

## Implementation of innovations in enterprises using the EU funds: A comparative analysis

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**Abstract.** The European Union sees the role of innovations as measurably influencing the improvement of social and economic development in the regions of its member states. Actions that promote the implementation of innovations in the SME sector as one of the elements having a positive impact on the European Union's cohesion policy have a special role in supporting enterprises. Therefore, the EU operational programmes dedicated to small and medium-sized enterprises are a valuable source of external financing for innovations in these entities. The implementation of innovative investment projects positively influences the development of enterprises. A company resistant to implementing innovations may lose its competitive position on the market and slow down its development. The aim of this article is to conduct a comparative analysis of the implementation of innovative investments between the enterprises that received financial assistance from the European Union in relation to the enterprises that implemented innovations using other sources of financing. The study shows that enterprises covered by financial support from operational programmes have a higher level of innovative investments than other economic entities. Companies receiving EU aid are more often implementing production innovations among all four types of innovations as compared to other enterprises. In addition, it was found that in the lack of financial support from the EU, almost half of the companies would not be able to implement innovations as such. Therefore, the issue of innovations implemented in enterprises with the use of the EU financial aid should be considered as a currently relevant topic and an extremely important one from the standpoint of entrepreneurship development. This study should be considered unique, as there are no studies, to the best of the author's knowledge, containing comparative analyses in this area.

**Keywords:** implementing innovation, investments, enterprises, entrepreneurship, SMEs, EU subsidies, operational programmes, Poland, Malopolska region, comparative analysis, competitive advantage, financial support.

**JEL Classification:** O33, O39, D25, M21, L20

**Received:**  
October, 2019  
**1st Revision:**  
January, 2020  
**Accepted:**  
May, 2020

DOI:  
10.14254/2071-  
8330.2020/13-2/8

## 1. INTRODUCTION

Development of civilization is strongly linked to innovations and innovation processes that occur at enterprises. These entities have the opportunity to strengthen their competitive position through the implementation of innovations. The European Union sees the role of innovations as measurably influencing the improvement of social and economic development in the regions of its member states. Thus, it contributes to the development and improvement of living conditions of the EU citizens overall. Economist P. Drucker (2014) claimed that the two main criteria for industrial development are innovative economy and entrepreneurial society.

Much attention is paid in the European Union to small and medium-sized enterprises, which have an important role in the national economies of each Member State. These enterprises are the driving force behind the development of the entire European economy.

The European Charter for Small Business recognized enterprises employing less than 50 employees "as the backbone of the European economy" (European Commission, 2002). In addition, small companies were identified as those that accelerate the development of innovation, employment, as well as social and local integration in the European Union. In the EU regional policy, small and medium-sized enterprises constitute one of the most important areas of public interventionism by promoting entrepreneurial culture, creation and development of small businesses. Scientists constantly emphasize in their research the significant role small and medium-sized enterprises play in the growth of national economies (Bosma & Schutjens, 2007; Machová, Huszárík & Šimonová, 2016; Stel, Carree & Thurik, 2005) as well as in separate regions (Hunady, Písar, Musa & Musova, 2017; Ivanová & Masárová, 2016).

Due to the importance of the SME sector for both economic growth and employment, the needs and problems of this sector are included in most of community policies and programmes, as well as in financial instruments (K. A. Fírléj, 2019). It should be noted that aid to the SME sector is one of the few exceptions that the European Commission regularly agrees to (Ehlermann, 1992). In general, the lack of financing in enterprises is considered to be a very serious barrier to the absorption of innovation and development among small and medium-sized European enterprises, in addition to two other factors, i.e., uncertain market demand and uncertain return on investment (European Commission, 2011; Urbaniec, 2015).

It is important to remember the biggest problem faced by small and medium-sized enterprises and what is characteristic of this sector – limited possibilities for self-financing, especially in the first stages of operation, as well as relatively high risks of doing business. For this reason, a large number of financial instruments offered by commercial entities are not available to them. The European Union's aid funds have been directed to meet the needs of this group of enterprises, recognizing them as a source of competitiveness and growth in European economy. For this purpose, various activities are undertaken to support these entities.

Aid funds from the EU operational programmes are a valuable source of external financing for small and medium enterprises. These funds allow supporting investment activities in the SME sector, especially in the form of development and innovative and modernization investments (Piątkowski, 2020). Entrepreneurs can benefit from the EU funding on the basis of competitions that are announced under operational programmes. These programmes are responsible for individual areas of support and are described in national and EU programming documents, including the National Strategic Reference Frameworks (NSRF) and the Community Strategic Guidelines. The research results of Wokoun, Kolařík and Kolaříková (2016) also confirm that the support of enterprises using European funds contributes to their development, because without this financial assistance these companies would not be able to realize their investments.

From the structural funds (with financial participation from the state budget and budgets of local government units) in 2007-2013, operational programmes were implemented in Poland with various scales of impact: national (OP Innovative Economy, OP Human Capital, OP Infrastructure and Environment, OP Technical Assistance), supra-regional (OP Development of Eastern Poland) and regional - these were implemented in each of the 16 provinces in Poland.

Actions that promote the implementation of innovations in the SME sector as one of the elements having a positive impact on the European Union's cohesion policy have a special role in supporting enterprises. This is reflected in supporting innovation processes and enterprise development. These activities result from the provisions of the renewed Lisbon Strategy of 2005 and detailed EU normative acts regarding the programming of funds and Community initiatives of the European Commission (Piątkowski, 2010; Kwaśny, Mroczek & Ulbrych, 2018).

Under the conditions of open market economy, which is subject to the influence of a constantly changing environment, development of innovations has a crucial meaning for shaping the competitive position of the company and the industry in which it operates. Small and medium enterprises are perceived as the driving force of every national economy and a source of enormous creative potential. Innovations are seen as gaining higher competitive advantage by enterprises over other business entities (Ruda & Svobodová, 2014; Sobeková Majková, Solík, & Sipko, 2014; Kosala, 2015). That is why survival and growth of SMEs depends on innovation (Demirbas, Hussain & Matlay, 2011).

