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# Evaluation of investments in Research and Technological Development (RTD) infrastructures and activities supported by the European Regional Development Funds (ERDF) in the period 2007-2013

Contract N° 2018CE16BAT111

Case study report

Poland

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## LIST OF ABBREVIATIONS

CS: Case Study

CA: Contribution Analysis

EIT: European Institute of Innovation and Technology

EPO: European Patent Office

ESIF: European Structural and Investment Funds

ERDF: European Regional Development Fund

FIR: Final Implementation Report

FP7: 7th Framework Programme

GDP: Gross Domestic Product

GERD: Gross Expenditure on Research and Development

H2020: Horizon 2020

HE: Higher Education

HEI: Higher Education Institute

HR: Human Resources

ICT: Information & Communication Technologies

IP: Intellectual Property

NCBR: National Centre for Research and Development

OP: Operational Programme

OPI: National Information Processing Centre

OP DEP: Operational Programme Development of Eastern Poland

OP HC: Operational Programme Human Capital

OP IE: Operational Programme Innovative Economy

OP Infra & Env: Operational Programme Infrastructure and Environment

PARP: Polish Agency for Enterprise Development

PCT: Patent Cooperation Treaty

ROP: Regional Operational Programme

RTD: Research, Technology and Development

R&D: Research and Development

R&I: Research and Innovation

SMEs: Small and Medium-sized Enterprises

ToC: Theory of Change

VC: Venture Capital

WCAT: Wielkopolska Centre for Advanced Technologies

# EXECUTIVE SUMMARY

## BACKGROUND AND GOAL OF THE CASE STUDY

Over the past decade, research and innovation have become a cornerstone of EU-level political and strategic goals. During the 2007-2013 programming period, over EUR 16 billion of European Regional Development Fund (ERDF) resources (almost 5% of the total ERDF allocation) were invested through 212 OPs in projects supporting RTD infrastructure, competence centres and activities in the EU Member States and regions (codes 01 and 02).

This evaluation study focuses on these two categories of ERDF expenditures and covers 53 OPs across 18 Member States selected by the European Commission. Among these Member States, Poland is the country with the highest volume of ERDF contribution in research activities and infrastructure, equal to more than EUR 3 billion, and accounting for more than 21% of the total ERDF contribution under the respective codes of expenditure in the sample of MS. As such, a specific case study has been conducted looking into the impact of ERDF funding for RTD activities and infrastructure in Poland.

This pilot case study looks into the ERDF support for RTD activities and infrastructure delivered in Poland between 2007 and 2013. It analyses two specific policy instruments implemented under two separate OPs, namely the collaborative research and development instrument financed under the OP Innovative Economy; and the infrastructure for higher education instrument financed under the OP Infrastructure and Environment. In addition, the case study includes a deep dive analysis into the 'Wielkopolska Centre for Advanced Technologies' major project financed as well under the former OP.

The main aim of the present case study is to illustrate the concrete and tangible effects (expected and unexpected) of investments in RTD conducted through the ERDF. The case study examines the use of funding in the implementation of a specific RTD policy mix in a specific geographical context; while assessing the rationale, effectiveness and the long-term sustainability of these investments. The analysis is conducted from the perspective of the Member State, allowing the national context and the interactions among the national and regional RTD policy mix to be duly taken into account. However, a very strong focus has been set on conducting a Contribution Analysis of the three selected policy instruments / major project, in light of drawing specific findings and lessons; conducting a cross-country comparison of similar instruments as part of the evaluation.

## OVERVIEW OF KEY FINDINGS AND CONCLUSIONS

### *Analysis of the policy context at the national level*

The results of analysis confirm that the ERDF played a significant role in Poland's RTD and quickly became one of the main sources of support in the overall national policy mix. It is worth noting that the Polish RTD policy considerably evolved during the 2007-2013 programming period, mostly as a result of the reform of science and HE sectors in 2010-2011. As such, the policy context within which ERDF OPs were implemented underwent significant changes during this time. But also, ERDF support also helped set the scene for these major reforms to take place. The case study highlights the existence of very close links between national RTD policies and ERDF support (national and regional) on both the strategic and operational level.

ERDF support for RTD is also shown to have played an important role in the implementation of regional RTD policies. During the 2007-2013 period, Polish regions were able to secure substantial financial resources for RTD investments for the first time (not taking into account the pre-accession funds and the financial assistance provided during the first short programming period between 2004-2006). However, the linkages between ERDF support for RTD and other European programmes (i.e. FP7 and the successor programme H2020) did not fully materialise, and the existing evidence points to the lack of direct mechanisms for maximising the potential synergies.

There was a relatively high number of institutions involved in the implementation of RTD policy instruments co-funded by the ERDF. Also, a number of changes in the institutional set-up of the delivery and management took place during the period, leading to the delegation of responsibilities for the delivery of the two selected policy instruments supported within the OP Innovative Economy and Infrastructure and the OP Infrastructure and Environment.

The data analysis at the MS-level shows that the strongest budgetary allocation across all OPs went to category 02 projects – RTD infrastructure (close to 3 times the amount allocated to category 01 – RTD activities). The main shortcomings for the 2007-2013 programming period were mainly related to the financial support being overly focused on fundamental research targeting the public research sector and individual organisations, rather than projects which involved co-operation among various partners – including from the private sector. The results of analysis also indicate that the ERDF RTD policy mix could have been enhanced through the introduction of additional instruments. In overall terms however, the RTD investments support through the ERDF were found to set the foundation for the implementation of further and more ambitious investments in RTD in the future.

***Achievement of intended effects of the analysed policy instruments (i.e. effectiveness)***

The case study has found that it is extremely challenging to determine the extent to which policy instruments have generated the types and levels of intended changes they set out to achieve. This is particularly true of intended medium-to-long-term outcomes and impacts. This is mainly due to the lack of clearly defined ambitions on behalf of OPs for these instruments, as well as measurable indicators and targets to assess them by. The case study has demonstrated that a major weakness of these OPs lies in the lack of more systematic use of intervention logics and/or theories of change, along with the necessary results monitoring frameworks, at the instrument of policy instruments. Overall, the we have found that performance indicators and targets have been defined for less than 20% of the intended results as defined in the instrument Theories of Change which have been developed for the purpose of this evaluation.

This said, out contribution analysis has demonstrated that for the most part, the intended goals have been achieved, particularly at the level of intended activities, outputs and immediate/intermediate outcomes. Data regarding the level of achievement of final outcomes and impacts has been much harder to come by, an in many cases, assessing these has been judged as pre-mature given the relatively short time-span since the operational implementation of the instruments and related projects. In general terms, ERDF investments in RTD infrastructure and activities are seen have played a key role in transforming and modernising the RTD capacities of the country, bringing in a much needed boost to existing RTD infrastructure, capacities and culture. As such, ERDF support allowed to bring Poland closer to other EU MS counterparts, bridge the gap between them, and build Poland’s reputation as a reliable and modern RTD partner.

However, despite the fact that most of the activities were successfully implemented, giving way to a body of interesting and relevant direct results, some of the key intended effects did not end up materialising. This is perhaps best illustrated by the collaborative R&D instrument, where the case study has found for instance that the commercialisation / uptake of new products and processes generated by the projects was extremely low. There is also limited evidence regarding the impact of the availability of an improved and stronger pool of skills for the local business community and employers, stemming from investments in higher education institutions. The analysis of the WCAT major project shows an underperformance on some of the planned targets, such as patenting activity, innovations introduced in companies and co-operation with foreign research entities. As such, the success of the ERDF appears to lie mostly in the changes it has brought about in terms of capacity (e.g. better management of R&D, increased supply of higher education) and behaviour (e.g. increased receptiveness to engaging in collaborative R&D, and heightened awareness of engaging in excellent science); rather than in the economic and competitiveness spill-overs of the projects the ERDF invested in. The lack of more generalised translation of research outputs into practical solutions and innovation – whether on the market or elsewhere – generally stems from the lack of a more hands-on involvement of the private sector in the ERDF-supported projects. In light of this, ERDF benefits and results are mostly concentrated in the research sector – and particularly the publicly funded research sector.

### *Drivers and barriers of success*

The effectiveness of collaborative R&D support (and the related effectiveness of the instrument 'causal packages') was significantly impacted by the limited policy capacity of the implementing authorities and instrument managers, the lack of adequate IPR framework, as well as the absence of sustained interest and capacity of industrial partners to carry out innovation on the basis of research project results. The latter in many cases came as a result of a lack of better designed policy measures, which offered clear incentives for the private sector to participate and remain engaged, and measures (i.e. project selection criteria) to ensure the market relevance and potential of supported projects. In addition, the analysis has put a major spotlight on the lack of prior experience and the limited role played by technology transfer offices, technology brokers or relevant departments of scientific organisations.

In the case of the higher education infrastructure investments, it is found that State Aid rules influenced the capacity of beneficiary institutions to engage in commercial practices through the newly built or modernised infrastructure financed. This has limited beneficiary capacity to engage in collaboration with the private sector, and diversify the sources of income and revenue for the supported infrastructure.

A number of external (to the policy instrument) contributing supporting factors have proven key to ensuring success. This included for instance the provision of capacity development activities for beneficiary institutions aimed at improving their management capacities. In the case of infrastructure investments, the support provided to the beneficiary institutions through other ERDF OPs (national or regional), has also been found to have played a major role in the generation of the observed positive results. In this case, the ERDF support provided through the OPs assessed as part of this case study can only be considered to have been one of the contributing factors to the achievement of positive results. The development and identification of explicit linkages among these OPs at the design stage proved to be a key determinant for these synergies to take place.

### *Relevance*

The findings of the present case study suggest that the provided support responded to the identified challenges and needs of Polish RTD system. For example, the OP Innovative Economy included a large portfolio of measures addressing multiple priorities, going beyond RTD activities and infrastructures support. The OP Infrastructure and Environment aimed at increasing number of students in priority fields of study and improving the quality of education. The main thematic foci of the ERDF support are found to be in line with national priorities and needs. This is illustrated by the strong levels of support provided to engineering and technology, as well as life sciences (e.g. Medical and Health Sciences). More than half of the RTD funding was concentrated on applied/industrial research, while experimental development activities accounted for a relatively small share (5.6%).

Despite the existence of a significant, intentional, and relevant thematic focus of ERDF on a select number of fields and themes, the geographical targeting of the ERDF investments is more limited. The analysis of the selected policy tools showed that ERDF investments were not necessarily guided by geographical targets, or the intention to support specific regions over others. As a result, projects were mostly selected on the basis of their research and innovation merit, leading to a concentration of support in leading centres and universities where the country's strongest regional research ecosystems already existed. Overall the concentration of RTD investments reflects the existing regional scientific research base and economic potential. The RTD investments in Mazowieckie, Malopolskie, and Wielkopolskie accounted for approximately €1.7 billion which represented more than half of total RTD investments in the country. This said, Regional Operational Programmes and the OP Development of Eastern Poland provided substantial support to specific regions, in light of strengthening the capacity of regional scientific and research base and eliminating the inter-regional differences.

### *Efficiency*

The volume of financial support provided by the ERDF to support RTD activities and infrastructures was sufficiently high in order to 'move the needle' for the country's research system. RTD was not only one of the fields which benefitted the most from the ERDF support (i.e. the data analysis at the MS-level shows RTD investments in Poland accounted for more than €3 billion representing more than 21% of the total ERDF contribution); but ERDF RTD investments were also very significant in comparison to the existing national and regional policies and programmes in support of RTD. Yet, while the level of funding was sufficiently concentrated to make a perceptible difference in the overall level of quality of the national research and higher educations system; this was not found to be the case when it came to supporting the development of a more vibrant and innovative private sector. Investments were overwhelmingly focused on supporting infrastructure in research and higher education organisations, where the focus on enhancing collaboration with the private sector (in light of generating positive innovation spill-overs) was either overseen or did not materialise as expected.

### *Sustainability and replicability*

The case study found that in case of collaborative R&D, the sustainability of the observed capacity and behavioural effects among the beneficiary community was ensured. However, this policy instrument was not successful in ensuring the sustainability of the results of the collaborative research projects and in forming long-term research partnerships. While the financial sustainability of the higher education infrastructure investments is not a threat at least in short-term, in the case for the WCAT major project further financial and operational sustainability could be enhanced through the diversification of sources of revenue.

In terms of replicability, the funding mechanism of collaborative R&D support, which was developed to increase the likelihood of generating project proposals corresponding to the actual needs of enterprises, could be of interest to other regions planning the launch of this type of support. Educational infrastructure investments is an interesting example of the possible synergies which can be developed with the assistance of the different OPs, whereas the experience of WCAT provides valuable lessons for the creation and management of large multidisciplinary research centre in high-tech domains.

### *Coherence*

Complementary interventions were planned in different national OPs (OP Infrastructure and Environment: infrastructure for higher education; OP Development of Eastern Poland: provided additional funding for investments related to RTD infrastructure in the selected low-income regions of the country, bordering the external frontiers of the EU) as well as regional OPs for 16 Polish regions. The OP Innovative Economy was intended to be the core support programme for activities directly related to RTD activities and research infrastructures as opposed to infrastructures implemented to support education. In the programming documents the list of synergies was rather broadly defined and there was a lack more detailed information about the foreseen complementarities and synergies. To eliminate the possible overlapping of interventions the Managing Authority developed and implemented document establishing a demarcation line between the OPs. The criteria set out in this document were mainly based on the territorial scope of activities, project values, type of beneficiary, etc. There were no formal mechanisms or procedures to ensure coordination and complementarity between national and regional programmes. In practice, experts reviewing proposals were expected among others to evaluate the novelty of proposed infrastructures, analysing regionally available infrastructures financed from other sources. There were also no direct mechanisms put in place to ensure synergies with FP7 / H2020.

The RTD investments are found to be coherent in general, even though there was clearly a scope for further maximising the synergies and complementarities. This said, in the case of the infrastructure for higher education instrument, the complementarities between the OP supporting this instrument, and other ERDF OPs, was found to be one of the drivers of success of the instrument.

### *EU added value*

National and regional budgets were considered not sufficient to offer financing for sizeable RTD investments and related infrastructure. The use of EU funding was planned to function as a trigger for a transformation of the higher education system, but also in wider context economy and the Polish innovation system. It is most likely that that the investments would not have been undertaken without the EU support or at least the intensity of investment would be much lower due to budgetary limitations. The case study found that there is also a clear EU added value in relation to the selected policy instruments / major project.

The evaluation did not find that the ERDF support for RTD activities and infrastructure genereated significant EU-wide effects; or let to an incrase in the levels of cooperation between regions and Members States in the EU. This said, infrastructure investments are foudn to have considerably increased the appeal of the Polish research and highe educations system, leading to increased levels of collaboration with EU counterparts, as well as an influx of foreign students.

# 1. INTRODUCTION

This report has been prepared in the framework of the Evaluation of investments in Research and Technological Development (RTD) infrastructures and activities supported by the European Regional Development Funds (ERDF) in the period 2007-2013. The main objective of evaluation is to identify the effectiveness of RTD infrastructures and activities, their coherence with other policies, their efficiency, relevance and EU added value. The evaluation covers 53 Operational Programmes (OPs) selected by the European Commission covering a substantial amount of the RTD funding (€14.64 billion, or about 85% of the EU total for the relevant themes) provided during this programming period.

As part of the evaluation, a total of seven case studies (CS) have been carried out in order to illustrate the concrete effects of ERDF-supported RTD policy instruments. The CS were designed to examine the use of funding for different policy instruments in the selected Member States (MS) and the specific context in which they were implemented, their rationale, their effectiveness and their long-term sustainability.

The CS have been conducted on the basis of a Contribution Analysis (CA) approach and the underlying development of Theories of Change (ToC) for selected policy instruments. This involved disentangling the complex causal relationships within different stages of implementation and production of results of these policy instruments, in light of identifying the contributions made by the ERDF to improving RTD in specific regions and MS. The aim of this approach was to build a detailed narrative of the ToC 'at work' in a specific region/MS and context, addressing the specific conditions influencing the policy rationale, the interplay of different stakeholders, their expectations and observed effects as a result of the policy instruments.

This pilot CS focuses on the ERDF support for RTD activities and infrastructure delivered in Poland between 2007 and 2013. More specifically, the CS analyses two specific policy instruments implemented under two separate OPs:

- **Collaborative research and development financed under the OP Innovative Economy (OP IE):** Support for collaborative research and development (R&D) during the 2007-2013 programming period of the EU Structural Funds was particularly important for the innovation-oriented transformation of Poland's R&D system, contributing to the changes of research themes and project modalities at public science organisations, and opening up important opportunities for private sector organisations. Prior to the 2007-2013 programming period, the limited levels of science-industry co-operation and inter-sectoral knowledge transfer had been identified as one of key challenges for Poland's innovation system. As such, support in this field was provided by the national-level OP IE. The programme initially provided minor allocations for collaborative R&D activities, and the relevant instrument was focused on applied R&D projects defined and carried out by scientific institutions, in light of addressing potential needs of industry. Over time however, the inter-sectoral collaboration in R&D was identified by policy makers as one of important challenges, and during the mid-term OP re-programming in 2012, the support measure was updated in light of further supporting joint science-industry R&D projects, involving consortia with both companies and universities or public research institutes.
- **Infrastructure investments to improve education financed under the OP Infrastructure and Environment (OP Infra & Env):** Upon joining the EU, the infrastructure gap between Poland and "old Member States" was recognised as one of the major factors hindering the optimal use of the country's potential. The challenges in the area of Higher Education (HE) and Science were related to

decreasing expenditures, low level of infrastructure investments and a decreasing share of technical, natural sciences and medicine students. In particular, the latter was identified as a threat for boosting companies' innovativeness due to the limited access to highly qualified technical and scientific workforce. Investments in educational infrastructure of higher education institutions (HEIs) were considered a means to a) implement modern education (including ICT learning techniques), in particular on the MSc and PhD level in best Polish HEIs; b) strengthen research component of education, in particular on the PhD level (according to the Principles of Modern Doctoral Education), and c) create environment and infrastructure base for more interdisciplinary study/research in technical, engineering or natural sciences. The OP Infra & Env support for infrastructure of HEIs laid down the foundations for the implementation of reforms in HE sector and for other synergetic activities financed from other OPs or directly from the budget. It stimulated the chain reaction in HE system: new infrastructure – new teaching and research opportunities – higher quality of education and research – strengthened and multiplied effects thanks to synergies with other OPs.

In addition, the CS carries out an in depth analysis of a **major project concerning research infrastructure, namely the Wielkopolska Centre for Advanced Technologies (WCAT),** financed under the OP IE. The WCAT is a multidisciplinary research centre located in Poznań, the capital city of the Voivodeship of Wielkopolska. The establishment of WCAT has been one of the strategic investments with the view of further boosting research and innovation activities in the region. At the outset of the 2007-2013 programming period, there was widespread recognition of the need for a new paradigm of regional development that went beyond the simple and unsustainable principle of offering lower costs. The WCAT offers an interesting case in mobilising the specialists from various HE and research institutions in science and technology, focused on new materials and biomaterials for a wide range of applications. The initiative sought to bring together five higher education institutions[1], four institutes of the Polish Academy of Sciences[2], the Poznań Science and Technology Park of Adam Mickiewicz University Foundation, and Poznań City Hall.

