

## INNOVATIVENESS OF ENTERPRISES IN POLISH TECHNOLOGY PARKS AND INCUBATORS

Michał Borowy<sup>1</sup>✉, Tomasz Pajewski<sup>1</sup>, Joanna Rudawska<sup>2</sup>

<sup>1</sup> Warsaw University of Life Sciences – SGGW

<sup>2</sup> Jan Kochanowski University in Kielce

### ABSTRACT

Most of Polish small and medium-sized enterprises (SMEs) treat the implementation of a new product or service as too expensive, time-consuming and risky. The share of innovative industrial and service enterprises in the years 2015–2017 in the total number of these enterprises amounted to 18.5% and 10.4%, respectively. Most of these companies do not have their own R&D department. Therefore, for many of them the cooperation with innovation centres, such as technology parks or incubators would be a great opportunity to build a long-term competitive advantage. This study aims to assess the innovativeness of companies – tenants of the mentioned institutions.

**Key words:** technology parks, technology incubators, enterprise innovativeness, innovation centres, start-up, spin-off

**JEL codes:** D02; D22; E02; L26; M21; O12; O32; O43; R11

### INTRODUCTION

#### Reasons for undertaking research theme

The progressing globalisation process and the widespread availability of modern information technologies significantly facilitate the entry of new economic entities onto the market. The growing number of enterprises also increases a demand for the quality of products and services provided by them. Therefore, knowledge and innovation are becoming the key resources of the modern economy; that is why, those entities which are building their long-term competitive advantage based on innovation as the key development factor, not on price, have the greatest chance of maintaining their market position. However, not all market entities have sufficient resources in order to develop innovation.

Polish entrepreneurs, especially those in the SME sector, treat this type of activity as too expensive, time-

consuming and risky, although they are aware of the benefits of implementing new solutions. As a result, they lose the chance to build a long-term competitive advantage [Kurznack and Timmer 2019].

In the meantime, those enterprises which do not have their own R&D facilities may cooperate with innovation centres acting as business support institutions created to support enterprises in their development at its every stage. This article is to explain the functions of these centres and to analyse the effects of their operation by assessing the innovativeness of enterprises located in technology parks and incubators.

#### Research aim

The main research aim of this article was to assess the innovativeness of enterprises located in the Polish technology parks and incubators.

Michał Borowy <https://www.orcid.org/0000-0001-6707-5961>; Tomasz Pajewski <https://www.orcid.org/0000-0001-7058-6375>;  
Joanna Rudawska <https://www.orcid.org/0000-0003-1484-8283>

✉ [michal\\_borowy@sggw.pl](mailto:michal_borowy@sggw.pl)

### Specific research aims

As part of the main research aim, the following specific research aims were identified:

1. Assessing the innovativeness of enterprises of the Polish SME sector
2. Defining the role of technology parks and incubators in stimulating innovative activities of enterprises
3. Assessing the proneness of enterprises located in technology parks and incubators to undertake innovative activities.

### Research hypothesis

The article was to verify the following research hypothesis:

- H – Innovativeness of enterprises located in Polish technology parks and incubators usually remains at a higher level than the national average, but it is not satisfactory.

## RESEARCH METHODOLOGY

The presented analysis is a fragment of a broader nationwide research on technology parks and incubators, which has been cyclically carried out by the Polish Business and Innovation Centres Association in Poland (PBICA) since 2009.

For the purposes of this analysis, empirical data was used to describe only the selected aspect of enterprises' operations, i.e. innovativeness. Other issues regarding adaptation of these entities to the changing global trends related to Industry 4.0 or their involvement in network (horizontal) cooperation with the economic environment will be the subject of more extensive considerations in a book to be published.

The research material was collected using two methods of data collection: 1) Desk research – based on existing sources, i.e. subject literature review, available documents, statistical studies, databases, laws, regulations, reports, summaries, and other materials available in paper and electronic versions; 2) quantitative method for collecting empirical data – CAWI

(Computer Assisted Web Interview) – a computer-aided interview using a website. The method is based on a traditional questionnaire survey where the paper questionnaire is replaced by a sheet displayed on the computer screen after selecting the appropriate website address. Answers are automatically saved in an electronic version, and the interview itself is conducted anonymously by a program which displays questions and controls the responses of respondents.

