

Factors Influencing Innovative Activities in Selected Enterprises

Jacek Piotr Kwasniewski
MBA Business School in Bydgoszcz

The article aims to analyze the factors influencing innovative activities in construction companies in Wielkopolska. As a key strategic element, innovation plays an important role in ensuring competitiveness in a dynamically developing market environment. The research was conducted on a sample of 80 companies and 5136 employees, focusing on financial outlays on innovation, technological advancement and modern material techniques. In particular, attention was paid to the relationships between these factors, the inclination to undertake innovative activities, and the influence of sociodemographic variables (gender, age, education) on the approach to innovation. The statistical analysis results showed significant correlations, confirming the importance of appropriate investments and technological resources in stimulating innovative activity. The research that was conducted emphasizes the need for further monitoring of innovation factors and adapting companies' strategies to the changing market and technological context, which can contribute to the sustainable development of the construction sector in Poland.

Keywords: innovation, innovation activities, enterprise, innovation factors

INTRODUCTION

This article is a continuation of research on innovation and future innovations. Because innovations play a strategic role in the success of enterprises in a dynamically changing market, only original, innovative and sometimes risky actions can give them a competitive advantage. This article analyzes the main factors that influence innovative activities in enterprises to a greater or lesser extent. Particular attention was paid to factors influencing innovative activities in construction, among which those that can shape the construction of the future were analyzed, mainly technological and economic factors, such as financial outlay on innovative activities, technological advancement (digitalization and automation of processes) and advancement in the use of modern material techniques (ecological, energy-saving and efficient). These factors were confronted with sociodemographic factors, such as: gender, age and education of employees. Other factors, such as cultural, climate change, and extreme weather phenomena, equally important, were omitted due to the limited volume of the article.

The article aimed to learn about and verify the factors influencing innovative activities in construction using the example of construction companies in Wielkopolska. The research subjects were the factors influencing innovative activities in these companies, and the subjects were the aforementioned construction companies. This article attempts to answer the following questions:

- 1) Is there a correlation between the propensity to undertake innovative activity and expenditure on innovative activities?

- 2) Is there a correlation between the tendency to undertake innovative activities and possessing advanced technology?
- 3) Is there a correlation between the tendency to undertake innovative activities and modern material techniques?
- 4) Can variables such as education, gender and age influence the innovative attitude?

The main research method was a diagnostic survey method carried out in two stages: the first stage was addressed to 5,136 employees of these enterprises and the second stage was addressed to 80 managers.

The article consists of two parts. The first part discusses the types of internal and external factors influencing innovation activities. The second part is devoted to the analysis of the impact of some factors on innovation activities in selected enterprises. It presents its research methodology, indicators selected for the study and statistical analysis of the impact of selected factors on innovation activities in construction. This part determines the propensity to undertake innovation activities depending on having resources for innovation activities, advanced technology, and modern material techniques. The frequency distribution for the assessment of innovation activities in the surveyed enterprises depending on the education of the employees, their gender and age is also given. The article ends with a discussion, conclusions and a conclusion.

TYPES OF FACTORS INFLUENCING INNOVATION ACTIVITIES

There are many classifications of the conditions of innovation activity. According to A. Kłopotek (2002, p. 30), the greatest influence on the conduct of innovation activity in an enterprise has its external and internal environment. The author includes organizational culture, knowledge management and human resources among internal factors, and competition, customer requirements and technological changes among external factors. T. Boczko (2018, p. 235) is of a similar opinion. According to this theory, the factors of enterprise innovation can be classified as follows (Pomykalski, 2001, pp. 80-81):

- resource of scientific knowledge, research and development potential (it is a source of innovation),
- science development strategy, innovation policy (decides on R&D expenditure (Kilian-Kowerko, 2023, p. 6),
- the structure of the country's economy (determines the general shape of the innovation mechanism),
- the system of functioning of the economy (determines the effectiveness of the innovation mechanism),
- socio-psychological and cultural factors (including motives for innovative activity, such as ambition or prestige).

Another classification was proposed by W. Janasz (2006, p. 340) who divided the factors of innovation into economic (analysis of innovation costs and economic risk), internal (staff level and qualifications) and other (legal regulations, procedures, standards). According to I. Bielski (2005, p. 10), innovation activity is shaped by external and internal factors. M. Kolarz (2006, p. 57) distinguished the following external factors of innovation:

- R&D work carried out in agreement with or on behalf of external entities,
- exchange of technical knowledge between enterprises and universities,
- provision of services to external entities,
- foreign trade,
- undertaking foreign investments,
- license export/import.

S. Rychtowski (2004, pp. 588-589) included the following among the external conditions of enterprise innovation:

- socio-political climate,
- service processes including scientific research, information systems,

- legal norms and administrative orders,
- market links with partners who are a source of technology, information,
- economic calculation,
- education and training system,
- technical infrastructure.

