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Sources of innovation funding in Polish companies in the light of statistical surveys

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Abstract: One of the key components of the innovation management process is selection of sources of funding innovative projects in the company. The research problem taken up by the authors is important for Polish companies, especially SMEs, which base their strategies upon innovations. The analysis of publications concerning strategic choices confirms the existence of a relatively small number of scientific and research studies within this area. Thus, there is a cognitive gap, which encouraged the authors to carry out analyses of the research problem defined in this manner. The purpose of the article is to discuss the criteria and variants of strategic selection of the funding sources of innovations in a company. Based on the experience of others, described in the literature, and their own analyses, the following criteria were adopted: market development, type of innovation and potential sources of its financing. Then, the process of selecting sources of financing innovation was developed. The article analyses the available literature, internet data, results published in the European Innovation Scoreboard 2017 and statistical data prepared by the Polish Central Statistical Office (GUS) regarding sources of financing innovations. It enabled separation of sources of financing innovations in Polish enterprises and assessment of their applications in the practice of business.The obtained results indicate that despite the existence of various innovation funding sources, Polish companies are definitely dominated by their own financing. There is a small contribution of public and external funds.

Keywords: enterprise**,** market, innovation, innovation funding sources.

JEL codes: G24, L0, O10

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1. Introduction

Financing plays a strategic role in innovation management as it allows enterprises to conduct research, adopt and develop new technologies necessary for inventions as well as develop and commercialize innovations. Accessing different sources of finance for innovation is an important challenge for enterprises. They can fund innovation activities using a variety of funding sources provided by different types of financial instruments and investors.The purpose and content of the article is consistent with the issues of strategic choices of an organisation, which constitutes the essence of strategic management and is the key component of the strategy development process. The research problem taken up by the authors is important for Polish companies, especially SMEs, which base their strategies upon innovations. The analysis of publications concerning strategic choices confirms the existence of a relatively small number of scientific and research studies within this area (Urbanowska-Sojkin, 2017: 101). Thus, there is a cognitive gap, which encourages the authors of this study to carry out their own analysis and reflect upon the research problem defined in this manner. Consequently, the purpose of the article is to discuss the criteria and variants of strategic selection of innovation funding sources. Based on the experiences of others, described in the literature as well as the authors' own analyses, the following criteria were adopted: market development, type of innovation and potential sources of its financing. Then, the authors identified the selection process of the sources of innovation funding in the process of effective company management. The empirical part of the article contains an analysis of statistical data concerning innovation investments and funds. Sources of statistical data come from European Innovation Scoreboard 2017 and research reports on Polish companies in the industrial and service sector in Poland prepared by the Polish Central Statistical Office (GUS). This data analysis enabled evaluation of the commonness and usability of the distinguished innovation funding sources and allowed concluding that Polish companies from the SME sector have limited possibilities to utilise the sources of innovation funding, which exist in practice.

2. Innovation funding sources in the company

The analysis of the existing innovation funding sources and their use in business practice shows a connection between the type of funding source and the particular phases of organisational development. P. Głodek and M. Gołębiowski present a relationship between the phases of development of an innovative project and the main sources of its financing (Głodek, Gołębiowski, 2006: 10-11). According to these authors, each innovative project includes four phases: sowing, start, early growth, and sustainable growth. Each of these phases is supported by the appropriate source of financing. The first and the second phase is significantly supported by: own funds of the owner and the organisation, as well as family and friends. The early growth and the sustainable growth phase is essentially funded by: banks and public capital markets. Other funding sources, such as: public and quasi-public funds, angel investors, seed funds, venture capital funds, and funds of industrial companies, are used at all stages of the innovation process.

According to P. Kokot-Stępień, the opportunity to make use of a given form of financing of the innovation process also depends on the development phase of the innovative design (Kokot-Stepień, 2016: 18-19). The author also distinguishes four stages of an innovative project: sowing, start, expansion, and development, and she similarly indicates the sources of their financing. A new element is the distinction and indication of innovation funding sources such as: private equity, mezzanine capital fund, bank loans, and funding on the securities market. In practice, the former three of the aforementioned sources are present during the start, expansion and sustainable development phase. In turn, funding on the securities market is actually present in the phase of expansion and sustainable development.