Upon the selection of policy instruments and major project, the CS was developed on the basis of the following **methodological approach**:

- **Step 1:** Carry out background research on the selected OPs, policy instruments, and major project;
- **Step 2:** Screening of key stakeholders;
- **Step 3:** Developing an initial Theory of Change (ToC) for each of the selected instrument and major project and identifying performance metrics;
- **Step 4:** Establishing initial contact with key case study stakeholders, including the first interview with Managing Authorities or Programme Managers to discuss the initial ToC and field visits;
- **Step 5:** Developing a pre-mission report;
- **Step 6:** Field visits & interviews;
- **Step 7:** Completing the contribution analysis assessment framework for the selected instruments and major project ToCs; and
- **Step 8:** Drafting of case study report (post mission).

[1] Adam Mickiewicz University in Poznań, Poznań University of Technology, Poznań University of Life Sciences, Poznań University of Medical Sciences, and Poznan University of Economics

[2] Institute of Bioorganic Chemistry, Institute of Plant Genetics, Institute of Human Genetics, Institute of Molecular Physics, and Institute of Natural Fibres and Medicinal Plants

Altogether 31 stakeholders have been consulted in preparation of this report. Information was collected from stakeholders representing managing and implementing authorities as well as direct and final beneficiaries. The stakeholders consultation was done through face-to-face interviews and carried out by the team from Technopolis Group during the period from 20 January until 28 February 2020. Since the interviews were carried out in the beginning of 2020, some of the interviewees were no longer employed by the focal organisations, but experts preparing this report were still able to reach out to them and discuss their experiences from the period of 2007-2013. There were no problems with arranging the interviews, and the availability of data was relatively good, taking into account the passage of time, imperfect recollection of detailed timelines and events, and lack of data collection for some of the specific outputs and outcomes included in the ToC, which were not part of the official sets of OP IE performance indicators. Interviews provided more useful insights than highly aggregate quantitative indicators, which were primarily available on the level of the entire programme, most of them not being decomposed into individual support measures. The analytical reliability is further strengthened by the reliance on the official monitoring data, including large-scale beneficiary surveys commissioned by the implementing authorities throughout the programming period.

# 2. ANALYSIS OF THE POLICY CONTEXT AT THE NATIONAL LEVEL

## 2.1. National RTD objectives and strategies

Poland joined the EU in 2004 and as the 7th largest economy in the EU, with over 38 million of inhabitants. ERDF support in 2007-2013 was the first full programming cycle implemented by the country. The OPs covered by the present evaluation were the first integrated sets of support measures addressing the challenges of innovation and industrial R&D in Poland since the 1980s, with significant availability of funding for both public and private RTD agents. The country had witnessed positive GDP growth rates since the 1990s, being one of the fastest growing EU economies in 2007-2013. The implementation of ERDF support coincided not only with this positive economic growth, but also with gradual improvements of RTD-related indicators. Poland's intramural R&D expenditure (GERD) was €1,512.565 million in 2006, and it went up to €3,864.016 million in 2014 (increase by 155.46%, 2006-2014) (Eurostat, 2020). GERD per capita was €39.6 in 2006 and increased to €101.6 in 2014. Despite this impressive increase, the indicator remained low in comparison to the EU average at the time (€436.1 in 2006, €562.1 in 2014). GERD as percentage of GDP was 0.55% in 2006 and 0.94% in 2014 (vs. EU average: 1.76% in 2006, 2.02% in 2014).

When Poland joined the EU it was faced with challenges typical for post-socialist transition economies, with the required structural adjustments concerning not merely the scale of private RTD investments but also local stakeholders' limited propensity to incur such expenditures. The majority of Polish companies was not interested in undertaking innovative endeavours, relying on low cost advantages related to internationally competitive salaries. Companies lacked strategic awareness of the importance of innovations, particularly product innovations. Furthermore, the manufacturing base had to be upgraded, with urgent needs to replace obsolete production technologies with world-class solutions that would enable them to compete internationally. Among business enterprises, more focus was placed on adoption of existing technologies (in particular, financing purchases of modern production lines) than RTD or development of innovations, creation of knowledge-based workplaces or use of intellectual property. At the same time, the HEIs had been severely under-funded in previous years and needed investments in research infrastructures to be able to participate in international projects and attract industrial partners.

Polish scientific units had mostly outdated equipment, which made it extremely difficult to conduct advanced research to address the most important socio-economic needs of the country. In addition, one of the most significant obstacles for research implementation was the fragmentation of the existing research base, which resulted in inefficient use of research facilities. The dispersion of specialised research equipment also caused a difficulty in conducting large R&D projects with an international dimension.

Poland's RTD policy landscape considerably evolved during the OPs implementation, mostly as a result of a reform of science and HE sectors in 2010-2011. Policies and regulations related to the absorption of the EU Structural Funds, including a set of instruments providing support for innovative enterprises and R&D projects, were coordinated by the Ministry of Regional Development, which acted as the Managing Authority for the EU Structural Funds. The bulk of innovation-related policies were coordinated by the Ministry of Economy; while science and research policies were overseen by the Ministry of Science and Higher Education.

In addition to these ministries, the following organisations and agencies also provided active policy support in the field of RTD:

- The Polish Agency for Enterprise Development (PARP) provided support for the business sector, offering funding for RTD and innovations.
- The National Centre for Research and Development (NCBR) provided financing for applied research and innovations, including RTD projects of business enterprises and research infrastructures.
- The National Science Centre (NCN) provided support basic research in Poland.
- The National Information Processing Centre (OPI) implemented instruments related to collaborative research and research infrastructure, but its role was gradually reduced after the 2010-2011 reform, when a number of its competences were transferred to the NCBR.

In its evaluation of Poland's innovation support system, the World Bank characterised it as excessively complex, with a number of responsibilities shared among multiple government agencies, and heavy administrative burdens stemming from an "institutional disequilibrium" (Kapil et al., 2012: 39). Furthermore, the system included 16 regions (voivodeships) with their Marshal Offices that defined their own regional operational programmes (ROPs) for the distribution of the EU Funds. Some of these OPs also included RTD-related components, implemented in parallel to the centrally-distributed governance of the national innovation system.

In defining the overall goals of the ERDF support and other RTD-related policies, policy makers emphasised the need to revitalise the industry and science sector, leveraging the available funding to strengthen industrial interests in innovation, and scientific activities related to applied research. The policies were meant to overcome private sector's unwillingness to invest in RTD, scientists' focus on fundamental and non-applicable research topics, the lack of modern infrastructure for scientific and industrial R&D, as well as limited awareness of global technological trends. The policy framework was also meant to address the chronic underfunding of RTD performers, who were not able to benefit from large-scale public funding for RTD in the past or had limited access to private financial institutions including banks or VCs. Other identified barriers included a lack of willingness to develop partnerships among stakeholders in the innovation systems, limited uptake of e-business solutions and lack of international promotion of Polish economy. Furthermore, ERDF support for RTD offered opportunities to co-ordinated activities of various ministries and align their missions around the topic of research and innovation support, stimulating the creation of dedicated implementing agencies.

In light of understanding and interpreting the results of ERDF support for RTD during the 2007-2013 period, it is important to take into account that the Polish economy witnessed a number of notable developments during this period, including increases in the competitiveness of companies and GDP per capita; as well as a revival of innovative capacities and promotion of excellence in the science sector. This is reflected in the results of cluster analysis carried out within this evaluation, whereby the RTD performance during the period covered by this evaluation increased for four regions and remained unchanged in the remaining 12. The regions of Małopolskie, Podlaskie, and Mazowieckie went from being "Modest +" RTD performers to "Moderate –" performers, while the Warsaw area changed from "Moderate –" to "Moderate +". Poland's economic growth was not significantly affected by the slowdown in other EU countries linked to the economic and financial crises, as the country benefited from an influx of foreign investments, internationalisation of businesses, changes in skills and HR availability, growing importance of innovations in the economy and reforms of the science sector.

## 2.2. The links between national, regional and European objectives and strategies in the field of RTD support

### *2.2.1. Linkages between national RTD policies and ERDF support*

Since Poland joined the European Union in 2004, European funding has started to play a significant role in R&D resource mobilisation. This has resulted in a considerable increase in the amount of financial support allocated to RTD and innovation through the EU Structural Funds. The total allocation from the National Development Plan 2004 - 2006 amounted to €800 million for innovation and R&D support. In the context of the Lisbon Strategy, the 2005-2008 National Reform Programme (NRP) was designed with assumption that a level of 1.65% GERD will be reached in 2008. Additional target of increasing private funding of R&D from 0.17% of GDP in 2004 to 0.55% of GDP by 2008 was also set.

However, when preparation for the financial perspective 2007-2013 started there was no integrated strategic framework for RTD and innovation policies. An important input to the process was the National Foresight Programme "Poland 2020". Also, a legal framework was updated in 2007 in the form of amendments to the 2004 Act on the Principles of Financing Science which introduced for the first time a basis for multi-annual research programmes.

Concerning the innovation policy area, the Act on Some Forms of Supporting Innovation Activities adopted in 2005 introduced additional mechanisms to support R&D activities in the private sector. One of the incentives was the creation of the status of private R&D centres. For the first time, the Act allowed R&D expenditures to be considered as costs for the tax purposes regardless of the final results of R&D activities. Additional incentives were also provided for the acquisition of technologies, and the Innovation Strategy for years 2007-2013 laid down the foundations for programming of the EU Structural Funds interventions in support of RTD and innovation activities. It is worthwhile noting that the strategy followed more horizontal than sector approach, and proposed a number of mechanisms to support R&I activities of enterprises and development of new technology based companies.

As it is mentioned already in the previous section, Polish RTD policy considerably evolved during the OPs implementation between 2007-13, mostly as a results of a reform of science and HE sectors in 2010-2011. An important and visible effect of this reform was a shift of the implementation of the OP IE measures from the Ministry of Science and Higher Education to the NCBR in 2010.

Adopted in 2011, the updated NRP set the thematic strategic directions for the RTD activities. These directions were defined to tackle important socio-economic and technological challenges, with defined goals and objectives, influencing medium- and long-term national policies. They were chosen by considering the long-term needs of the Polish economy, future niche markets for high-tech products, as well as the quality and concentration of the research potential and priorities of the European research programmes. Strategic directions provided a basis for the NCBR to formulate and finance strategic R&D programmes. The NRP defined seven strategic interdisciplinary directions for R&D activities, proposing almost 70 research topics in areas of:

1. New technologies in the field of energy;
2. Civilisation diseases, new drugs and regenerative medicine;
3. Advanced information technologies, telecommunication and mechatronics;
4. Modern materials technologies;
5. Environment, agriculture and forestry;

6. Social and economic development of Poland in an increasingly global world; and
7. Security and defence.

This thematic oriented approach of NRP was complemented with the Polish Roadmap for Research Infrastructures, developed in 2011, including 33 domestic and international projects in various fields of science.

This said, there was a very close link between national RTD policies and ERDF support on many levels. On strategic level, the programming of the EU Structural Funds OPs stimulated the strategy development process. Legal framework was substantially changed in period 2007-2013 to adopt to rules and requirements of ERDF support, as well as to enhance the effectiveness of public interventions. On operational level, new institutions like NCBR were established and new financial mechanisms were introduced. Most of these instruments were novel in Poland, even though they were widely known in many other countries. For example, collaborative R&D in Polish innovation system was a relatively rare phenomenon at the beginning of the financial perspective 2007-2013. At the launch of OPs, most companies in Poland did not show any interests in working with academia, and scientists primarily focused on fundamental research which was regarded as more prestigious and better indicator of scientific excellence than applied R&D.

#### *2.2.2. Linkages between regional RTD policies and ERDF support*

Although for the programming period 2007 – 2013 all Polish regions developed Regional Innovation Strategies (RIS), the priorities for RTD support were broadly defined and common practice was to focus on horizontal, technology-agnostic support for innovations. This was the case for example for regions of Mazowieckie, Małopolskie and Podkarpackie covered by the present evaluation, where a relatively large number of horizontal activities and infrastructure support to create more favourable conditions for RDI activity was offered.

In Małopolskie, some references in the ROP were made to the areas/technologies identified in the RIS Strategy, grouped in four cluster Environment, Industry, Health and Food, Knowledge and Communication

In Mazowieckie, general evaluation criteria applicable to all calls in the OP referred to "consistency with regional development directions", "competitiveness of the region", "synergies with other socio-economic domains", and detailed criteria for the RTD infrastructure call also pointed to opportunities for co-operation with other scientific organisations and potential users, also from business sector.

In Podkarpackie, there was a requirement of alignment with the objectives defined in its RIS 2005-2013. The support was provided to projects in the following thematic areas: advanced genetics and its application; combating major diseases; information society technologies, nanotechnologies, intelligent materials and new production processes; aeronautics and space; food safety and health threats; sustainable development; sustainable energy systems; sustainable ground transport; development and commercialisation of organisational innovations for innovation of the regional economy; and support and development of new and existing industrial clusters.

It needs to be acknowledged that for the first time Polish regions were obliged to prepare and implement integrated RIS strategies to be able to secure substantial financial resources from the EU Structural Funds. All in all, there is no doubt that ERDF support has played an important role for implementation of the regional RTD policies.

### 2.2.3. *Linkages between ERDF support for RTD and FP7 / Horizon 2020*

In the initial OP IE, explicit links with the 7th Framework Programme (FP7) were declared, and one of the monitoring indicators referred to Poland's financial share in projects financed under FP7, but in 2012 this indicator was deemed unsuitable and discarded. No direct mechanisms ensuring synergies with FP7 were foreseen. The OP IE included also explicit plans to support Poland's participation in the future establishment of EIT, expecting the establishment of a dedicated Knowledge and Innovation Community in the Polish city of Wrocław, with a view to use funding synergies between ERDF and FP7. These plans never materialised, as the seat of EIT was located in Budapest, but part of OP IE funding was used for major projects targeting a local entity in Wrocław called EIT+, actively engaged in the EIT initiative.

In case of the OP Infra & Env the potential synergies with FP7 was not explicitly expressed, however for obvious reasons, strengthening of the educational and research infrastructure of universities contributes to developing the potential and competitive position on the ERA, what naturally creates synergy with European programmes (i.e. FP7 and the successor programme H2020).

## 2.3. Implementation of ERDF funds for the 2007-2013 period in Poland

The Managing Authorities for **national ERDF OPs** were located within the Ministry of Infrastructure and Development (previously the Ministry of Regional Development), while those for **ROPs** were hosted by the Marshall’s Offices of relevant voivodeships. Specifically the following departments were responsible for overseeing the OP’s analysed in detail in this case study:

- The **OP IE** was overseen by the Department for Competitiveness and Innovation Programmes in the Ministry of Infrastructure and Development (previously the Ministry of Regional Development). To ensure the effective implementation of the Programme, certain responsibilities were delegated to Intermediate Bodies such as the NCBR for RTD interventions. The OPI acted as the Implementing Authority of specific instruments in support of research projects using the foresight method, as well as R&D projects for entrepreneurs carried out by scientific entities.
- The Managing Authority for the **OP Infra & Env** was Department of Infrastructural Programmes in the Ministry of Infrastructure and Development. The NCBR was tasked with overseeing the implementation of RTD interventions in the position of the Intermediate Body and the OPI played a role of the Implementing Authority.

In addition to both of these OPs, the Department of Supra-regional Programmes in the Ministry of Infrastructure and Development (previously the Ministry of Regional Development) oversaw the implementation of the Operational Programme Development of Eastern Poland (**OP DEP**) with the support of PARP.

### 2.3.1. *Volume of ERDF financing for RTD-related activities and supported OPs*

For the period under consideration, Poland was allocated €67 billion for its Cohesion Policy (of which 33 billion for ERDF), making it the largest beneficiary of European Cohesion Policy alongside the Czech Republic and Germany. The specific analysis of ERDF funding allocated to RTD activities in Poland has been carried out on the basis of the information gathered through this evaluation linked to the sample of selected Polish OPs.

Specifically, this relates to the levels of funding identified by the evaluation team under each of the following OPs:

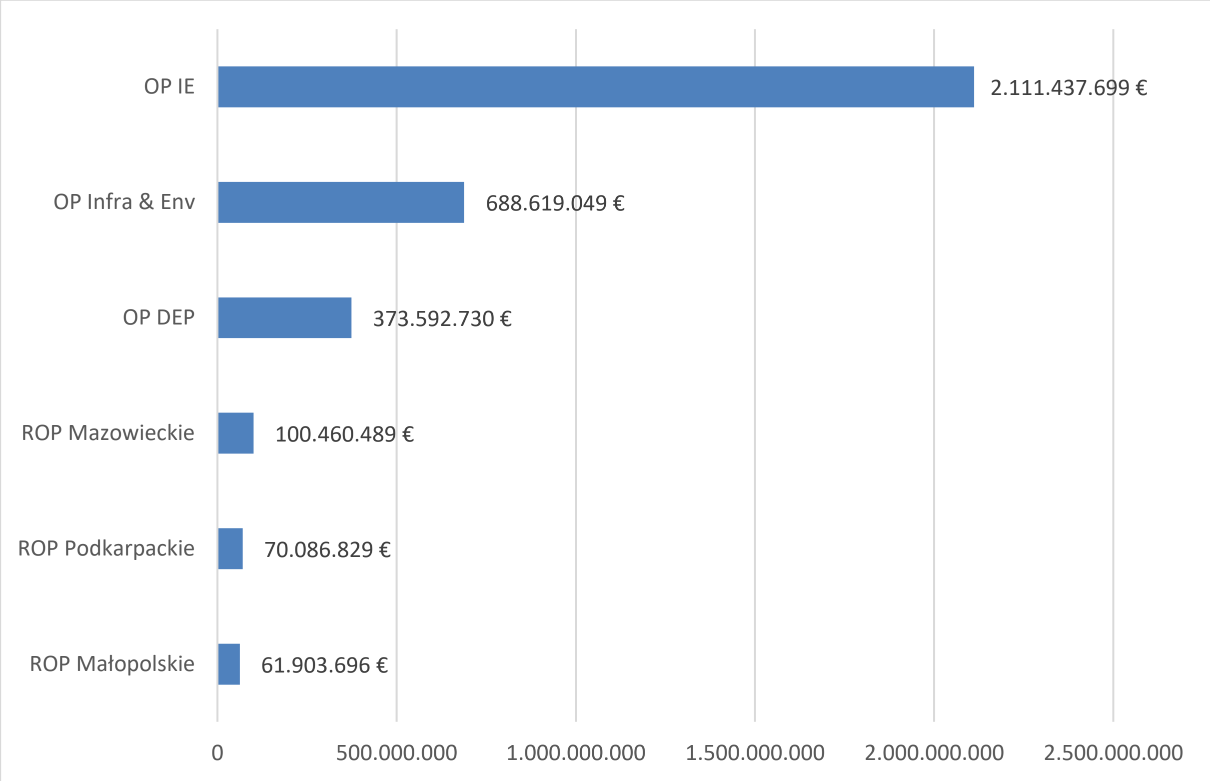
- **2007PL161PO001**: Operational Programme Innovative Economy, 2007-2013 (OP IE);
- **2007PL161PO002:** Operational Programme Infrastructure and Environment, 2007-2013 (OP Infra & Env);
- **2007PL161PO003:** Operational Programme Development of Eastern Poland, 2007-2013 (OP DEP);
- **2007PL161PO010:** Regional Operational Programme of the Voivodeship of Małopolskie, 2007-2013 (ROP Małopolskie);
- **2007PL161PO011:** Regional Operational Programme of the Voivodeship of Mazowieckie, 2007-2013 (ROP Mazowieckie); and
- **2007PL161PO013:** Regional Operational Programme of the Voivodeship of Podkarpackie, 2007-2013 (ROP Podkarpackie).