A. Francik and A. Pochtowski (1991, pp. 26-27), like most authors, divided factors into external and internal. They included the following innovativeness factors in the group of endogenous (internal) factors:

- market knowledge,
- the economic strength of the enterprise and its size,
- willingness to take risks,
- continuity of enterprise management.

The exogenous (external) factors included:

- competition,
- the pace of technical progress,
- the upward trend of the market,
- economic situation,
- industry synergy regarding innovation,
- state influence on the economy.

The influence of the state on innovative activities may be one of the most important factors of enterprise innovation. Appropriate policy creates appropriate conditions for the functioning of enterprises and creates a research base for innovation (Mroczko, 2004, pp. 434-435).

Internal factors of innovation result from various components of enterprises themselves, which determine their innovativeness. This group of factors of innovation includes factors such as (Kolarz, 2006, p. 57):

- own expenditure on innovation,
- own expenditure on R&D work,
- effectiveness of communication and motivation systems,
- staff qualifications, research and marketing experience.

The authors M. Dworczyk and R. Szlasa (2001, pp. 178-180) distinguished the following factors of innovation:

- innovation needs,
- financial, personnel and material resources for innovative projects,
- managing the implementation of innovative projects,
- designing innovative solutions,
- implementation of innovative projects,
- expanding research and development potential,
- organizing funds for innovative activities,
- using the innovative potential of the staff.

According to A. Linowska (Linowska, 2011), the development of innovation: those occurring within the enterprise (innovative susceptibility) and those belonging to its environment. The author believes that the most important factors shaping the organization's ability to innovate are (Linowska, 2011, pp. 393-394):

- the intellectual potential of employees (independence, critical thinking, creativity),
- the ability to acquire scientific and technical knowledge and predict changes,
- willingness to take risks, openness to the surroundings,
- opportunities for support of innovative activities from the environment,

Factors influencing the level of innovation occurring in the enterprise environment are (Linowska, 2011, p. 394):

- investing in research and development,

- motivational intellectual property system,
- availability of preferential credit supporting innovation,
- high level of management staff,
- knowledge flow between universities,
- development of scientific research institutions (R&D),
- creating pro-innovation policy,
- efficient flow of information.

The search for factors that influence the innovativeness of enterprises has been going on for a dozen or so years. A catalogue of universal factors has not yet been identified.

Based on the above-mentioned theory, the following factors were adopted for research:

- financial outlays for innovative activities,
- technological advancement (digitization and automation of processes),
- advancement in the use of modern material techniques (ecological, energy-saving and efficient),
- education, age and gender of employees.

Eighty enterprises employing more than 50 employees (a total of 5,136 people) were qualified for statistical analysis – Appendix Table No. 1 and 2.

ANALYSIS OF THE IMPACT OF CERTAIN FACTORS ON INNOVATIVE ACTIVITIES IN SELECTED ENTERPRISES

Own Research Methodology

One of the most important issues in scientific research is the formulation of the research goal (Kowalska, 2016, pp. 7-8). Authors T. Pilch and T. Bauman defined the goal of scientific research as a certain action that allows for the examination of the significance of the impact of specific data (Pilch, Bauman, 2001, p. 36). This article adopted the following definition of the research goal: it is the scientific cognition of social reality, description of a phenomenon or institution or individual (Kowalska, 2016, p. 8).

The article aims to learn about and verify the factors influencing innovative activities in construction using the example of construction companies located in Wielkopolska. The research subjects were the factors influencing innovative activities in these companies, and the subjects were the aforementioned construction companies. The definition of the research subject was taken from the works of AW Maszke, who assumed that these would be all phenomena subject to established processes and based on which research questions can be formulated (Maszke, 2004, p. 44).

The following research problems were adopted in this article:

- 1) Is there a correlation between the propensity to undertake innovative activity and expenditure on innovative activities?
- 2) Is there a correlation between the tendency to undertake innovative activities and the possession of advanced technology?
- 3) Is there a correlation between the tendency to undertake innovative activities and the use of modern material techniques?
- 4) Can variables such as education, gender and age influence the innovative attitude?

A research problem is a question or a set of questions that will be answered after conducting the research. It concerns the research subject's properties, conditions, dependencies, significance, and joint or exclusive impact (Kucinski, 2010, p. 84).

Indicators Selected for the Study

The empirical basis for the research is regional measurements carried out in the Wielkopolska province in October and December 2023. The relationship between the propensity to have resources for innovative activities, advanced technology, modern material techniques, and undertake innovative activities was analyzed within 80 enterprises and their 5,136 employees, according to education, gender, and age. The

statistical analysis of the research results was performed using statistical tests of independence (t-Student, chi-square). The calculations were performed using Excel.

