

Seweryn Krupnik, Anna Szczucka, Katarzyna Lisek

The Effects of Supporting Business Innovation and R&D Activities from European Union Funds in Poland: A Review of Evaluation Studies

Abstract:

Objectives: In order to create more accurate public policies in the field of innovation subsidies, it is crucial to provide timely knowledge about the effectiveness of implemented interventions. This article explores the effects of EU programmes realised in Poland. The results are derived from evaluation reports.

Research Design & Methods: The article is based on a review of the most important evaluation research concerning innovation policies implemented as a part of the operational programmes in Poland.

Findings: The results from a review of evaluation studies show the impact of the policies on the innovativeness of Polish enterprises. An increase in indicators of innovation performance and R&D activities among the beneficiaries was observed. The achievements of particular enterprises translate into change at the macro level. However, there is not enough evidence to ascertain the sustainability of the programmes' effects. Based on the gathered evidence, it is hard to indicate a straight link between an increase of innovation and higher competitiveness of beneficiaries.

Implications / Recommendations: The results suggest a need for changes at different stages of the public policy cycle, namely design, implementation, and evaluation.

Contribution / Value Added: The article gives a picture of today's achievements in cohesive policy when it comes to innovation in enterprises; it sums up the knowledge about the effects of the implemented solutions, pointing out the fields that need more evidence.

Keywords: evaluation, public policies, innovation policy, innovation subsidies, technology policy, research and development policy

Article classification: theoretical/review paper

JEL classification: O380

Seweryn Krupnik (corresponding author) – Centre for Evaluation and Analysis of Public Policies, Jagiellonian University; ul. Ingardena 3, Kraków; e-mail: seweryn.krupnik@uj.edu.pl; ORCID: 0000-0003-2486-0702. **Anna Szczucka** – Centre for Evaluation and Analysis of Public Policies, Jagiellonian University; ul. Ingardena 3, Kraków; e-mail: anna.szczucka@uj.edu.pl; ORCID: 0000-0001-9524-4347. **Katarzyna Lisek** – Centre for Evaluation and Analysis of Public Policies, Jagiellonian University; ul. Ingardena 3, Kraków; e-mail: katarzyna.lisek@uj.edu.pl; ORCID: 0000-0003-2431-8307.

Introduction

Business innovation is important for national economies. Indeed, innovation results in a country becoming more attractive for investors, the economy gaining competitiveness, and its place in the value chain becoming more favourable. Unfortunately, the Polish economy is not recognised as being innovative – in the Global Innovation Index, it occupies the 39th place, with only four EU countries behind it (Dutta et al., 2019). At the level of national strategic actions, a key document targeting support and stimulation for business innovation and investments in R&D is the Strategy for Economic Development of Poland. This strategy is implemented through direct investments; instruments indirectly mobilised to help businesses make increased investments and fiscal reforms or support for foreign investors; and programmes supporting the ecosystem (Orechwo, 2017).

At the same time, these interventions can be made more effective when it comes to their ability to improve the innovativeness of the economy; this can be done by adopting an evidence-informed approach to designing and implementing solutions. This approach assumes that before making decisions, the actors involved in the process should first familiarise themselves with a full set of information from various sources (Langer et al., 2016; Head, 2010). The concept of evidence-informed policymaking emphasises that the collected evidence is not the only factor present in the decision-making process; yet, it should play a significant role (Nevo & Slonim-Nevo, 2011). Applying an evidence-informed approach makes it possible to base the management of limited public resources on earlier experiences while also increasing investments in programmes proven to be effective, thereby increasing the efficiency of money spending. This also leads to greater control of the public funds (OECD, 2015; Urahn et al., 2014). This method expands the range of possible solutions to social problems while helping choose those with the greatest chance of success (Parkhurst, 2017; Rantala et al., 2017).

To allow for this approach to be used in designing and implementing further interventions, it is essential to bring about a streamlined system for generating, collecting, and providing access to knowledge from the implemented interventions.

The objective of the current article is to present the most important findings from the evaluation studies of public interventions that are aimed at increasing business innovation and R&D activities. The current article answers the following research questions: 1) What are the effects of support at the level of the Polish economy? 2) What are the effects of support at the level of the supported businesses?