It is worth highlighting that in the case of Poland, there are very slight differences in the levels of funding recorded by the Final Implementation Reports (FIRs) of these OPs, and the figures generated by the evaluation team through the analysis of individual OPs. The deviations in the category of expenditures 01 – RTD activities in research centres and 02 – RTD infrastructure and centres of competence in a specific technology accounted for 11% and 8% respectively. In both categories, the investments calculated on the basis of data collected as part of this evaluation were higher than the expenditures reported in the FIRs. This divergence is not substantial and it is most likely that the difference is due to the fact that the Managing Authorities reported in the FIRs the actual payments and not values of signed contracts as in the monitoring database of projects and beneficiaries.

**The total ERDF contribution to RTD activities across all six OPs studied was approximately €3.4 billion for the 2007-2013 period.** The ERDF across all six programmes accounts for 83% of all contributions for the OPs. National and regional counterpart contributions account for only 13% of total contributions, while private contributions represent 3% of total funding.

The following figures provide an overview of the breakdown of ERDF RTD support by OP. As can be seen, the ERDF support is largely concentrated on the three national OPs (i.e. OP IE, OP Infra & Env, and OP DEP).

**Figure 1 Distribution of ERDF funding for RTD in Poland by OP**

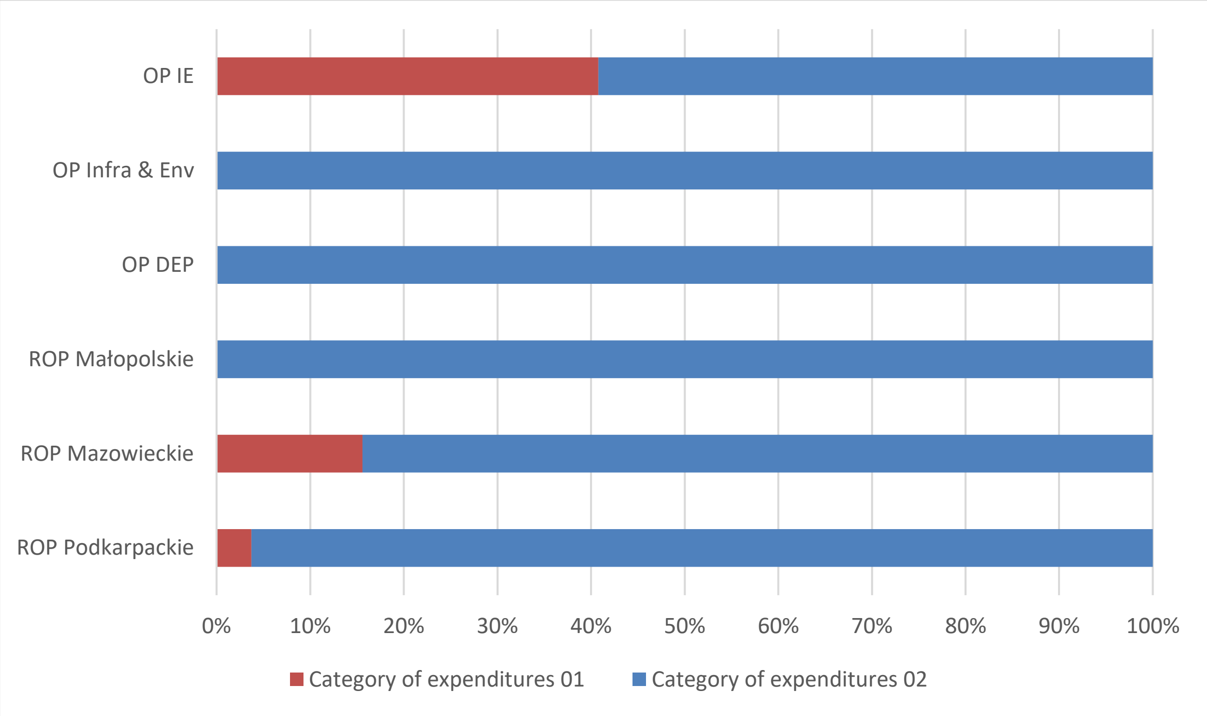



*Source: Authors based on CSIL calculations*

When it comes to the types of interventions and forms of financing, the strongest budgetary allocation across all OPs was for category 02 – RTD infrastructure (close to 3 times the amount allocated to category 01 – RTD activities). Half of the OPs studied in Poland (i.e. OP Infra & Env, OP DEP, and ROP Małopolskie) did not allocate any funding to RTD activities. The OP IE was by far the major source of funding accounting for almost 98% of total investments in RTD activities. Also, the highest share of support for category 02 is recorded under the OP IE, which allocated more than 40% of available funding to this category.

The existing evidence indicates that the RTD support consisted primarily of instruments driven by research demands, i.e. implemented in a bottom-up mode, with applicants able to put forward their desired project topics and apply for funding the RTD activities. Some instruments were also designed to address the existing infrastructure and related gaps (top-down), including projects financing large research infrastructures.

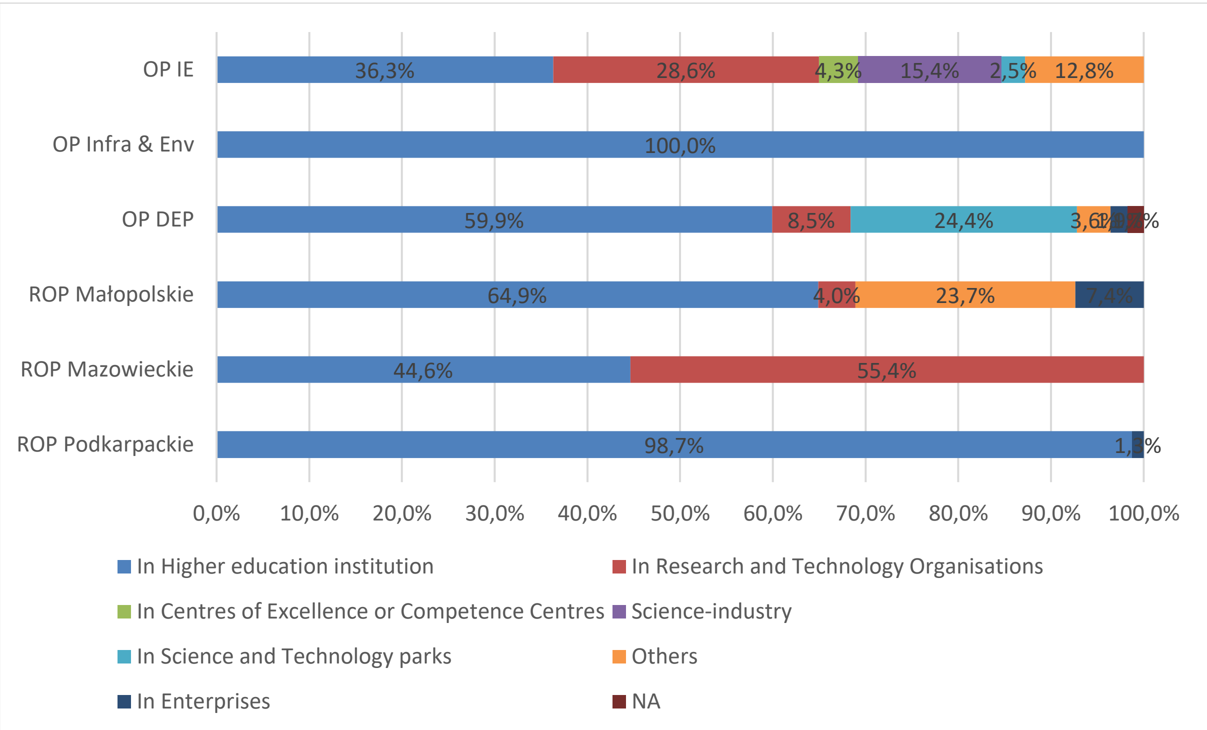
**Figure 2 Share of themes in ERDF funding for RTD in Poland by OP**




*Source: Authors based on CSIL calculations*

Overall, OPs allocated the largest share of funding in support of HEIs. For instance, in the case of OP Infra & Env and ROP Podkarpackie, 100% or close to 100% of funds were directed towards HEIs. The second most important target group were Research and Technology Organisations. Science and Technology Parks, Science-Industry organisations, Centres of Excellence and Competences Centres and Enterprises were not strongly targeted by the RTD interventions during the 2007-2013 programming period.

**Figure 3 Distribution of funding by target for the OPs**




*Source: Authors based on CSIL calculations*

With respect to the geographical and sectoral targeting strategy of ERDF OP designers, the analysis of beneficiary data shows that:

- Within the largest national OP (i.e. OP IE), the funding was concentrated in a handful of regions with stronger RTD potential : Mazowieckie (42.2%), Małopolskie (17.6%) and Wielkopolska (11.3%). Comparatively, in the five regions of Eastern Poland the support provided to beneficiaries within the OP IE accounted for 6.3% of funding. The most successful region in undertaking ERDF financial support for RTD was the Voivodeship of Lubelskie which accounted for 2.6% of funding.
- The funding provided within OP Infra & Env for educational infrastructure has been mainly concentrated in Mazowieckie (20.5%), Pomorskie (15.9%), Łódzkie (10.8%), and Wielkopolska (10.7%). The concentration of funding in the group of five regions of Eastern Poland provided within the OP Infra & Env accounted for 11.6% of funding. Most of the funding was concentrated in the voivodeship of Podlaskie (5.4%) and it is also worthwhile noting the absence of investments undertaken within this OP in the Voivodeship of Warmińsko-Mazurskie.
- Additional funding for research infrastructure was provided within the multi-regional OP DEP with the highest concentration of funding the Voivodeship of Lubelskie (43.%) and Podkarpackie (23.2%).

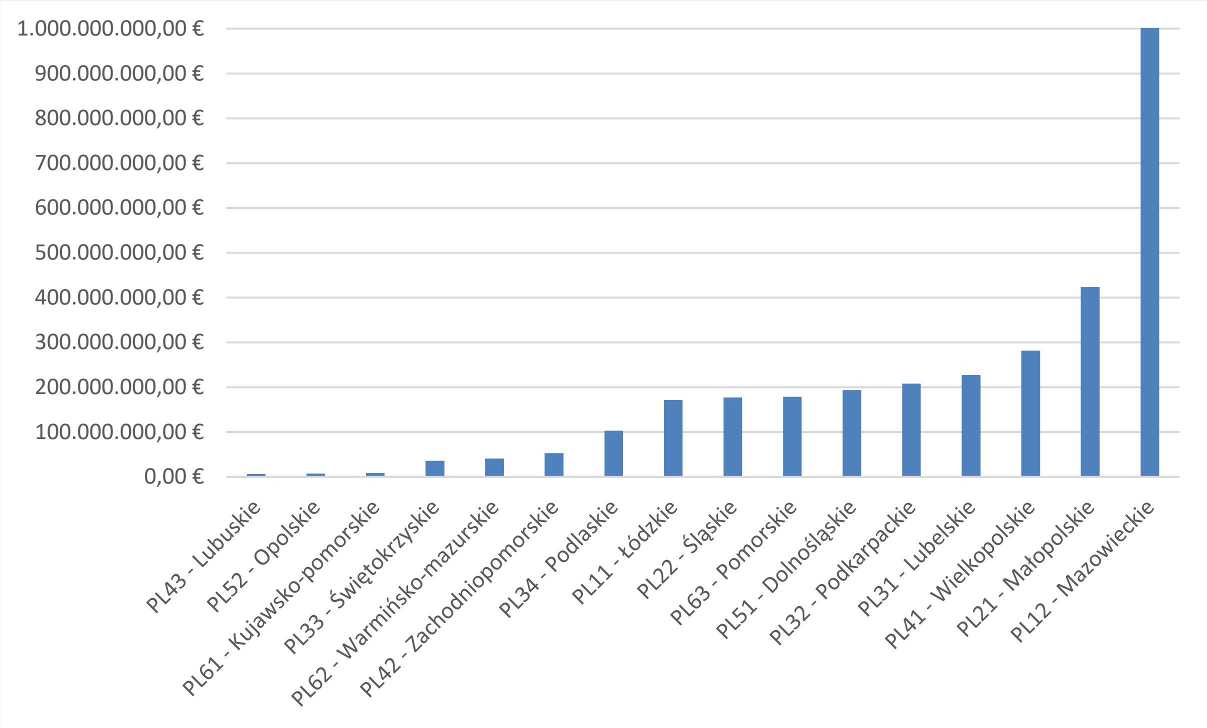
Given the nature of investments, the highest concentration of funding was found in the sector of professional, scientific and technical activities (78%) followed by manufacturing (6.5%). This is a trend observed in all OPs except OP Infra & Env which was exclusively targeted at entities carrying out professional, scientific and technical activities.

ERDF provided a critical mass of support of RTD activities. The support was channelled mainly via the national and multi-regional OPs. Additional financial support was also provided within the ROPs which provided relatively less funding than programmes managed centrally, but which still undeniably represented a very important source of support particularly in lagging regions. The main shortcomings in the 2007-2013 programming period were mainly related to the financial support being overly focused on fundamental research targeting the public research sector and individual organisations, rather than projects which involved co-operation among various partners. It is also important to note that there were attempts to mitigate this risk by introducing for instance the measure in support of collaborative R&D in the national programme OP IE (cf. Section 3.1).

Based on the interviews carried out, only a handful of research infrastructure projects have actually tapped into the possibility of using 20% of allocations for the provision of research services on a commercial basis. This means that the preferred option for many beneficiaries was to engage in this type of activities only after the sustainability period of five years had elapsed, and in the meantime, they focused on carrying out basic research projects. The choice of interventions has been influenced by the State Aid rules.

As shown in the next figure, the following three regions (Mazowieckie, Malopolskie, and Wielkopolskie) accounted for approximately €1.7 billion which represented more than half of total RTD investments. Comparatively, the five regions, comprising Lubelskie, Podkarpackie, Podlaskie, Świętokrzyskie and Warmińsko-Mazurskie, which are areas located in eastern part of Poland and characterised by the low level of economic development implemented RTD investments worth €614.5 million representing almost 20% of the total RTD investments. Overall the concentration of RTD investments reflects the existing regional scientific research base and economic potential.

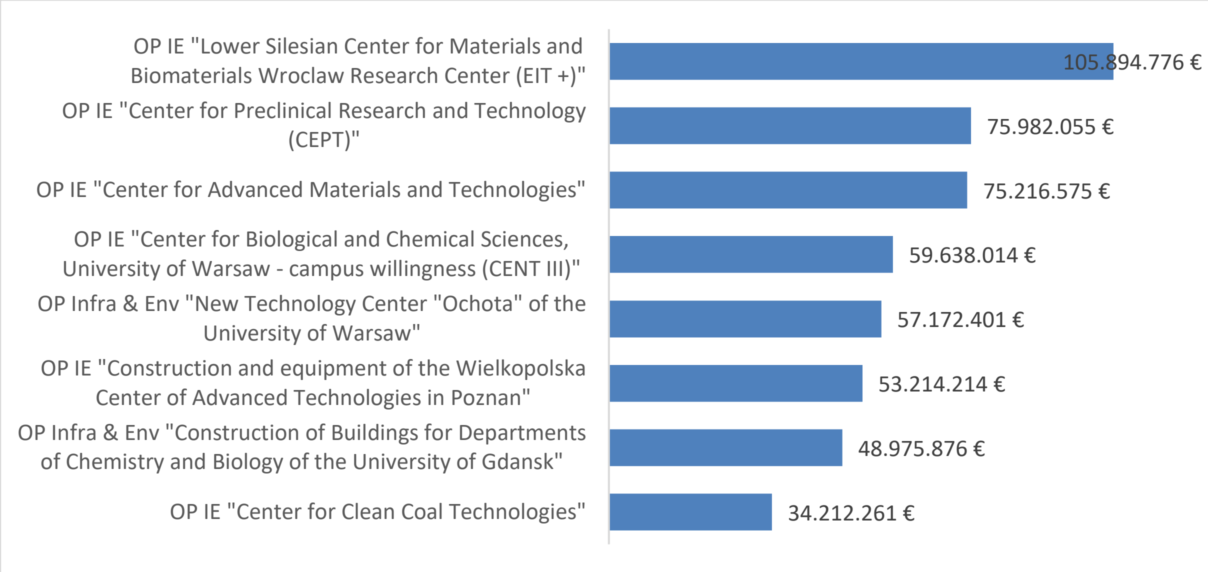
**Figure 4 Regional concentration of RTD investments**




*Source: Authors based on CSIL calculations*

There were eight major projects related to RTD infrastructures co-funded with the assistance of the EU Structural Funds for the total amount of some €510 million. Within the OP IE five major projects were implemented, all successfully concluded with the establishment of new infrastructures, purchase of specialist equipment and creation of research laboratories. Three projects were directly linked to existing higher education institutions offering synergies with their other streams of activities (major projects in Warsaw and Poznań), contributing to the strengthening of scientific excellence and commercially oriented, applied R&D activities. One of the projects was intended to establish a new, publicly co-funded research organisation EIT+ (Lower Silesian Centre for Materials and Biomaterials, Wrocław Research Centre EIT+) which was by far the largest investment. It was initially expected to be key element of the EIT/Knowledge and Innovation Communities. Even though the major project at EIT+ was finished, with successful implementation of the planned RTD infrastructures, the organisation faced problems with subsequent financial sustainability of the costly infrastructure, limited embeddedness in the regional/national innovation ecosystem, and lack of demand for specialist research services or opportunities for commercial uses of the infrastructure, with further problems related to competitive tensions with higher education and research institutes from the same city/region. Within OP Infrastructure and Environment, the two major projects were similar to the major projects implemented under OP Innovative Economy. Financial sustainability remains a potential challenge for all large RTD infrastructure investments in public-sector scientific organisation and especially in universities.