When analysing the particular above-described funding sources of innovative processes in companies, they can be divided into two groups. The first group contains sources based on the mechanism of loaning funds from various persons and institutions. In turn, the second group concerns capital injections administered to the company without the need to return the cash contributions. Each of the aforementioned groups contains diverse instruments and funding methods of arising and developing innovations. Such an approach is typical of the company MCI Management S.A. (Gromada, 2008: 34-35). This company ordered the sources of innovation funding by adopting two criteria: stages of company development and types of capital (external capital and own funds). The stages of company development include: seed/start-up, development/growth, expansion, and maturity. In turn, the external capital (debt) covers: family

and friends, credit cards, credit lines, trade credit, factoring, leasing, bank credits, and bonds. In turn, own funds cover: own savings, subsidies, grants, angel investors, seed capital, venture capital, retained profits, private equity, Pre-Initial Public Offering (Pre-IPO), and IPO. Such a perspective of the mutual relationship between the process of company development and the type of capital (foreign and own funds) shows the leading importance of own funds, especially in the seed and start-up phase.

However, the type of owned capital is not the only key criterion when it comes to funding sources of the innovation process. K. Allen additionally indicates risk as an important criterion, often determining the success of innovative projects (Allen, 2010: 188-190). The author distinguishes three stages of the innovation process, to which she assigned a specific source of financing. The first stage is the seed stage. This stage covers: self-financing, funding by friends and family, private investors, grants, *Small Business Innovation Researches* (SBIR), Small Business Technology Transfer (STTR) programme. The author identified the next stage as the early stage. It is financed by: private investors, venture capital, strategic partners, Small Business Administration (SBA) loans, Small Business Investment Company (SBIC) programme, bank loans. The third stage – growth (mezzanine) covers such innovation funding sources as: venture capital, public equity and strategic partnership. Implementation of the three indicated stages is supposed to lead to obtaining funds for further development of innovation through public offering of the sale of shares (Initial Public Offering – IPO)

Based on the distinguished stages of the innovation process, K. Allen indicates the risks occurring at each of these stages, which impact the success of the innovative project. The *seed* stage, where the organisation still has no revenues, is associated with two risks: R&D risk and manufacturing risk. These risks are reduced upon obtaining the first customer and the first revenue, however, they are replaced with new ones, relevant for the subsequent two stages: early development and mezzanine growth. Marketing risk and management risk. These two risks are reduced upon presentation and implementation of the public offer of the sale of shares in the innovative project being developed.

An in-depth overview of literature on the subject allows distinguishing two other essential criteria which determine the course of the innovative process. These are: implementation time of the innovative investment project and the revenues obtained from this project (Start-up company, 2017). The aforementioned time consists of four periods, for which various sources of financing

are available: the first period is defined as conceptualisation and financed by co-founders; the second period – valley of death is financed by seed capital, angel investors, declared investors (Family, Friends and Fools – FFF), accelerators. The third period of growth is financed by venture capital, acquisitions, mergers, and strategic alliances. In turn, the fourth period is public offering and sale of shares in the innovative project.

In the innovative project implementation time perceived in such a way, the most difficult period is the valley of death. It is the moment when a financial gap emerges, when the organisation has no (usually) public funds left for the innovative project implementation, and private investors are undecided as to their financial involvement in the innovation being developed. It should be emphasised that the definition of this phenomenon is open-ended. It may occur at every stage of development works and presentation of new technologies.

The trap in the form of *the valley of death* can be avoided using funds obtained from the following sources: seed capital, angel investors, declared investors (FFF), and accelerators. A novelty in this regard is the possibility to acquire funds from the "crowd" through *equity crowdfunding* and *crowdlending* instruments.

The latter two sources indicated above can allow funding of the subsequent stage of innovation development, namely the growth. This stage can also be financed using sources such as venture capital, sales, mergers, and strategic alliances. The described cycle is completed by public offering of shares in the innovative project.

