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## INNOVATIVE PROJECTS IN ENTERPRISES

**Abstract.** With the competitive market conditions, enterprises are increasingly often forced to develop. The development is ensured by innovations implemented in the form of projects. The aim of this study was to present the potential and outcomes of innovative activities in enterprises. Management of innovative projects was also emphasized as providing opportunities for the development of enterprises, supported within various EU and national programmes. The effects of an innovative project were illustrated based on a project implemented in a maintenance enterprise operating in the energy sector.

**Keywords:** innovation, innovative projects, enterprises.

### 1. Introduction

Nowadays, the problems of innovativeness are considered as key priorities for economic growth. Setting the objectives connected with increased level of innovativeness concerns both macroeconomic and microeconomic scales. The macroeconomic scale is determined by the strategy of innovativeness adopted by the European Union. The microeconomic scale involves initiatives which are consistent with the adopted strategies, especially innovative projects in enterprises. These projects mainly concern the development of knowledge and innovation-based economy. Furthermore, the sustainable development is also supported and emphasized in economic activities that show high effectiveness of utilization of resources while taking into consideration the requirements for friendly environment and high competitiveness. The emphasis should be also on innovative projects that support development while promoting social inclusion and ensuring economic, social and territorial cohesion.

With the focus on their priorities, enterprises prepare and implement innovative projects. Due to its substantial differentiation, these activities require adjustment of innovative projects to ensure the achievement of a higher level of development of technology in enterprises. Development of technology is stimulated by innovative projects accepted for implementation

within many EU projects. One of the most important areas of the programs is energy sector. In this context, an innovative project was presented, concerning maintenance management in the energy sector.

## 2. Innovativeness in business development

The problems of innovativeness are being examined using a multi-aspect analysis due to the growing complexity of globalization and competitiveness of economies in individual countries or their relationships. The reasons that create new principles or assumptions for innovativeness are directly linked to the explorations that emphasize topicality of the economic growth in the context of scientific and technological achievements. It is justified to refer to the assumptions of the European Union which emphasize knowledge and innovation-based economic growth as a key priority.<sup>1</sup> The overall aim is to improve the conditions of preparation and implementation of innovative activities of enterprises, increase in the contribution of the SME sector to R&D expenditures while ensuring higher effectiveness of technological innovations.<sup>2</sup> Such explorations were presented by E. Mączyńska who found that "contemporary scientific and technological development and the decisive role of information, knowledge and competencies lead to the establishment of a new paradigm for development"<sup>3</sup>. Similar context occurs with respect to the development of technology. The above context highlights the view that „ technological innovations have improved the manufacturing process – the technology used, material and also the organization and management of the production process.”<sup>4</sup>

The market determinants lead to the changes in enterprise activity that consists in particular in adaptation of innovative projects. The scope and scale of these projects are determined by enterprise resources. There are examples of innovation implementation in both current and new markets, as well as innovations influencing short and longer perspective of organization development.<sup>5</sup> The resources include organizational structures with flexible character, position and reputation of the enterprise, competencies and unique skills of employees, production potential, knowledge of market requirements and customer

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<sup>1</sup> Report on execution in 2013 of the National Strategic Reference Framework for the years 2007-2013. The Ministry of Infrastructure and Development, p. 146.

<sup>2</sup> Hahner Ch.: Nachhaltig bewegt. Energieeffizient Mobil. Ein Zukunftsprojekt in der Hightech – Strategie der Bundesregierung. (2012-09-24/25). (2013-03-23)[http://www.tuvpt.de/index, php](http://www.tuvpt.de/index.php).

<sup>3</sup> Mączyńska E.: Anomiczne podłoże erozji ładu gospodarczego. [in:] P. Pysz, A. Grabska, M. Moszyński. (ed.), Spontaniczne i stanowione elementy ładu gospodarczego w procesie transformacji – dryf ładu czy jego doskonalenie?. PTE, Warsaw 2014, p. 40.

<sup>4</sup> Lisý J.: Economic Growth In New (Knowledge Based) Economy. [in:] R. Borowiecki, A. Jaki (ed.), Global and Regional Challenges of the 21<sup>st</sup> Century Economy, UE in Krakow, Kraków 2011, p. 23.