Analysis of the Impact of Selected Factors on Innovative Activities in Construction

The frequency distribution for the assessment of innovative activity in the surveyed construction enterprises depending on financial outlays is presented in Appendix Table No. 3. The preparation of data for calculating theoretical numbers is presented in Appendix Table No. 4.

To apply the test χ^2 you can use the formula (Kończak, 2014, p. 41):

$$\chi^2 = \sum_{i=1}^k \sum_{j=1}^s \frac{(n_{ij} - n'_{ij})^2}{n'_{ij}} \quad (1)$$

where: n_{ij} - observed frequencies; n'_{ij} - theoretical

Statistical Relationships

The variables: “Willingness to undertake innovative activity” and “Having resources for innovative activities” in the context of annual expenditure on innovative activity above PLN 100,000, demonstrate a statistically significant relationship: $\chi^2 = 26.67$; $df = 5$; significance = $0.000023 < 0.001$.

The variables: “Willingness to undertake innovative activity” and “Possession of advanced technology”, in the context of annual expenditure on innovative activity above PLN 100,000, demonstrate a statistically significant relationship: $\chi^2 = 56.81$; $df = 5$; significance = $0.000000000014 < 0.001$.

The variables: “Willingness to undertake innovative activity” and “Use of modern material techniques”, in the context of annual expenditure on innovative activity above PLN 100,000, demonstrate a statistically significant relationship: $\chi^2 = 23.86$; $df = 5$; significance = $0.000085 < 0.001$.

Statistical relationships for other variables:

1) by education:

The frequency distribution for the assessment of innovative activity in the surveyed construction enterprises depending on the education of the employees is presented in Appendix Table No. 5.

The variables: “The willingness of a given company to undertake innovative activities” and “Having resources for innovative activities” in the context of the number of employees with higher education employed there, show a statistically significant relationship: $\chi^2 = 14.06$; $df = 5$; significance $0.0071 > 0.001$ and significance $0.0071 < 0.05$.

The variables: “The willingness of a given company to undertake innovative activities” and “Possession of advanced technology” in the context of the number of employees with higher education employed there, show a statistically significant relationship: $\chi^2 = 12.81$; $df = 5$; significance = $0.0122 > 0.001$ and significance = $0.0122 < 0.05$.

The variables: “The willingness of a given company to undertake innovative activities” and “The use of modern material techniques” in the context of the number of employees with higher education demonstrate a strongly statistically significant relationship: $\chi^2 = 24.10$; $df = 5$; significance = $0.000076 < 0.001$.

2) by gender:

The frequency distribution for the assessment of innovative activity in the surveyed construction enterprises depending on the employees' gender is presented in Appendix Table No. 6.

The variables: “The willingness of a given company to undertake innovative activities” and “Having resources for innovative activities” in the context of the gender of the employees employed there show a statistically insignificant relationship: $\chi^2 = 7.93$; $df = 5$; significance = $0.0941 > 0.001$ and $0.0941 > 0.05$.

The variables: “The willingness of a given company to undertake innovative activities” and “Possession of advanced technology” in the context of the gender of the employees employed there show a statistically significant correlation: $\chi^2 = 31.21$; $df = 5$; significance = $0.0000028 < 0.001$.

The variables: “The willingness of a given company to undertake innovative activities” and “The use of modern material techniques” in the context of the gender of the employees employed there show a statistically significant correlation: $\chi^2 = 52.99$; $df = 5$; significance = $0,000000000085 < 0.001$.

3) by age:

The frequency distribution for the assessment of innovative activity in the surveyed construction enterprises depending on the age of employees is presented in Appendix Table No. 7.

The variables: “The willingness of a given company to undertake innovative activities” and “Having resources for innovative activities” in the context of the age of the employees employed there show a statistically significant relationship: $\chi^2 = 39.29$; $df = 5$; significance = $0,000000061 < 0.001$.

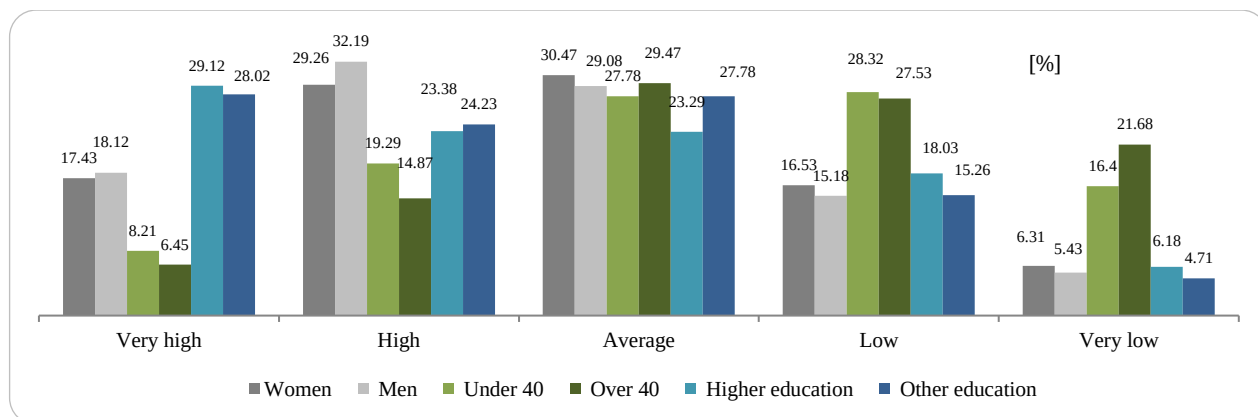
The variables: “The willingness of a given company to undertake innovative activities” and “Possession of advanced technology” in the context of the age of the employees employed there show a statistically significant relationship: $\chi^2 = 20.40$; $df = 5$; significance = $0,00042 < 0.001$.