The discussed issues are analysed in an interesting way by A. Kiska, who presents a cycle of investing in the innovative project (Kiska, 2017). He distinguished five stages of innovation funding: idea, product/prototype, first consumers, growth and expansion. Every aforementioned stage has specific funding sources assigned. The first stage is financed by: declared investors (FFF) and angel investors. The second stage is financed by seed funds. The third stage is implemented on the basis of venture capital. In turn, the fourth stage of the innovative project can be implemented thanks to funds originating from the public market and private capitals. The sources of funding of the fifth stage come from the revenue earned from sales of the innovative product.

The quoted author, just like K. Allen, draws the attention to the importance of risk in the implementation of an innovative project. This risk decreases with moving along to the execution

of subsequent stages. Such a situation is connected with a kind of funding certainty and revenues obtained by the organisation on a regular basis.

The above review of opinions and views on the funding sources of innovations in a company is practically convergent when it comes to the exemplification of these sources. However, differences relate to criteria qualifying particular sources for implementation of subsequent stages of the innovative project. In our opinion, these differences are of no crucial importance, since there are other criteria that affect the strategy of selection of innovation funding sources in practice.

3. Selection of innovation funding sources in the company

Implementation of every innovative project is strictly connected with the choice of funding sources. As written by E. Urbanowska-Sojkin (2011: 65-66), making a choice means an "intellectual thought process requiring evaluation of benefits related to different operation options as well as indication of one of them as the recommended one." This process is subject to various conditions and is dynamic and variable. Its operationalisation enables identification of four phases of selection: strategic problems, identification of internal and external conditions of operation, formulation of strategic options, and strategic selection – decision (Urbanowska-Sojkin, 2011: 57).

The proposed approach can be adapted and used in the process of selecting innovation funding sources in the organisation. In this perspective, what E. Urbanowska-Sojkin defines as strategic problems, we define as market investigation for the innovation, namely identification of the environment, conditions of diffusion and further development of the innovation. In turn, the second phase is the concrete proposal of the innovative project for the identified market. The third phase is the identification of potential options of funding sources. The last phase consists in selection of a source or sources adequate for the financing of innovative activities.

The strategy of selection of the funding sources in the organisation was developed using the model of the market and innovation development cycle, prepared by E.G. Moore. The approach offered by this researcher assumes the presence of the economic space of various markets: early market, chasm, bowling alley, tornado, main street (early), indefinitely elastic middle period, declining market (declining), fault line, end of life. These various markets are assigned the relevant types of innovation: disruptive innovation, application innovation, product

innovation, process innovation, experiential innovation, marketing innovation, business model innovation, and structural innovation (Moore, 2006: 83, 84).

Table 1 compares a set of potential sources of innovation funding, the starting point of which was the review of these sources presented in the first part of this article. The map of these sources was prepared on the basis of the following criteria: market development and type of innovation. Acquaintance with the market and the specific character of the type of innovation enables segmentation and selection of its sources of financing by the organisation.

The strategic selection process of the sources of innovation funding ends in the decision to use one or several relevant sources that will enable execution of the innovative project in the organisation.

The described selection strategy of the funding sources in the organisation covers the whole market development cycle, which is assigned specific innovations and sources of their financing. Such a perspective allows noticing the phase of innovation decline, where it is also necessary to ensure proper financing.

The specification of potential sources of innovation funding shows their diversity and flexibility when it comes to funding particular stages of innovative activities. Furthermore, some of the aforementioned sources may be used to finance different phases. The largest accumulation of funding sources can be observed in the phase of growth, popularisation and stabilisation (indefinitely elastic middle period) of innovation.