## Figure 5 ERDF contribution to major projects

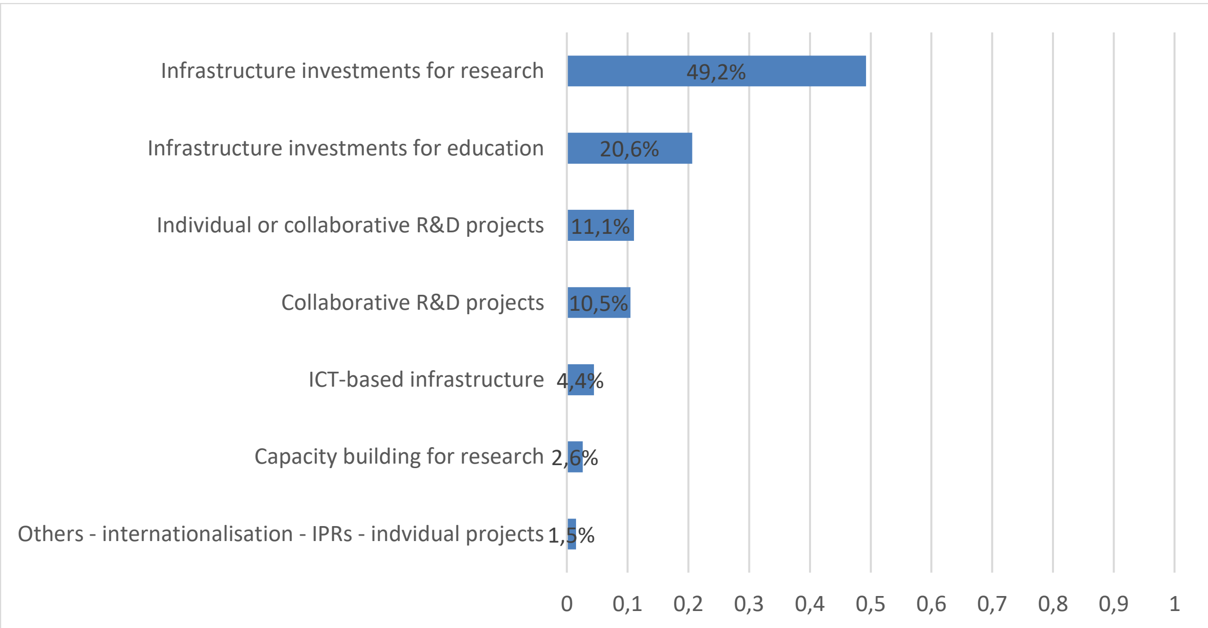



*Source: Authors based on CSIL calculations*

### *2.3.1. The ERDF RTD support policy mix: key instruments and rationale for selection*

The following figure provides an overview of ERDF funding by policy instruments, based on the taxonomy developed for the purpose of this evaluation. Infrastructure investment for research accounts for close to half of the total funding (49.2%), followed by infrastructure investment for education (20.6%). The main rationale behind the prioritisation on infrastructure investments was to create conditions necessary for conducting advanced research in response to the socio-economic needs and developing modern education system. By contrast, several policy instruments are barely present in the ERDF RTD policy mix including capacity building for research, and internationalisation of research, ICT-based infrastructure, and intellectual property protection instruments (classified as others in the following figure).

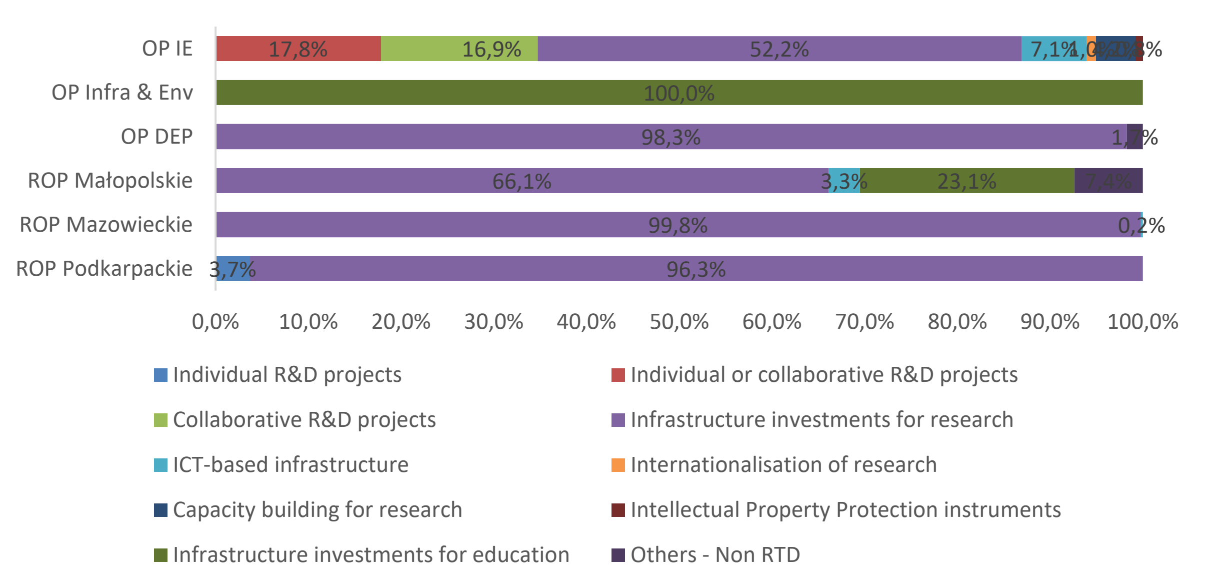
## Figure 6 Overview of ERDF funding by policy instrument




*Source: Authors based on CSIL calculations*

The distribution of funding by policy instrument varies however across the different OPs being analysed. For instance, the OP IE uses a variety of different policy instruments, whereas ROP Mazowieckie and ROP Podkarpackie are exclusively focused on infrastructure investments for research, and the OP Infra & Env on infrastructure for education. The following figure presents the distribution of ERDF support per instrument, and per OP.

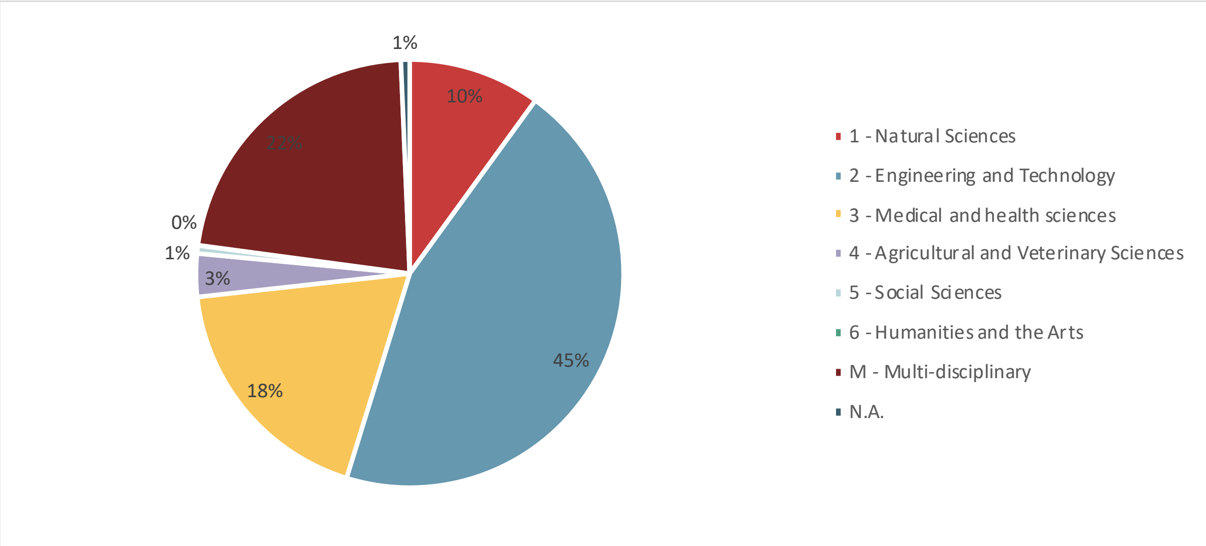
**Figure 7 Distribution of ERDF per instrument and per OP**




*Source: Authors based on CSIL calculations*

As regards the specific fields of science supported by the OPs for the period, Engineering and Technology is the best supported field across all OPs, both in terms of number of projects supported (in total 449 projects) and budgetary support (45% of ERDF funding). The Medical and Health Sciences field is also well supported with 170 projects, representing 18% of ERDF funding. The Natural Sciences and Agricultural and Veterinary Sciences accounted for 109 projects and 13% of ERDF funding. Projects under the Multidisciplinary field accounted for 22% of ERDF funding, for a total number of 67 projects.

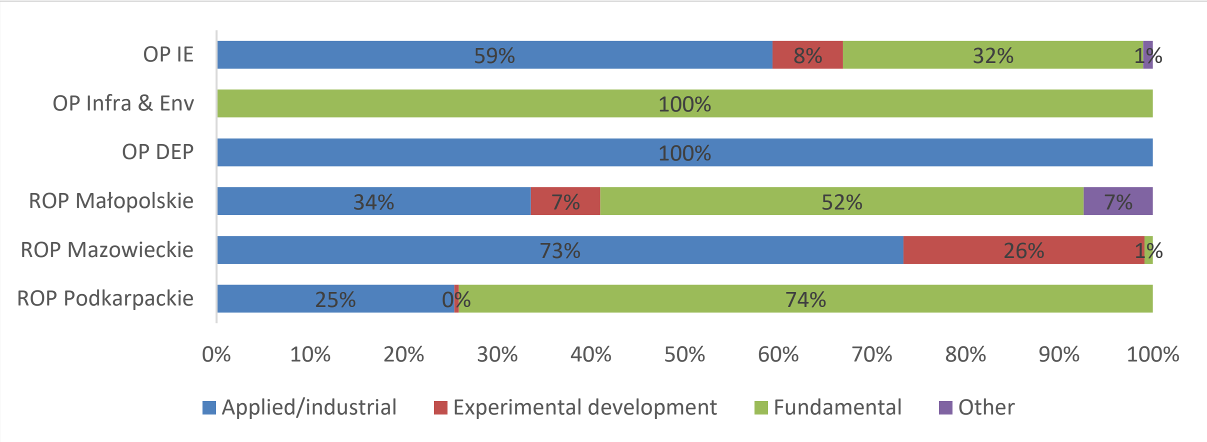
**Figure 8 Distribution of ERDF per field of science**




*Source: Authors based on CSIL calculations*

More than half of the RTD funding was concentrated on applied/industrial research, while experimental development activities accounted for a relatively small share (5.6%). In comparison, the funding provided for fundamental research represented slightly more than two-fifths of total RTD investments. The main sources of funding of applied/industrial activities were the OP Innovative Economy and the OP Development of Eastern Poland. The OP Infrastructure and Environment constituted together with the OP Innovative Economy the main sources of funding for fundamental activities. The figure below shows the distribution of funding by type of RTD in the respective OPs. The two OPs providing support for only one type of RTD activities were the OP Infrastructure and Environmental for fundamental research and the OP Development of Eastern Poland for applied/industrial related infrastructure. In the ROPs, the focus of investments is to a large extent on fundamental research with the exception of the ROP Mazowieckie which mainly provided the financial support for applied/industrial research projects.

**Figure 9 Shares of ERDF funding by type of RTD for the OPs**




*Source: Authors based on CSIL calculations*

# 3. CONTRIBUTION ANALYSIS OF SELECTED POLICY INSTRUMENTS / MAJOR PROJECT

As mentioned in the introduction of this report, two policy instruments and a major project financed by the OPs presented in the previous chapter, have been selected for a deep dive analysis. The selected policy instruments and major project are:

- Collaborative research and development financed under the OP Innovative Economy (OP IE);
- Infrastructure investments for education financed under the OP Infrastructure and Environment (OP Infra & Env); and
- The Wielkopolska Centre for Advanced Technologies (WCAT), financed under OP IE.

The analysis of these policy instruments / major project have been conducted on the basis of CA approach, which in turn has been developed on the basis of a ToC defined for each policy instrument / major project. The aim of this chapter is thus three-fold:

- To present an overview of the policy instrument / major project ToC developed for the purpose of this evaluation. It is worth noting that this ToC has been built ex-post by the case study team on the basis of available data and information, including information drawn from interviews with the relevant stakeholders. In all three cases, the ToC have been discussed and validated with the appropriate programme managers. These ToCs are then used as the basis to carry out the CA presented in this section.
- To describe the observed effects of the policy instrument based on the expected results identified in the ToC, and on the basis of the data collected by the evaluation team (primary and secondary).
- To provide an assessment of the observed effects as direct results of the ERDF funding and support for the policy instruments / major project, as well as an analysis of the extent to which the overall ToC materialised as initially expected.

Each of the following sub-sections presents the comprehensive analysis of each of the selected policy instruments for Poland. Each section is structured around the following sections:

- To begin, we present an overview of the Operational Programme under which the policy instrument has been implemented. This overview 'sets the scene' in terms of the rationale of the policy instrument and how it links to other measures and ambitions established by the programme. It also presents the general ambitions and rationale of the OP itself.
- The second section presents the Theory of Change of the policy instrument. It is worth highlighting that Theories of Change have been developed by the case study team for the purpose of conducting the contribution analysis. As such, Theories of Change are an ex-post reconstruction of the intended goals and purpose of the policy instrument, and of the causal package that was intended to lead to the generation of such goals. It is worth mentioning however that the ToCs presented in each chapter present somewhat of a snapshot of policy-makers intentions at a given point in time. However, ToCs are generally shifting and adapting to the realities of specific territories and of the agents in charge of executing. As such, the ToCs presented here in many cases underwent gradual changes which we tried to reflect both in the design of the ToCs, as well as in the final depiction of the ToC testing.

- The third section is focused on presenting the results of the contribution analysis conducted on the basis of the ToC for each instrument. This section intends to provide an explanation of what happened when the policy instrument was implemented, as well as why and how this happened. The contribution analysis has been carried out by assessing the extent to which the different components identified in the ToC actually took place, as as well as the extent to which they influenced the effectiveness of the instrument. As such the contribution analysis assessed each of the following:
    - The extent to which expected result thresholds were achieved: this involved identifying specific ambitions for each type of result (e.g. outputs, immediate outcomes, intermediate outcomes, final outcomes and impacts) and assessing whether these thresholds had been reached based on the available data. This section also includes information regarding any identified intended or unintended results.
    - The extent to which activities were implemented according to the intended plans, rules and procedures (i.e. where there any significant deviations in terms of implementation of the activities?)
    - The extent to which identified pre-conditions took place: this involved assessing whether the necessary pre-conditions actually existed in reality, as well as the extent to which their existence or absence played a role in achieving intended results.
    - The extent to which supporting factors took place, and the type of role they played in achieving the instruments intended goals.
    - The extent to which identified risks materialized, and whether these were effectively managed or mitigated or ended up limiting the effectiveness of the instrument.

The combination of the results obtained for each of the previously described assessments led us to establish a contribution claim for the different results which were observed and verified by the case study team. On this basis we were able to establish one of the following types of contribution claims for each type of intended result:

- The intended threshold was achieved and the policy instrument was likely to be the main contributor to this result
- The intended threshold was achieved and the policy instrument was only one of the factors which contributed to this result
- The intended threshold was not achieved or only partially achieved given that:
    - The activities were not implemented as originally foreseen, or there were flaws in the design of activities
    - The necessary pre-conditions did not take place
    - The necessary supporting factors did not take place
    - Some risks materialized effectively hampering the effectiveness of the instrument

The third sub-section is thus structured around each of these elements and the results of their assessemt. At the end, we provide a final conclusion on each policy instrument which presents the overall results of the contribution analysis, and the underlying explanation of this result.

## 3.1. Policy instrument: Collaborative research and development implemented under the Operational Programme Innovative Economy (OP IE)

### *3.1.1. Overview of the Operational Programme Innovative Economy*

The OP IE represented the first integrated set of support measures addressing the challenges of innovation and industrial R&D in Poland since the 1980s, and the scale of allocated funding exceeded any other publicly funded initiatives which had been previously available in the country. The OP covered the entire territory of Poland, and included instruments targeting various populations such the business sector and research/ scientific organisations. The programme was launched three years after Poland's accession to the EU and benefited from the country's initial experiences in programming for EU funding, as well as strong societal support for the EU membership. It was developed in coordination among ministries responsible for regional development, economy, science, tourism and digitalisation; with a view on targeting SMEs and scientific organisations, focusing on applied research, product development and diffusion of innovations.

The OP IE encompassed a wide variety of instruments, covering multiple types of interventions that included not only RTD activities and research infrastructures, but also broader support for the development of innovative environments and activities including clusters, technology transfer, acquisition and use of technologies by industrial and service sectors, intellectual property protection, entrepreneurship, internationalisation of companies, foreign promotion of Poland and tourism. Dedicated instruments were offered for each of the identified barriers, including: private sector's propensity to invest in industrial R&D; science-industry co-operation and cluster initiatives; scientific research focused on industrially applicable topics; overhaul and improvements of infrastructural bases for science and industry; increasing the availability of equity instruments and entrepreneurship support; promoting internationalisation of Polish companies. This said, the unifying topic of the OP was the support for the development of Poland's economy based on innovative business enterprises, which required investments in R&D projects, infrastructures and personnel, and alignment of activities of scientific organisations to generate industrially-relevant R&D results.

The set of support measures within Priority 1, related to R&D projects, accounted for 14.9% of the OP IE allocated budget. Support measures within Priority 2 were aimed at financing the development of RTD infrastructures, representing 14.1% of OP IE allocated budget. Additional support lines included: capital for innovations including VC support (Priority 3, 3.1% of budget), support for investments in non-R&D innovations in business sector (Priority 4, 36.2% of budget), diffusion of existing innovations among companies (Priority 5, 4.4% of budget), international promotion of companies (Priority 6, 4.1% of budget), e-government (Priority 7, 9.3% of budget) and e-business/ICT for companies (Priority 8, 11.8% of budget).

Policy makers developing the OP encountered specific challenges related to EU State Aid rules, as relevant regulations had to be implemented in the Polish legal system to enable RTD support to be disbursed to business enterprises, taking into account specific requirements for private co-funding and the intensity of public aid depending on the characteristics of its beneficiaries. As a result to these challenges, the initial design of some instruments included some specificities, as will be illustrated by the example of the OP IE Measure 1.3.1 (cf. Section 3.1).

The OP IE sought to create synergies with instruments supported under other OPs: OP Infra & Env, OP DEP and 16 OPs defined for Polish regions. Complementary interventions were planned in several other OPs at the national level (OP Infra & Env: infrastructure for higher education; OP DEP: infrastructures and activities in selected low-income regions of the country, bordering the external frontiers of the EU), as well as 16 regional OPs (each offering support for regional HEIs and companies).

The OP IE was intended to be the core support programme for activities directly related to RTD activities and research infrastructures (as opposed to infrastructures implemented to support education). Government institutions were represented in the steering committee of various national-level OPs, ensuring coherence between the programmes. More limited coordination was available between national and regional programmes, as some regions introduced instruments similar to support available from the OP IE, offering regional R&D performers opportunities to finance their intended investments from multiple sources.

Direct synergies were also planned with the ESF-based Operational Programme Human Capital (OP HC), which offered support for the development of researchers and R&D personnel, including the launch of new higher education programmes and specialist training for companies. Both of the OPs were complementary in this respect, with the OP IE supporting RTD activities and infrastructures, while the OP HC focused on development of soft skills, capabilities and knowledge required to carry out RTD activities and use the established infrastructures. Regarding the European-level linkages, in the initial OP, explicit links with were identified but no direct mechanisms ensuring synergies with FP7 and H2020 were foreseen.

In order to better grasp the European added-value and expected synergies, one must note that while the OP was being developed, the Polish economy was expected to become further integrated with the EU common market, with local companies and scientific organisations observing international trends and initiating structural adjustments to increase their competitiveness, innovativeness and scientific excellence. At that time however, existing national and regional funding were seen as insufficient to finance these sizeable investments in infrastructure and RTD activities. The use of EU funding was expected to act as a trigger for the transformation of the economy and the Polish innovation system. In general, beneficiaries of RTD support instruments lacked capabilities and experiences that would allow them to actively participate in pan-European initiatives including FP7 and H2020, and the OP IE introduced a number of instruments that were gradually increasing the internal capabilities of local RTD agents, even though these intentions were not explicitly formulated in the programming documents.

The interventions under the OP IE provided incentives to beneficiaries who started engaging in R&D projects and using the implemented infrastructures. The OP's primary focus was placed on upgrading the technological bases of industry and encouraging local companies to introduce product and process innovations. Funding for industrial R&D activities and infrastructures was included among other priorities of OP IE, but the overall focus of the Programme was on the diffusion of innovations rather than their development. The OP also served as the key source of financing for HE and research institutes which had traditionally suffered from under-funding in previous years.