The issue of innovations implemented in enterprises should be considered a current topic and an extremely important one from the standpoint of assessing the application of operational programmes for the purposes of enterprise development through investments. In their assumptions, operational programmes place particular emphasis on supporting innovative investments among small and medium enterprises. This allows increasing the innovativeness of this sector and of the products (services) which are the result of business activity in this sector.

The main goal set by the author of this article was to conduct a comparative analysis of the implementation of innovative investments between the enterprises using EU funds, relative to the enterprises that implemented innovations using other sources of financing.

Very rarely, scientists use the comparative method to assess the application of European funds at enterprises. The most frequently presented results include simple quantitative and quota data. For this reason, the research method chosen by the author can be considered interesting and extremely needed. In addition, it is readable for the reader and allows clear presentation of the results for both groups of enterprises which were studied.

The article is both theoretical and empirical. The first part of the article presents the theoretical aspect of the importance of innovative investments for enterprise development. A literature review was also carried out regarding the definition and typology of innovations. Next, description of the research methodology was made and the contents of research hypotheses were analyzed. Part three contains statistical analysis of the research hypotheses. It is based on the results of the author's own research carried out by a survey method among SMEs. The results are based on the data regarding types of innovations implemented by individual groups of enterprises as well as the impact range of innovations. The whole work ends with the author's conclusions.

## 2. LITERATURE REVIEW

### 2.1. The importance of innovative investments for business development

It should be remembered that the main purpose of a modern enterprise is to generate and create innovations based on an in-depth analysis of the needs of recipients (see Fig. 1). The full process of an innovative company covers activities from understanding market behaviour, through the phase of excellence, to customer satisfaction (Schuman, Prestwood, Tong, & Vanston, 1994).



**Figure 1. The main goals of enterprise development**

*Source: own evaluation*

According to A. Francik (2003), from the point of view of the company's strategy, innovation is not expressed only by implementing the original product based on the previously created invention. In this case, the innovation will be any beneficial change through which progress in the company is observed compared to the previous state. This change was made within the enterprise itself or outside of it and was initiated to the expectations of the market, satisfying customers' needs that have not yet been satisfied or creating a new one.

Immediately after making the decision to implement innovative investments, the entrepreneur is waiting for certain benefits from implementing the innovation. These benefits include: improving the quality of products or services provided, increasing the type of assortment, increasing production efficiency, increasing or maintaining the current market share, entering new markets, reducing material and energy costs, and reducing unit labor costs.

The expected goals that the company wants to achieve through the implementation of innovation are possible to achieve in two ways. The first one involves undertaking creative investments and developing innovations independently or in cooperation with external partners. The second method results from the diffusion process by assimilating innovation already developed by other companies or institutions. In this way, an enterprise can, for example, assimilate organizational innovation previously developed by another entity and adapt it to its own mechanisms of action. Another example is the adaptation of purchased new production technology as part of our own production line (OECD, 2005). The goal of the undertaken actions is always to improve the company's results, although the effects usually appear with a delay compared to the moment of implementing the innovation.

It should be mentioned that enterprise innovations are systemic character, which means that it is possible to influence other enterprise subsystems in one place, implementing innovations in another place. (Francik, 2003).

It should also be emphasized that the innovative activity of an enterprise may take various forms and nature, which depends on the specifics of the company itself as well as the sector of the economy and the environment in which it operates. The differences result directly from the current level of enterprise development, access to knowledge, the pace of implemented technologies, the organizational structure itself and institutional factors. In some sectors, implementation of radical innovations is observed (e.g. high-tech), while in others innovations occur in an incremental manner and involve a series of smaller changes, taking the character of a continuous process, which concerns the service sector (Gromelska, 2011).

As a result of the changing environment, the company must constantly adapt. Interesting conclusions are presented by G. Hamel (2001), who think, that the adaptability of enterprises only allows them to survive, but does not ensure competitiveness. He claims that building the company's main competitive advantage is only possible thanks to radical and systemic innovations.

Innovations contribute to the development of an enterprise. A company that restricts the implementation of innovation may lose market position in relation to competing companies and may contribute to its stagnation (Janasz & Koziol, 2007; Rajnoha & Lorincova, 2015). Undertaking innovative investment projects allows to positively not only improve the situation of the enterprise and relations with its stakeholders, but also serves its employees as well as the interests of the natural and social environment. The application of more modern machinery, equipment or, for example, material- and energy-saving production technology, allows not only to improve the quality of manufactured products, but also to reduce the level of waste or pollutant emissions as well as occupational health and safety.

Increasing the value of an enterprise through innovative investments is possible gradually through evolutionary or more aggressive changes. However, it is not possible for all companies to be the authors of revolutionary innovations. On the contrary, we usually have evolutionary innovations called incremental or secondary innovations (Urabe, 1988). For this reason, imitative innovations have an equally important contribution to the development of enterprises, regions, economies, and their application can cause revolutionary changes, especially in less developed countries (Francik, 2003). Where the imitation method is used, implementation costs are lower than for the original innovation. Enterprises using imitation have the opportunity to improve themselves in areas they know well and develop their strengths, which ultimately serves competition between business entities (Parker, 1974).

However, with regard to the SME sector, there is an opinion that small and medium-sized enterprises only implement ready-made innovations obtained from the outside. This belief is due to the high costs of research that these companies cannot incur (Szot-Gabryś, 2016). Although the costs of these innovations that create in scientific institutes or research and development units are also so high that small and medium enterprises are not able to meet them in order to obtain them (Firszt, 2013). In addition, the narrow specialization in which small businesses operate, affects their low innovation. The result of it, is to make an innovation by these entities within one type of product or service (Łuszczuk, 2010).