The variables: “The willingness of a given company to undertake innovative activities” and “The use of modern material techniques” in the context of the age of the employees employed there show a statistically significant relationship: $\chi^2 = 16.77$; $df = 5$; significance = $0,002137 > 0.001$, but $0,002137 < 0.05$.

Relationship Between Having Resources for Innovation Activities and the Tendency to Undertake Innovation Activities

The relationship between having resources for innovation activities and the willingness to undertake innovation activities was indicated most highly by people with higher education (52% - very high and high), then by men (50%) and people under 40 years of age (27%) – FIGURE 1.

FIGURE 1
THE RELATIONSHIP BETWEEN HAVING RESOURCES FOR INNOVATION ACTIVITIES
AND THE TENDENCY TO UNDERTAKE INNOVATION ACTIVITIES
(BASED ON OWN RESEARCH RESULTS)

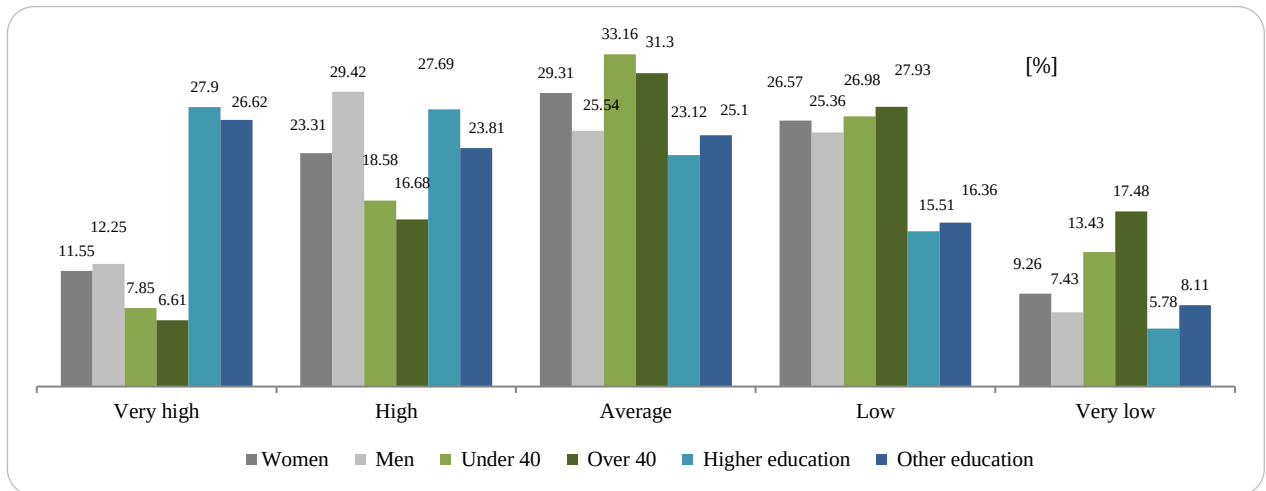


The least likely to undertake innovative activities are people over 40 (49% – very low and low) and women (23%).

The Relationship Between Having Advanced Technology and the Tendency to Undertake Innovative Activities

The relationship between having advanced technology and the tendency to undertake innovative activities was indicated most highly by people with higher education (56% - very high and high), then by men (42%) and people under 40 years of age (26%) – FIGURE 2.