Materials and methods

The review focuses on 35 reports from the time programming period of 2007 to 2013 (reviewing the following cohesion policy programmes: Innovative Economy, Infrastructure and Environment, Human Capital, Development of Eastern Poland, and Regional Programmes). Only 4 out of these reports used most rigorous counterfactual approach to measure the net effect, i.e. the change which can actually be attributed to the investigated programmes. The findings from these studies are described in more detail. Where possible, the authors also considered the conclusions from 14 reports referring to the period of 2014 to 2020 (reviewing the following programmes: Smart Growth, Eastern Poland, and Regional Programmes). The 2004 to 2006 timeframe was used as a reference point (11 of the analysed reports referred to the following programmes: Sectoral Operational Programme Improvement of the Competitiveness of Enterprises and Integrated Operational Programme Regional Development). The evaluations of these programmes were considered in the overview, where the studies concentrated on issues of business innovation or R&D. We considered studies produced on behalf of the European Commission, the Polish National Evaluation Office, and other institutions involved in the implementation of the operational

Table 1. Fields of the evaluation studies' database

1. Number	6. Month and year of finishing the study
2. Title	7. Commissioning Party
3. Type (Ex ante, On going, Ex post)	8. Contractor
4. Operational Programme	9. Size of the study (small, medium, large)
5. Topic (e.g. 'Innovation of economy', 'Innovation and research & development')	

Source: Own elaboration.

programmes taking place in Poland. In total, we analysed 58 reports (several of which went beyond one financial perspective).

The reports were identified using the Evaluative Research Database run by the National Evaluation Office at the Ministry of Development Funds and Regional Policy.¹ All reports from the categories 'Innovation of economy' and 'Innovation and research & development', and related to the described above programming periods, were

selected from the database. The structure of the database is presented in Table 1. In addition, we identified relevant studies from the Website of the European Commission.

Literature review

There is a visible division in the analysed studies between those concerning innovation and those regarding R&D. An additional differentiation is

Table 2. Indicators of supporting innovation and R&D activity

	Level of the whole economy	Level of the supported businesses
Research & development activity	<ol style="list-style-type: none"> 1. The units active in R&D in the enterprise sector 2. R&D expenditure in GDP (total/enterprise sector) 3. Level of employment in R&D activity [EPC] (total/enterprise sector) 4. Companies with R&D departments 5. Number of patent applications to the Polish Patent Office/the European Patent Office 	<ol style="list-style-type: none"> 1. R&D activity (internally or externally) 2. Private expenditure on R&D in the company 3. Employment in R&D positions 4. The R&D department (non-existent before the project) 5. Number of requests for patent protection filed with the Polish Patent Office/the European Patent Office 6. Cooperation with scientific institutions
Innovation	<ol style="list-style-type: none"> 1. Share of companies undertaking innovative activity 2. Total/private spending on innovation activities 3. Spendings on industrial innovation 4. Sales of new and significantly improved products in total manufacture in industrial enterprises 5. Export of high-tech products in total exports 	<ol style="list-style-type: none"> 1. Number of introduced innovations (by type/level of innovation) 2. Income from the sales of innovative products and/or services in Polish and international markets 3. Total/private spendings on innovation activities 4. Total factor productivity (TFP) 5. Share of innovatively active businesses working together in innovation activities as a direct result of the funded projects

Source: Own elaboration.

¹ See: <https://www.ewaluacja.gov.pl/strony/badania-i-analizy/wyniki-badan-ewaluacyjnych/baza-badan-w-arkuszu-kalkulacyjnym/> (accessed: 07.01.2020).

the level of measurement and conclusions applied to individual enterprises and/or the entire economy. In the analysed studies, these effects are monitored

using an array of indicators, the most popular of which are listed in Table 2.

Effects at the level of the whole economy

One perspective when examining the effects of public interventions on innovativeness and R&D activities is the macroeconomic one. In general, those studies that introduce this approach indicated a positive impact of the interventions on the analysed indicators. In the case of one of the key indicators from Polish strategic documents concerning innovation policy, in 2008–2018, expenditure on R&D in the business sector in relation to GDP saw growth from 0.19% to 0.8%. The studies showed that around one-third of the change between 2008 and 2015 resulted from support from EU funds (Imapp, 2017). In 2010, when this inflow was the greatest, around 40% of annual spending on R&D activity resulted from the cohesion policy. At the same time, the effect on overall expenditure on R&D activity in the entire economy was around 22% in 2010–2011 (Regulski et al., 2017). In 2020, the programmes impact on the value of expenditure on R&D in the business enterprise became visible, with GDP at the level 0.11 percentage points higher than in the scenario without the public support (Bienias et al., 2020).