The programme established predictable, multi-annual funding streams for large research infrastructure and sought to establish internationally competitive research centres. It also sought to offer incentives for launching scientific R&D projects driven by needs identified by business sector. Furthermore, it funded several instruments addressing identified performance gaps in the innovation system (e.g. establishment of research teams by young scientists; home-coming instrument reversing brain drain; grants for scientists interested in applied research and commercialisation; support for international patenting by companies; support for development of prototypes and technology demonstrators to increase the technology readiness levels; international networking of innovative companies; promotion of clusters and entrepreneurship; support for ICT start-ups and implementation of e-business solutions). Most of these instruments were new to Poland

and had never been provided, even though they were widely known in many other countries.

OP IE measures included support for collaborative R&D projects. However, in the overall context of the OP, this policy instrument played a relatively limited role (i.e. the total budget of Measure 1.3.1 amounted to €347.87 million). As will explained later in the case study, the support was targeted at science-industry consortia, but funding was made available to scientific partners (universities or public research institutes). Companies could benefit from access to R&D results and were included in project budgets as co-funding sources, but not directly benefiting from OP IE funding.

The OP IE offered policy makers an opportunity to experiment with support measures, test and verify the most relevant instruments, and its design allowed flexibility in definition of individual competitive calls. Funding was distributed through open calls, aspiring to select beneficiaries based on excellence, innovativeness or potential for commercial impacts, without geographical restrictions. Individual instruments were targeted at specific populations (including business enterprises, universities and/or research institutes), and some support instruments for the businesses sector distinguished support for SMEs and large enterprises. The OP IE was focused on the investments that could radically increase the innovativeness of Poland's economy and thus, it was not intended to incentivise stakeholders that were lagging behind, but some regional OPs offered complementary support mechanisms.

### Box 1 Examples of Collaborative research projects

The OP IE initially had only minor allocations for collaborative R&D activities, and the relevant instrument was focused on applied R&D projects defined and carried out by scientific institutions, with a view to address potential needs of industrial companies. Following the mid-term OP reprogramming in 2012, the funding was provided for joint science-industry R&D projects, involving consortia with both companies and universities or public research institutes.

*Comprehensive Intelligent Vehicle Identification - ISKIP*

The Road and Bridge Research Institute is one of the leading Polish research institution in the field of communication infrastructure. It established the co-operation with the company called Neurosoft, which was founded by graduates and former employees of the Wrocław University of Technology and the University of Wrocław. The company conducts research on algorithms, technologies and solutions using artificial intelligence. The aim of the project was to create a system identifying the features of vehicles in terms of brand, model, colour and registration plate. Thanks to the ISKIP project, it was possible to automate statistical calculations related to the traffic of vehicles, which will largely contribute to increasing public safety, reducing the number of theft and traffic violations.

*Management System of Liquidation of CO2 emissions dumps waste*

The project leader was the Central Mining Institute and the partner organisation involved in the implementation of the project was the Silesian University of Technology, which is one of the most important technical universities in the the region. The main objective of the project was to increase the innovative potential of the Central Mining Institute and the Silesian University of Technology in the area of developing and implementing techniques for the elimination of diffused CO2 emissions by developing innovative methods / techniques; preparing of the implementation of the results; and developing the basis for the introduction of difussed CO2 emissions into the Emissions Trading System or Clean Development Mechanism. The nature of the undertaken tasks was closely related to the regional specificity of the Voivodeship of Silesia, which for many years has been an area of intense coal mining, the by-product of which is the formation of dumps. The co-operation with business enterprises took place in the framework of specific tasks, resulting in the joint development of technologies and products.

*Source: Authors based on Re-Source (2014)*

Additionally, several major projects related to RTD infrastructures were also included: large research centres at Warsaw University of Technology (CEZAMAT), Warsaw Medical

University (CePT), Adam Mickiewicz University in Poznań (WCAT, cf. Section 3.3), and University of Warsaw (CENT III), matching the host universities' existing research specialisations and offering major infrastructural improvements, allowing research teams to engage in internationally visible initiatives. Another project was linked to the establishment of EIT+ (Lower Silesian Centre for Materials and Biomaterials, Wrocław Research Centre EIT+), a newly established research institute, initially expected to be the location of the EIT or headquarters of one of EIT's Knowledge and Innovation Communities. The major projects were identified based on top-down analysis of RTD infrastructure needs, offering investments in three key academic agglomerations of Warsaw, Poznań and Wrocław.

#### *3.1.2. Theory of Change of the Collaborative R&D policy instrument*

The focus of this case study is the collaborative R&D policy instrument implemented under OP IE. Collaborative R&D projects were funded by the OP IE, Measure 1.3.1, which offered non-reimbursable grants to finance R&D projects intended to address industrially relevant or societal challenges, in light of commercialising or otherwise implement the project results.

The support measure was designed to address the following challenges linked the Polish innovation system:

- low propensity of companies to cooperate with scientific organisations;
- limited interests of scientists in applied research and commercialisation of R&D results; and
- low R&D expenditures of companies and lack of state-of-the-art technologies following international R&D tendencies.

The Implementing Authority presented the Measure 1.3.1 as a means of strengthening the competitiveness of Polish companies and promoting social development by increasing the supply of innovative solutions coming from the public research science sector, and at the same time generating demand for such solutions on the side of companies. As such, Measure 1.3.1 formally referred to "development projects" (pl. *projekty rozwojowe*), which were defined as projects with economic or societal relevance, allowing direct implementation of their results in practice. As such, not only was there a collaborative dimension to the instrument, but also an applied one.

The main activity of the policy instrument was the delivery of non-reimbursable grants to fund applied and collaborative R&D intended to address industrially relevant or societal challenges, with a view to commercialise or implement their results. Grants were offered to consortia of scientific organisations with the involvement of business enterprises. The average ERDF contribution of collaborative research project accounted for €1.68 million, ranging from between €116,000 and €9.24 million. The beneficiaries of these grants were selected through open call for proposals. As will be explained in subsequent sections, the design of these calls and eligibility rules were reviewed during the course of implementation in light of facilitating the involvement of industrial partners in supported projects. This explains why activities presented in the ToC below have been divided into two boxes (i.e. before and after this change was introduced)[3]. The collaborative R&D projects financed by the ERDF represent the main outputs of the instrument, upon which all further effects (i.e. immediate /intermediate / final outcomes, and impacts), were meant to be generated.

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[3] Since this change only relates to the design of the activities delivered thorugh the instrument (i.e. the calls for projects), it does not fundamentally alter the remaining elements of the ToC.

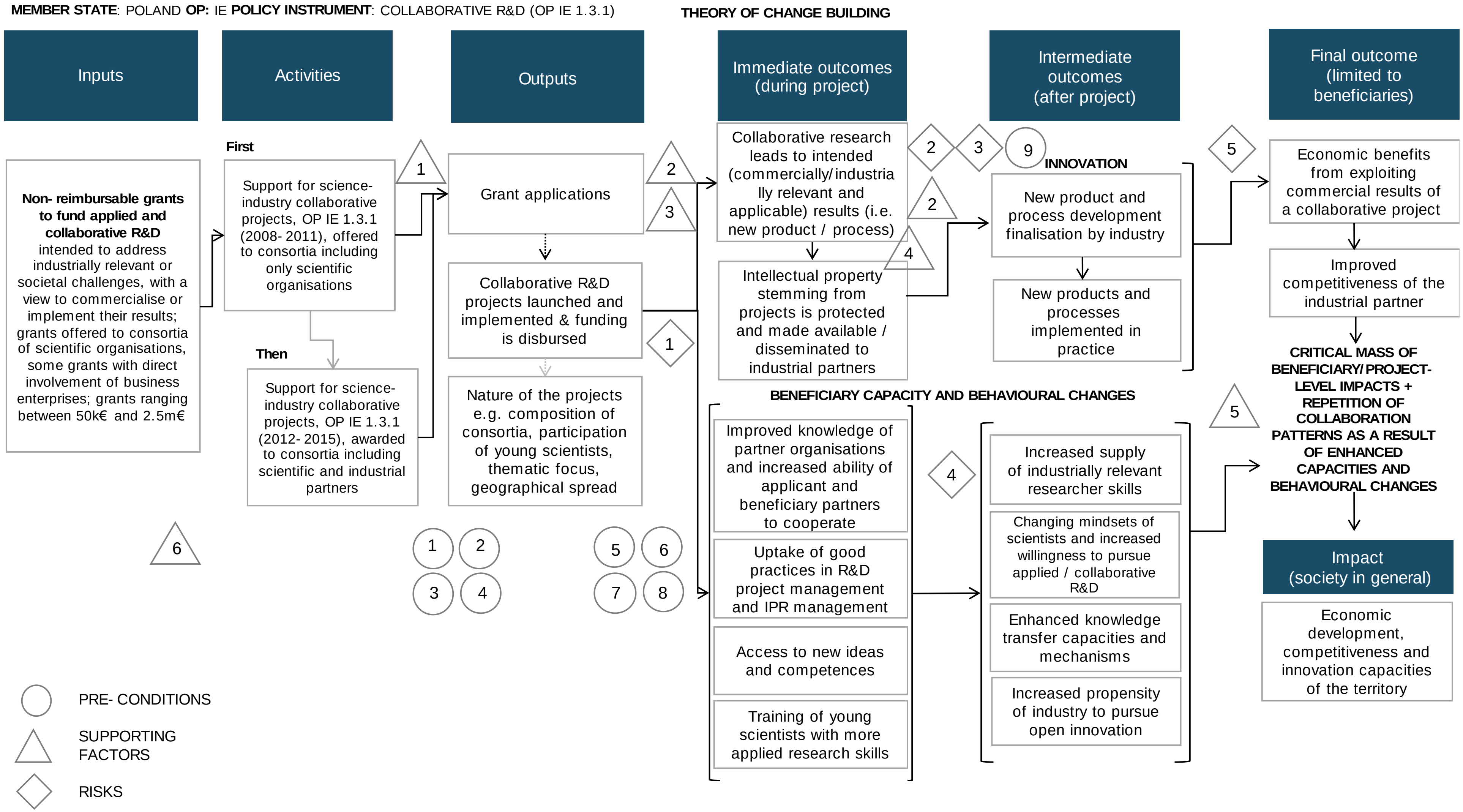
The ToC makes a clear distinction between two types or levels of intended results: those relating to the results stemming directly from the collaborative research projects financed by the ERDF and the collaborative R&D instrument; and ‘softer’ results linked to capacity and behavioural changes taking place within participating collaborative project partner institutions. While the former were the primary focus of the policy instrument and the OP results framework; the latter are considered to be of equal importance. It is worth noticing however that capacity and behavioural changes are seldom recognised as being formal objectives of the policy instrument in formal policy documents.

The ToC uses solid arrows to illustrate the causal pathways between the different levels of instrument intended effects. As can be seen, the nature of this causal links has not be defined given that programming documents and implementing authorities have little or nothing to say when it comes to the causal links between different elements of the ToC. Defining the nature of causal links purely on the basis of our evaluation team’s interpretation of the original intended ToC of the instrument would be misleading. The nature of these causal links has been analysed and defined as part of the contribution analysis, the results of which are presented in later sections of this case study.

The measure did not foresee any performance targets related to geographical spread of funding or targeting specific industrial sectors or types of technologies. As such, the instrument was sector/region/beneficiary agnostic. This also meant that the instrument did not define ex-ante any type of targeting or selection criteria with regard to the type of organisation it would seek to support (i.e. level of excellence).

The original programme documentation provided a starting point for the development of a Theory of Change for the Collaborative R&D policy instrument. However, in order to build a complete ToC, the evaluation team had to recur to a number of additional sources including the literature review carried out as part of this evaluation, interviews with programme managers and beneficiaries, as well as our own knowledge and insight of the programme and local contextual factors. This has led us to develop a ToC as depicted in the following figure, with the intention of illustrating the intended effects of the policy instrument, the underpinning pre-conditions, contributing factors and potential risks and threats; and the causal pathways across the results chain.

**Figure 10 ToC for the collaborative R&D (see legend on following page)**




*Source: Evaluation team on the basis of primary and secondary data collected*

**Pre- conditions**

1. The implementing agent of policy instrument activities has the necessary policy capacity to effectively do so, activity design is based on best practice and is in line with expected objectives i.e. implementing agent capacity diligence & implementation arrangement diligence
2. Potential applicants are aware of the call and they have interest and capacity to apply
3. Technology readiness level before the start of the project justifies the pursuit of collaborative R&D i.e. project diligence
4. Application of the foreseen R&D results in industry is realistic and stems from the real market need for the solution subject of the project i.e. project diligence.
5. The applicants have the necessary resources and capacities in terms of organisation, management, human resources and infrastructure to carry out the project and foreseen activities (based on scope and ambitions defined in the project) i.e. beneficiary diligence
6. The adequate IPR framework / regime is in place to enable collaboration and knowledge transfer between industry and research i.e. regulatory diligence
7. The risk burden of research is adequately shared across partners, on the basis of clear rules and conditions for collaboration i.e. project diligence
8. The industrial partner has the necessary resources to cover obligations and contribute to the implementation of the research project i.e. beneficiary diligence
9. The industrial partners have sustained interest and capacity to carry out innovation on the basis of research project results

**Supporting factors**

1. Public research performance frameworks and funding mechanisms acknowledge applied R&D and industrial collaboration and the outcomes of such collaborations
2. Access to other (i.e. OP IE and external) support measures targeting industrial R&D agents
3. Previous experience in conducting collaborative R&D
4. Active role played by transfer offices, technology brokers or relevant departments of scientific organisations
5. Public support for collaborative R&D is sustained over time
6. Alignment of the collaborative R&D instrument within a broader supporting and complementary set of policies

**Risks and threats**

1. Inherent risks of collaborative and applied research projects (i.e. research project risks)
2. Technological, social, regulatory or economic changes render the research result irrelevant and commercially unappealing / unviable
3. Industrial partners disengage from project given the need for short-term results
4. Brain drain
5. Innovations are commercially unsuccessful or technically impaired

### *3.1.3. Contribution analysis of the collaborative R&D research policy instrument*

***Verification of intended intervention implementation***

The implementation of the instrument took place according to original intended plans. However, as illustrated in the ToC figure, the instrument did go an important re-design half-way through its implementation period which led to a significant change in the way it was being implemented and the results it managed to generate. It is worth noting however, that this change did not alter the underlying rationale and goals of the instrument. It only influenced the way in which beneficiaries were selected and funding was distributed.

The instrument offered non-reimbursable grants to fund applied and collaborative R&D intended to address industrially relevant or societal challenges, with a view to commercialise or implement their results; grants offered to consortia of scientific organisations, some grants with direct involvement of business enterprises; grants ranging between 50k€ and 2.5m€. Initially, this instrument was co-ordinated by the public research institute "Information Processing Centre" (OPI, pl. *Ośrodek Przetwarzania Informacji*), which was commissioned by the Ministry of Science and Higher Education to distribute the funding and monitor the performance of beneficiaries. For 2008-2011, eligible beneficiaries were scientific organisations (including universities and public research institutes), science-industrial consortia (represented only by consortium partners from public research organisations) and non-profit organisations involving scientific and industrial partners. Companies were not directly eligible to receive funding due to legal barriers related to State Aid regulations in Poland at the beginning of the programming period 2007-2013 (initially, Poland did not have legal standards addressing the distribution of R&D-related state aid that would transpose the EU-level regulations), but grant beneficiaries were required to transfer the project results to the business sector or disseminate them openly, allowing interested business entities to exploit them. As a result, projects intended to stimulate science-industry collaboration were not actually including industrial partners at all. Scientific organisations were benefiting from EU grants covering 100% of project funding (no co-funding was required), and they were allowed to either commercialise the project results by signing licensing or transfer agreements with specific companies or making the results publicly available, including through scientific publications.

In 2012, following on results of the mid-term evaluation, the support measure was re-designed (MRR, 2012, p. 343).  and taken over by the governmental agency tasked with funding applied R&D: NCBR (pl. Narodowe Centrum Badań i Rozwoju). The updated Measure 1.3.1 focused on responding to specific demands expressed by a company or industrial partner. As a result, project beneficiaries were consortia consisting of both scientific and industrial partners, and a co-funding requirement was included in project budgets. Companies did not directly receive shares of the EU grants, but were merely providing project co-funding, in accordance with cost eligibility principles of the support measure. In return for these financial contributions, they were granted free access to the project R&D results. This partnership governance model diverged from a typical form of R&D collaboration known in other countries. This funding mechanism was expected to increase the likelihood of generating project proposals corresponding to the actual needs of enterprises. It must be mentioned that companies were also able to benefit from numerous other support measures of the OP IE, directly targeting industrial R&D agents, which in turn did not require beneficiaries to cooperate with scientific partners. As such, the updated design of OPIE 1.3.1 was seen as a practical way to stimulate R&D co-operation between science and industry.

While this change to the intervention implementation was introduced, the evidence gathered by the evaluation team does not point to any major inconsistencies or alterations in the way the instrument was implemented in practical terms (as compared to the formal intended implementation plans). As such, the rules of the game and participation / selection procedures were respected and followed by the implementing partners. As such, weaknesses in instrument effectiveness which will be described in further sections stem from flaws in instrument design and limited policy capacity on behalf of the MA / implementing partners, rather than from inconsistencies in the application of implementation procedures /rules.

### *Achievement of intended and unintended effects at the level of the expected threshold*

The performance indicators defined for OPIE 1.3.1 reflected to a very limited extent the goals of the instrument as a whole (formal and informal). As such, the performance framework defined by the OP IE (and related KPIs) cannot be considered a primary source of information when it comes to assessing the extent to which expected results (see Instrument ToC) were achieved. The formal goals of the policy measure were:

- 200 collaborative projects to be funded;
- 185 R&D project results to be implemented; and

- 205 patent applications to be filed based on project results (MRR, 2012, p. 192).

As a result of this, the extent to which the intended effects have been generated at the level of expected thresholds has mainly relied on the data and information collected by the evaluation team through secondary sources. A major challenge in conducting this assessment however stems from the fact that no specific thresholds were formally identified or adopted by the MA, the implementing partners, or by the beneficiaries of the grant scheme themselves. As such, the assessment process is based on criteria and targets defined by the evaluation team.

As can be seen in the figure presenting the results of the contribution analysis, an important share of expected outputs and immediate outcomes were achieved to an significant or full extent. However, the level of achievement of these effects does significantly decrease at the stage of immediate outcomes. The level of achievement of expected intermediate outcomes, final results and impacts – particularly those relating to the direct results of the collaborative R&D projects – is generally low. A table is presented in the Appendix containing more specific information on the data collected for each of the expected effects and the assessment of the expected threshold for each one of these.

This evaluation shed light on a number of additional effects which were not originally intended for this policy instrument. For instance, the several beneficiaries reported the improvement of research infrastructure and R&D management capacities as one of the positive unintended results of the instrument. They have subsequently led to improved internationalisation and integration with the international community as well as improved quality of research outputs. Many interviewees confirmed that pursuit of collaborative R&D projects allowed them to develop R&D results that were appealing to the international community, particularly in terms of scientific conferences and peer-reviewed articles. The research infrastructures built with project funding were also available for other internationally-oriented projects. The data from CORDIS Portal provide additional information about the general trends observed in terms of participation in FP7 and H2020 projects for the beneficiaries of Measure 1.3.1. Altogether some 967 FP7 projects were carried out during the period 2007-2015 and the number of H2020 projects accounted for 603 in the period 2014-2020 for which the data is available. The funding obtained by the beneficiaries of the collaborative R&D instrument has remained at comparable levels across both periods.