FIGURE 2
THE RELATIONSHIP BETWEEN POSSESSION OF ADVANCED TECHNOLOGY
AND THE TENDENCY TO UNDERTAKE INNOVATIVE ACTIVITIES
(BASED ON OWN RESEARCH RESULTS)

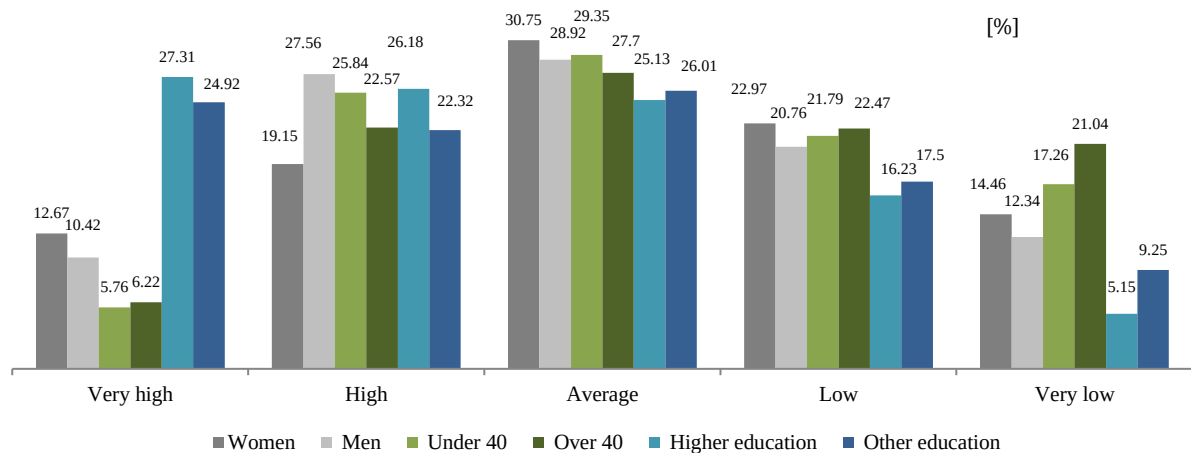


The least likely to undertake innovative activities were people over 40 years of age (45% – very low and low) and women (36%).

The Relationship Between the Use of Modern Material Techniques and the Tendency to Undertake Innovative Activities

The relationship between the use of modern material techniques and the tendency to undertake innovative activities was indicated most highly by people with higher education (53% - very high and high), then by men (38%) and people under 40 years of age (31%) – FIGURE 3.

FIGURE 3
THE RELATIONSHIP BETWEEN THE USE OF MODERN MATERIAL TECHNIQUES
AND THE TENDENCY TO UNDERTAKE INNOVATIVE ACTIVITIES
(BASED ON OWN RESEARCH RESULTS)



The least likely to undertake innovative activities are people over 40 (43% – very low and low) and women (33%).

DISCUSSION

Many scientists have researched the factors influencing innovative activities in enterprises. Polish researchers of this phenomenon have mostly been described in the section on the types of factors influencing innovative activities (K. Szopik-Depczyńska 2006, A. Wziątek-Kubiak and E. Balcerowicz 2009, A. Linowska 2011, A. Rojek 2017, E. Stawasz 2014, E. Michalski 2015, M. Jakubiec 2016). Among foreign authors, we can distinguish VG Vol'ka 2104, M. Ehrenberg, P. Koudelkova and W. Strielkowski 2015.

A. Wziątek-Kubiak and E. Balcerowicz (2009, p. 57) analyzed the determinants of the development of a company's innovativeness in the context of the level of education of employees. The authors showed that the key factor of innovativeness is the level of education of employees, which, according to the authors, results from its complementary role to other innovation factors. This factor is the main source of knowledge accumulation. Therefore, it has a priority significance for the ability to absorb, create, introduce and implement innovations.

VG Vol'ka (2104, pp. 134-135) studied the factors that influenced the innovativeness of enterprises. The author proved their relationship and mutual influence. He constructed graphic reflections on the influence of external and internal environmental factors on the innovative features of the enterprise. He distinguished the factors of indirect influence (political, legal, economic, scientific-technical, social and natural-climatic) and direct (suppliers, consumers, employees). He introduced a system of internal and external environmental factors that influence the innovativeness of the enterprise and determined their influence on the main features of innovation. By analyzing these factors, he proved that it is possible to reduce the uncertainty of the environment to improve the enterprise management level.

Factors influencing innovation in small and medium-sized enterprises were the subject of interest of M. Ehrenberg, P. Koudelkova and W. Strielkowski (2015, pp. 81-82). The authors analyzed data from surveys among 1,144 small- and medium-sized enterprise employees. The authors presented the following as key factors of innovation: the legal form of the enterprise (limited liability companies are more innovative than other legal forms), government support for investment activities, employee education and export expansion into new markets.

Azimovna and UD Ilkhomovna (2022, pp. 146-148) dealt with the factors influencing the innovation activity of industrial enterprises. The authors emphasized the importance of external factors in innovation activity, which may be the subject of business strategy, coordinated social actions or public policy. They analyzed factors such as environmental or contextual, spatial and locational, related to the external market, the flow of knowledge, politics and the natural environment.

None of the cited authors conducted a statistical calculation of the actual impact of the examined factors on the enterprise's innovativeness.