The effectiveness of spendings on R&D in Poland is estimated to be average or low (Regulski et al., 2017). The significant factors limiting the effectiveness of R&D expenditure include weak collaboration between science and business, the low quality of regulation of protection of intellectual property rights, and high bureaucratic costs.

Still at the macroeconomic scale but referring to the effects of innovation activities, in 2012–2015, around one-fifth of industrial enterprises were innovative, i.e. they introduced to the market at least one product or process innovation. Macroeconomic estimates show that in 2014, for example, one in four innovative companies had this status because of EU funds (Regulski et al., 2017). Greater innovation of the beneficiaries of this support translates to

greater innovation for all businesses in a country (Imapp, 2017; Regulski et al., 2017).

An important measurement of the effects of R&D work is activity in the field of intellectual property protection. The cohesion policy resulted in an increase in the number of patent applications to the Polish Patent Office and the European Patent Office (Feldy et al., 2014; Imapp, 2017).

The implementation of projects also contributed to a significant increase in employment in the field of R&D (Imapp, 2017). In the periods showing the greatest inflow, the intervention accounted for almost 20% of R&D positions in the economy in a given year.

Effects at the level of the supported businesses

Another perspective focuses on the effects of public interventions obtained at the level of particular supported businesses. Here, the most reliable evidence comes from counterfactual research schemes. Among the evaluation research reports that have measured the effects of the Innovative Economy Operational Programme, four included conclusions about innovativeness and R&D activities derived from quasi-experimental research.

The counterfactual evaluation studies indicate some influence of cohesion policy on the key indicators of the beneficiaries' innovativeness and R&D activities (Table 3). Most of the studies investigated the results of the specific measures included in the fourth axis of the Innovative Economy Operational Programme. When it comes to the positive effects resulting from the intervention, the studies mentioned the growth of expenditures on internal and external R&D, the increase in number of implemented innovative products, and processes and the growth of total factor productivity.

Overall, beneficiaries spend more on innovative activity and introduce innovations to the market more frequently. This situation results directly from the way interventions are designed; receiving support for the implementation of innovations almost

Table 3. Indicators of innovation and R&D activity at the level of the businesses supported within IE OP as measured in quasi-experimental schemes

Category of effects	Key indicators	Results	Study	Additional comments
R&D	Expenditures on internal and external R&D	Positive effect for measure 4.4	Koniewski et al. (2015)	Relatively small samples (ca. 100 or lower)
		Lack of effect of measure 8.2		
Innovation	Implementation of product or process innovations to the market	The positive effect for the fourth axis measures	GUS (2015)	The beneficiaries of measures 1.4-4.1, 4.2, 4.3 and 4.4
		Effects aligned with goals of interventions for the fourth axis measures	Koniewski et al. (2015)	Relative effect (comparing different groups of beneficiaries)
	Effects aligned with goals of interventions for measures 4.2, 4.4 and 8.2	Trzciński (2013)	Relative effect (comparing different groups of beneficiaries)	
	Share of entities involved in innovative activities	The positive effect for the fourth axis measures	GUS (2015)	The beneficiaries of measures 1.4-4.1, 4.2, 4.3 and 4.4
	TFP – total factor productivity	The positive effect	Gajewski et al. (2014)	Research conducted exclusively on large companies → small samples (n=45 for OP IE)

Source: Own elaboration.

automatically results in innovative activity expenses and inclusion in the group of innovative enterprises (Regulski et al., 2017). The first evaluations of the effects of the Operational Programme Smart Growth (OP SG) point to a significant effect of incentives among the beneficiaries. The increase in their expenditure on R&D activity is higher than in unsupported enterprises. The beneficiaries declare that if it had not been for public support, they would not have carried out activities at this scale and at a comparable time (Bienias et al., 2020; PARP, 2020b). Almost two-thirds of the beneficiaries of the first and second axes of the OP SG declare that the R&D work they have performed ended with the implementation of results, which amounted to commencing the production or provision of services (Borowczak et al., 2020).

Some of the studies noted that this effect often refers to innovation at the level of the company, not to the market or world level (Imapp, 2017; Ciężka, 2017). At the same time, the findings indicate that in each financial perspective, the proportion of innovations at the market or international level

increases (Feldy et al., 2014; Miller et al., 2014). Almost half of the OP SG beneficiaries define the innovations developed within the project as groundbreaking. One-third of the innovations from this programme are ranked at least at the European level, and one-fifth are ranked at the global level (PARP, 2018). Yet, some of the OP SG instruments still do not result in the production of solutions at the scale of innovation expected at the support design stage (PARP, 2020a).