Empirical data was collected in 18 technology parks and 2 independent technology incubators. This constituted 56% and 40% of their total number in Poland, respectively. The research was participated by centres from 15 Polish regions. Data collection process took place in two stages. First of all, a database maintained by the PBICA was updated based on official registers and with the help of parks' administrators. In this way, basic information about 1270 tenant enterprises was collected<sup>1</sup>, such as: entities' name, contact details, and REGON (National Business Registry Number) or NIP (Tax Identification Number) numbers. The second stage carried out in the period from April to June 2019 involved conducting an online survey with the representatives of enterprises who agreed to participate in the research.

A total of 177 enterprises participated in the questionnaire survey, i.e. 82% from technology parks and 18% from technology incubators. The surveyed entities were mainly micro-enterprises (having on average 3 employees) – 71% and small enterprises – 21%. Most often they were young enterprises (start-up stage) registered after 2015 – 46%. Enterprises operating on the market for up to 10 years constituted 32% of the surveyed group, and the elder ones – 22%. In total, medium-sized and large enterprises accounted for 8%.

### Innovativeness of SME sector in Poland

Small and medium-sized enterprises (SMEs) play an important role for the Polish economy. They constitute over 99% of all economic entities, are a workplace for 69% of all employees, and their share in the national GDP exceeds 50%. It is worth noting that as many as

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<sup>1</sup> A technology park's tenant was regarded an enterprise having a lease agreement for the area in the technology park. Enterprises using virtual office services, which do not have an office in the technology park infrastructure (office or production space) and only use the park's address were excluded.

96% of enterprises in this group are micro-enterprises [Skowrońska and Tarnawa 2018] most of which are conducted by self-employed persons. Due to the constantly growing number of entities and, as a result of it, the continuing increase in consumer requirements, the skilful building of competitive advantage of these entities through innovation is increasingly important.

In the meantime, the Polish SMEs are most often not interested in implementing innovative activities, and treat it as too expensive, time-consuming and risky. They struggle to stay on the market more often than they implement a long-term innovation strategy [Starcewska-Krzysztozek 2014 and Haiduk 2018]. In 2017, expenditure on innovation activities of Polish industrial enterprises amounted to PLN 28 billion, while 94.4% of it concentrated in enterprises employing over 49 persons, representing less than 30% of all enterprises in Poland. In the services sector, on the other hand, this expenditure reached PLN 13 billion and 88% of it was concentrated in enterprises employing over 49 persons, constituting less than 17% of the population being surveyed [GUS 2019].

The share of innovative industrial and service enterprises in the years 2015–2017 in the total number of these enterprises amounted to 18.5% and 10.4%, respectively (to compare to the years 2014–2016, it decreased by 0.2% in industry and by 3.2% in services) [GUS 2018]. In the analysed period, process and product innovations were most often used in industry – 15% and 12%, respectively. In services, the 8% share of process innovations slightly exceeded the percentage of applied organisational and marketing innovations, each of which amounting to 7%. The group of innovative entities was dominated by large enterprises employing over 250 persons. In the SME sector, medium-sized enterprises employing 50–249 persons dominated among innovative enterprises, i.e. 32% in industry and 24% in services, respectively. Small innovative enterprises employing 10–49 persons constituted 11% of the surveyed group in the case of industry and 7% in the case of services [GUS 2018].

According to the report of the Ministry of Entrepreneurship and Technology and Siemens Polska, the most commonly used technologies by the enterprises being surveyed were: automation of production lines, data analytics and production optimisation, as well as application of software reducing costs of prototyping. Among the least popular technologies associated with Industry 4.0 implemented by the surveyed SMEs were: artificial intelligence, big data and cloud computing [Ministerstwo Przedsiębiorczości i Technologii and Siemens 2018].

In 2017, the share of revenues from sales of new or significantly improved products in total revenues from sales in the SME sector did not exceed 5% [GUS 2018].