<sup>5</sup> Mielcarek P.: Development of innovation process In open innovation model – a case study. “Przegląd Organizacji”, nr 6, 2015, p. 39.

preferences, adequate infrastructure, required level of quality and financial standing of enterprises.<sup>6</sup> These resources determine enterprise innovativeness.<sup>7</sup> This concerns in particular the use of the resources.<sup>8</sup> Therefore, the essential problem is to conduct the analysis of expenditures for enterprise innovativeness.<sup>9</sup> Analysis of the contribution of the expenditure on innovative activities in enterprises of the sector of manufacturing and supply of electricity, gas, steam and hot water in the expenditure on innovative activities of industrial enterprises in total leads to the conclusion that this contribution in the period of 2011-2015 ranged from 13 to 25% and has been rising steadily since 2011 (Fig. 1). The decline in the expenditures on innovative activities in this sector compared to the year 2012 was observed only for the 2013.

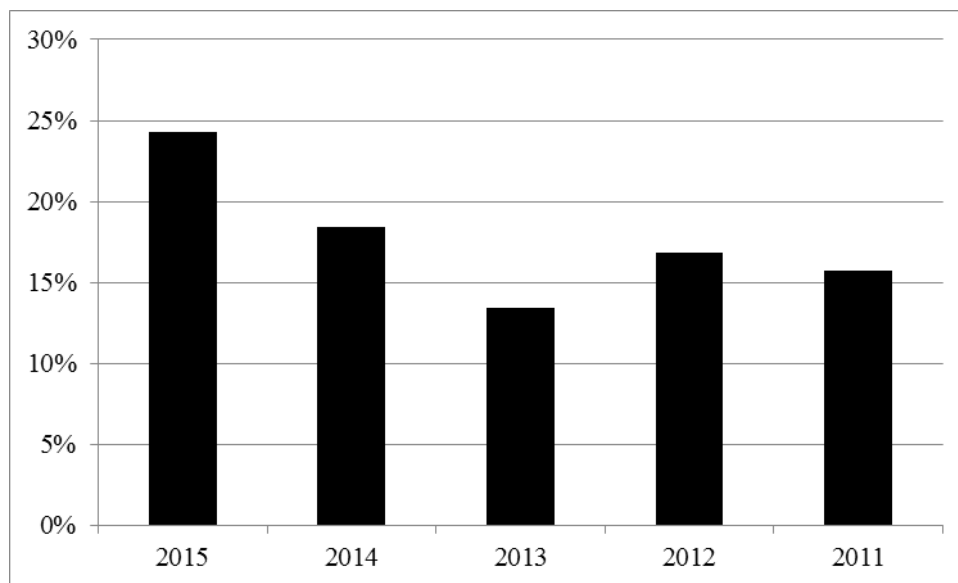


Fig. 1. Contribution of the expenditure on innovative activities in enterprises of the sector of manufacturing and supply of electricity, gas, steam and hot water in expenditure on innovative activities in industrial enterprises in total in Poland.

Source: author's own elaboration based on the data obtained from the Central Statistical Office [www.stat.gov.pl](http://www.stat.gov.pl)

The increase in the contribution of the expenditure on innovative activities in the enterprises of this sector to the expenditure on innovative activities in industrial enterprises in total suggests the increasing importance of enterprises of the energy sector in innovative activities. Enterprises in this sector are becoming more and more willing to implement innovative projects in order to improve the quality of products offered. However, the

<sup>6</sup> Cs Illes B., Dunay A., Jelonek D.: The Entrepreneurship in Poland and in Hungary. Future Entrepreneurs Education Perspective, "Polish Journal of Management Studies", Vol. 11, No. 1, 2015, p. 50.

<sup>7</sup> Sopińska A.: Potencjał zasobowy polskich przedsiębiorstw. [in:] , M. Romanowska, W. Mierzejewska (ed.). Przedsiębiorstwo odporne na kryzys, Wolters Kluwer business, Warszawa 2016, p. 113-114.

