]. Another concept that requires explanation is the so-called innovative enterprise. According to P. Nowakowska, an innovative enterprise is one that, in a period of usually three years, has led to the introduction of at least one innovation to the market – FIGURE 1.

FIGURE 1
THREE PHASES DISTINGUISHED IN THE PROCESS OF INNOVATIVE CHANGES



Nowakowska, 2021, p. 42

An innovative enterprise can be active in terms of innovation or innovation. This division concerns the activity of the enterprise in the field of innovation. An innovative enterprise means a company that has introduced or implemented at least one innovative project in the period under review; this project may have been interrupted or abandoned (not completed). On the other hand, an innovative enterprise is a company that has introduced at least one product or process innovation to the market (in the period under review) [Oksanych, 2015, p. 44]. In this situation, the condition for the enterprise's innovativeness was considered to be the need to implement a new product, service, or process - in practice, then commercialize it and take care of the acceptance of the environment to which this innovation was directed (Popławski, 2007, p. 103).

Innovation is also associated with such concepts as absorption and diffusion of innovation and knowledge transfer. Absorption of innovation is the process of its assimilation by a specific entity, and diffusion of innovation is its dissemination in the place of first implementation, as well as in other markets. Knowledge transfer consists of the multilateral flow of information across the boundaries of science, technology and the practical world, which contributes to the development of innovation [Niedzielski, Markiewicz, Rychlik, Rzewuski 2007, p. 15].

An innovative enterprise should be characterized by the following features [Radomska, 2015, pp. 71-72]:

- building and using innovative potential,
- developing employee competencies,
- using a motivational system that activates innovative attitudes,
- shaping an innovation culture among employees,
- effective knowledge management in innovation processes,
- openness to new concepts, perceiving innovation as an opportunity to increase competitiveness,
- monitoring the environment and flexibly responding to changes,
- conducting research and development work, introducing innovative products,
- allocating high financial outlays for innovative activities,
- taking the risk of investing in innovation,
- searching for and implementing new ideas or inventions,

- involving customers in the process of creating a new market offer,
- cooperation with research and development units,
- recognizing human capital as an important element in strengthening innovation,

Innovation and innovative enterprises are key factors enabling the development of a country, region or individual entity. Innovations of the future will be particularly important. It is increasingly said that industry can once again become a stabilizer of the economy and a driving force of development, but one that will be based on new, innovative technologies that support a low-emission economy. In the EU's long-term development plans, terms such as industrial renaissance or re-industrialization appear [Kożuch, 2018, pp. 66-67].

INNOVATIONS OF THE FUTURE

In an era of dynamic changes in the production and services market, innovative activities are becoming essential to achieve market advantage. New technologies are becoming increasingly important, allowing the creation of innovative products and changes in ways of thinking that promote creativity, and thus adaptation to new conditions. Innovations of the future cover a very wide range of fields: from information and communication technologies, through renewable energy, and medicine, to transport or education. Examples of such innovations include artificial intelligence, biotechnology, blockchain or electric cars [Lewicki, 2021, pp. 149-150].

The key factor stimulating innovation in the future will be cooperation between different sectors, as well as interdisciplinarity. Cooperation between science, business and administration will enable faster transfer of technology from the laboratory to practice. Interdisciplinarity will enable looking at different problems from different perspectives, which will consequently lead to the creation of innovative solutions [Łukasiewicz-Wieleba, Jabłońska, 2022, p. 160]. Education is also an important factor influencing innovation of the future. Introducing new teaching methods, teaching the principles of critical thinking and promoting innovation and entrepreneurship from an early age will be key to stimulating social potential.

Interesting observations on the subject of future innovations were presented by T. Cowen [2011, pp. 43-49], who focused on the analysis of the decline in the dynamics of economic growth. The author drew attention to the problem of access to innovations. In his opinion, the further development of the global ICT network will be perceived as an important area of most innovations, which will lead to the development of new areas of computer science, such as augmented reality or artificial intelligence. However, in this case, the dominant model is that these innovations will be available to an increasingly narrow group of people (with an appropriate level of income and high level of education). Such people will achieve economic profit from them, but it will be only 10-20% of the population. This situation means that the market for future innovations will shrink, and economies that were based on such innovations will begin to lose importance.

ANALYSIS OF INNOVATIONS AND FUTURE INNOVATIONS IN SELECTED ENTERPRISES

Own Research Methodology

The article aims to determine the expected areas of future innovation in construction companies from the Wielkopolska province. The main research methods adopted were the survey and graphic methods. The subject of the research is the innovation of the future, and the subject is construction companies.