CONCLUSIONS

The results of the research confirm that innovative activities in selected construction companies in Wielkopolska are strongly related to specific financial and technological factors. Statistical analysis showed significant relationships between financial outlays on innovation and the tendency to undertake innovative activities, which indicates the importance of appropriate investments in the development of innovation in this industry.

Thanks to the applied methodology, it was possible to answer the problematic questions posed at the beginning concerning the impact of advanced technology and modern material techniques on innovation activity, which confirms the thesis that enterprises that invest in technologies and modern materials are more likely to implement innovative projects.

Observations on the impact of sociodemographic factors, such as gender, age and education, on the innovativeness of enterprises, although less clear, still indicate significant differences in the approach of

different groups of employees to innovation. The analysis shows that younger generations and people with higher education show greater openness to innovation and willingness to engage in innovative activities.

Certainly, further research on innovation factors in various economic sectors should also take into account the cultural and regulatory context, as well as the development of pro-innovation policy, which may influence the shaping of an innovation-friendly environment.

The research indicates a significant correlation between financial outlays on innovation and the willingness to undertake innovative activities in enterprises. High investments in technologies and modern materials are conducive to implementing innovative projects. Enterprises with advanced technology and modern material techniques demonstrate greater innovation activity. This phenomenon suggests that the development and adoption of new technologies are necessary to stimulate innovation in the construction industry. Analysis of the impact of sociodemographic variables, such as gender, age and education, reveals certain differences in the approach to innovation. Younger people and employees with higher education are more likely to engage in innovation activities, which may indicate changes in attitudes and skills among various social groups. The author of the article emphasizes the need to continue research on innovation factors, taking into account the cultural and regulatory context. The construction sector requires continuous adjustment of strategies to changing market and technological conditions, which is important for sustainable development. The conclusions suggest that pro-innovation policy and state support are key to creating favourable conditions for innovation development. Effective actions can increase Polish enterprises' competitiveness in domestic and international markets. Innovations are a key element of competitiveness strategy. Construction companies that effectively implement modern solutions can gain an advantage over the competition, which directly impacts their development and the industry's sustainable development.

Innovation in the construction sector in Wielkopolska is closely related to appropriate investments, technologies, and human resources, and diverse approaches to innovation depend on sociodemographic factors. The article indicates the need for an active and comprehensive approach to innovation in construction companies, favoring their long-term competitiveness.

REFERENCES

- Azimovna, M.S., Ilkhomovna, U.D. (2018). *Measuring external factors influencing innovation in companies*. OSLO MANUAL - OECD/European Union, pp. 145–162.
- Baczko, T. (2018). Product innovations. *Polish Academy of Sciences*, 3, 22–251.
- Baj, W., & Pietucha, I. (2006). Factors stimulating the creation of innovations in an enterprisem. *Przegląd Organizacji*, 7/8, 32–36.
- Bielski, I. (2005). Factors influencing innovativeness. *Nowator*, 21(1), 10–12.
- Central Statistical Office. (2022). *Innovation activity of enterprises in Poland in 2019-2021*. Warsaw.
- Decision No 1608/2003 of the European Parliament and of the Council of 22 July 2003 concerning the production and development of Community statistics on science and technology.
- Dworczyk, M., & Szlasa, R. (2001). *Innovation management*. PW, Warsaw.
- Ehrenberger, M., Koudelková, P., & Strielkowski, W. (2015). Factors Influencing Innovation in Small and Medium Enterprises. *Social and Management Sciences*, 23(2), 73–83.
- Francik, A., & Pochtowski, A. (1991). *Innovation processes*. AE, Kraków.
- Frascati Manual. (2015). Guidelines for Collecting and Reporting Data on Research and Experimental Development. *OECD*, 36–37.
- Janasz, W. (ed.) (2006). *Outline of the industrial development strategy*. Difin, Warsaw.
- Kilian-Kowerko, K. (2023). *How to describe R&D work and obtain grants*. Sell Worldwide LLC, Warsaw.
- Kłopotek, A. (2002). *Pro-innovation policy as a condition for increasing the competitiveness of enterprises*. SGH, Warsaw.
- Kolarz, M. (2006). *The impact of foreign direct investment on the innovativeness of enterprises*. UŚ, Katowice.

- Kończak, G. (2014). *On testing the significance of partial and multiple correlation coefficients for multidimensional contingency tables*. UE, Katowice.
- Kowalska, K. (2016). *Deviant behaviour of minors*. PTK No. 23, 7–28.
- Kucinski, K. (2010). *Methodology of economic sciences*. Difin, Warsaw.
- Linowska, A. (2011). *Factors and barriers of innovation development*. PB, Białystok
- Maszkę, A.W. (2004). *Methodological basis of research*. URz , Rzeszów.
- Mroczo, F. (2004). *Problems of innovation management*. AE, Wrocław.
- Pomykalski, A. (2001). *Innovation management*. PWN, Warsaw.
- Rojek, D. (2017). Internal factors of innovation. *Management. Theory and Practice*, 3(21), 23–32.
- Rychtowski, S. (2004). *External and internal conditions of innovativeness*. AE, Wrocław.
- Schumpeter, J. (1960). *Theory of economic development*. PWN, Warsaw.
- Vol'ka, V.G. (2104). *Econtechmod. An international quarterly journal*. NAOŚ, Simferopol, 1, 133–138.