#### **Role of technology parks and incubators as stimulants of enterprise innovativeness**

In the Polish literature, technology parks and incubators are included in the group of innovation centres being one of the three forms of institutional business support<sup>2</sup> along with entrepreneurship centres and non-banking financing institutions [Bąkowski and Mażewska 2015, Wójcik-Karpacz and Rudawska 2016, Borowy 2017]. Their basic role is to conduct activities aimed at improving the competitiveness of the economy by supporting the process of implementation of scientific research results, developing the innovative activities of enterprises, and supporting the creation of start-up enterprises [Borowy 2017].

The main difference between innovation centres and entrepreneurship centres is that the former institutions focus mainly on supporting innovativeness through involvement in technology transfer processes and commercialisation as well as provision of pro-innovative services, including consulting in the field of intellectual property protection, finance, establishment and organisation of new and innovative economic entities [Matusiak 2010, NIK 2016]. The main aim of entrepreneurship centres is, in turn, professional activation, promotion of entrepreneurial attitudes and support of economic initiatives among local communities.

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<sup>2</sup> In addition to innovation centres, entrepreneurship centres are listed as entities providing broadly defined business promotion and incubation, whose activity is focused on informing, training, consulting and creating new work places. The third group consists of non-bank financing institutions dealing with distribution of non-returnable and returnable instruments which include loan funds, loan guarantees, seed capital funds, and business angel networks.

Innovation centres such as technology parks and incubators are the most developed form of support among business environment institutions. Technology incubators (TI) operate in an environment or in close connection with scientific and research institutions, offering support during subsequent development phases of enterprises, such as the so-called start-up phase (incubation stage) and the development phase, i.e. entry onto the market (acceleration stage) [Borowy 2017, Yusubova et al. 2019]. Technology incubators often have specialised R&D facilities (e.g. laboratories or modern equipment) and business premises. The basic role of TI is to support the creation of innovative (high-tech) enterprises and provision of help in surviving on a competitive market with a high risk of failure [Matusiak 2011, Mas-Verdu et al. 2015, Borowy 2017].

Technology parks are the most comprehensive form of institutional support for innovative entrepreneurship. Their role is to strengthen inter-sectoral connections by initiating active cooperation with scientific and research institutions, local and regional public administration as well as financial instruments [Rudawska, 2016]. According to the definition of the International Association of Science Parks [IASP 2002], a park is defined as an organisation managed by professionals whose goal is to increase social well-being in a given area by promoting a culture of innovation and competitiveness among knowledge-based enterprises and institutions. The park stimulates and manages the flow of knowledge and technology among universities, research and development institutions, enterprises, and markets. It facilitates the creation and development of enterprises operating on the basis of innovation through incubating spin-off enterprises and providing high-quality infrastructure and services affecting their added value [Borowy 2012, 2017].

Depending on the country in which the parks operate, their specifics, offers or shareholders, they function under different names, e.g. technopolis; technopark; research park; science park; technology park; science and research park; science and technology park; and industry and technology park [Matusiak 2010]. And although different types of parks have their own specificity, their common task is to stimulate innovative entrepreneurship; therefore, they are called by some authors as seedbeds of innovation [Felsenstein 1994].

Polish parks provide newly established enterprises using modern technologies with consulting services in the creation and development of an enterprise, technology transfer and commercialisation of scientific research results, as well as offer them real estate and infrastructure [Kandefer et al. 2007]. Most often they are multi-tasking. They combine functions of entrepreneurship incubators, technology incubators, technology transfer centres, and some of them manage capital funds as well [Mażewska and Tórz 2019].

Technology parks make it easier for their tenants (enterprises) to interact with each other, which, along with solid support of the business-related environment, may cause a unique synergy effect. This effect, strengthened by the specific atmosphere of entrepreneurship and the specific competition, is an incentive for young people who want to open and develop their own enterprise [Hołub-Iwan et al. 2012, Borowy 2017].

The analysis carried out in 2019 by the Polish Business and Innovation Centres Association in Poland has confirmed the activity of 32 technology parks and 5 independent technology incubators [Mażewska and Tórz 2019] located throughout the country. They are most often found in large academic centres such as Kraków, Poznań, Wrocław or Katowice or in less developed areas with high unemployment rate and low technological potential (including agricultural areas, e.g. Podlaskie, Warmińsko-Mazurskie, and Zachodniopomorskie regions), serving the implementation of pro-development innovation policy.