To achieve the research objective, the following research problems were adopted:

1. What types of innovations are implemented by construction companies in Greater Poland?
2. What are the areas of planned future innovation?
3. What types of future innovations are planned in the surveyed entities?

The definition of the research objective was taken from the observations of K. Kowalska [2016, p. 9], as a certain scientific knowledge of reality, a description of a phenomenon, an individual, or an institution. The subject of the research was adopted based on the definition of AW Maszke [2004, p. 44],

as a phenomenon that is subject to specific changes and based on which it is possible to formulate research problems, which were adopted based on the definition of K. Kucinski [2010, p. 84], as a set of questions or a question that will be answered in the final stage of the research. Among the research methods used in this study, the self-return survey method was adopted [Skarbek, 2013, p. 72], consisting in sending previously prepared questionnaires to selected enterprises by e-mail with a request to return them after completing them.

The empirical basis for the research was regional measurements in the Wielkopolska voivodeship, carried out in 2023.

INNOVATIONS IN CONSTRUCTION

The final analysis included 80 correctly completed surveys from construction companies employing more than 50 people (a total of 5,136 people) – Table 1.

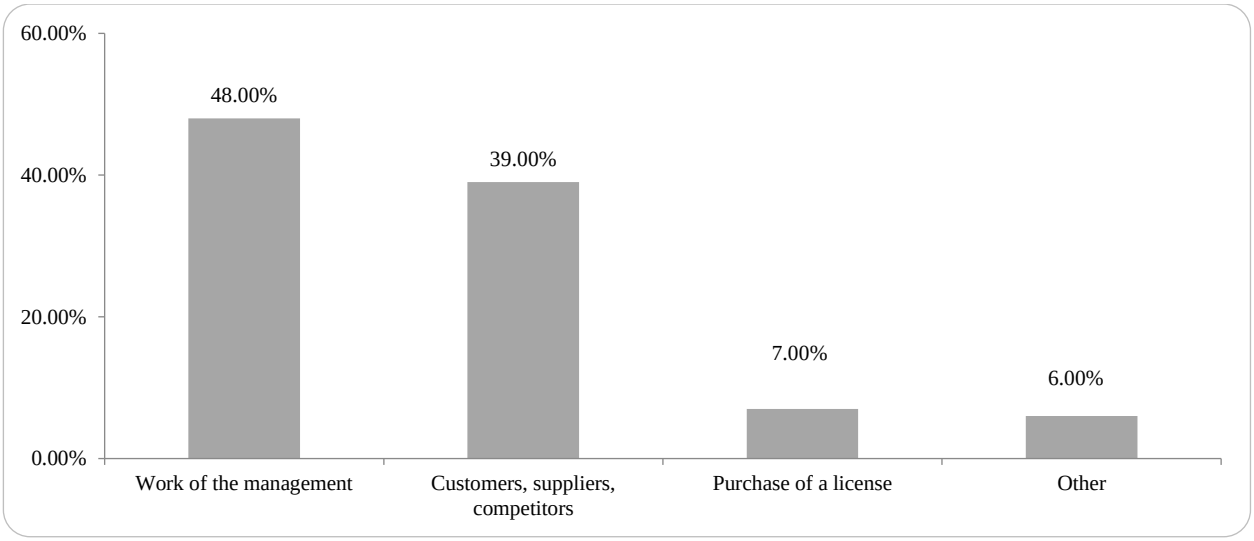
TABLE 1
SUMMARY OF SURVEY RESULTS FROM OWN RESEARCH

LP.	QUESTION	VARIABLES	EMPLOYEES IN THE SURVEYED COMPANIES (5136)	
			number	%
1.	Age	Under 40 years old	3015	58.71
		Over 40 years old	2121	41.29
2.	Sex	Woman	2517	49.00
		Man	2619	51.00
3.	Education	Higher	1004	19.54
		Other	4132	80.46
4.	Sources of innovation	The work of management staff	2465	48.00
		Customers, suppliers, competitors	2003	39.00
		Purchase of license	360	7.00
		Other	308	6.00
5.	Annual number of implemented innovations	1-3	5008	97.50
		4-6	103	2.00
		Above 6	25	0.50
6.	Type of implemented innovations	Product	192	3.74
		Process	32	0.62
		Marketing	1241	24.16
		Organizational	3139	61.12
		Imitation-adaptive	532	10.36