Despite the small involvement of the SME sector in ground-breaking innovations, small companies are able to make a new product or service to offer in response to the clients' needs. The innovativeness of this sector is mainly based on the ability to use market opportunities related to generating changes that are a reaction to the socio-economic situation (Borkowski, 2014). In the case of small enterprises, they most often implement local innovations that do not require any special preparation or significant financial outlays. Despite this, they become a source of competitive advantage for an enterprise in the area of the market in which they operate (Gudkova, 2007).

It is worth emphasizing at this point the statement of W. Janasz (2003), who states that innovations can be created in any business entity, regardless of its size. He more widely justifies that not only the size of the company affects its innovation, but also the way of management, openness to acquiring new knowledge, the ability to see market needs and opportunities appearing on it.

Entrepreneurs are aware that by implementing innovations in their company, they have a chance to change qualitatively compared to the initial situation and take to the next level of enterprise development. Undertaking investments leading to the implementation of innovations gives them the opportunity to improve the economic efficiency of the enterprise and to take advantage of new market opportunities and gain competitive advantage (Szot-Gabryś, 2016).

## 2.2. Defining and typology of innovation

The issue of innovation occurs in economic, sociological and psychological sciences. The role attributed to innovations in economic terms is to increase the company's profit and market share, which are associated with the costs and risk of their implementation.

In contrast to non-creative changes, innovations arise in the conceptual and application phase (Zajączkowski, 2003). This means that a distinction should be made between the concept of an invention as an economically neutral scientific state for an enterprise, and its implementation and practical application when it becomes an innovation.

This means that a distinction should be made between the notion of invention as a scientific state (economically neutral for the enterprise), in contrast to its implementation and practical application when it becomes an innovation. So the area of invention is attributed to creativity, and the moment of implementing ideas is a zone of innovation (Francik, 2003).

Creating innovations is possible by original ideas of their authors, which over time turn into inventions, products, services, methods, processes (Gallo & Jobs, 2011). Thus, the term innovation means not every change that occurs in an organization, but one that is based on a concept or new idea. On the other hand, the idea alone is not enough for innovation to appear and should be implemented into practice (Bielski, 2000).

Economists define innovation as making new products to the market or to an enterprise (Albach, 1988). This means that it can be the first application of the invention (Schumpeter, 1960) or a novelty implemented throughout the country (Townsend, 1981), or a novelty in the company itself.

In the literature, J. Schumpeter is considered the creator of the definition of innovation, who at the beginning of the 20th century described it as:

- making a new good which consumers have not yet dealt with, or a new type of good,
- making a new production method that has not yet been tried in an industry,
- the opening of a new market, i.e. one in which a type of domestic industry did not previously operate, irrespective of whether this market existed before or not,
- acquiring a new source of raw materials or semi-finished products, regardless of whether this source already existed or had to be created,
- making a new industry organization, e.g. establishing a monopoly or breaking it.

The problem of novelty in innovation in global terms, described by J. Schumpeter, has now been replaced by the micro-scale approach observed at the enterprise level.

The definition of innovation by P. Drucker refers to the statement that it is a special tool of entrepreneurs, through which they use the change as an opportunity to start a new business or to provide new services and at the same time a tool enabling to use resources in a new way to enrich themselves. (Drucker, 2014).

S. Gomulka (1998) defines innovation as "new", which is something specific at the enterprise level. An innovative product is one that has been redesigned or improved based on another that already existed on the market. While process innovations relate to a new way of organizing the industry or new marketing and management methods. An innovation that is new at the enterprise level was also highlighted by F. Damanpour (1991), recognizing that it is a product (service), process, program or device that was first adapted or implemented by the company. W. Kotarba (1987) thought similarly, considering innovation as a process or process result, assessed by a company as new and beneficial.

H. Barnett (1953) and E. M. Rogers (1962, 2003) also emphasize the aspect of novelty in relation to innovation in their research. They believe that innovation is any thought, behaviour or thing that is new, i.e. qualitatively different from existing forms. Thus, innovation is an idea perceived by the individual as new.

Another of the creators of this issue, Ch. Freeman (1997) argued that innovation only occurs when a product that we intend to define as innovative becomes a subject of trade for the first time.

Sources of innovation, regardless of their type, can be ascribed to inside or outside the company. Internal sources include, among others running own research and development, marketing research, stimulating creativity among employees and senior management. The second group includes the purchase of knowledge in the form of patents, licenses, know-how or the results of scientific and technical research developed in R&D centres or academic centres, called disembodied technology. It is also possible to buy completed machinery and equipment with increased technical parameters, which directly contributes to the implementation of new processes and production of products (the so-called: embodied technology). External sources also include employee recruitment, specialist consultancy or joint ventures with other entities (Niedzielski, Markiewicz, Rychlik, & Rzewuski, 2007).

The next issue is to discuss the types of innovation. Dyer, Gregersen and Christensen identified two types of innovations: "refuting" which create a completely new market category in the form of surprising products, new procedures, implementation methods, work organization methods, and "supportive" innovations, of an evolutionary character that affect, inter alia for better implementation or reduction of production costs of existing products (Dyer, Gregersen, & Christensen, 2008). The first type of innovation as a novelty on the market cause rapid demand, satisfying completely new needs. The second type is the result of gradual improvement of products through observation and opinion surveys, as well as conversations with customers and suppliers.

The division of innovations currently used in many statistical and scientific studies is based on the typology used in „Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data”, in which four types of innovations are distinguished (OECD, 2005): product innovations, process innovations, marketing innovations, organizational innovations. This division of innovation was also used in this article.

Product innovation is linked with the launch of a product or service on the market that significantly differs from the one previously offered (with technical parameters, manner of use or purpose). As a result, the consumer obtains greater benefits and ease of use of this product. The improvement can also include the area of components, materials and software. In the service sector, innovation can consist of increasing the efficiency or speed of its provision or adding new functions or functions to an existing service.