Table 1. Potential innovation funding sources in the company depending on the phase of life cycle of the market and the type of innovation

Phase 1 Early market	Phase 2 Chasm	Phase 3 Bowling alley	Phase 4 Tornado	Phase 5 Main street (early)	Phase 6 Indefinitely elastic middle period	Phase 7 Main street (declining)	Phase 8 Fault line	Phase 9 End of life
Disruptive innovation	Disruptive innovation	Application innovation	Product innovation	Process innovation; Experiential innovation	Experiential innovation; Marketing innovation	Marketing innovation; Business model innovation; Structural innovation	Structural innovation	Market innovation
any public and quasi-public funds; own funds; seed capital funds; co-founders; seed capital; angel investors, FFF; accelerators; venture capital; subsidies; grants	any public and quasi-public funds; own funds; seed capital funds; co-founders; seed capital; angel investors, FFF; accelerators; venture capital; subsidies; grants	any public and quasi-public funds; own funds; seed capital funds; co-founders; seed capital; angel investors, FFF; accelerators; venture capital; equity crowdfunding; crowdlending; subsidies; grants	any public and quasi-public funds; own funds; co-founders; seed capital; angel investors, FFF; accelerators; venture capital; equity crowdfunding; crowdlending; subsidies; grants	any public and quasi-public funds; own funds; co-founders; seed capital; angel investors, FFF; accelerators; venture capital; equity crowdfunding; crowdlending; mezzanine funds; acquisition; mergers, strategic alliances; bank credits, leasing; factoring; retained profits	any public and quasi-public funds; own funds; co-founders; seed capital; angel investors, FFF; accelerators; venture capital; equity crowdfunding; crowdlending; mezzanine funds; acquisition; mergers, strategic alliances; bank credits, leasing; factoring; Pre-IPO; IPO; credit lines; retained profits	any public and quasi-public funds; own funds; co-founders; seed capital; angel investors, FFF; accelerators; venture capital; equity crowdfunding; crowdlending; retained profits	own funds; co-founders; retained profits	own funds; co-founders; retained profits

Source: prepared by the authors

4. Sources of innovation funding in Polish companies

The issue of financing innovation is a key subject of research and analysis by the European Commission. The basic document in this respect is the European Innovation Scoreboard. This report presents the results of European countries' innovation systems. In order to produce the European Innovation Scoreboard, four main types of indicators (Framework conditions; Investments; Innovation activities; Impacts) and ten innovation dimensions are distinguished, which together translate into 27 different indicators.

Framework conditions are the main factors for innovation that are beyond the control of companies and cover three dimensions of innovation such as: Human resources (New doctorate graduates; Population aged 25-34 with tertiary education; Lifelong learning); Attractive research systems (International scientific co-publications; Top 10% most cited publications; Foreign doctorate students); Innovation-friendly environment (Broadband penetration; Opportunity-driven entrepreneurship).

Investments mean public and private investment in research and innovation, and cover the two dimensions such as: Finance and support (R&D expenditure in the public sector; Venture capital expenditures); Firm investments (R&D expenditure in the business sector; Non-R&D innovation expenditures; Enterprises providing training to develop or upgrade ICT skills of their personnel).

Innovation activities are illustrated by innovation efforts at the enterprise level, included in the three dimensions of innovation such as: Innovators (SMEs with product or process innovations; SMEs with marketing or organizational innovations; SMEs innovating in-house), Linkages (Innovative SMEs collaborating with others; Public-private co-publications; Private co-funding of public R&D expenditures) and Intellectual assets (PCT patent applications; Trademark applications; Design applications).

The impacts include the impact of innovation activities in enterprises in two dimensions of innovation such as: Employment impacts (Employment in knowledge-intensive activities; Employment fast-growing enterprises of innovative sectors) and Sales impacts (Medium and high tech product exports; Knowledge-intensive services exports; Sales of new-to-market and new-to-firm product innovators).

Member States are classified on the basis of the average of results and classified into one of four groups. Based on the average of results calculated on the basis of the aggregate indicator - the total innovation indicator - Member States were divided into four groups.

The first group includes countries identified as Innovation Leaders, whose innovation results are well above the EU average (Denmark, Finland, Germany, the Netherlands, Sweden and the United Kingdom).