### **Empirical research results**

According to the Polish Classification of Activity (PKD), the surveyed group consisted mainly of enterprises whose activity is defined as professional scientific and technical (Section M) – 36%. These entities were dealing with scientific research and development works, advertising, market research, as well as legal and accounting services. The ICT industry representation was comparable (Section J) – 34%. These enterprises were mainly dealing with software and IT consulting. Industrial processing enterprises (Section C) – 10% or commercial ones (Section G) – 7% were much less frequent than the previous ones. Other types of activity were marginal – 1–3%.

According to the OECD classification, most of the surveyed entities – 52% could not be qualified to those whose activities use high or medium-high production technologies. Among 177 enterprises, only three enterprises represented high technologies and five – medium-high ones. On the other hand, the respondents were dominated by enterprises providing services based on advanced technological knowledge – 44%. In addition, taking into account the aforementioned Polish Classification of Activity (PKD), high and medium technology industries present in technology parks and incubators were represented only by enterprises operating in the field of industrial processing (Section C). However, high-tech services were mostly provided by enterprises included in Section M, representing professional scientific and technical activity – 74%. The remaining 26% was constituted by the ICT enterprises.

In this article, the assessment of enterprise innovativeness was made using only those parameters used in the subject literature, whose measurement was possible. Therefore, the research included: number of implemented innovations; number of patents, utility and industrial designs, and licenses; having own research and development (R&D) department or cooperating with scientific and research units [Wojnicka 2004, Narocki 2015, Rudawska 2017, OECD, Eurostat 2018].

When analysing the number of implemented innovations, a division into product, process, marketing and organisational innovations was adopted in accordance with the Oslo Manual [2008, 2018] (Table).

In the surveyed group, product and process innovations were most often implemented, i.e. in 23% and 16% of enterprises, respectively. The percentage share of enterprises implementing marketing or organisational innovations was significantly lower and amounted to 7% and 6%, respectively. The solutions used by the vast majority of enterprises were new and mostly on a national scale – up to about 70% or even 90% in the case of organisational innovations. Marketing solutions most often had a chance to compete on the international European Union markets – 33%. Globally, in turn, there were product innovations – 45%.

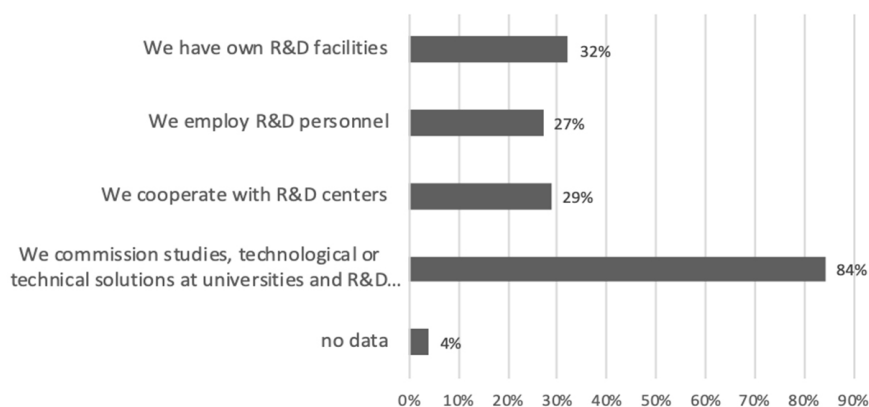
The share of innovative products and services in the total sales of the surveyed enterprises was also analysed. According to the respondents' opinions, 20% of enterprises did not have them at all or they constitute 100% of the offer in the case of 19% of enterprises. Considering that 23% of enterprises did not answer this question, it may be assumed that 57% of the surveyed entities had in their assortment at least one innovative product or service.

The surveyed enterprises usually did not apply intellectual property protection – 50%. A domestic patent was held by 10% of them and a foreign one by 5%. The share of enterprises possessing a domestic or foreign utility/industrial design did not exceed 7%. It should be remembered, however, that most of the surveyed enterprises using advanced technological knowledge were service-oriented. This could also result in a small share of enterprises which granted or acquired licenses. They accounted for 10% and 3%,

**Table.** Percentage share of enterprises which implemented product, process, marketing or organisational innovations taking into account the scale of impact (enterprise, Poland, European Union, world)

Type of innovation	enterprises (%)	Including			
		enterprise's scale (%)	Polish market (%)	European Union market (%)	global market (%)
Product innovation	23	60	60	23	45
Process innovation	16	69	69	14	21
Marketing innovation	7	58	67	33	17
Organisational innovation	6	91	64	9	9

Source: own elaboration based on the PBICA's primary data.