Process innovation is defined as make a new or significantly improved production method in enterprise or delivering a product, which includes make significant changes in technology, hardware and / or software.

A significant change in the product (packaging) design, positioning, promotion, distribution or pricing policy of the product or business model results from the new marketing strategy of the company. That is why this type of innovation was called marketing innovation (OECD, 2005).

Organizational innovations are defined as a new method of business organization, workplace organization or relationships outside the company (Daszkiewicz, 2008).

From the point of view of the level of novelty of innovation, we distinguish radical (revolutionary) innovations, which are new in a given field, and incremental innovations, which are something new for the enterprise itself, but can already be used by competitors (OECD, 2005).

According to W. J. Abernathy, who researched and described the division into product and process innovations, most often in organizations there is a process of transition from radical product innovations to incremental process innovations. Radical product innovations usually appear at the initial stage of enterprise development, but do not allow economies of scale. Incremental process innovations allow to facilitate the production process by minimizing costs and increasing quality and efficiency, becoming the main source of competitive advantage (Abernathy, 1978).

The literature on the subject abounds in many definitions of innovation. Trying to summarize this issue, which is so often the subject of research, it can be concluded that scientists in their definitions describe

innovation as a novelty on the market or in an enterprise that has an impact on the growth and development of this enterprise.

In this way, innovation facilitates achieving production and economic goals, and its implementation ultimately translates into social benefits.

Innovation is perceived as a strategic instrument that should be used to build and expand the competitive capabilities of business entities, and belongs to the group of success factors of enterprises. It becomes a kind of key to the progress and development of companies, as well as a source of inventions in all areas of life (Farazmand, 2004). When referring to the national economy, promoting the idea of innovation - as in the case of Poland - is to give rise to a new economic order based on the restructuring of the economy and based on modernized enterprises (K. Firlej & Żmija, 2014).

### 3. METHODOLOGY OF THE STUDY AND HYPOTHESES

The empirical part of the article was developed using the research method based on a questionnaire completed by the respondent - CSAQ. In addition, in-depth research was carried out in the form of individual telephone conversations with entrepreneurs. The study was prepared and conducted by the author himself in the period from December 2016 to March 2017, and it was preceded by a pilot study in November 2016.

The Malopolska province was selected as the research area. The reason for this decision was that Malopolska is the first province in Poland to receive the title of "European Entrepreneurial Region" in 2016. It is an award promoting EU regions that are distinguished by an outstanding and innovative strategy for entrepreneurship, which in its assumptions is able to meet expectations in the context of the objectives of the Europe 2020 strategy for smart and sustainable development. Activities undertaken in the region should promote social inclusion and allow effective implementation of the Small Business Act for Europe. In addition, considering the innovation indicator of the EU Regional Innovation Index (RII), Malopolska belongs to one of the best province in the field of innovation assessment in Poland (European Commission, 2019). When determining the region with the highest RII Index in Poland, the Warszawski stoleczny (capital) region, which only functions as a statistical region, was not taken into account. This region was separated from the Mazowieckie province only on January 1, 2018, and is not a province within the meaning of the law as a local government unit. The Malopolska province is located in the southern part of Poland and covers 4.9% of the country's area. From the south, the province border is also part of the southern border of the country with the Slovak Republic. At the end of 2015, there were 177 569 enterprises in Malopolska, including 177 312 enterprises belonging to the SME sector, in which micro-enterprises dominated (96.1%), which is in line with the general trend for this sector, both in Poland and in the European Union.

The research group consisted of 160 enterprises belonging to the SME sector, i.e. employing less than 250 people who made investments in 2007-2015. The research group consisted of two sets. The first set consisted of enterprises that implemented investments (including innovative ones) using EU subsidies (78) and companies that implemented innovative investments using other sources of financing (83). The second set of companies acts as a comparative group in relation to the companies from the first set. The set of entities using EU subsidies consists of those companies that used EU aid in the 2007–13 programming period and completed the project by December 31, 2015. Therefore, the survey period covers the years 2007–2015. In the process of selecting enterprises, only projects co-financed from operational programmes that were responsible for implementing the national strategic reference framework were analyzed. In addition, enterprises had to implement projects whose specific objective under the operational programme were activities related to innovative investments and enterprise development, and they were not only of a training character. Information on enterprises was taken from the SIMIK 07-13 National Information

System. The adopted assumptions allowed the selection of enterprises from the Malopolska province under two operational programmes in the EU perspective for 2007-2013: the Innovative Economy Operational Program on a national scale and the Malopolska Regional Operational Programme on a regional scale implemented only in the Malopolska province. The second set of enterprises (acting as a comparative group for the first set) was selected on the basis of e-mail addresses from the EMIS and ORBIS international databases from the Malopolska province. As indicated by G. Churchill (2002) and S. Sudman (1976) in the case of regional research (as is the case in this article) for a small number of subgroups in enterprise research, a sufficient sample is considered when it is already in the range of 50-200 entities. Therefore, the sample size can be considered sufficient.

In addition, in order to determine the effects of implemented innovative investments, information collected from the combined databases SIMIK 07-13 and data of the Ministry of Development, regarding all enterprises and projects from the Malopolska region that meet the above assumptions were used. This collection contains information on 1679 enterprises from the SME sector (micro – 50%, small – 37%, medium – 13%), which using EU funds in the analyzed period implemented a total of 2389 investment projects of an innovative nature (number of projects by size of enterprises: 966, 994, 429).

In the article, the author put forward the following hypotheses:

H1: In enterprises from the SME sector that were beneficiaries of EU funds, a higher level of implementation of innovative investments is observed in comparison to economic entities that did not benefit from EU funds.

H2: Enterprises that have received an EU subsidy have invested more in product innovation than other entities.