<sup>8</sup> Sepulveda F., Gabrielsson M.: Network development and firm growth: A resource based study of B2B Born Globals, "Industrial Marketing Management" nr 42, 2013, p. 795.

<sup>9</sup> Ostraszewska Z., Tylec A.: Nakłady wewnętrzne na działalność badawczo-rozwojową w Polsce i źródła jej finansowania w sektorze przedsiębiorstw. „Zeszyty Naukowe Politechniki Częstochowskiej, Zarządzanie”, nr 24, 2016, p. 40.

dominant role in the expenditure on innovative activities is observed for industrial enterprises. Table 1 presents indices of similarity of the structures for the year 2014 and other years of the period of 2011-2013.

Table 1

Indices of the structure and indices of similarity of the structures for the expenditure on innovative activities in industrial enterprises

Sectors	Structure indices in %					Minimum for years %		
	2015	2014	2013	2012	2011	2014 and 2013	2014 and 2012	2014 and 2011
Mining and quarrying	-	5.5	8.2	6.1	3.8	5.5	5.5	4%
Manufacturing	66.8	71.2	75.1	74.3	75.8	71.2	71.	71.
Electricity, gas, steam and air conditioning supply	24.3	18.4	13.5	16.9	15.8	13.4	16.	15.
Water supply; sewerage, waste management and remediation activities	-	4.9	3.3	2.8	4.7	3.3	2.8	4.6
Structure similarity indices						93.5	96.	95.

Source: author's own elaboration based on the data obtained from the Central Statistical Office.

High values of structure similarity indices suggest a substantial similarity in terms of the contribution of the expenditure on innovative activities in enterprises of individual sectors in the expenditures on innovative activities of enterprises in total. The highest contribution of expenditures in all the years studied was observed for the sector of industrial processing, reaching over 70% in 2011-2014.

The analysis also concerned the dynamics of changes in the expenditure on innovative activities in enterprises of individual sectors. The results of the analysis are presented in Tables 2 and 3.

Table 2

Mean rate of changes in the expenditure on innovative enterprises  
in industrial enterprises in 2011-2015

Sectors	Mean rate of changes in 2011-2014	Mean rate of changes in 2011-2015
Total	5.75%	10.55%
Mining and quarrying	19.29%	-
Manufacturing	3.59%	7.11%
Electricity, gas, steam and air conditioning supply	11.40%	23.14%
Water supply; sewerage, waste management and remediation activities	7.33%	-

Source: author's own elaboration based on the data obtained from the Central Statistical Office.

In 2011-2014, enterprises of the sector of electricity, gas, steam and air conditioning supply were characterized by one of the highest mean annual rate of changes in the expenditures on innovative activities. Mean annual increase in the expenditure on innovative activities in these enterprises exceeds mean annual increase in expenditure on industrial enterprises in Poland in total. In 2011-2014, this increase was even higher, which was caused by a substantial increase in the expenditure on innovative activities in the enterprises of this sector in 2015 compared to 2014.

Table 3

Chain indices for the expenditure on innovative enterprises  
in industrial enterprises in 2011-2015

Sectors	Chain indices for the years			
	2015	2014	2013	2012
Total	126.29%	117.48%	97.32%	103.43%
Mining and quarrying	-	78.73%	130.02%	165.81%
Manufacturing	118.41%	111.48%	98.39%	101.35%
Electricity, gas, steam and air conditioning supply	166.31%	160.87%	77.77%	110.50%
Water supply; sewerage, waste management and remediation activities	-	172.56%	115.22%	62.19%

Source: author's own elaboration based on the data obtained from the Central Statistical Office.

Analysis of the dynamics of changes in the expenditure on innovative activities in the enterprises of the sector of electricity, gas, steam and air conditioning supply reveals an upward tendency. The decline in the expenditure on innovative activities was observed only in 2013 compared to 2012. The decline was relatively high (22.23%) and it substantially affected the decrease in the expenditure on innovative activities of industrial enterprises in Poland in total.