On the downside, given the challenges faced by the industrial partners and the perceived difficulties; they may have subsequently discouraged companies from seeking to participate in subsequent collaborative R&D projects. Scientific partners were found to pursue different motives focusing on publications and broad dissemination rather than commercial developments. There were problems reported by the consulted stakeholders concerning the IP and technology transfer resulting from overly bureaucratic frameworks. Despite that they were modified based on science and higher education reforms from 2010-2011, the necessary changes were transposed into laws of scientific organisations several years later. Most interviewed representatives of both scientific and industrial organisations confirmed that no joint R&D projects were carried out with the same partner following the conclusion of Measure 1.3.1, and some of the interviewed companies have even highlighted the benefits of in-house R&D (as opposed to collaborative R&D) praising the design of alternative support schemes, targeting only companies without the need to involve scientific partners.

### *Verification of assumed pre-conditions*

Most of the pre-conditions identified in the ToC were found to either have been place to some extent, or not to have been in place.

To begin with, the evaluation found that the effectiveness of the instrument was significantly impacted by the limited policy capacity of the implementing authorities (i.e. pre-condition 1). OPI overseeing the implementation of this instrument and other institutions in the country due to its novelty had no prior experience in providing support for collaborative R&D projects. NCBiR played a role of the Intermediary Institution and took over the responsibilities from OPI for launching the call in 2012.

This impacted not only the design of the instrument, but also the selection criteria that were used to identify future beneficiaries. Under the first phase of instrument implementation a major flaw is linked to the fact that industrial partners are not involved in the projects; while under the second phase, there were no sufficient incentives provided to ensure proper engagement of the industrial partner until implementation of research projects was successfully carried out. The lack of financial incentives as well as formal recognition of industrial partners as beneficiaries probably undermined their overall commitment to ensuring that project results were effectively implemented, commercialised, or used in practice.

Funding was distributed through open calls, aspiring to select beneficiaries based on excellence, innovativeness or potential for commercial impacts, without geographical restrictions. The call was adequately circulated and generated an important number of proposals. The interest however came mainly from the research sector, and not from the private sector. In addition, the lack of sectoral and geographical targeting means that from the outset, the instrument’s potential to create change or significantly ‘move the needle’ in any particular region or sector was limited.

In principle adequate project and partner diligence was carried out as part of the selection process. The Implementing Authority used the following criteria to confirm eligibility of project applications and carry out project selection:

- the applicant's intention to develop product or process innovation;
- the proposed solution could be classified as a high or medium-high technology;
- the planned outcome would be innovative at least at the level of the country; and
- the proposal outlined an implementation plan responding to realistic market demands.

In practice however, the evidence collected through the evaluation (e.g. interviews with beneficiaries) pointed to the fact that a number of these elements were the reason for which research results were never turned into innovations. For example, a number of interviews revealed that projects often lacked comprehensive collaborative project plans, including market analyses and commercialisation plans; that there was a tendency to avoid excessively ambitious R&D initiatives to mitigate potential implementation risks (relevant both for scientific and industrial partners), seeking to reduce the risk of incurring ineligible costs in publicly funded projects through conservative approaches to R&D project planning; or that industrial partners claimed that TRL levels of research results were too low for them to further pursue their implementation. Interviews with stakeholders indicated that many organisations participating in Measure 1.3.1 projects were primarily uninterested in commercial implementation of their R&D results, but rather embarked on the projects with ambitious scientific objectives. In addition, results showed an insufficient diligence of consortium members-programme participants leading to the selection of suboptimal industrial partners (i.e. companies not genuinely interested in commercialisation of R&D results).

Pre-conditions at the level of immediate outcomes are found to have been only partially ensured. There were important challenges faced with regard to the capacities of applicants and beneficiaries to carry out the projects, given that engaging in collaborative R&D projects was relatively new to them. Technology transfer capacities of beneficiaries were also found to have been a major hurdle to the commercialisation and transfer of research outputs to industrial partners (see also supporting factor 'previous experience in conducting collaborative R&D').

The risk burden/sharing principle which is at the core of collaborative R&D support[4] instruments does not appear to have materialised in this case. This is mainly due to the asymmetrical implication and share of responsibilities / benefits between research organisation and industrial partners. This stems mainly from the fact that industrial partners were not formally involved in the projects during the early stages of the instrument, and were never made eligible to receive ERDF support as part of the grants distributed. In addition to this, the evaluation found that the insufficiently developed IPR/tech transfer regulations at the national level also acted as a key inhibitor to more successful technology and knowledge transfer in the framework of these projects.

Interviews with project beneficiaries confirmed that the support measure did not promote governance models or contractual arrangements which are typically associated with science-industry technology transfer (i.e. collaborative R&D project governance). In addition, they implicitly defined the role of scientific partners as responding to "whims" and demands of the industrial organisations, not committed to engage in a partnership of equals. Scientific partners were benefiting from the available grant funding, which was used to finance research infrastructures and R&D personnel salaries, but they were also responsible for project reporting and delivering the promised results, including development, protection and implementation of R&D results. Most interviewed beneficiaries indicated limited interests of industrial partners in commercialisation of the project results or follow-up investments to bring the developed technologies closer to the market, and scientific partners seemed to have been left alone with the obligations to take up R&D results.

The evaluation did not find evidence pointing to any difficulties industrial partners may have faced to allocate necessary resources to cover obligations and contribute to the implementation of the research projects (particularly after the redesign of the instrument). However, it did find that industrial partners did gradually dis-engage from the projects and the goal of eventually commercialising results. Some SMEs were found to be unable to absorb R&D results due to low technological sophistication and financial constraints, while large companies were either not interested in innovations or already had inhouse R&D activities, disregarding the benefits of open innovations (Re-Source, 2014, p. 13).

Scientific organisations seemed disillusioned with their potential industrial partners, and as many as 63% of them declared that R&D objectives of science and industry were divergent, based on their project experiences (Re-Source, 2014, p. 18), and most of them faced problems transferring R&D results due to limited demands from business partners despite the initial interests at the stages of project planning (Re-Source, 2014, p. 29). Scientists were found to lack certain marketing skills needed for successful commercialisation of R&D results, and had limited awareness of effective commercialisation efforts, e.g. their promotional activities were primarily focused on attendance of scientific conferences and peer-reviewed publications rather than e.g. attendance of industry fairs or company seminars (Re-Source, 2014, pp. 31-32).

[4] This was highlighted by the literature review carried out as part of this evaluation.

On the side of industrial partners, many of them linked the reasons for the lack of more sustained involvement in the projects, to the lack of business experiences of scientific partners, administrative burdens of grant management and co-funding documentation, disparities in financial burdens among consortium partners and different working cultures at industrial and scientific organisations.

### *Verification of supporting factors*

Supporting factors also played an important role in the implementation of the instrument, and the level of achievement of intended results.

From a design perspective, the alignment between the policy instrument and other OP IE supported instruments, as well as with other ESIF OPs was considerable. The OP IE encompassed a wide variety of instruments, covering multiple types of interventions that included not only RTD activities and research infrastructures, but also broader support for the development of innovative environments and activities including clusters, technology transfer, acquisition and use of technologies by industrial and service sectors, intellectual property protection, entrepreneurship, internationalisation of companies, foreign promotion of Poland and tourism. The main complementarity was identified in relation to support for individual R&D projects provided within Measure 1.4 of Operational Programme Innovative Economy (OP IE). The OP IE sought to create synergies with instruments supported under other OPs: OP Infra & Env, OP DEP and 16 OPs defined for Polish regions. Complementary interventions were planned in several other OPs at the national level. Direct synergies were also planned with the ESF-based Operational Programme Human Capital (OP HC), which offered support for the development of researchers and R&D personnel, including the launch of new higher education programmes and specialist training for companies. The alignment of the policy instrument with other (non-ERDF) policy instruments is less explicit.

In practice however, it does not appear that these complementarities materialised since the number of OP IE collaborative research beneficiaries, who also benefitted from other complementary support schemes was low. This said, the evaluation did reveal the existence of direct synergies between the OP IE and Operational Programme Human Capital, which offered support for the development of researchers and R&D personnel, including also launch of new higher education programmes and specialist training for companies. OPIE supported RTD activities and infrastructures, while OPHC focused on development of soft skills, capabilities and knowledge required to carry out RTD activities and use the established infrastructures.

The national assessment framework of research performance which existed in Poland at the time did not fully acknowledge the merits of pursuing applied R&D and industrial collaboration. While this did not influence the level of participation in calls for grants implemented under the instrument, it may have discouraged scientific organisations from follow-up commercially oriented research as this was not incentivised by the national assessment framework.

The two supporting factors which were largely absent during the course of implementation are the existence of previous experience in conducting collaborative R&D; as well as the playing of an active role on behalf of technology transfer offices, technology brokers and / or relevant departments of scientific organisations in order to promote the effective transfer of research results to industry or other stakeholders of the Polish economy. In both cases, the evaluation shows that the absence of these contributing factors played a major role in the in the extent to which intermediate outcomes were realised. For instance, given the lack of additional experience in conducting collaborative R&D, scientific organisations tended to overestimate the opportunities for implementation of new products and processes, lacking knowledge about strategic priorities of business partners, the complexity of decision-making in private sector, or cost and administrative efforts related to regulatory compliance. In consequence, the interviews with scientific beneficiaries indicated that projects ended up with disillusionment and regrets about insufficient appreciation of the R&D efforts by industrial partners. Limited successes in commercialisation results were probably linked to these naive attitudes rather than to opportunistic uses of the grants for purposes different than R&D collaboration.

Many interviewed beneficiaries admitted that projects were their first direct experiences of industrial partnerships. For scientific partners, the projects offered opportunities to invest in research infrastructures, prepare academic publications and award doctoral degrees to members of project teams. For some of them, the mere fact of working with companies on a joint project was perceived as something extraordinary and prestigious. In the Polish innovation system, science-industry technology transfer intensified after the legal overhaul of the science system in 2010-2011, and in the beginning of OP-IE implementation, cases of cross-sectoral projects were still relatively rare.

The existence of sustained support for collaborative R&D was confirmed to some extent by the evaluation team, given the long-term nature of the instrument (i.e. 7 years), as well as the existence of subsequent support schemes under the following programming period. However, given the lack of more tangible intermediate and final outcomes, this contributing factor only played a minor role in driving expected results. In addition, it’s not certain that the beneficiaries of this policy instrument (and related grants) were able to benefit from any additional or subsequent public funding.

***Verification of risks and threats***

A number of the anticipated risks identified by the ToC did materialise throughout the lifetime of the policy instrument. To begin with, typical R&D project-related risks materialized and were widely discussed by interviewees. However, the materialisation of these risks does not appear to have affected the effectiveness of the instrument, as much as the inability of the project partners to successfully anticipate and mitigate these risks. Collaborative and applied R&D endeavours are by essence risky. The key to success is the ability of partners to manage this risk, anticipate necessary changes, and implement the adequate collaboration structures to minimise these risks and their potential negative consequences.

The risk that industrial partners may disengage from the project did end up materialising for some of the reasons explained earlier. This clearly impacted the effectiveness of the instrument. The reasons for which this risk materialised are attributed to the lack of adequate pre-conditions or absence of contributing factors (e.g. mismatch between the research orientations of companies (focused on short-term technology development) and scientists (focused on long-term, more innovative research, including fundamental R&D); excessively scientific character of projects; and failure of the R&D results to meet the demands of industrial users).

A number of the innovations introduced did end up being commercially unsuccessful or technically impaired. This limited the potential to generate the types of final outcomes and impacts the instrument intended to generate.

#### *3.1.4. General assessment of the Collaborative R&D Policy Instrument*

On the basis of the elements presented in the previous section (see section 3.1.3) the evaluation has been able to conduct a general assessment of the policy instrument, as well as of the individual causal claims identified in the original ToC (see Figure 10).

On the basis of the effects which were observed and recorded by the evaluation team, the instrument can only be said to have been effective in reaching its intended activites, outputs and immediate outcomes. It is clear that while the instrument managed to generate a significant number of collaborative R&D projects aimed at generating commercially and industrially applicable results, a major leak in the pipe presented itself at the stage of uptake of research results on behalf of industrial partners, and the translation of these results into market or process innovations. In practice, this meant the short-to-medium economic benefits and were not achieved.

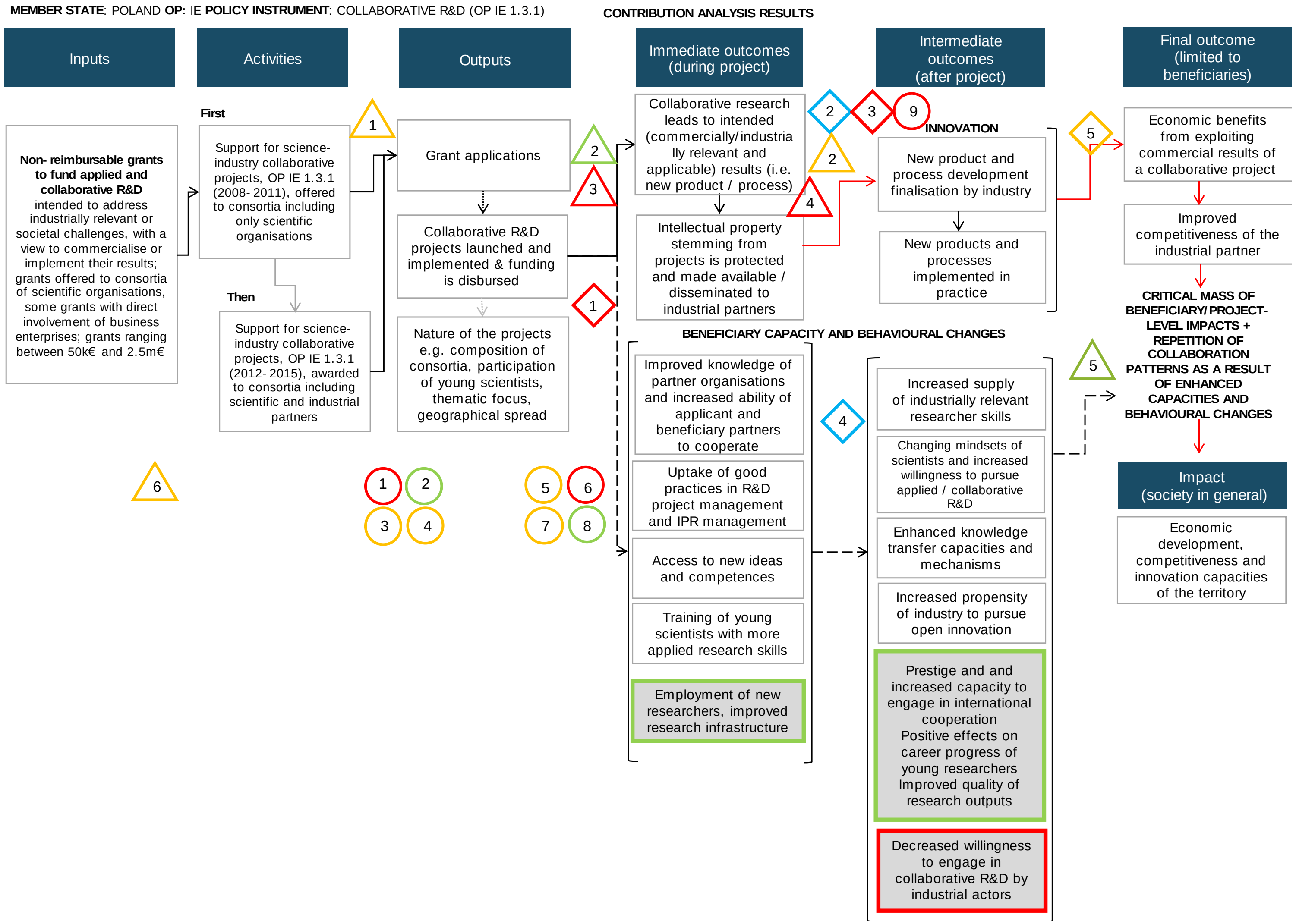
The intended outputs of the instruments were achieved, and given the existence of the necessary pre-conditions, contributing factors; as well as the absence of any influential risks, the policy instrument is believed to be the main cause of these outputs. In other words, it's unlikely that these collaborative R&D projects would have taken place in the absence of the policy instrument. The same applies to the grant proposals receive by the implementing authorities as a result of the calls for grant proposals. In spite of this, it is clear from the data collected through the evaluation that while the target for total number of projects launched was reached, the implementing authorities failed to give serious thought to the types of beneficiaries, sectoral and geographical spread to be achieved within the grant portfolio, so as to generate 'critical masses' of support leading to the achievement of potentially significant change.

Despite the fact that intended immediate outcomes were only achieved to a limited extent, the policy instrument is also believed to be the main contributing factor behind the existence of recorded immediate outcomes. The recorded research results were the direct product of the work carried out by partners in the framework of the collaborative research projects funded by the ERDF. There is no reason to believe that any additional external factors played a role in the production of these results, lessening the causal significance of the policy instrument to the immediate results achieved.

More importantly however is understanding why the expected level of threshold immediate outcomes and intermediate outcomes was not achieved. In this case, the lack of more significant results stems from a number of factors including the absence of key pre-conditions and supporting factors. As previously described, factors such as poor instrument design, lack of more experience in conducting collaborative R&D on behalf of beneficiaries, and gradual disengagement on behalf of industrial partners from the projects all played a role in the lack of higher numbers of innovations taking place as a result of the projects funded.

On the other hand, the instrument did manage to generate significant changes when it comes to changes in beneficiary capacities and behavioural patterns. The instrument is believed to have been the source of a significant 'paradigm shift' when it comes to the relevance and importance of engaging in collaborative and applied research activities within public research organisations. Additionally, participation in the supported projects did considerably develop the R&D project management and technology transfer capacities of the beneficiary research organisations. Given the existence of a range of support mechanisms for higher education and research institutions at the time, these changes can only be partially attributed to the collaborative R&D policy instrument. As such, while the causal link has been confirmed for observed immediate and intermediate capacity and behavioural outcomes, the policy instrument is only one of the causes for these observed effects.