Despite an increase in the scale of R&D and innovation activity among businesses, the economic effects of this process are not necessarily visible. Looking at the analysed indicators, the support provided was more significant for the measurements for the scale of the undertaken innovation and R&D activity than for those showing the measurable effects of this activity on the businesses' sales activity.²

² The lack of evidence of economic effects might not only result from the small scale of these effects, but also from a measurement problem – the effects are usually delayed, much harder to test, and occur far less often than evaluative research.

Table 4. Indicators of competitiveness at the level of the businesses supported within IE OP as measured in quasi-experimental schemes

Category of effects	Examples of indicators	Results	Study	Additional comments
Competitiveness	Number of employees	The negative effect for measure 8.2 Lack of effect for measure 4.4	Koniewski et al. (2015)	Relatively small samples (ca. 100 or lower)
		Positive effects for measures 4.2 and 4.4	Trzeciński (2013)	Relative effect (comparing different groups of beneficiaries)
		Lack of significant effect	GUS (2015)*	A decreasing, though insignificant, trend in the number of employees was marked in measures 1.4–4.1
		Lack of significant effect	Gajewski et al. (2014)	Research conducted exclusively on large companies => small samples (n=45 for OP IE)
	Gross profit divided by net income from sales	The positive effect for measure 8.2 Lack of effect for measure 4.4	Koniewski et al. (2015)	The beneficiaries had higher long-term liabilities than nonbeneficiaries Relatively small samples (ca. 100 or lower) Relatively short time that elapsed since the completion of the analysed projects (from 0.5 to 1.5 years) to achieve the expected economic effects
		Mixed effects	Trzeciński (2013)	Relative effect (comparing different groups of beneficiaries)
	Profit on business activity	The positive effect for the fourth axis measures	GUS (2015)*	The average profit was similar (comparing beneficiaries and control groups)
	Value of net sales revenues	Inconclusive (<i>the positive effect but the deadweight loss</i>)	Gajewski et al. (2014)	Research conducted exclusively only on large companies => small samples (n=45 for OP IE)
		Lack of significant effect	GUS (2015)*	
	Exporting products or services	Lack of effect	Koniewski et al. (2015)	Relative effect (comparing different groups of beneficiaries)
The positive effect for most of the fourth axis measures (p<0.1)		GUS (2015)*		
Revenues from sale for export	Lack of significant effect	GUS (2015)*		

* The beneficiaries of measures 1.4–4.1, 4.2, 4.3 and 4.4.

Source: Own elaboration.

According to the premises of the cohesion policy, more intensive innovation activity should lead to greater competitiveness. Yet, this correlation is not always obvious. Innovative activity is

laden with risk, and the probability of failure is an inextricable part of it. From the point of view of some businesses, the main use of support is to implement simpler investment projects rather than

ambitious ones. Paradoxically, in the companies' view, implementing such simpler projects can be rational in the market sense (Ciężka et al., 2014; Koniewski et al., 2015; Regulski et al., 2017). In these cases, support may not result in increased innovation, but it boosts beneficiaries' competitiveness (Krupnik et al., 2010; Miller et al., 2018; Regulski et al., 2017).³ From the perspective of innovation policy, however, this situation is undesirable (Bartkiewicz & Dębowski, 2010). At the same time, the desired intervention effect is the increased innovation of a business and the lasting benefits for it, i.e. increased competitiveness; in simple terms, innovation growth makes sense only if it translates into greater competitiveness (European Commission, 2016). Therefore, support should be considered as a certain long-term process, not an individual stimulus (European Commission, 2016).

The results of the evaluative studies, both those using quasi-experimental (Table 4) and less rigorous methods, reveal the moderately positive influence of support on the beneficiaries' competitive position. In particular, this support led to increased productivity, an improved financial situation, or growth in employment (Bukowski et al., 2017; Ciężka et al., 2017; European Commission, 2016; Regulski et al., 2017). However, this impact is significantly smaller than in the case of innovative activity (Regulski et al., 2017). Furthermore, the positive effects were not always observed (Bartkiewicz & Dębowski, 2010; GUS, 2015; Koniewski et al., 2015), which confirms the complicated nature of the relations between R&D activity, innovation, and competitiveness.