It can be concluded that the sector of electricity, gas, steam and air conditioning supply is not dominant in terms of the expenditures on innovative activities of industrial enterprises in Poland although it is characterized by a substantial potential in this area. This results from the fact that this sector is also not dominant in terms of the number of enterprises. However, due to the specific nature of the product, and production infrastructure, enterprises of this sector are becoming more and more frequently involved in innovative activities through their participation in research and development projects.

### 3. Innovative projects in enterprise activities

Project management has become a key area of enterprise activities, with the number of developed and implemented projects steadily increasing.<sup>10</sup> Projects are assessed from various standpoints, including: professional activities, complexity, uniqueness, objectives and limitations.<sup>11</sup> Due to the area of the explorations and based on numerous definitions of projects, it was adopted that a project means the activity started in order to obtain unique products or services.<sup>12</sup> The scope of innovative projects in different areas is gradually increasing.<sup>13</sup> Furthermore, the number of ecological and economic determinants that should be taken into consideration in innovative projects is increasing (see Fig. 2). These determinants form a basic data set for positioning of innovative projects, especially in the resource-based context.<sup>14</sup>

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<sup>10</sup> Pietrasieński P.: Silicon Valley Acceleration Center A Case Study of the First Polish Governmental Bridge Organization. "Przegląd Organizacji", nr 8, 2013, p. 58.

<sup>11</sup> Wiśniewska J.: Podstawy zarządzania projektami, [w:] Janasz K., Wiśniewska J. (red.): Zarządzanie projektami w organizacji, Difin, Warszawa 2014, p. 56.

<sup>12</sup> A Guide to the Project Management Body of Knowledge: PMBOK Guide, Project Management Institute, Newton Square, Pensylwania 2000, p. 4.

<sup>13</sup> Szymański G.: Snapchat jako innowacyjna aplikacja marketingu mobilnego. „Zeszyty Naukowe Politechniki Częstochowskiej Zarządzanie”, Nr 22, 2016, s. 156.

<sup>14</sup> Brzozowska A., Kalinichenko A., Minkova O.: Ecological perspective of it in environmental Management. Poltava State Agrarian Academy, Ukraine Czestochowa University of Technology Poland, Opole University, Poland 2015, p. 100.

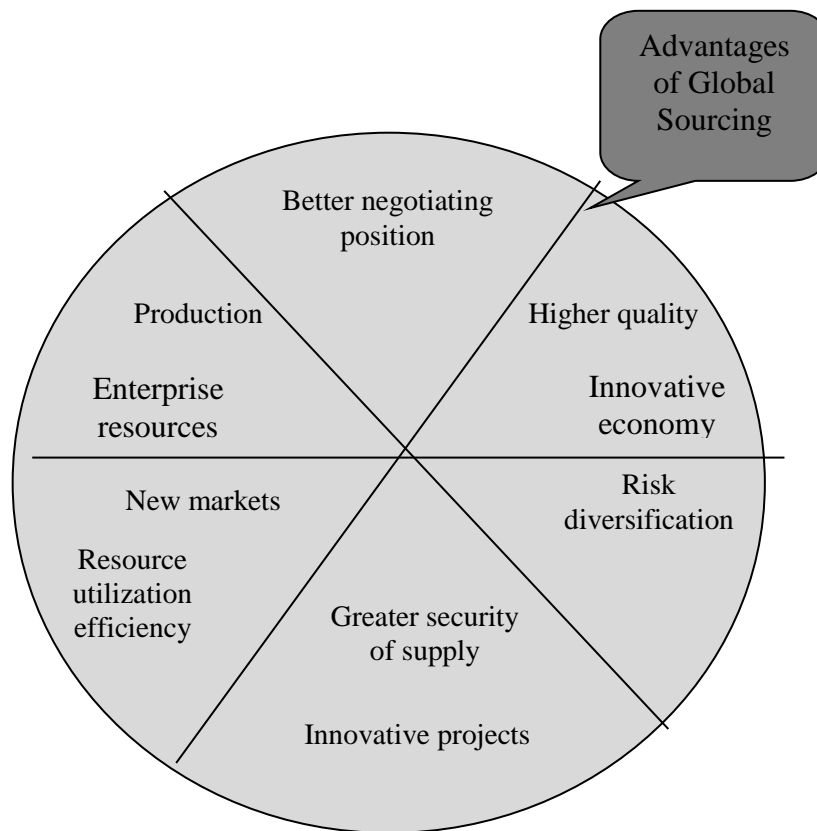


Fig. 2. Innovative projects in the company  
Source: Author's own study.