H3: In enterprises that have used an EU subsidy, the scope of innovation (level of internationalization) is greater than in enterprises that use other sources of financing for innovation.

For each of the three hypotheses presented as alternative hypotheses (H1), the null hypothesis (H0) was also established, which assumes that there are no statistically verified differences between the observed groups. This means that if the null hypothesis is rejected, the statistical significance of the described hypothesis presented by the author may be considered.

$$\text{Null hypothesis } H_0: \mu_1 = \mu_0$$

$$\text{Alternative hypothesis } H_1: \mu_1 \neq \mu_0$$

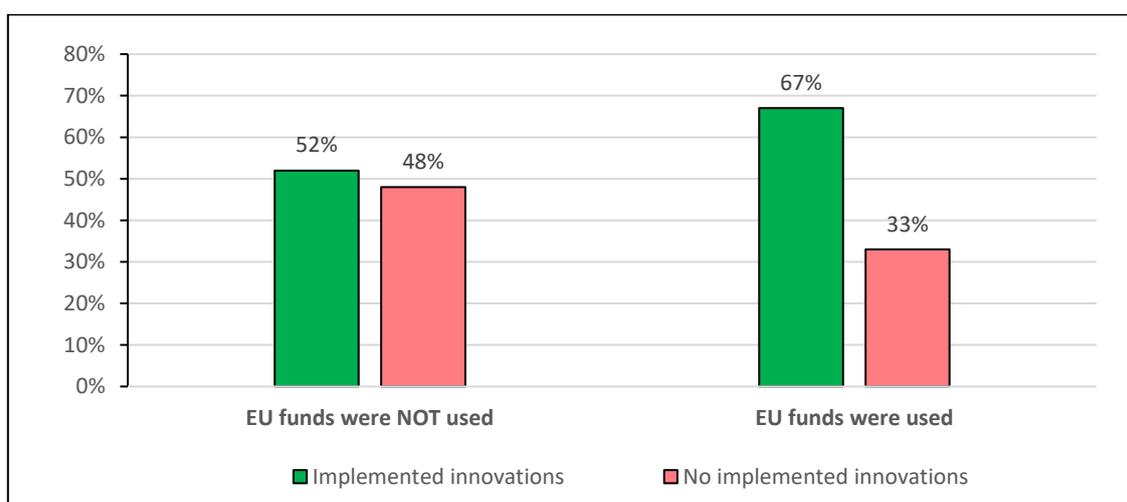
To verify the research hypotheses, the  $\chi^2$  test of independence was used, assuming the significance level  $\alpha = 0.05$  and the probability value of the test  $p < 0.05$ . Fulfilling the assumption that  $p < \alpha$  allowed to reject the null hypothesis (H0), which means that there is a significant difference between the parameter values. However, if  $p > \alpha$ , then at the significance level  $p$  there are no grounds to reject the null hypothesis (H0). Before using the test, the assumption regarding the minimum number of fields in the table with the expected values was checked (Sheskin, 2000).

Statistical analyzes based on the collected research materials were carried out on the basis of electronic calculation techniques, using the following programs for this purpose: Statistica v.13.3 and Microsoft Excel 2016.

#### 4. EMPIRICAL RESULTS AND DISCUSSION

Below are the results of comparative studies showing the diversity of innovative investments made in two groups of enterprises depending on the sources of financing. In the group of entities that implemented implementations of an innovative nature, using financial support in the form of grants, and in companies that have not benefited from EU aid.

The distribution of variable values presented in Figure 2 allows concluding that in the group of enterprises which took advantage of the EU support a greater share of innovative investments is observed. The ratio between the firms that implemented innovations as a result of incurring investment expenditure and those that did not implement any innovations while at the same time taking advantage of the EU funds is 2:3 while among the firms belonging to the comparator group this ratio is 1:2.



**Figure 2. Surveyed enterprises that implemented innovations depending on the sources of financing**

*Source: own study based on research*

The value of the test probability ( $p = 0.0488$ ) for the  $\chi^2$  test of independence in the analysis of qualitative data justifies rejection of the null hypothesis. In view of the above, the results obtained legitimise the statement that there is a dependence between implementation of an innovation in an enterprise and utilisation of financial support in the form of a subsidy from the EU funds.

Furthermore, based on the empirical studies carried out, it was established that in a situation of no funding from the EU funds almost half of the respondents (45%) would not be able to achieve implementation of innovation. And 55% of respondents stated that even if the EU had not been granted to them, the planned implementation of innovation in the enterprise would have been effected. Despite the slight predominance of answers from firm representatives who would strive at implementing an innovation irrespective of the source of funding, it turns out that the underdevelopment might even concern half of the enterprises surveyed.

For the purpose of the survey, analyses were performed with regard to differentiation of innovations in enterprises from both of the groups in the survey, and the detailed data are presented in Table 1. Entrepreneurs taking advantage of the EU subsidies as well as those who funded their investments from other sources most frequently effected implementations of innovations concerning products (with a visible predominance of innovations in services) and processes. However, the percentage of enterprises that implemented these innovations is greater in the group of entities which took advantage of the operational programmes. The share of the firms that effected implementations in the range of products increases along

with an increase in the size of these entities and decreases for innovations in services, more of which were implemented by micro-enterprises.

The results of the  $\chi^2$  test of independence for which the value of test probability  $p$  is less than the adopted level of significance  $\alpha = 0.05$  ( $p < 0.05$ ), allows to state that both groups statistically differ from each other, and thus there is a connection between the implementation of innovation products with obtaining EU support by enterprises.

For innovations concerning processes, firms that received the EU aid more frequently implemented innovations concerning methods of manufacturing products (53%) with medium-sized firms predominant over the on the ones, and based on methods supporting processes in the (49%) with a predominant share of small firms. This second type of innovations prevails in firms that did not take advantage from european aid (51%) while the first one was only implemented in every third enterprises in the survey (33%). Innovations in the area of distribution and logistics occurred more seldom in both survey groups (the largest numbers of them were implemented by the largest firms in the SME sector) but with a noticeable share in firms in the comparator group.