7.	Areas of Planned Future Innovations	Information and communication technologies	1264	24.61
		Renewable energy	2342	45.60
		Logistics	978	19.04
		Artificial intelligence	320	6.23
		Decentralized Data Registry	232	4.52
8.	Type of planned future innovations	Robotics	132	2.57
		5G connectivity	2821	54.93
		Smart sensors	1813	35.30
		Intelligent production or service implementation systems	176	3.43
		Augmented reality	28	0.55
		Digital twin	89	1.73
		Analytics	23	0.45
		Additive manufacturing	54	1.05

The number of employees in the surveyed entities amounted to 5136 people in total, of whom 58.71% were over 40, and 41.29% were under 40. The majority of employees were men (51%). People with higher education constituted 19.54%, and 80.46% were with the rest. The main source of innovation in the surveyed entities was the work of management staff (48.00%), followed by: customers, suppliers, competitors (39.00%) and others 13% - FIGURE 2.

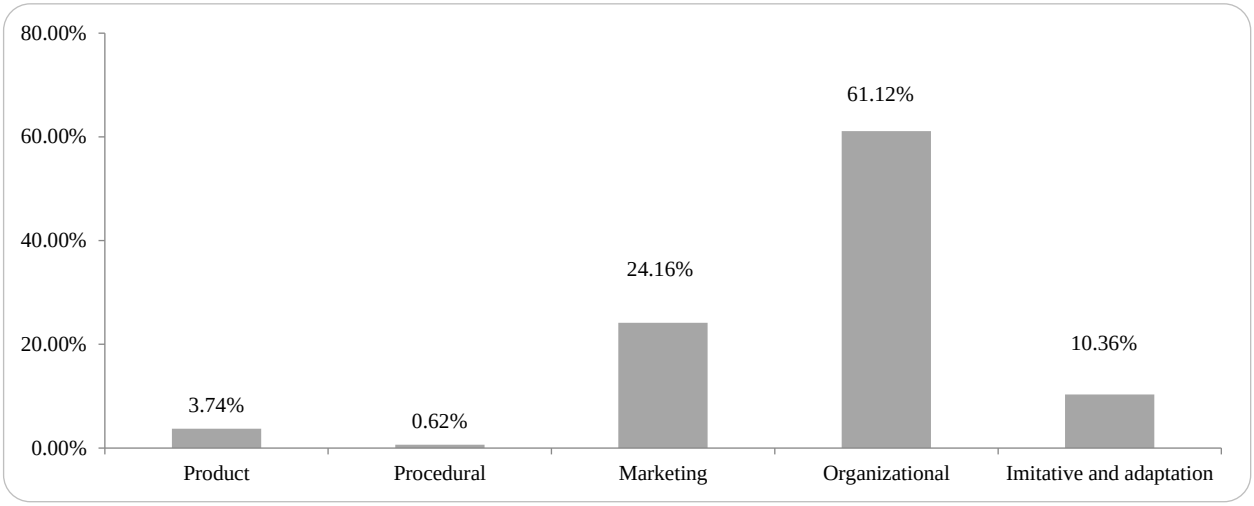
FIGURE 2
MAIN SOURCES OF INNOVATION IN THE SURVEYED ENTITIES



Own study based on table 1

Virtually all surveyed enterprises fall within the range of 1 to 3 implemented innovations per year. The most frequently mentioned type of implemented innovation was organizational innovation (61.12%), followed by: marketing innovation (24.16%), imitative-adaptive innovation (10.36%), product innovation (3.74%) and process innovation (0.62%) – FIGURE 3.