Innovativeness of the economy is directly linked to competitiveness and globalization. The international scope and multiple aspects of these problems justify the emphasis on the procedure of management of innovative projects (Fig. 3).

As project activities, innovations require employees' commitment to their implementation. It should be emphasized that learning and improving skills represents the basic determinant of implementation of innovations and projects with this character. The employees are required to search for and implement innovative projects. It is important for the processes of creation of such projects to identify knowledge and create knowledge by employees. Employees' commitment to implementation of innovative projects is manifested in their involvement in organizational activities.<sup>15</sup> It is also essential to determine the level of employees' involvement in innovative projects. During the assessment of employees' involvement, it is useful to point to the components of entrepreneurship and creativity, which are especially important for innovative projects.<sup>16</sup> Similar relationships can be found in the view that

<sup>15</sup> Selejdak J., Corejova T., Ulewicz R.: Total Quality Management, Częstochowa University of Technology, Częstochowa 2016, p. 136-137.

<sup>16</sup> Stankiewicz J., Moczulska M.: Zachowania pracowników sprzyjające innowacyjności organizacji w świetle badań. „Przegląd Organizacji”, nr 2, 2016, p. 37.

"reaching adequate level of absorption and diffusion of innovation in enterprises depends on the development of attitudes typical of innovation managements in these organizations." <sup>17</sup> Such attitudes are developed in enterprise employees.<sup>18</sup> Combined with the key role of employees, using an adequate procedure for innovative project management helps improve innovation effectiveness and, consequently, enhance enterprise competitiveness.