Both types of organisational innovations were more frequently implemented in enterprises that did not receive the EU support than in those that took advantage of it (36%-38% and 16-24% respectively). Innovations based on new methods in the principles of operation in the enterprises (serving, inter alia, the purpose of learning and sharing knowledge within the firm) as well as those that included new methods of distributing tasks and decision-making powers among employees were predominantly implemented in small enterprises.

Table 1

Types of implemented innovations in enterprises

Type of innovation	Companies which didn't use EU funds				Companies which used EU funds			
	Micro	Small	Medium	SMEs Total	Micro	Small	Medium	SMEs Total
<b>Product innovations</b>								
New or significantly improved product	48%	44%	67%	49%	35%	53%	79%	53%
New or significantly improved service	61%	44%	33%	56%	85%	53%	50%	65%
<b>Process innovations</b>								
Methods of manufacturing products	33%	33%	33%	33%	40%	53%	71%	53%
Methods in the field of logistics and distribution	15%	44%	67%	24%	10%	13%	21%	14%
Methods supporting processes in an enterprise	45%	78%	33%	51%	45%	53%	50%	49%
Methods of cost optimization	33%	56%	33%	38%	20%	33%	43%	31%
<b>Organizational innovations</b>								
Methods in the principles of the company's operation	30%	56%	33%	36%	20%	20%	36%	24%
Methods of division of tasks and decision-making powers among employees	30%	67%	33%	38%	10%	20%	21%	16%
<b>Marketing innovations</b>								
Organizational methods in the field of relations with the environment	24%	16%	-	29%	20%	7%	21%	16%
Significant changes in design or packaging	21%	22%	33%	22%	10%	7%	36%	16%
Promotion or advertising methods	24%	33%	67%	29%	20%	7%	36%	20%
Methods for distribution or sales channels	6%	11%	33%	9%	20%	7%	14%	14%
Price formation methods / strategies	18%	33%	33%	22%	20%	27%	21%	22%

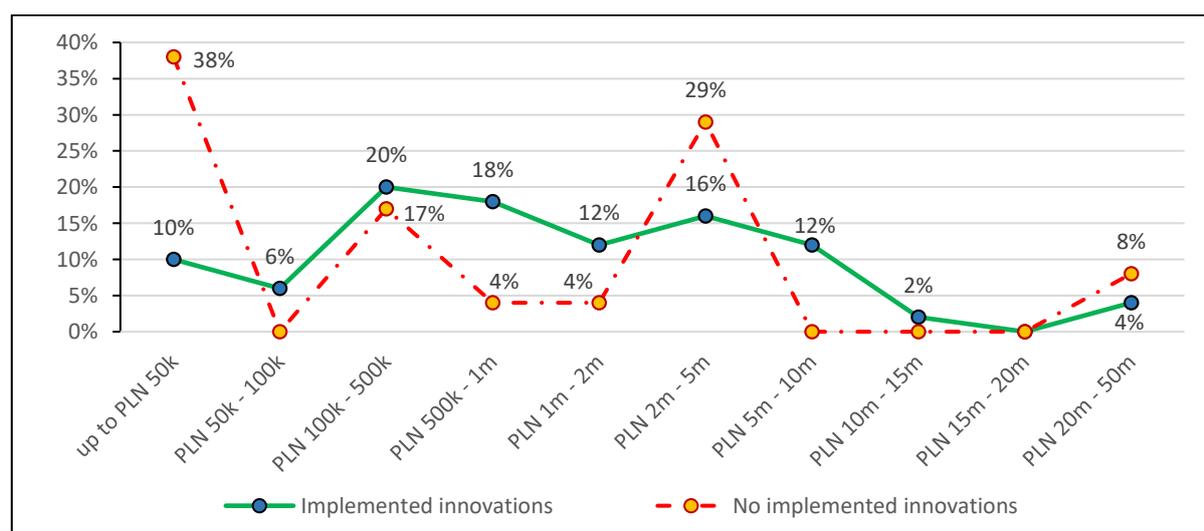
\*The results do not add up to 100% because the respondents were able to indicate several variants of the answer.

Source: own study based on research

Enterprises belonging to the comparator group were more willing to incur expenditure on marketing innovations than those whose investment projects were supported by EU funds. This is visible with respect to those non-technological innovations that concern new methods of promotion or advertising (29% and 20% respectively) as well as those involving considerable changes in design or packaging (22% and 16%). In the group of firms that were not included in the EU support, their growing share in incurring expenditure on innovations along with an increase in the size of the enterprises can be seen. An identical level of involvement was found for both groups of firms in the survey (22%) with regard to innovations resulting in new methods of determining prices. A higher level of involvement in non-technological innovations being new methods concerning distribution of products (services) or their sales channels was found among the enterprises which received the EU support in the form of subsidies (14%) even though that was the least frequently implemented type of innovation in those enterprises, similarly like in the other group.

Within the framework of further analyses, the value of the investments accomplished in enterprises with the financial support from the EU operational programmes was compared with implementation of innovation in those firms. (For this purpose, the variable 'investment value' was grouped so that the analysis could be carried out). The value of the test probability ( $p = 0.0398$ ) for the chi-squared test of independence justifies rejection of the null hypothesis, which means that there is a correlation between the value of investments in an enterprises and implementation of innovation. The level of the total value of investments in the case of the projects included in the funding from EU funds was higher in the group of the enterprises that implemented innovation projects.