**Fig.** Availability of R&D facilities for enterprises  
Source: own elaboration based on the PBICA's primary data.

respectively. However, it is worth highlighting the activities of two of the surveyed enterprises operating in the IT industry, which have granted up to 1200 and 2000 licenses so far.

Also, the analysed entities usually did not use quality certificates – 79%. Only 19% of them had ISO (ISO 9001, ISO 27001, ISO 17025, ISO 22000, ISO14001).

Almost one in three entities had their own research and development (R&D) facilities, and slightly less as 27% of them employed specialised personnel for R&D tasks (Fig.). The low propensity to employ R&D personnel may result from the easy availability of resources of neighbouring knowledge centres. Most enterprises confirmed that they commission universities or R&D centres to develop the necessary technical/technological solutions – 84%, which, compared to 29% of respondents declaring cooperation with scientific and research units, may indicate the apparent nature of some agreements concluded between institutions (Fig.).

## CONCLUSIONS

The task of technology parks and incubators is to facilitate the start of young enterprises and create conditions for technology transfer through contacts with scientific units, verification of business concepts, implementation of various types of consulting and training services for enterprises. Through their activities, they strengthen the mutual interaction of their tenants, which, along with solid support of the business-re-

lated environment, may cause a unique synergy effect. This effect, strengthened by the specific atmosphere of entrepreneurship and the specific competition, is an incentive for young people who want to open and develop their own enterprise.

It is not surprising then that the percentage of innovative enterprises operating within technology parks and incubators is three times higher than the average in Poland. Nevertheless, innovative imitation still dominates here (H). The majority of enterprises have their offer new at the national level – 70% to 90% in the case of organisational innovations. Most of the surveyed entities – 52% did not use high or medium-high production technologies. Also, they usually did not acquire or grant licences. They sporadically applied available forms of intellectual property protection, such as patents, utility or industrial designs.

These arguments confirm the hypothesis (H) set out in the article. However, despite the fact that the tenant enterprises have not achieved high values of indicators proving their innovativeness yet, their strong commitment to real cooperation with knowledge centres should be emphasised. As much as 84% of them commission universities or R&D centres to develop technical/technological solutions. Continuation of this cooperation is an opportunity for further innovative development of the enterprises being surveyed.

To sum up, it should be emphasized that today, an immanent element of the SME development are innovations, whose scope of influence goes beyond the national economy. Therefore, it is extremely important

from the point of view of building competitive advantage of these companies to base their offer not on imitative solutions, but actually new ones, better suited to changing market preferences. To this end, in particular Polish small companies should be more involved in their own R&D activities, but also cooperate with renowned innovation centres, as well as create new value based on already available solutions. These actions give the chance to create the right long-term strategy in a globalizing market.

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## INNOWACYJNOŚĆ PRZEDSIĘBIORSTW W POLSKICH PARKACH I INKUBATORACH TECHNOLOGICZNYCH

### STRESZCZENIE

Większość polskich małych i średnich przedsiębiorstw (MSP) traktuje wdrażanie nowego produktu lub usługi jako zbyt drogie, czasochłonne i ryzykowne. Udział innowacyjnych przedsiębiorstw przemysłowych oraz usługowych w latach 2015–2017 w ogólnej liczbie przedsiębiorstw wynosił odpowiednio 18,5% i 10,4%. Większość tych firm nie ma własnego zaplecza badawczo-rozwojowego (B+R). Dlatego, dla wielu z nich, doskonałą okazją zbudowania długofalowej przewagi konkurencyjnej byłaby współpraca z ośrodkami innowacji, takimi jak parki oraz inkubatory technologiczne. Niniejsze opracowanie ma na celu ocenę innowacyjności firm-lokatorów wspomnianych instytucji.

**Słowa kluczowe:** park technologiczny, inkubator technologiczny, innowacyjne przedsiębiorstwo, ośrodek innowacji, start-up, spin-off