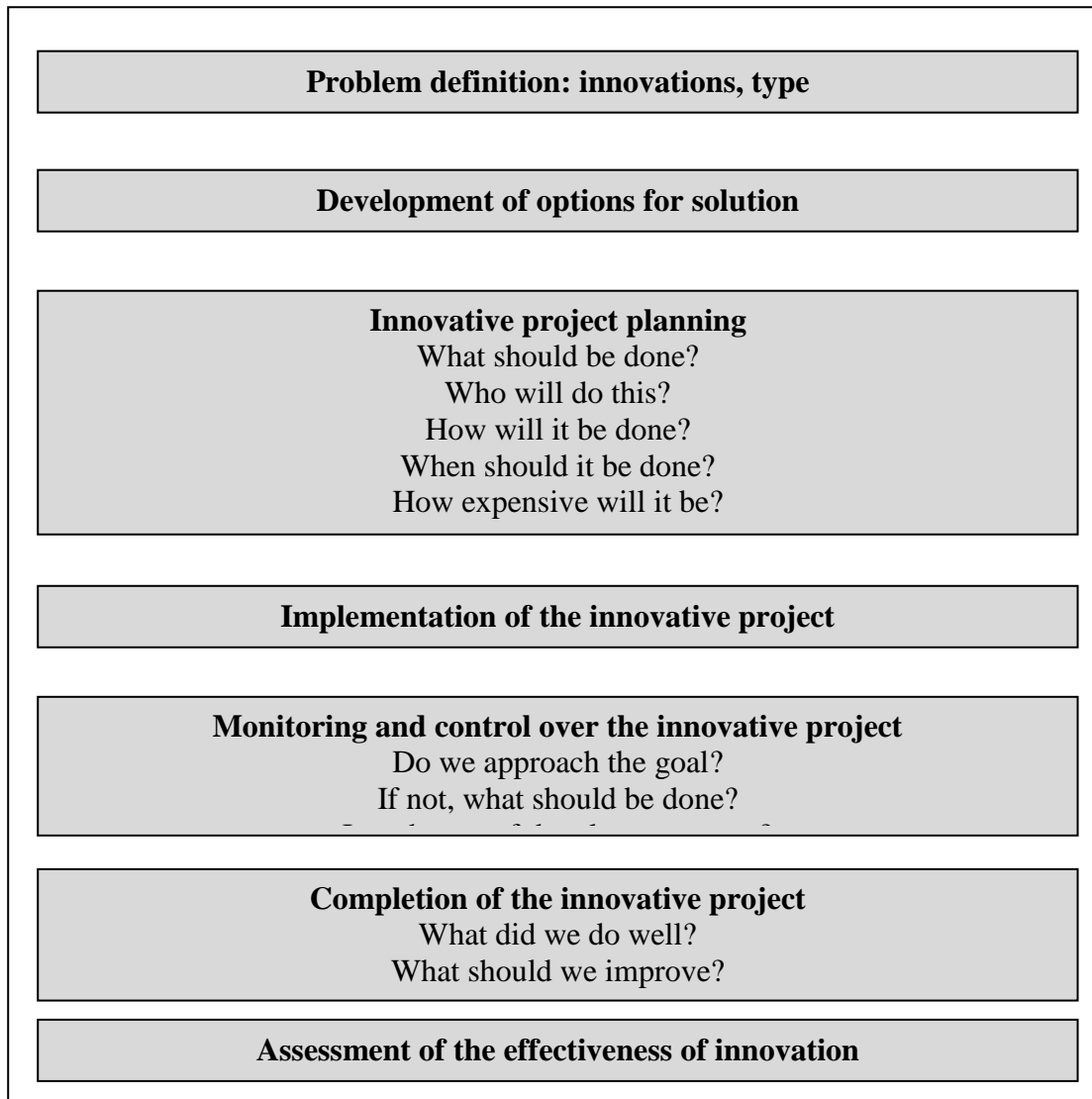


Fig. 3. Procedure for management of innovative project

Source: elaboration based on: K. Janasz, J. Wiśniewska, (red.), Zarządzanie projektami w organizacji. Difin, Warszawa, 2014 p. 60.

<sup>17</sup> R. Błażlak: Innowacyjność przedsiębiorstw a problematyka transferu technologii. „Zeszyty Naukowe Politechniki Częstochowskiej, Zarządzanie”, nr 22 2016, p. 149.

<sup>18</sup> W.L. Tate, L.M. Elram, I. Gołgeci: Diffusion on environmental business practices: A network approach, “Journal of Purchasing and Supply Management”, nr 19, 2013, p. 265.



#### 4. Application of innovative projects in enterprises

Enterprises represent basic entities where innovative projects are implemented. The factors that allow for application of innovative projects show substantial variation. Therefore, the aim of the survey of Polish industrial enterprises conducted in 100 micro, small and medium-sized enterprises was to identify determinants of innovativeness.

The factors which are conducive to innovative activities include:<sup>19</sup>

- knowledge of tendencies in research and development at both national and international level,
- challenges of competitiveness caused by other enterprises in the same sector,
- implementation of projects of innovative character in collaboration with research and development centres,
- having internal research and development potential represented by tangible and intangible resources.

The inhibiting factors are:<sup>20</sup>

- limitations of innovative activities caused by the lack of employees with required competencies,
- lack of interest in research and development entities in commercialization of research findings across enterprises and the risk involved in this process.<sup>21</sup>

In a study focused on regional businesses, concerning the innovativeness of enterprises, the area of four Polish voivodeships were analysed: Lodz Voivodeship, Podlaskie Voivodeship, Silesian Voivodeship and Masovian Voivodeship.

In total, 264 experts and 216 respondents from the academic community participated in the study. The results of the survey show that the most important determinants of innovation adaptation are: human and information resources, support from the members of management team, internal communication and specialization. It is essential at each stage of innovation that orientation towards innovation is developed and market orientation is adopted.<sup>22</sup>

Similar study was conducted within the project "Program for professional preparation of specialists-leaders of innovation transfer and modern technologies in enterprises near Polish-Czech border", funded from the resources of the European Fund for Regional Development

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<sup>19</sup> Poznańska K.: Determinanty wzrostu innowacyjności polskich przedsiębiorstw przemysłowych, [w:] Kaczmarek J., Szymła W. (red.): Teoria i praktyka zarządzania w obliczu nowych wyzwań. Wyd. UE Kraków, Kraków 2015, s. 86-87.