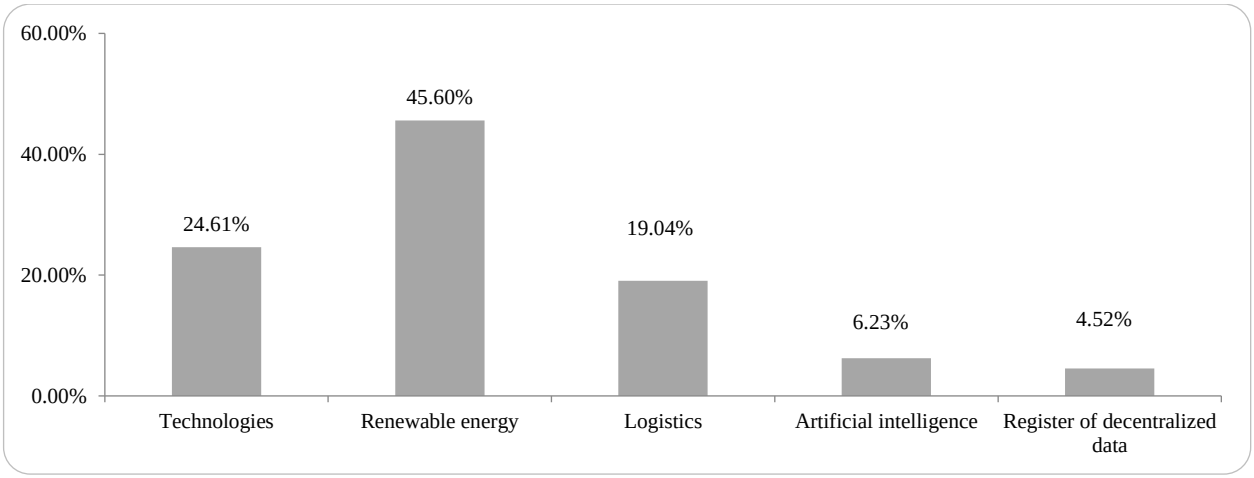
FIGURE 3
THE MOST FREQUENTLY MENTIONED TYPES OF IMPLEMENTED INNOVATIONS



Own study based on table 1

Among the areas of planned future innovations, respondents most often indicated renewable energy (45.60%), information and communication technologies (24.61%) and logistics (19.04%). Significantly less attention was paid to artificial intelligence (6.23%) and the register of decentralized data (4.52%) – FIGURE 4.

FIGURE 4
AREAS OF PLANNED INNOVATIONS OF THE FUTURE

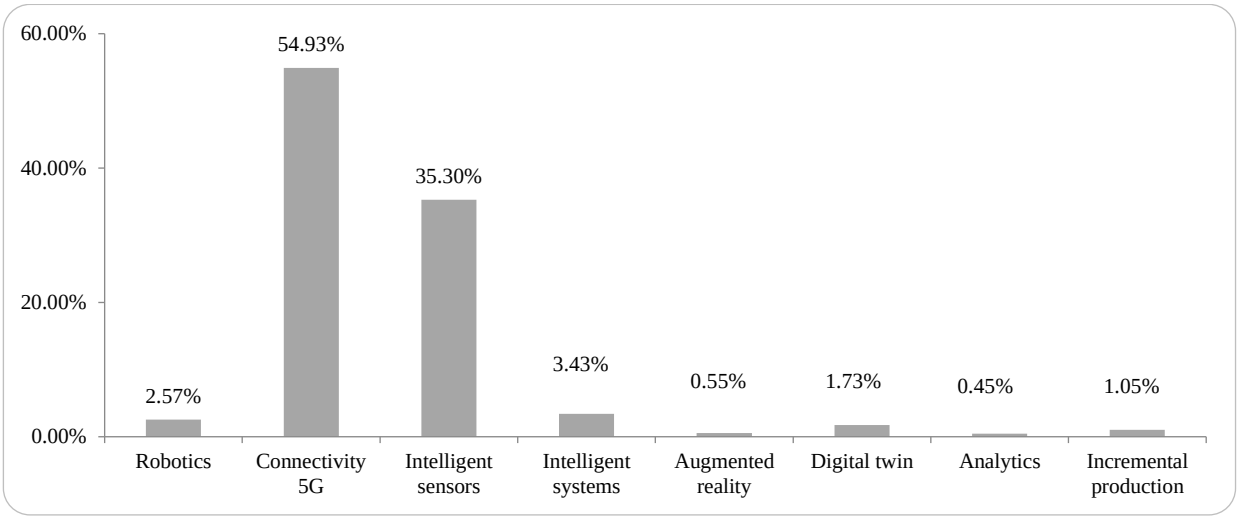


Own study based on table 1

The most popular types of planned future innovations were 5G connectivity (54.93%) and intelligent sensors (35.30%), with less attention paid to such future innovations as intelligent production or service

delivery systems (3.43%), robotics (2.57%), digital twin (1.73%), additive manufacturing (1.05%), augmented reality (0.55%) and analytics (0.45%) – FIGURE 5.