The vast majority were investment projects that involved implementation of innovation. Nearly every third project (28%) that included an innovation component was in the amount range from PLN 500k to PLN 2m, and 14% of all projects of this type reached a value between PLN 5m and PLN 15m (Fig. 3). Concerning innovation implementation in projects included in the EU funding, the value of investments was higher than PLN 1m in more than half of them. At the same time, 75% of enterprises incurred expenditure to a value of less than PLN 5m. The value of projects supported with EU funds in half of the enterprises which did not effected any innovative implementations within the framework of the funding received was lower than PLN 100k.

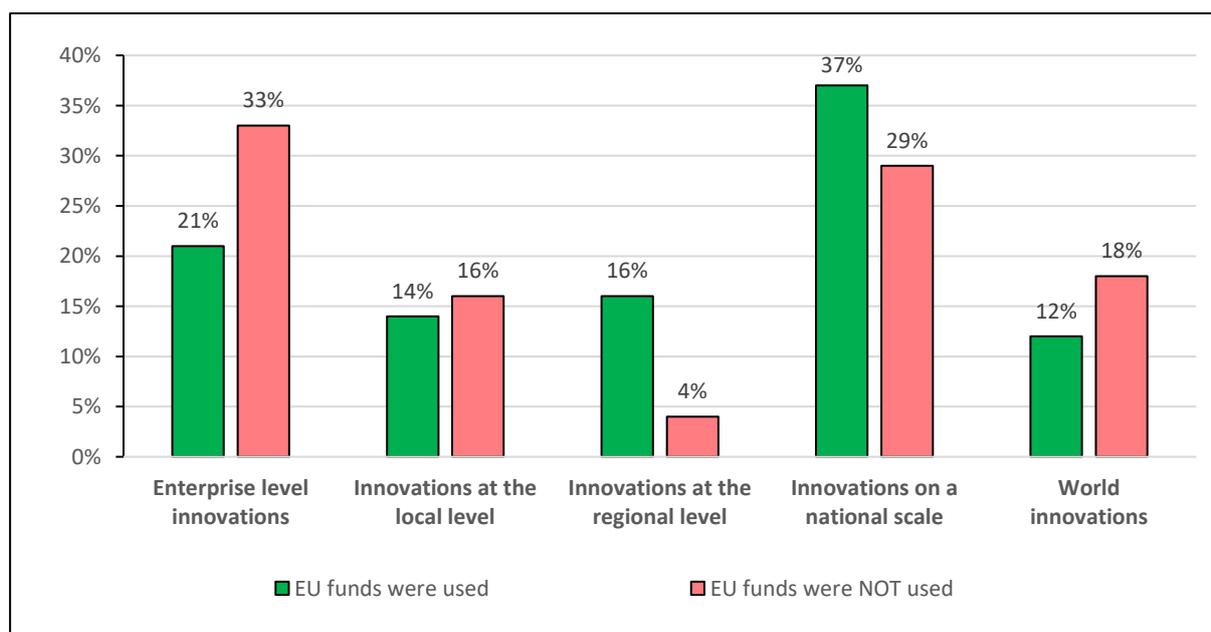


**Figure 3. Distribution of the investment value co-financed from EU funds in relation to the implementation of innovations in enterprises**

*Source: own study based on research*

It should be noted that 38% of entrepreneurs who carried out investments with the support of EU subsidies did not implement innovations in their companies. The value of those investments did not exceed PLN 50k. This is mainly due to the amount of support provided to entrepreneurs in announced competitions by institutions managing operational programmes. Generally, in competitions where the amount of support was the lowest (i.e. below PLN 50k), entrepreneurs were not required to implement innovative investments. However, it should also be emphasised that for 29% of firms, the value of investments accomplished with the support of EU subsidies was in the range between PLN 2m and PLN 5m. The amounts indicated concern the total value of the investments effected in the enterprises and not the mere value of the funding granted from the operational programmes, even though it is included in the total amount of the investment. It should also be emphasized that the institutions managing operational programmes have learned their lesson from this situation. The announced competitions for EU aid in the period 2014-2020 were intended mainly for entrepreneurs who had to plan to obtain effects in the form of implementing innovations, which had to be presented in the application form.

Further, an analysis was performed concerning the volume of the innovations implemented in the particular groups of the enterprises surveyed. The results presented in Figure 4 show that among the enterprises which received subsidies for investments which concerned implementation of innovation, the extent of innovation is larger in the scale of the whole country than at the regional level as compared with firms which did not use financial support from the European Union.



**Figure 4. The extent of implementation of innovations in the surveyed enterprises**

*Source: own study based on research*

In the comparator group of firms, a greater percentage of them effected implementation of innovations solely at the level of the enterprises themselves. At the same time, however, this group of enterprises had a larger share of innovation implementations in the scale of the world than the firms included in the EU aid. The results obtained were confirmed using a  $\chi^2$  test of independence. The value of test probability obtained ( $p = 0.2369$ ) at the adopted significance level ( $\alpha = 0.05$ ) does not allow the conclusion that there is a correlation between the groups of enterprises concerning the utilisation of the operational programmes and the extent of innovation. Thus, the hypothesis that, obtaining EU funding contributes to the fact that the

range of implemented innovations in these enterprises is greater than in companies that financed innovative investments from other sources, cannot be confirmed.

On this occasion, attention was also paid to the issue of the source (place of origin) of innovation. Co-financing of investment projects with the use of EU subsidies was encourage to increasing innovation activity in enterprises. The enterprise as the place of origin of innovation was indicated by 46% of companies assisted by EU financial aid and 40% of companies from the comparative group. In the analyzed group of entities, over half of the innovations were purchased outside of enterprises. This means that in both researched groups, business owners still order innovations in other entities (e.g. commissioned service, commissioned project, purchase of know-how, purchase of a patent) for the needs of the companies they manage.

For the purposes of this study, data was also analyzed in terms of the results obtained as a result of implemented innovative investment projects with the use of EU support in the studied area (Table 2). Attention should be paid to the four most important aspects of implemented innovative investments, which have a significant impact on SME enterprises in the following areas: creation of new products or services, employment, research infrastructure, protection of industrial property.