APPENDIX

TABLE 1
SUMMARY OF SURVEY RESULTS FROM OWN RESEARCH
(PART OF THE SURVEY COMPLETED BY EMPLOYEES)

LP.	QUESTION	VARIABLES	EMPLOYEES IN THE SURVEYED COMPANIES	
			number	%
1.	Age	Under 40 years old	3015	58.7
		Over 40 years old	2121	41.2
2.	Sex	Woman	2517	49.0
		Man	2619	51.0
3.	Education	Higher	1004	19.5
		Other	4132	80.4
4.	Sources of innovation	The work of management staff	2465	48.0
		Customers, suppliers, competitors	2003	39.0
		Purchase of license	360	7.0
		Other	308	6.0
5.	Annual number of implemented innovations	1-3	5008	97.5
		4-6	103	2.0
		Above 6	25	0.5
6.	Type of implemented innovations	Product	192	3.7
		Process	32	0.6
		Marketing	1241	24.1
		Organizational	3139	61.1
		Imitation-adaptive	532	10.3
7.		Information and communication technologies	1264	24.6
		Renewable energy	2342	45.6
		Logistics	978	19.0

	Areas of Planned Future Innovations	Artificial intelligence	320	6.2
		Decentralized Data Registry	232	4.5
8.	Type of planned future innovations	Robotics	132	2.5
		5G connectivity	2821	54.9
		Smart sensors	1813	35.3
		Intelligent production or service implementation systems	176	3.4
		Augmented reality	28	0.5
		Digital twin	89	1.7
		Additive manufacturing	54	1.0

TABLE 2
SUMMARY OF SURVEY RESULTS FROM OWN RESEARCH
(PART OF THE SURVEY COMPLETED BY MANAGERS)

1.	Annual financial outlays for innovation activities	< 10,000	6	7.5
		11,000 to 100,000	60	75.0
		101,000 to 1,000,000	12	15.0
		> 1,000,000	2	2.5
2.	Technological advancement (digitization and process automation)	Very high	3	3.7
		High	16	20.0
		Medium	52	65.0
		Low	5	6.2
		Very low	4	5.0
3.	Advancement in the use of modern material techniques (ecological, energy-saving and efficient)	Very high	9	11.2
		High	15	18.7
		Medium	42	52.5
		Low	8	10.0
		Very low	6	7.5

TABLE 1
FREQUENCY DISTRIBUTION FOR THE ASSESSMENT OF WILLINGNESS TO
UNDERTAKE INNOVATIVE ACTIVITY, ACCORDING TO EXPENDITURE ON
INNOVATIVE ACTIVITIES (OWN STUDY BASED ON TABLE 1)

Willingness to undertake innovative activities	Having resources for innovation activities				Possession advanced technology				Use of modern material techniques			
	Annual expenditure over 100,000 PLN		The remaining		Annual expenditure over 100,000 PLN		The remaining		Annual expenditure over 100,000 PLN		The remaining	
	n	%	n	%	n	%	n	%	n	%	n	%
Very high	8 (2)	57.2	4 (10)	6.1	7 (1)	50.0	0 (6)	0	6 (1)	42.8	2 (7)	3.0
High	3 (2)	21.4	9 (10)	13.6	5 (1)	35.8	2 (6)	3.0	3 (2)	21.4	7 (8)	10.6
Mean	2 (4)	14.2	22 (20)	33.4	1 (4)	7.1	23 (20)	34.8	3 (5)	21.4	23 (21)	34.8
Low	1 (4)	7.2	19 (17)	28.8	1 (5)	7.1	25 (21)	37.9	2 (5)	14.2	25 (22)	37.8
Very low	0 (2)	0.0	12 (10)	18.1	0 (3)	0.0	16 (13)	24.3	0 (2)	0.00	9 (7)	13.6
Total:	14	100	66	100	14	100	66	100	14	100	66	100

() – theoretical numbers

TABLE 4
PREPARATION OF DATA FOR CALCULATING THEORETICAL NUMBERS
(OWN STUDY BASED ON TABLE 1)