<sup>20</sup> Ibidem.

<sup>21</sup> Włodarczyk A.: Ocena dochodu i ryzyka inwestycji w akcje spółek z branży TSL notowanych na GPW w Warszawie, „Logistyka”, nr 5, 2012, s. 223.

<sup>22</sup> Pichlak M.: Uwarunkowania procesu adaptacji innowacji w polskich organizacjach. „Organizacja i Kierowanie”, Nr 2 (167), 2015, s. 44-46.

and state budget within the Poland-Czech Republic Cross-Border Operational Programme 2007-2013.<sup>23</sup>

The empirical study focused on evaluation of the innovativeness in different groups of enterprises. In one of the groups (31 enterprises), innovative projects were implemented within the Program for Goal-Oriented Projects for Small and Medium-Sized Enterprises of the Polish Central Technical Organization NOT. The survey showed that the basic barriers for innovative projects are: lack of professional trainings, low creativity of employees and insufficient level of collaboration with scientific and research institutions. The state of innovativeness in the enterprises requires implementation of various initiatives to improve the effects and objectives in this area of activities of business entities according to the model of partnership for innovations.

The following components were emphasized in this model:<sup>24</sup>

- innovation user (e.g. consumer),
- research and development centre,
- enterprise,
- professional agent (technology broker),
- financial investor,
- governmental or local government institution.

For the development of effective innovative projects, it is necessary to ensure the knowledge<sup>25</sup> and cooperation between the above listed participants in two areas. These areas are institutionality and interpersonality. Integration of these areas occurs in enterprises with different profile of activities. Due to the character of the innovative activity, a maintenance enterprises from the energy sector was used for the analysis.

The energy sector represents the priority area of the economy, with implementation of innovative projects being essential due to the Strategy Europe 2020 in the countries of the European Union. New innovative projects have been implemented in the enterprises of the energy sector in the areas of manufacturing, distribution<sup>26</sup> and maintenance. The detailed analysis concerned an innovative project implemented in Zakłady Remontowe Energetyki SA in Katowice.

The name of the task is: development of a prototype maintenance technology, a diagnostic method and comparative examinations of the repaired turbine blades (compared to new blades). The aim of the study was to conduct a comparison between the repaired blades and new blades. The aim of the study was also to develop a prototype for the diagnostic system

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<sup>23</sup> Jakubiec M.: Rola zarządzania wiedzą w kształtowaniu proinnowacyjnego działania kadr przedsiębiorstw, [w:] Dudzik-Lewicka J., Howaniec H., Klisiński J., Waszkielewicz W. (red.): Potencjał intelektualny i innowacyjny w zarządzaniu organizacją, ATH, Bielsko-Biała 2014, p. 185-186.

<sup>24</sup> Jasiński A.H.: Partnerstwo dla innowacji. Koncepcja modelu. „Przegląd Organizacji”, nr 8, 2013, p. 7.

<sup>25</sup> Paliszkievicz J., Koohang a.: Organizational trust as a foundation for knowledge sharing and its influence on organizational performance. “Journal of Applied, Knowledge Management”, Vol. 1, Issue 2, 2013, pp. 116-122.

<sup>26</sup> Matusiak B.E.: Innowacyjne rozwiązania w zarządzaniu energią a korzyści biznesowe dla interesariuszy. „Przegląd Organizacji”, nr 12, 2016, p. 28.

used to identify dynamic and mechanical properties. Then, they were compared to the expected parameters and the results obtained for new blades.

The project allows for implementation of the assumptions of the policy for sustainable development. The scope of the above principles focuses on the area of environmental protection. The particularly important components of the project were:

increasing the level of renewed use of materials in the form of the use of blades of the last stage of the high-pressure turbine. The effect of the project is to increase the consumption of materials by around 20% due to the repaired components, extending the product life. The use of innovative technology of blade repairing will lead to the increase in their life from 100,000 hours to 120,000 hours.