**Figure 11 Representation of the results of the contribution analysis for the Collaborative R&D instrument (see following page for legend)**




*Source: Evaluation team on the basis of primary and secondary data collected*

# FIGURE LEGEND

**ACHIEVEMENT OF INTENDED EFFECTS**

TO NO EXTENT

TO A LIMITED EXTENT

TO A FULL / IMPORTANT EXTENT

UNKNOWN

POSITIVE OR NEGATIVE UNINTENDED EFFECT

**CONFIRMATION OF EXISTENCE OF PRE CONDITIONS**

PRECONDITIONS DID NOT EXIST

PRECONDITIONS DID EXIST TO SOME EXTENT

PRECONDITIONS FULLY EXISTED

UNKNOWN

**CONFIRMATION OF EXISTENCE OF SUPPORTING FACTORS**

SUPPORTING FACTOR DID NOT EXIST LIMITING EFFECTIVENESS

SUPPORTING FACTOR DID OR DID NOT EXIST, BUT DID NOT INFLUENCE EFFECTIVENESS

SUPPORTING FACTOR EXISTED AND POSITIVELY INFLUENCED EFFECTIVENESS

UNKNOWN

**CONFIRMATION OF RISKS**

RISK MATERIALISED AND IMPACTED EFFECTIVENESS

RISK DID OR DID NOT MATERIALISE AND DID NOT INFLUENCE EFFECTIVENESS

RISK WAS ADEQUATELY MANAGED OR MITIGATED

UNKNOWN

**CONFIRMATION OF CAUSAL LINKS**

CAUSAL LINK WAS CONFIRMED AND THE INSTRUMENT IS LIKELY TO BE THE MAIN CAUSE OF THE OBSERVED EFFECT

CAUSAL LINK IS CONFIRMED AND THE INSTRUMENT IS ONE OF THE CAUSES OF THE OBSERVED EFFECT

CAUSAL LINK WAS NOT CONFIRMED OR DID NOT MATERIALISE

Overall, Measure 1.3.1 and the support it provided for collaborative R&D was an important learning process for scientific and industrial organisations. It was one of the first collaborative R&D support schemes implemented in the country since the 1980s. As such, adequate design and results were subject to some degree of initial trial and error. For scientific partners, the projects offered first-hand experiences working with industrial counterparts, opportunities to gain insights into technological markets and specific needs of companies. For companies, they contributed to developing a culture whereby R&D activities were more systematically planned, and submission of in-house R&D funding applications was stimulated. The learning processes of beneficiaries included: R&D planning and reporting, internal project management procedures, approaches to project communication and coordination of efforts distributed among partners and locations as well as intellectual property management standards. For many beneficiaries, these aspects were relatively novel, and interviewees repeatedly highlighted the positive roles of implementing authorities in promoting good practices and supporting capability building processes.

The funding scheme could be considered a large-scale pilot exercise that contributed to enhancing the maturity and robustness of the approach to supporting science-industry co-operation in the Polish innovation policy mix. In the subsequent ERDF programming period (2014-2020), more tailored approaches were adopted which were able to capitalise on the mistakes and successes of the previous period, including R&D support for companies (with an option of using scientific organisations as subcontractors) and for cross-sectoral consortia (treated as partnerships of equals, with more balanced approaches to project benefits and obligations). Technology transfer from academia to business took off after the 2010-2011 reform of the science sector, which established the necessary legal frameworks and offered incentives for scientists to engage in applied R&D. Collaborative R&D support paved the way for future developments and offered an important testbed for the future cross-sectoral alliances. Furthermore, it helped develop capabilities of a large group of scientists and corporate R&D experts, strengthening their project management skills and transferring good R&D practices.

Measure 1.3.1 demonstrated strong additionality effects of ERDF support, funding projects which would otherwise not be pursued by the implementing consortia. For scientific organisations, applied and industrially oriented R&D was novel and could not be funded from their own sources. For Polish companies, the concept of open innovations was relatively unfamiliar, and they did not yet appreciate the potential for scientific contributions or the use of existing research infrastructures, so the opportunity to bring together representatives of two sectors played an important role in the development of synergistic relations between corporate and academic stakeholders. At the same time, many R&D results of supported projects were not successfully implemented, and the effectiveness of the funding scheme functioned as a testbed for the design of future ERDF support measures. The policy instrument stimulated important learning processes among scientific and industrial stakeholders and played key role in the transformation of Polish innovation system.

## 3.2. Policy instrument: Infrastructure investments for education financed under the OP Infra & Env

### *3.2.1. Overview of the Operational Programme Infrastructure and Environment*

Upon joining the EU, the infrastructure gap between Poland and "old Member States" was recognised as one of the major barriers to economic and social development. The OP Infra & Env, through its ambition of increasing the investment attractiveness of Poland and its regions through development of technical infrastructure was seen as an integrated answer to that challenge. The OP Infra & Env was developed in coordination between several ministries overseeing regional development, infrastructure, environment, health, economy, science and higher education. During the programming of the 2007-2013 OPs, the Polish economy was witnessing some negative labour market trends, limited competitiveness of companies, limited technology absorption and science-industry co-operation, and low levels of investment in research and academic infrastructure. In addition, while the total number of students underwent a steep increase between 1990 and 2006 (almost four-fold increase) reaching almost 2 million students, the relative shares of students in technical (e.g. engineering), natural sciences and medicine were decreasing. This was identified as a potential threat to increasing the companies' innovativeness due to limited access to highly qualified technical and scientific workforce.

During this period, the level of public spending on HE increased significantly going from 0.66% GDP to almost 1% GDP, but expenditures per student did not increase. Only 5% of HE spending was invested in infrastructure in comparison with the OECD average of 11.6%. The lack of sufficient physical and technological infrastructure which could foster knowledge creation and technology transfer due to persistently low expenditure and rapid scientific and technical progress, combined with decreasing number of students in technical (engineering) and natural sciences were identified as key barriers to the implementation of modern education system in particular on the MSc and PhD level.

In response to the above-mentioned barriers, the RTD support put in place at the national level was focused on investments in education infrastructure of HEIs. The focus of support was placed on strengthening the research component of education and developing an infrastructural base for more interdisciplinary study and research in technical, engineering or natural sciences. The intention was to attract more and better students in topics (fields) of strategic importance for the development of economy and society. The OP also provided the support for infrastructure investments in other areas related to environment, energy, transport, health, and culture. There were only two major projects related to infrastructure investments for education: the Construction of Buildings for Departments of Chemistry and Biology of the University of Gdańsk and New Technology Centre "Ochota" of the University of Warsaw. The major projects were identified based on top-down analysis of RTD infrastructure needs, offering investments in two key academic agglomerations of Warsaw and Gdańsk.

The OP Infra & Env has not offered a mix of policy interventions, but adopted a relatively narrow focus on investments in new or modernised education infrastructure and directly related equipment. Despite this rarther narrow focus on infrastructure investments for education within the OP Infra & Env, multi-fold effects were expected in synergies with other OPs. The strongest expected synergy was between the presented support for infrastructure investments in education within the OP Infra & Env and the OP HC (Measure 4.1.2 Increasing the number of graduates of faculties of key importance for the knowledge-based economy). For the purpose of the latter, the Ministry of Science and Higher Education defined a list of faculties / study fields of key importance for the knowledge-based economy, including automation and robotics, biotechnology, architecture chemistry, energetics, physics / technical physics, informatics, material engineering, environmental engineering, maths, mechanical engineering, mechatronics environmental protection, industrial design, chemical and process engineering. The same list of facilities of key importance for the knowledge-based economy was used as a strategic reference in the OP Infra & Env. The synergies were also expected between the OP Infra & Env and the OP IE Priority Axis II (R&D Infrastructure). Activities under the OP Infra & Env were designed to be complementary to actions implemented under 16 ROPs as well as other OPs, in particular OP IE, OP HC, OP DEP, and European Territorial Co-operation programmes. As such, the instrument was designed with the intention of generating synergies with other OPs, in particular OP HC, OP DEP and OP IE, and to strengthened and multiply effects. As will be explained further on, this has made it challenging to distinguish effects of individual OPs.

#### *3.2.2. Theory of Change for HE instrument and rationale for implementation*

In response to above-mentioned challenges, the policy instrument for HE infrastructure investments was designed within the OP Infra & Env with the general objective of developing modern academic centres. Specific objectives of infrastructure investments for education were related to the modernisation of infrastructure, increasing the number of students in priority fields of study, and improving the quality of education through the use of ICT.

As mentioned in Chater 2, the Managing Authority for the OP Infra & Env was the Department of Infrastructural Programmes in the Ministry of Infrastructure and Development. The National Centre for Research and Devleopment (NCBR) was tasked with overseeing the implementation of RTD interventions in the position of the Intermediate Body and the OPI played a role of the Implementing Authority. The project selection procedure and rules, as well as the evaluation of applications were defined in the 'Detailed description of the Pririty Axes' (document accompanying OP infra & Env) - Annex 1 'Criteria for project selection' and in Annex 2 'Organization of project evaluation and selection system under the OP Infra & Env'. There were two selection modalities: competitive and individual. Individual projects were conducted according to the list published on the basis of Art. 28 section 1a of the Act on rules of conducting development policy. The competitive selection modality was used for available free funds under the priority, and was overseen by OPI. Finally, among 59 financed project under the measure, 26 projects were conducted on the basis of the individual modality, while the remaining ones were selected on a competitive basis. Within the list of individual projects, there were also two 'major projects' (Construction of Buildings for Departments of Chemistry and Biology of the University of Gdansk, New Technology Centre "Ochota" of the University of Warsaw).

Project were evaluated selected on the basis of three sets of selection criteria:

- Formal criteria - applicable to projects selected in individual and competition mode. There were 18 formal criteria for infrastructure investments for education projects. Examples of the critera range from very general, simple like eligible date of application, language of the application, use of appriopriate templete to more advanced like compliance with the OP Infra and Env and 'Detailed description of OP I & E priorities' or strategic character of the application. But several criteria refered to very specific issues related to the HE activity of the applicant e.g. university's qualifications to conduct II degree studies, appropriate assessment of the quality of education by Polish Accreditation Commission (PKA), qualification to offer docrtoral degrees etc., presentation of the Development Programm for education and research or conformity with university strategy.

- 1st degree substantive criteria - applicable to projects selected in the individual mode. There were 10 criteria of this type for infrastructure investments for education projects. Examples of the critera range from beneficiary experience in management projects financed with the participation of external funds, complexity of project ( and use of the ICT), complance with international standards (including implementation of the Bologna Process), quality of promotion strategy for studies at strategic faculties and some other directly related to possible achivements of project measurable effects (product indicators).
- 2nd degree substantive criteria - applicable to projects selected in individual and competition mode. There were 12 criteria of this type for infrastructure investments for education projects. Examples of the critera range from completnes of projet documentation, quality of financial and economic analysis, coherence of application information, organisational, technical and financial readiness of applicant, energy efficiency and compliance with environmental and other horizontal policies.

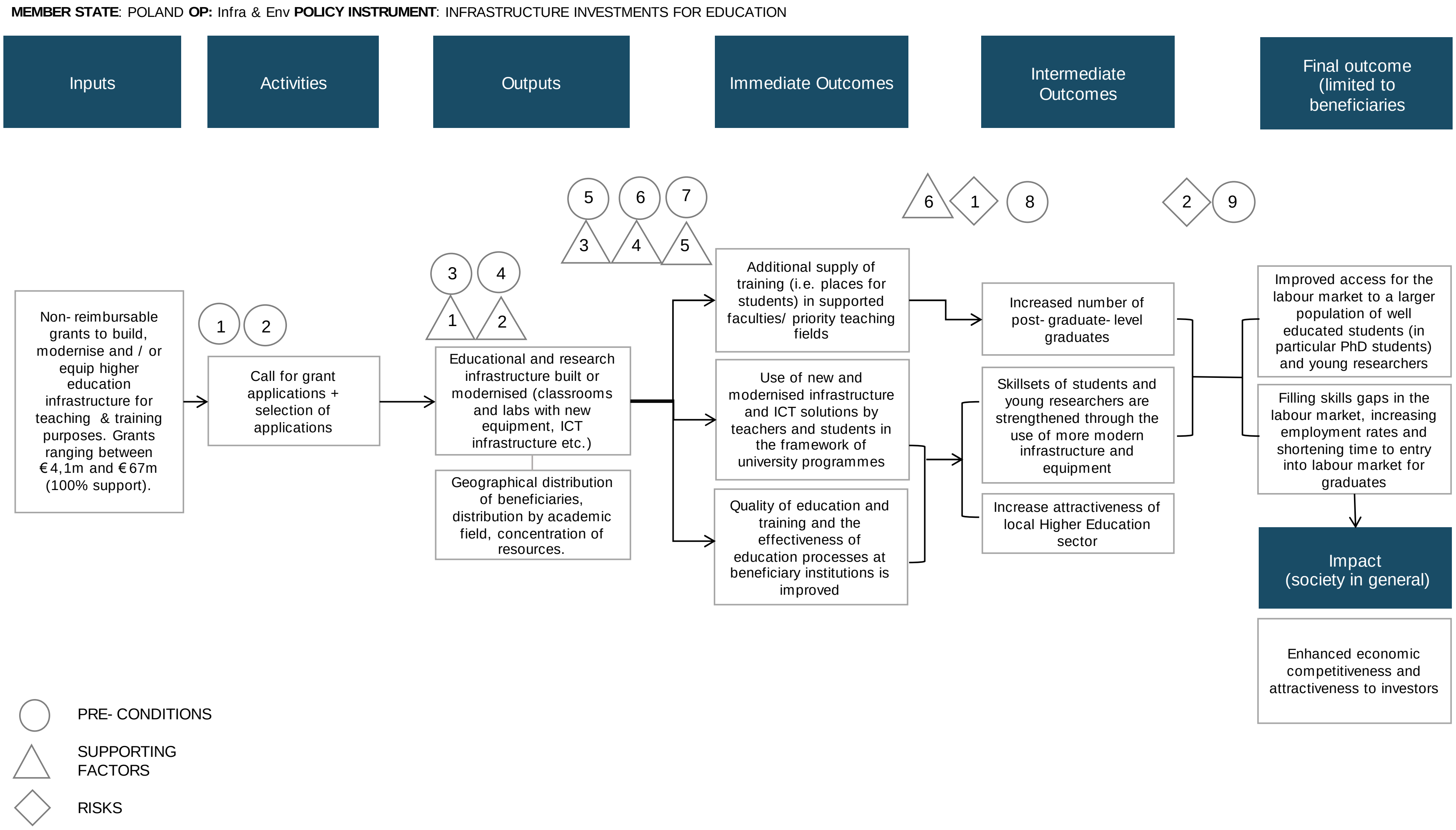
Priority Axis XIII of the OP Infra & Env offered non-reimbursable grants ranging between €4.1 million and €67 million (cf. Section 3.1) to build, modernise and / or equip higher education infrastructure for teacing and training purposes. The support was provided for the implementation of infrastructural investments for teaching at university level, mainly in the field of natural sciences and engineering and scientific and research activities related to teaching. The supported projects were expected in particular to be focused on: construction, reconstruction or expansion of existing infrastructure facilities (construction of modern lecture rooms and laboratories together with equipment used in the learning and teaching processes) and adapting the technical condition of the infrastructure to the requirements of the new equipment. To a limited extent, the projects involved construction, expansion or modernisation of associated infrastructure facilities used by students (e.g. university sports infrastructure facilities).

This financial assistance provided by the OP Infra & Env was expected to strengthen the education and research base at universities. It was foreseen that investments would contribute to increasing the quality of Polish HE as well as fostering international (in particular EU wide) teaching and scientific co-operation of Polish universities, creating more attractive, higher quality environment for international students.

National and regional budgets were considered insufficient to offer financing for these sizeable infrastructure investments (i.e. construction of new buildings, establishment of new laboratories equipped with state-of-the-art research apparatus, location of entire faculties in one place, construction of field research stations) and the use of EU funding was planned to function as a trigger for a transformation of the HE system in the wider context economy and the Polish innovation system.

The following figure presents the ToC of the infrastructure investments for education. It is meant to illustrate the intended results of the policy instrument, as well as the underpinning linkages among them.

## Figure 12 ToC for the infrastructure investments for education




*Source: Evaluation team on the basis of primary and secondary data collected*

**Pre- conditions**

1. Selected projects are in line with priority sectors of the economy and respond to identified skills gaps in the labour market.
2. The beneficiary institution is prepared to manage the project from a technical, organisational and institutional perspective.
3. Projects are carried out in compliance with procurement and State Aid rules and procedures.
4. Financial support is sufficiently concentrated in leading and high potential centres / institutions (scientific and educational potential).
5. New and modernised infrastructure is successfully incorporated into training programmes and curricula, and teaching staff is familiar with the new infrastructure.
6. Beneficiary universities have the necessary staff and resources to manage and oversee the new / modernised equipment and conduct practical activities.
7. Infrastructure development projects are accompanied by new and updated teaching / training and research activity programmes.
8. Infrastructure and equipment purchased with the support of the policy instrument is maintained and updated, and adequate university infrastructure management capacities are in place.
9. Skillsets being developed and fields of training being strengthened are in line with the needs of the labour market.

**Supporting factors**

1. Providing additional assistance to beneficiaries to build their research infrastructure management capacities & alignment with other support mechanisms
2. Alignment of the policy instrument with other R&D and infrastructure support mechanisms
3. Existence of strong ICT infrastructure at the regional and national level (i.e. high speed internet networks)
4. New / modernised infrastructure is given alternative use (i.e. outside of teaching), specifically for collaborative R&D and research services
5. Activities in support of university internationalisation.
6. Activities aimed at enhancing the level of appeal/attractiveness of priority fields of studies for students.

**Risks and threats**

1. Decrease in available funding for HEIs
2. Braindrain and demographic changes

### *3.2.3. Contribution analysis of the infrastructure investments for education*

#### ***Verification of intended intervention implementation***

The interviews and data analysis did not reveal the existence of any major deviations or challenges with regard to the implementation of foreseen activities. As such, activities were in implemented in line with original intended plans, and no key changes were introduced to such plans or guidelines during the course of implementation. This said, the OP Infra and Env was reprogramed five times during the implementation period (following the mid-term reprogramming and later Priority Axis XIII benefited three times from additional financial allocations related to National Performance Reserve). The total allocation of the Priority Axes XIII increased from initial €588 million (500 million from the EU budget) to €711 million (604 mln from the EU budget). This however did not fundamentally impact the instrument’s Theory of Change.

The implementation of these activities led to the funding of a total of 59 projects, which went well beyond the original intended goal of 36 supported projects. This increase in the number of supported projects was mainly facilitated by the additional allocation of funds to the instrument given the aforementioned re-programming. It worth mentioning that despite this increase of allocated funds, the relative performance indicators and targets were not reviewed or increased accordingly.

### *Achievement of intended effects at the level of the expected threshold*

The inputs allocated for building and construction as well as educational/research equipment, including IT infrastructure were committed and invested. In addition to a number of supported projects (59 - see previous sub-section), the direct output targets of the instrument (i.e. number of constructed, rebuilt or modernised educational infrastructures/facilities such as classrooms and labs with new equipment etc.; and the and number of HEIs implemented integrated ICT infrastructure for education) were exceeded[5]. In total, this represented 2,167 new or rebuilt laboratories (1,085 at universities, 724 at technical universities, 257 medical universities, and 101 in other HEIs) with a total area of 117,363 m². According to a recent evaluation (Agrotec Polska 2015) public support (in terms of financial allocation) was concentrated in major academic centres in Warszawa, Gdańsk, Poznań and Lodz, while in terms of number of projects the largest number of projects was implemented in Warsaw (10), Katowice (7), Łódź (7), Gdańsk (6), and Wrocław (5). In addition, when analysing the projects which received financial support, it should be noted that the directions/faculties that were most often supported were: chemistry, computer science, physics, materials engineering, environmental protection, biotechnology and mechanics and machine construction, which corresponds to the planned priority fields in the OP. From an outputs perspective, the instrument was very successful. One of the major factors influencing generation of outputs and achievements (exceed) of targets was the implementation of "science centres" i.e. buildings which were not only meant for students from a single faculty; as well as the and complementarity of OP Inf & Env projects with projects supported by RPOs and OP Eastern Poland.