FIGURE 5
TYPES OF PLANNED INNOVATIONS OF THE FUTURE



Own study based on table 1

DISCUSSION

Innovations in construction make the industry more productive, and more efficient but also improve the quality of services provided in design and construction. Thanks to them, companies can gain a competitive advantage and meet customer requirements. This is almost always associated with changes in companies, as well as with taking risks and creativity. We can say that innovation is the real engine of progress. As a result of the occurrence of innovative inventions, humanity has made extraordinary leaps in the field of technology, building materials, devices and machines. Discoveries were a response to needs or shortages. They were usually based on the knowledge of engineers from the past. It is similar today. Construction trends are shaped in connection with changes in the geopolitical situation, environmental challenges and the socio-economic situation.

Morzywołek wrote extensively about advanced technologies based on information systems, robotics and automation, which led to the creation of a special unit dealing exclusively with the analysis of the efficiency of new technologies and their impact on the environment. This department has made many patented implementations, for example, the introduction of universal digitization has facilitated and accelerated the management of the construction process and minimized the use of paper in document circulation. This type of innovation is also emphasized by the surveyed companies, which put organizational and imitative-adaptive innovations in the first place [Morzywołek 2023, p. 25].

Research on innovations related to robotics in construction was conducted by T. Bock and T. Linner [2017] and B. Chu, K. Jung, MT Lim, D. Hong [2013], as well as R. Marcinkowski and A. Krawczyńska-Piechna and S. Biruk [2018]. These researchers emphasized the importance of innovations in the field of automatic machine control systems and spatial printing of buildings (automatic building construction systems). In this study, the surveyed companies do not appreciate the importance of these innovations, placing robotics only in fourth place, after 5G connectivity, intelligent sensors and intelligent production or service implementation systems.

5G connectivity is a very important element of the exchange of information and images between designers and contractors in construction. The possibility of innovative solutions in connection with this indicator is invaluable, for example, the guarantee of transmission quality, the use of multiple access

techniques, the ability to receive and send data at the same time (*full duplex*), the use of cloud computing [Krupanek, Bogacz 2024, pp. 188-191].

On intelligent sensors, such as: photonic for special applications, for industry 4.0 and robotics and in Smart City monitoring, regarding their wide application in construction [Błach- Morysińska, Bogdanowicz, 2022]. Intelligent sensors were ranked second in terms of the type of planned future innovations, according to our own research. The choice of this future innovation is associated with the digitization of industry, technological progress in the field of materials engineering, the increase in the computing power of processors and progress in the field of artificial intelligence algorithms. Intelligent production or service implementation systems, augmented reality, digital twin, analytics and additive manufacturing - did not find interest among employees of the surveyed companies, although M. Okuń considers these aspects of future innovations in construction to be a priority (3D printing, drones, Internet of Things, digital twin, analytics) [Okuń, 2023, p. 24].

CONCLUSION

The research conducted on innovation and innovation of the future in construction companies shows that organizational innovations are most often implemented, and the expected innovations of the future focus mainly on renewable energy, as well as information and communication technologies and logistics. In the companies surveyed, the most important source of innovation is the work of management staff, although the influence of customers, suppliers and competition on innovation activities is also noticed. The review of scientific literature shows that innovations, especially those related to 5G connectivity, robotics, intelligent sensors and other technologies, play an important role in the development of the construction industry. However, the surveyed companies do not seem to see the full potential of these innovations. It can also be observed that interdisciplinary cooperation and education will be key factors influencing innovation in the future. For this reason, to enable the development of innovative activities in construction companies, it is necessary to initially increase employee awareness of new technologies and encourage them to cooperate between different sectors.

The solution to the research problems posed at the beginning, in the form of:

1. The following types of innovations are implemented by construction companies in Greater Poland: organizational, marketing and imitation-adaptive.
2. The areas of planned future innovations include renewable energy, information and communication technologies and logistics.
3. Future innovations planned in the surveyed entities include the following areas: 5G connectivity, intelligent sensors, intelligent production or service implementation systems, and robotics.

Objective was achieved as the expected areas of future innovation in the surveyed enterprises were identified.

The research also showed the importance of innovation for the development of this industry. However, there is potential for more conscious development, especially in areas related to new technologies, which have the potential to change the way buildings are built and used. In the future, these innovations will play a key role in creating (designing) more efficient, sustainable and intelligent buildings, as well as accompanying infrastructure. For this reason, construction companies should continue and increase their investments in research and development to remain competitive in local and global markets, to meet changing standards and customer needs. Innovations of the future may be the key to the development of the construction industry and may also contribute to creating better living conditions for societies.

A continuation of research related to future innovations will be the factors that influence the choice of directions for conducting innovative activities in construction.

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