It is worth noting the benefits of supporting innovation for entities other than the direct beneficiaries of support: entities collaborating with beneficiaries have larger orders and

the beneficiaries increase their payment funds, allowing employees to increase consumption. This increased investment and consumption translates into greater public subsidies. These effects are estimated using macroeconomic modelling conducted for some of the OPIE activities. Although the value of the analysed activities amounted to 14 billion PLN, its launch resulted in further 92 billion PLN being generated in 2007–2017 (Bukowski et al., 2017). The first effects concerning the dynamic growth of beneficiaries' external costs – which demonstrate the intensification of their cooperation with their surroundings – were observed within submeasure 3.2.1. of the OP SG (PARP, 2020b).

Concluding discussion

The conclusions from a review of evaluation studies show the impact of the introduced policies on the innovativeness of Polish enterprises. The policies led to an increase of indicators of innovation performance and R&D activities among the beneficiaries. The number of evidence gathered in counterfactual studies is limited. The achievements of particular enterprises translate into change at the macro level. However, there is not enough evidence to ascertain the sustainability of the programmes' effects. Moreover, based on the gathered evidence, it is hard to indicate a direct link between an increase of innovation and higher competitiveness of beneficiaries.

The results suggest that there is a need for clearer conceptualisation of the strategic premises of support, i.e. its programme theories (European Commission, 2016). At both the level of the entire support and that of specific measures, the anticipated effects are not specified sufficiently. The studies made it clear that different effects will be achieved by supporting new enterprises previously inactive in terms of R&D and innovation activity when compared with directing support to businesses with a high potential, which can be defined as having experience, previous investments, and more human capital (Regulski et al., 2017). The examples

³ As shown by a report prepared for the European Commission, the support granted in 2007–2013 helped many businesses cope with the crisis, and, in the short term, this can be assessed positively. It is more difficult, however, to evaluate the long-term effect of support in the context of innovation.

of European innovation economies, i.e. Switzerland and Finland, show that making choices of this type brings tangible effects. In the case of Switzerland, an example might be the large concentration on SMEs, and in the case of Finland, there is sectoral concentration and its creation of domestic advantages (Feldy et al., 2014). For Poland, there is a lack of clarity regarding the strategic direction that subsidies should support, as indicated by the often contradictory recommendations presented in the evaluation reports.

The possibility of achieving the effects envisaged within the programmes heavily depends on the characteristics of the beneficiaries receiving support. These, in turn, are determined by the operation of the project selection system. Various strategies for developing the criteria for accepting the categories of enterprises into the programmes significantly modify the achieved effects of the interventions (Gajewski et al., 2019). At the same time, there are few in-depth analyses of these connections.

Measuring the effects of support concentrates too heavily on the direct results of the support projects and/or opinions of beneficiaries, and refers too little to the long-term effects, as illustrated by indicators of the economic situation. Supporting innovation and R&D activities is not an end in itself; it should lead to the economic growth of enterprises and the economy (and, more broadly, to socioeconomic development). Yet, the effects of support are largely measured at the level of indicators related to the scale of support, i.e. the number of innovations introduced or the increase in R&D expenditure, and, at the macro level, the percentage of enterprises conducting R&D. There is less research referring to the economic effects of provided support, but there are also calls for a greater emphasis on the long-term dimension of effects, as measured by indicators such as a company's operational margin, gross added value per employee, and total factor productivity.

The findings of the current study complement the literature on the innovation of the Polish economy and the effects of the interventions

in the programming period of 2007 to 2013. The most important added value of the present study is the contribution to the accumulation of knowledge from diverse sources – in particular, studies based on authors' expert knowledge and empirical research reports. Even if the results refer to Poland, they have broader relevance to all catching-up countries (Krupnik, 2012, Szczygielski et al., 2016).

The main limitations of the current article involve the evaluation reports themselves, including their methodological inadequacies or premature measurement of effects. Specifically, the present article does not compare quantitative results from reports, because the format of the studies and reports does not provide a basis for such comparisons.

The evaluation reports usually did not refer to the premises of supporting innovation, e.g. the most popular linear model of public support, according to which the most effective way of supporting the development of innovation is intensive direct subsidies to enterprises' R&D activity (Godin, 2006). The evaluation reports also did not refer to the alternative models of conducting innovation policy, including systemic (Smits & Kuhlmann, 2004) and mission-oriented ones (Mazzucato, 2016). The role of evaluation reports often did not go beyond summarising the results from rather short lists of the monitored indicators. The situation changed from the new financial perspective, when the reports summarising the realisation of the OP ID aid plans were based on programme theory.

This overview shows that despite the large number of evaluation reports, there remains insufficient knowledge on the effects of interventions. Further actions are needed, and these should be geared towards more studies using rigorous and comparable methodology enabling mutual verification, accumulation, and reflexive analysis of the findings from the reports.

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