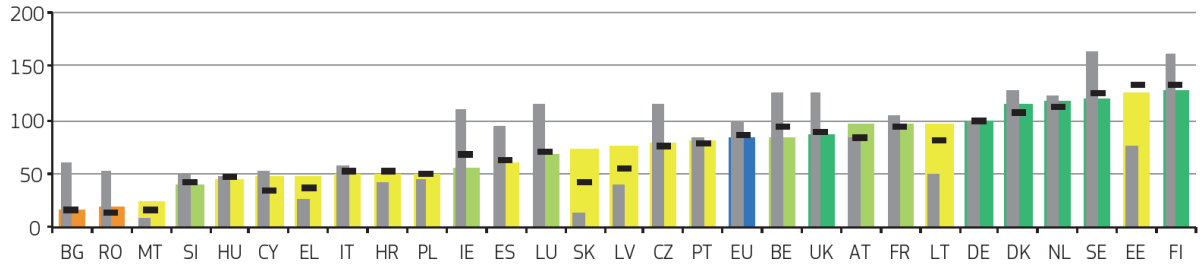
The second group is called Strong Innovators, i.e. countries with results above or near the EU average (Austria, Belgium, France, Ireland, Luxembourg and Slovenia).

The third group includes the following countries: Croatia, Cyprus, the Czech Republic, Estonia, Greece, Hungary, Italy, Lithuania, Latvia, Malta, Poland, Portugal, Slovakia and Spain. These are countries in which the level of innovation is below the EU average. These countries were therefore included in the group of Moderate Innovators.

The fourth group includes Bulgaria and Romania, which are referred to as the so-called Modest Innovators with results far below the EU average.

According to the data included in the European Innovation Scoreboard, Poland is in the group of the so-called moderate innovators, taking the 25th place (Figure 1). However, taking into account investments in research and innovation that cover the two dimensions of financing and support as well as business investments, our country occupies a higher position (the 19th and 16th place) among EU countries (Figures 2-3).

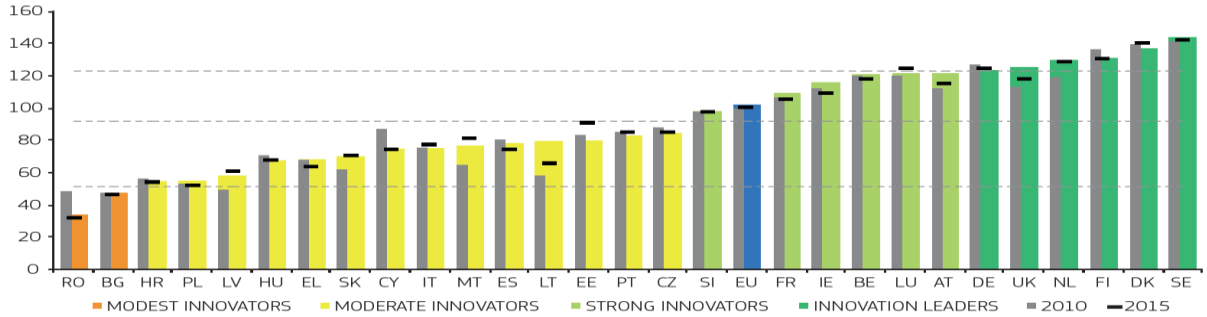
Figure 1. Performance of EU Member States' innovation systems*



Source: *European Innovation Scoreboard 2017*, p.6.

* Coloured columns show Member States' performance in 2016, using the most recent data for the indicators in this dimension, relative to that of the EU in 2010. The horizontal hyphens show performance in 2015, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2010. Grey columns show performance in 2010 relative to that of the EU in 2010.

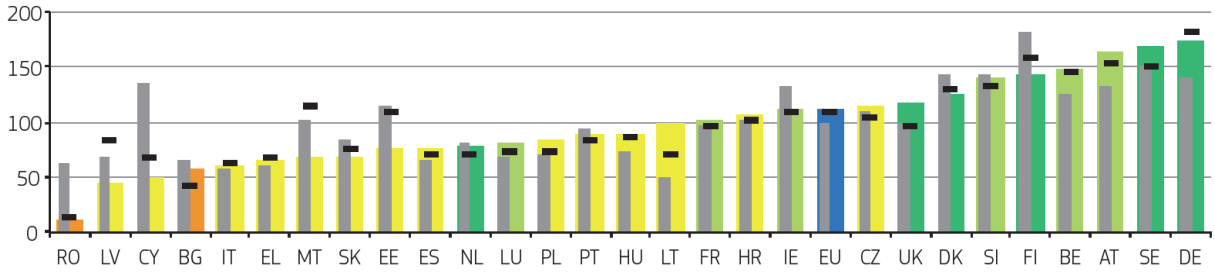
Figure 2. Finance and support*



Source: *European Innovation Scoreboard* 2017, p.22.