Table 2

Selected indicators in the scope of implemented innovative projects in SMEs

Type of indicator	Value of the indicator achieved in projects						
	Micro	Small	Medium	Micro	Small	Medium	SMEs Total
	Percentages			Quantity			
New and improved products or services	44%	45%	11%	2429	2518	592	5539
Technologies implemented	12%	38%	50%	12	38	50	100
Patent applications, utility and industrial designs ensuring legal protection in the country	25%	53%	22%	16	34	14	64
Patent applications, utility and industrial designs providing legal protection abroad	69%	18%	14%	35	9	7	51
Research equipment purchased	25%	45%	29%	279	501	326	1106
Laboratories created or modernized	32%	41%	28%	32	41	28	101
New workplaces created	26%	51%	23%	1217,3	2395,2	1089,1	4701,6
New R+D workplaces created	23%	45%	33%	20,7	41,4	30	92,1

Source: own study based on data from SIMIK 07-13 and the Ministry of Development

Entities using EU subsidies have implemented over 5000 new or improved products or services, as well as 100 new technologies. The largest involvement in this area can be observed among small and micro enterprises that have largely achieved this ratio (45% and 44% respectively). A positive consequence of innovative investments was also an increase in employment. In small enterprises, as a result of implementing projects from EU subsidies of an innovative nature, 2395.2 new workplaces were created (of which 41.4 were directly research-related), which represents 51% of all new workplaces. Micro- and medium-sized entities created respectively 1217.3 and 1089.1 new workplaces in which people found employment as part of projects of an innovative nature and supported by EU aid. Most research positions were created in the case of projects implemented by small companies (41.4), and the least in micro-enterprises (20.7). The third important area resulting from EU aid received by enterprises concerns the purchase of research equipment. In all types of enterprises, 1106 various types of research equipment were purchased and 101 laboratories were created or

modernized. Also in this aspect, the dominant position is occupied by small- and medium-sized enterprises in the SME group, whose investments in research equipment amounted to 45% and 29% of the total number, respectively. The last of the results of innovative investments implemented in the SME sector with the support of EU subsidies concerns the area related to the protection of industrial property. Enterprises submitted 105 patent applications, utility models and industrial designs providing legal protection, of which 64 concerned protection within the country and 51 abroad. In the case of patent protection in the country, small enterprises play a leading role (53%). Interestingly, in the case of protection outside Poland, in the case of implementing innovative projects with the participation of EU subsidies, micro-enterprises gained a definite advantage in terms of the number of patent applications (69%).

## 5. CONCLUSION

When assessing support in the form of subsidies from EU funds for innovative investment activities in the SME sector, attention should be paid to the results of these investments. As a result of the analysis of all innovative projects implemented by the SME sector with the support of the EU, it can be stated that the consequences of these projects for enterprises concern the following four areas: creation of new products or services, increase in employment, including creation of research positions, investments in research infrastructure and aspect of the property protection industry.

On the basis of statistical analyzes, the H1 hypothesis has been positively verified, according to which enterprises covered by support from EU funds have a higher level of innovative investment implementation in relation to other business entities.

There is a positive correlation between the implementation of innovation in the enterprise and the application of financial support from the EU subsidy for the needs of the investment. In enterprises using EU subsidy, a higher percentage of innovative projects was observed (69%) than among companies that did not use such support (51%). This situation was conducive to building an innovative economy. However, the European definition of innovation was particularly painful (especially in the years 2007-2013), according to the methodology of Oslo, which considered any new or significantly improved activity even at the level of the company itself. Even if in the economy such technology has been used for a long time.

The H2 hypothesis has been positively verified, confirming that the most frequently implemented innovations in enterprises that received an EU subsidy were of a product nature. In those enterprises, compared to entities that did not use EU funds, an advantage in implemented process innovations was also observed. Among the companies that have implemented product innovations, their share increases with the size of these entities, and decreases for innovations in services, the more of which have been implemented by microenterprises. Companies that received financial aid from EU funds more often implemented innovations in the field of production methods of products (53%) with a predominance of medium companies over others and regarding methods supporting processes in the enterprise (49%), with a majority share of small companies. Innovations in the field of distribution and logistics were the least frequent in both groups (most often implemented by the largest companies in the SME sector). On the other hand, process and marketing innovations were mostly implemented by enterprises that did not benefit from support from EU aid, but implemented them through own financing or from other sources.

The share of enterprises which received subsidies for investments under which the implementation of innovations on the national and regional level has been made is greater than in the case of companies that did not use financial support from EU funds. The receipt of co-financing from EU funds was crucial for a significant number of enterprises in the field of implementing innovations. In almost half of the companies (49%), innovations were national and world-wide. However, the statistical analysis carried out does not

allow for positive verification of the hypothesis H3 that the scope of innovation (level of internationalization) depends on the receipt of EU funds.

However, despite the fact that the hypothesis regarding the scope (range) of implemented innovations cannot be confirmed, it should be mentioned that obtaining subsidy support for investment projects from operational programmes was conducive to increasing innovation activity in enterprises that used them. Research has shown that almost half of enterprises that received EU financial aid indicated the company as a place (source) of innovation, compared to 40% of companies that used another source of financing for innovation. While, more than half of the innovations were created outside of enterprises and were purchased and implemented by these entities. The most frequently implemented innovations in enterprises were of a product character (with a predominance of innovation in services) and a process advantage with the majority of entities that benefited from EU funds.

In addition, an important conclusion of the study is that in the absence of financial support using EU subsidies, almost half of the respondents would not be able to implement innovation.

## ACKNOWLEDGEMENT

The article is financed by the Ministry of Science and Higher Education in the Republic of Poland from a subsidy allocated to the Cracow University of Economics (Project No. 066/WE-KPI/01/2019/S/9066).

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