The project includes the following types of innovations:

- product innovation,
- process innovation.

In the product innovation, the high level of technological advancement of the modifications points to:

- the application of the innovative method of increment-gradient hardfacing,
- the use of laser hardfacing and plasma hardfacing in the technology of repairing blades of steam energy turbines.

The practical implications of the results of research and development are offered by the development of an innovative technology for repair of blades of steam turbines that improves functional properties of the surface layer. Among the effects of the study and implementation of the above technologies, the most important are activities that are aimed at:

- extension of turbine failure-free life,
- reduction in repair costs,
- increased competitive position of the enterprise that implements the project.

The process innovation is also present in the project and it concerns the development of the measurement method that allows for the high-level diagnostic process. The particular importance of this type of process innovativeness consists in the opportunities of measurements performed during the use of energy equipment. The innovativeness lies in the use of high-speed cameras and laser lighting that ensure recording problematic surfaces of the turbine blades. Another innovation is the use of the computer software for analysis of images. This initiative is of systematic character and, with the laser photography equipment, will ensure monitoring of selected zones on the surface of steam turbine blades. The scope of monitoring concerns degradation processes. They include erosion and fatigue cracking of blade material. Consequently it becomes real to utilize the system for measurement of the level of blade vibrations and making measurement of the changes in the focal length of the optic system. With respect to process innovations, another important feature is the innovativeness of the technological changes. These include in particular:

- world-level uniqueness of diagnostic solutions for the energy system,
- opportunities for vision diagnostics during turbine operation,
- uniqueness of the vision system in terms of diagnostics conducted in extremely difficult conditions of observation,
- diagnostic system, which is characterized by exceptional parameters in terms of recording and analysis of the phenomena in time and spatial segmentation.

Following the implementation of R&D works, the practical utility will be identified by:

- the increase in the effective time of turbine operation,
- minimization of potential failure rate in the turbine caused by damaged turbines,
- building the advanced high-quality diagnostic equipment to perform currently unavailable measurements.

Project implementation will allow for achievement of the specific effects due to reduction of waste caused by damaged turbine. New equipment developed in the study and reconfigured in the measurement system, due to its portable character, will be used in intervention and planned maintenance of turbines.

The presented examples of innovative projects allow for implementation of the adopted objectives by the enterprise and achievement of the economic and social effects. The particular focus on the project of maintenance enterprise from the energy sector resulted from the character of world-class unique technological innovations.

## 5. Conclusion

Innovative activities in the form of projects in enterprises have been implemented in various areas and scopes. The study identified a group of factors conducive to innovative initiatives and a group of factors inhibiting such activities. Furthermore, the study examined the areas evaluated by experts and respondents from the academic community. The determinants of adaptation of innovations were demonstrated, with the emphasis on the importance of human and informational resources. The above determinants were confirmed by the examinations of the innovative projects within the Program for Goal-Oriented Projects for Small and Medium-Sized Enterprises of the Central Technical Organization NOT. It was found that the presented state of innovativeness for the improvement in the effects and goals should be based on the model which should emphasize: innovation users, research and development centre, enterprises, professional broker and financial investor. This set of entities, with adequate measures, ensures the implementation of the innovative projects in enterprises.

The important factor in implementation is the character of enterprise activities. For this reason, a maintenance enterprise in the energy sector was chosen for the analysis of implementation of the innovative project. The enterprise implemented the task which consisted in the development of a prototype repair technology, a diagnostic method and comparative examinations of the repaired turbine blades (compared with new blades). The particularly important components of the innovative project were: increased level in re-use of materials and elongation of the blade life.

The implementation of the innovative project in the maintenance enterprise in the energy sector (Zakłady Remontowe Energetyki SA Katowice) resulted in the following benefits:

- elongation of equipment operation time,
- reduction in repair costs,
- increased competitive position of the enterprise that uses modern technologies with high level of innovativeness.

In conclusion, innovative projects help enterprises face the challenges of the competitive economy.

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