* Coloured columns show Member States' performance in 2016, using the most recent data for the indicators in this dimension, relative to that of the EU in 2010. The horizontal hyphens show performance in 2015, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2010. Grey columns show performance in 2010 relative to that of the EU in 2010.

Figure 3. Firm investments*



Source: *European Innovation Scoreboard 2017*, p.23.

* Coloured columns show Member States' performance in 2016, using the most recent data for the indicators in this dimension, relative to that of the EU in 2010. The horizontal hyphens show performance in 2015, using the next most recent data for the indicators in this dimension, relative to that of the EU in 2010. Grey columns show performance in 2010 relative to that of the EU in 2010.

The results presented above are general in nature and do not directly indicate the sources of financing of innovative activities in Poland. On the other hand, the lists included in the European Innovation Scoreboard prompted the authors to analyze one of the key factors for the development of innovation, namely the sources of their financing.

The actual reservoir of financing innovative activities in Poland is presented below, which is illustrated by the data in Tables 2, 3 and 4.

The data presented in Table 2 clearly indicate that the main and dominant source of financing of innovative start up-type projects in Poland are the company's own funds. The contribution of EU subsidies as well as venture capital and angel investors is noticeable. In turn, there is a low level of financing using such sources as: accelerators, strategic investors, bank loans and crowdfunding.

Table 2. Sources of financing innovative projects (start-ups) in Poland (multiple choice)

Year	**Own funds**	**EU subsidies**	**Venture capital**	**Angel investors**	**Accelerator**	**Strategic trade investor**	**Bank credits**	**Crowdfunding**
2016	79%	24%	22%	17%	7%	6%	6%	2%
2015	59%	23%	18%	20%	-	-	8%	3%

Source: prepared by the authors on the basis of: Skala, Kruczkowska, 2016: 33 and Skala, Kruczkowska, Olczak, 2015: 24.

The data in Table 3, concerning innovative projects implemented in industrial companies in Poland (where the number of employees exceeds 49 people), indicate that one of the main sources of innovation funding is also the company's own funds (approximately 64% in 2015).

Table 3. Outlays in PLN million (in current prices) on innovative activities in industrial companies in Poland (where the number of employees exceeds 49 people), according to sources of funding

Years	Total	Own funds	Funds received from the state budget	Funds received from abroad (non-refundable)	Measures originating from funds of venture capital	Bank credits
2015	28,920.7	18,397.9	526.0	1,528.0	-	3,140.6
2014	22,544.3	16,268.7	362.5	1,886.8	-	1,939.4

2013	19,520.7	14,090.2	284.9	1,518.3	-	1,318.4
2012	20,293.2	15,225.9	388.3	1,245.5	-	1,200.6
2011	19,376.5	14,766.6	233.4	1,342.5	-	1,738.4
2010	22,379.0	17,302.1	233.4	1,621.7	0.3	1,636.5
2009	21,405.5	14,929.3	172.8	568.7	0.2	5,433.1
2008	23,686.1	17,029.7	284.2	376.8	37.6	4,889.3
2007	19,804.6	14,794.8	223.1	218.8	7.9	2,808.3

Source: Prepared by the authors on the basis of: Nauka i technika w 2011 r. (Science and Technology in 2011): 134 and Nauka i technika w 2015 r. (Science and Technology in 2015): 133.

In turn, in companies from the service sector in Poland (Table 4), the contribution of own funds is higher (approximately 74% in 2015). A much lower importance for both sectors is held by funds originating from other sources, such as: funds received from abroad (non-refundable), bank loans, and from the state budget. Measures originating from risk capital funds practically do not play any significant role in innovation funding.