Willingness to undertake business activity	Having resources for innovation activities			Possession advanced technology			Use of modern material techniques		
	Annual expenditure over 100,000 PLN	The remaining	SUM	Annual expenditure over 100,000 PLN	The remaining	SUM	Annual expenditure over 100,000 PLN	The remaining	SUM
Very high	8	4	12	7	0	7	6	2	8
High	3	9	12	5	2	7	3	7	10
Mean	2	22	24	1	23	24	3	23	26
Low	1	19	48	1	25	26	2	25	27
Very low	0	12	96	0	16	16	0	9	9
Total:	14	66	192	14	66	80	14	66	80

TABLE 5
FREQUENCY DISTRIBUTION FOR THE ASSESSMENT OF WILLINGNESS TO
UNDERTAKE INNOVATIVE ACTIVITIES IN CONSTRUCTION ENTERPRISES,
ACCORDING TO EMPLOYEE EDUCATION
(OWN STUDY BASED ON TABLE 1)

Willingness to undertake innovative activities	Having resources for innovation activities				Possession advanced technology				Use of modern material techniques			
	Higher education		Other		Higher education		Other		Higher education		Other	
	n	%	n	%	n	%	n	%	n	%	n	%
Very high	292 (283)	29.12	1158 (1167)	28.02	280 (270)	27.9	1100 (1110)	26.62	274 (255)	27.31	1030 (1049)	24.92
High	235 (242)	23.38	1001 (994)	24.23	278 (247)	27.69	984 (1015)	23.81	263 (232)	26.18	922 (953)	22.32
Mean	234 (270)	23.29	1147 (1112)	27.78	232 (248)	23.12	1037 (1021)	25.1	252 (259)	25.13	1075 (1068)	26.01
Low	181 (159)	18.03	631 (653)	15.26	156 (163)	15.51	676 (669)	16.36	163 (173)	16.23	723 (713)	17.5
Very low	62 (50)	6.18	195 (206)	4.71	58 (77)	5.78	335 (316)	8.11	52 (85)	5.15	382 (349)	9.25
Total:	1004	100	4132	100	1004	100	4132	100	1004	100	4132	100

TABLE 2
FREQUENCY DISTRIBUTION FOR THE ASSESSMENT OF WILLINGNESS TO
UNDERTAKE INNOVATIVE ACTIVITIES IN CONSTRUCTION ENTERPRISES,
BY EMPLOYEE GENDER (OWN STUDY BASED ON TABLE 1)

Willingness to undertake innovative activities	Having resources for innovation activities				Possession advanced technology				Use of modern material techniques			
	Men		Women		Men		Women		Men		Women	
	n	%	n	%	n	%	n	%	n	%	n	%
Very high	475 (466)	18.2	439 (448)	17.4	321 (312)	12.2	291 (300)	11.5	273 (302)	10.4	319 (290)	12.7
High	843 (805)	32.2	736 (774)	29.3	771 (692)	29.5	587 (666)	23.4	722 (614)	27.6	482 (590)	19.2
Mean	761 (779)	29.1	767 (749)	30.5	668 (717)	25.6	738 (689)	29.4	757 (781)	28.9	774 (750)	30.8
Low	398 (415)	15,1	416 (399)	16.5	664 (679)	25.3	668 (653)	26.5	544 (572)	20.8	578 (550)	22.9
Very low	142 (153)	5.4	159 (148)	6.3	195 (218)	7.4	233 (210)	9.2	323 (350)	12.3	364 (337)	14.4
Total:	2619	100	2517	100	2619	100	2517	100	2619	100	2517	100

TABLE 7
FREQUENCY DISTRIBUTION FOR THE ASSESSMENT OF WILLINGNESS TO
UNDERTAKE INNOVATIVE ACTIVITIES IN CONSTRUCTION ENTERPRISES,
BY EMPLOYEE AGE (OWN STUDY BASED ON TABLE 1)

Willingness to undertake innovative activities	Having resources for innovation activities				Possession advanced technology				Use of modern material techniques			
	Age below 40 years		Age over 40		Age below 40 years		Age over 40		Age below 40 years		Age over 40	
	n	%	n	%	n	%	n	%	n	%	n	%
Very high	248 (226)	8.2	137 (159)	6.4	237 (221)	7.89	140 (156)	6.6	174 (179)	5.8	132 (126)	6.2
High	582 (527)	19.3	315 (370)	14.9	560 (537)	18.7	354 (377)	16.7	779 (738)	25.8	479 (519)	22.6
Mean	838 (859)	27.8	625 (604)	29.5	1000 (977)	33.1	664 (687)	31.4	885 (864)	29.3	588 (608)	27.7
Low	853 (844)	28.3	584 (594)	27.5	813 (825)	26.9	592 (581)	27.9	657 (665)	21.8	476 (468)	22.5
Very low	494 (560)	16.4	460 (394)	21.7	405 (455)	13.4	371 (320)	17.4	520 (567)	17.3	446 (399)	21.0
Total:	3015	100	2121	100	3015	100	2121	100	3015	100	2121	100