Table 4. Outlays in PLN million (in current prices) on innovative activities in companies from the service sector in Poland, according to sources of funding

Years	Total	Own funds	Funds received from the state budget	Funds received from abroad (non-refundable)	Measures originating from funds of venture capital	Bank credits
2015	11,855.5	8,724.3	152.1	1,949.2	-	738.6
2014	10,790.6	7,338.6	185.4	1,607.4	-	1,200.7
2013	9,702.3	7,941.	190.6	469.2	-	947.0
2012	14,178.2	9,929.8	2,082.4	792.5	-	634.4
2011	10,317.9	8,659.2	87.2	114.3	-	1,058.4
2010	9,921.1	8,597.0	38.6	194.4	-	1,036.8
2009	7,624.3	6,530.0	53.9	24.8	-	1,002.2
2008	9,794.6	8,507.6	103.8	64.1	0.0	868.1

Source: Prepared by the authors on the basis of: Nauka i technika w 2011 r. (Science and Technology in 2011): 134 and Nauka i technika w 2015 r. (Science and Technology in 2015): 133.

When analysing the presented statistical data, it can be debated whether the causes of such a state of affairs should be seen in the absence of a comprehensive and long-range policy and strategy supporting the development of innovation in Poland. This results in a small share of funds from the state budget, banks, and risk capital funds in the financing of innovations in Polish companies. In this situation, non-refundable measures originating from abroad, mostly from the EU, still constitute a kind of compensation.

5. Conclusion

There are a good number of factors impacting the success of an innovative project which can be distinguished. Among them, one of the fundamental ones is selection of the right source of financing. As presented, these sources may have various forms, from innovators' own funds to external funds, including private and those originating from measures provided by the state and its financial institutions.

However, such a diversity of innovation funding sources existing on the market requires a strategic approach, covering four phases: investigation of the market for innovation, adjustment of the type of innovation to a specific market, identification of potential options of funding sources for the particular innovation, selection of the source or sources adequate for the financing of innovative activities. In our opinion, such a strategic approach to innovation may significantly reduce the risk of its failure. This is significant, especially in the conditions of innovative activities of SMEs in Poland. We believe that a significant barrier in the development and implementation of innovations in our country is the lack of a strategy of selection of innovation funding sources, both at the state level (its institutions and agendas), as well as at the level of companies. This lack of a strategy hinders identification and proper adaptation and use of the existing funds which enable implementation of consecutive stages of the innovative project in the organisation.

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Źródła finansowania innowacji w polskich przedsiębiorstwach w świetle badań statystycznych

Streszczenie

Jednym z kluczowych składników procesu zarzadzania innowacją jest wybór źródeł finansowania przedsięwzięć innowacyjnych w przedsiębiorstwie. Podjęty przez autorów problem badawczy jest ważny dla polskich przedsiębiorstw, w tym zwłaszcza MŚP, które swoje strategie opierają na innowacjach. Analiza publikacji dotyczących wyborów strategicznych, potwierdza istnienie stosunkowo małej liczby opracowań naukowo-badawczych z tego obszaru. Istnieje zatem luka poznawcza, która skłania do przeprowadzenia analizy tak określonego problemu badawczego. Celem artykułu jest omówienie kryteriów i wariantów wyboru strategicznego źródeł finansowania innowacji w przedsiębiorstwie. W oparciu o doświadczenia innych opisywane w literaturze oraz własne analizy, przyjęto następujące kryteria: rozwój rynku, rodzaj innowacji i potencjalne źródła jego finansowania. Następnie opracowano proces wyboru źródeł finansowania innowacji. W artykule dokonano analizy dostępnej literatury, danych internetowych, wyników zamieszczonych w European Innovation Scoreboard 2017 oraz danych statystycznych opracowanych przez GUS, dotyczących źródeł finansowania innowacji. Umożliwiło to wyodrębnienie źródeł finansowania innowacji w polskich przedsiębiorstwach i ocenę ich zastosowań w praktyce działalności gospodarczej. Otrzymane wyniki wskazują, że mimo istnienia wielu różnych źródeł finansowania innowacji, w polskich przedsiębiorstwach zdecydowanie dominuje finasowanie własne. Mały jest udział środków publicznych i obcych.

Słowa kluczowe: przedsiębiorstwo, rynek, innowacja, źródła finansowania innowacji.