## Box 2 Example of the University of Białystok Campus

In the case of some universities, such as the University of Białystok, one of the goals of building the facilities was to create a new campus. The construction of the campus was financed by various programmes, including the OP Infra & Env, OP DEP, and Regional Operational Programme of the Voivodeship of Podlaskie.

Prior to the launch of investments, the units of the University were scattered throughout the city in buildings with insufficient space and not fully adapted to the scientific and teaching needs. The newly established infrastructure is part of different projects aimed at creating a modern teaching and research base of the university and strengthening the innovation of the region. The University of Bialystok was established in 1997 from the Branch of Warsaw University. Today the University is one of the largest and strongest academic centres in North-Eastern Poland. It consists of nine faculties, including one located abroad in Vilnius. Classes and lectures are delivered by some 850 academic teachers. At present the University educates 17.000 students in almost 30 fields of study.

The new campus of the University of Białystok is designed as modern education centre for Faculty of Physics and the Institute of Chemistry funded within Measure 13.1 Infrastructure for Higher Education of the OP Infra & Env for the total amount of PLN 120.2 million or approximately €27 million. The construction of Faculties of Physics, Biology and Mathematics and Informatics with University Computation Centre was financed with the assistance provided within Measure I.1 University Infrastructure of the OP DEP. The total value of investment accounted for PLN 129.6 million or approximately €29 million.

Source: Authors based on desk research; https://uwb.edu.pl

[5] Monitoring data related to the OP shows that an important number of quantitative indicator targets relating to expected outputs and immediate outcomes were exceeded (some of them significantly): number of educational facilities supported in the result implementation of projects (built, rebuilt, modernised) – 114%, number of universities that implemented comprehensive ICT solutions for teaching – 570%, additional number of places in supported faculties/teaching fields – 532%, number of students using supported infrastructure – 425%, number of students in natural sciences and engineering using supported infrastructure – 2,292%, number of students using created ICT infrastructure – 857% (including participating in eLearning courses – 1,467%).

The OP also defined and adopted KPI relating to the instrument's immediate outcomes. Here again, target thresholds were met to a full extent. This included a strong increase in the number of places in supported faculties and teaching fields, the number of universities having implemented comprehensive ICT solutions for teaching, as well as the use of the new infrastructure on behalf of the student population. For instance, the frequent use of the new infrastructure and ICT solutions by students attending beneficiary institutions was documented by ex-post evaluations. One of these[6] indicated that the new infrastructure was used by a significant number of students attending HEIs participating in the programme. Where it was possible to indicate the percentage of students taking advantage of new infrastructure, it was evaluated that 32% of overall number of students and 83% of students of faculties directly supported by the project benefit from new facilities. In addition, it is worth noting that there was a steady and significant growth trend in student's choices of strategic (i.e. OP-supported) faculties starting from the academic year 2008/2009 to 2015/2016, while the total number of students decreasing in the same period[7].

However, as illustrated by these figures, the monitoring system focused mainly on capturing additional supply of education, and access to education and infrastructure on behalf of the student population. On the other hand, measurement of changes in the quality of the education being provided is less prominent in the adopted KPIs. This said, despite the investment character of implemented projects, the consulted stakeholders confirmed in interviews that infrastructural investments have also contributed to increasing the quality of teaching. This perception was generally underpinned by the recognition that the increased use of specialist equipment in modern educational laboratories is crucial in the teaching process, in particular on the MSc and PhD level, where students can in practice acquire the necessary skills.

The availability of formal KPIs and related monitoring data for intermediary/final outcomes and impacts is scarce, particularly as compared to that pertaining to outputs and immediate outcomes. As such, availability of data regarding the level of threshold achievement of intended intermediate/final outcomes and impacts is more limited, as compared to outputs and immediate outcomes.

This said, the data collected as part of this evaluation indicates that critical levels of intended intermediate outcomes were effectively reached. The increased number of student populations in priority areas led to an increase in the number of post-graduate-level graduates, including PhDs. According to one evaluation of the instrument, "the policy instrument largely contributed to increasing the potential of universities in providing practical education and training. It also improved the access to research equipment which had consequently a positive impact on the development of skillsets of students (Agrotec 2015)". During the same period, beneficiary HEIs also witnessed higher levels of cooperation with foreign partners, as well as an influx of foreign researchers and students. Similarly, there was an increase in the use of new/modernised infrastructure for the purpose of organising specialist international scientific conferences in strictly defined areas.

According to the latest data, nearly 85,000 foreign students from more than 170 countries world-wide are pursuing their education in Polish HEIs in academic year 2019/2020 (Perspektywy 2020). It is an impressive result, considering that in 2005 there were only 8, 000 foreign students in Poland. It contributes to the internationalisation index of Polish

[6] Badanie podsumowujące realizację Priorytetu XIII Infrastruktura szkolnictwa wyższego Programu Operacyjnego Infrastruktura i Środowisko (pakiet 2)", EGO, Warszawa 2013, p. 10.
[7] Idem.

HEIs, which has grown significantly over years from approximately 0.5% in 2005 to 5.63% in 2017.

The evaluation did not allow the team to gather any reliable data regarding the final outcomes or impact of the instrument. This may be due on the one hand to the absence of any official KPIs or targets defined within the OP at this level. More importantly however, this stems from the fact that public infrastructure investments for education are characterised by the long-term nature of the results they are intended to generate, making it possible only to observe such results at least 5 years after they are initially implemented. As already mentioned, many of the projects implemented under this policy instruments were not launched until 2015/2016, meaning that the expected effects cannot be expected to have taken place at the time of its evaluation.

According to the recent peer review of Poland's Higher Education and Science system (PSF 2017) the employment of recent HE graduates is above the EU average, but there are growing concerns about labour market mismatches. In 2015, the employment of recent tertiary graduates in Poland stood at 85.1% compared to the EU average of 81.9%, but a substantial and increasing number of tertiary education graduates are in medium-or low-skilled jobs, which points to labour market skills mismatches (EC 2016a). Nonetheless, the extent of 'over-qualification' remains significantly below the EU average, as evidenced by recent studies (Cedefop 2015). Current performance and results of doctoral training are suboptimal. A substantial share of the 40000 doctoral candidates are inactive. The graduation age is high compared to the OECD average, and PhD holders are relatively old and not flexible enough to permeate the market for advanced human capital.

A table is presented in the Appendix containing more specific information on the data collected for each of the expected effects and the assessment of the expected threshold for each one of these.

Interestingly, the evaluation has shed light on a number of positive unintended results associated to the policy instrument. For instance, among the main unintentional effects identified in the evaluation study (Agrotec 2015) are the improvement of safety of the conducted laboratory studies, as well as the improvement of comfort of work and study conditions. Finally, the supported investments appear to have acted in some cases as drivers or motivators for HEI managers and authorities to carry out similar investments (at a smaller scale) in areas and faculties not directly targeted by the policy instrument. In some cases, it has been reported that as a result of the investments, the local business sector has become more involved in the development and teaching of associated curricula at beneficiary HEIs.

### *Verification of assumed pre-conditions*

As can be seen in Figure 13, the great majority of the identified ToC pre-conditions took place. The only exceptions to this rule were the preconditions 'projects are carried out in compliance with procurement and State Aid rules and procedures' linked to intended outputs, and 'skillsets being developed and fields of training being strengthened are in line with the needs of the labour market' linked to the intended final outcomes. Regarding the former, there was a general consensus among the consulted stakeholders that the State Aid rules represented a troublesome legal issue. However, in the end, State Aid rules played a more important role in the exploitation of new infrastructure, rather than in the actual implementation of the investment projects. The reason was mainly due to unfortunate definition of demarcation criterion between the OP Infra & Env and OP IE Priority Axis II (R&D Infrastructure) related to purpose of the infrastructure (teaching or research). The interpretation by the Managing Authority did not allow to use supported infrastructure for R&D activity in particular for projects with participation of the business partners (commercial use) and only at a later stage later a change in the EU legislation has allowed that 20% of the infrastructure capacity could be used for commercial purpose.

As regards the latter, this pre-condition has been only partially met given that the evidence pointing towards stronger collaboration between HEIs and the private sector, on the basis of the investments carried out, is limited. While, the supported HE infrastructure has provided a basis foundation for building the education offer corresponding to the needs of the labour market, the potential of co-operation with the industry, due to restrictions resulting from the specificity of this instrument has not been not fully utilised (Agrotec 2015). As such, while there is plenty of evidence pointing to the fact that education has been improved, it is uncertain whether these improvements are in line with the needs of the labour market and potential employers, as well as the extent to which improved education has led to higher employability and increased recruitments.

As regards the remaining pre-conditions, ample evidence has been collected pointing to their existence. For instance, there was high concentration of investments in priority areas and fields, as well as in leading HEIs. The fact that highly prestigeous universities were behind the projects is seen as one of the success factors of the instrument. This said, the beneficiaries did face some challenges when it came to the management of the investment projects. The lack of further experience in the implementation of projects with such extensive range and lack of experienced managers were identified as an important challenge by most of the interviewees. Problems regarding the selection of contractors in compliance with the public procurement requirements were frequent; and the reporting and compliance requirements of the funding instrument were often-times perceived as burdensome. This however is not considered as having fundamentally influenced the success of the instrument, and beneficiary HEIs generally managed to solve these challenges internally.

The use of the new and updated equipment and infrastructure was integrated into education and training curricula. In addition, there were not major issues flagged with regard to the sustained funding of the new and improved infrastructure. On this issue, the improved scientific potential is seen to have contributed to successful applications for funding within the national and EU programmes. In spite of a challenge related to the issue of sustainability, it was noted that the completed investments will allow in the future to engage in commercial activities and large research projects (Agrotec 2015). In comparison to investments in research infrastructure addressed to all types of research organisations including universities, it is easier to ensure sustainability of support for educational infrastructure. This is due to the existence of a different support mechanism allocated through educational subsidies for HEIs, which is a relatively stable source of funding. However, as noted during the interviews, there is a need to ensure continuous development of educational and research equipment.

### *Verification of supporting factors*

The majority of the identified supporting factors took place, positively influencing the achievement of intended results. Only one factor did not take place, but did not influence the performance of the instrument; and one factor did not take place limiting the performance of the instrument. This last supporting factor was 'new / modernised infrastructure is given alternative use (i.e. outside of teaching), specifically for collaborative R&D and research services', and its absence is mostly linked to the issues faced by beneficiaries in relation to State Aid rules. The absence of this supporting factor limited the possibilities to generate additional revenue, use new and modernised infrastructure to engage in more extensive technology and knowledge transfer activities, and extent the use of the infrastructure beyond the community of users hosted by the beneficiary institution.

Two supporting factors which are considered key in the context of this policy instrument are the provision of additional assistance to beneficiaries to build their research infrastructure management capacities & alignment with other support mechanisms; and the alignment of the infrastructure for HE instrument with other R&D and infrastructure support mechanisms (in particular those supported by other ERDF OPs).

With regard to the first supporting factor, it is worth noting that the Ministry of Science and Higher Education, in collaboration with the NCBR, implemented a Science Infrastructure Management Support project providing assistance to beneficiaries of RTD infrastructures funded within the OP IE. The goal was to provide Polish scientific institutions with knowledge, tools and advice for effective management of research infrastructure. In effect over 250 people from 35 institutions, many of them HEIs, took part in internships, trainings and received consulting support. Also, beneficiaries of infrastructure investments projects for education funded within the OP Infra & Env received indirectly this type of support.

When it comes to the second factor (i.e. alignment with other R&D and infrastructure support instruments), it is clear that the infrastructure for Higher Education instrument was designed with the goal of generating synergies with other OPs (e.g. synergies with other infrastructure support provided by the OP HC - Measure 4.1.2 Increasing the number of graduates of faculties of key importance for the knowledge-based economy). These inter-OP complementarities clearly materialised, and contributed to generating collective results which went beyond what the sum of individual OPs could have achieved. Activities under the OP Infra & Env were designed to be complementary to actions implemented under 16 ROPs as well as other OPs , in particular OP IE, OP HC, OP DEP, and European Territorial Co-operation programmes.

#### *Verification of risks*

Anticipated risks did not play a major role in the ToC of this policy instrument. Both of the anticipated risks were not shown to have influenced in a positive or negative way the results of the instrument. It is worth nothing however that demographic trends led to a general decrease in the overall student population of the country. In 2018, the population of students in higher education was 1.23 million, i.e. by 4.8% less than in the previous year. The number of students is steadily decreasing, mainly due to the demographic changes. HEIs are trying to offset the negative effects this demographic decline, by enriching their educational offer, by for instance, creating more courses and trying to attract foreign students. In addition to the decline in student populations, decisions were taken by the Polish authorities to establish restrictions in acceptance quotas for specific study programmes. The decisions on the number of places in individual faculties are taken at the central level which in practice makes it impossible to accept more students. Both of these factors have influence the expansion of student populations and enrolment levels at the country level.

Poland has not put in place any major reforms or has taken measures to reduce the level of funding available for HEIs.

### *3.2.4. General assessment of the Infrastructure for Higher Education policy instrument*

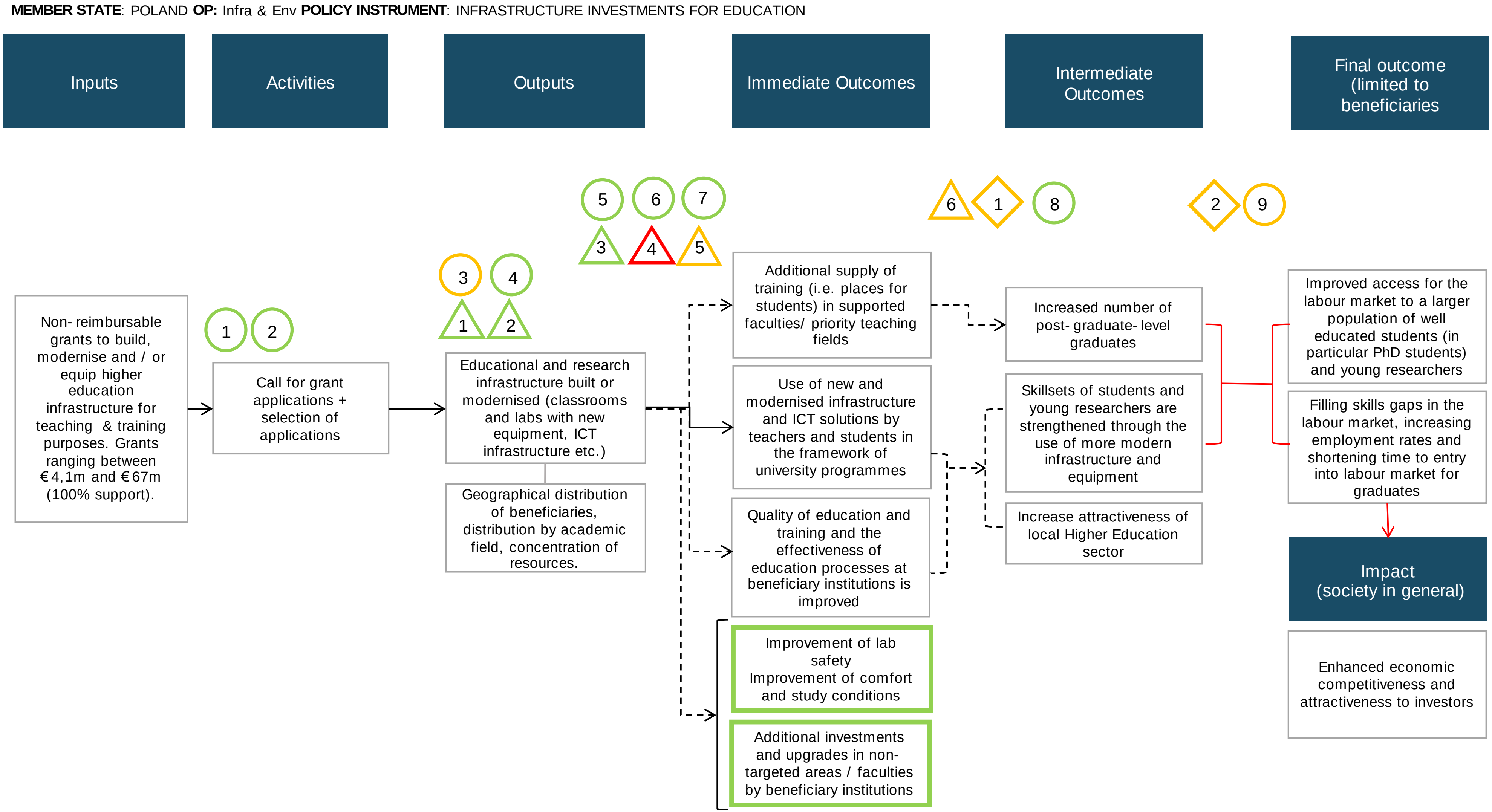
Overall, the ToC for the infrastructure for Higher Education was largely confirmed. The great majority of expected results at the activity, output and immediate/intermediate outcome level, were achieved. Underpinning these results, were a number of pre-conditions and supporting factors which contributed to establishing a strong causal claim between the instrument itself, and the great majority of the intended / observed effects.

The instrument activities were implemented without any major changes or deviations as compared to the original plans. The evaluation did not reveal the existence of any major technical or administrative challenges or roadblock to the implementation of such activities. In terms of pre-conditions, as previously stated, the existence of the majority of these has been confirmed through our analysis. However, State Aid regulation does appear to have played a key role in limiting the capacity of the instrument to a) enable a more diversified use of the developed and renewed infrastructure, b) generate additional revenue through these alternative uses, and c) allowing beneficiary institutions to use the infrastructure as a means to engage in more pro-active knowledge transfer and cooperation with the private sector. While, these however were not identified as core goals of the instrument, they do appear to be considerable missed opportunities for the OP and the Infrastructure for HE instrument.

The above is especially important in light of the persisting difficulties Poland is facing in developing a stronger culture and framework of knowledge transfer between higher education institutions, and broader sectors of society - including the private sector. Despite the changes following the Science and Higher Education Reform of 2010-2011, the HEIs’ third mission and their engagement with society and industry remain challenges: action is limited to a narrow range of activities, with emphasis on research publications, graduating students and mostly linear models of knowledge transfer. The related policies in HE and R&I in Poland primarily focus on technology transfer, copying US-style commercialisation efforts, which are unlikely to yield the expected results, while disregarding a broader knowledge exchange and the role of HEIs in addressing societal challenges. It also lacks focus on the crucial role of students in knowledge transfer and community engagement. The MNiSW is aware of these shortcomings and works to ensure that the Law2.0 will enhance the role of higher education in social development and the innovation-based economy, as well as the social responsibility of science (PSF Poland 2017).

The use of the new / modernised infrastructure for purposes other than education is also considered to be one of the supporting factors which did not take place, limiting the effectiveness of the instrument. While the absence of this factor did not directly impact the capacity of the instrument to improve the supply, volume and quality of education at beneficiary institutions; it undoubtedly contributed to limiting the potential for the generation of additional spill-overs linked to these investment in regional innovation eco-systems.

**Figure 13 Representation of the results of the contribution analysis for the Infrastructure for HE instrument (see following page for legend)**




*Source: Evaluation team on the basis of primary and secondary data collected*

**MEMBER STATE**: POLAND **OP:** IE **POLICY INSTRUMENT**: COLLABORATIVE R&D (OP IE 1.3.1)

# FIGURE LEGEND

**ACHIEVEMENT OF INTENDED EFFECTS**

- TO NO EXTENT
- TO A LIMITED EXTENT
- TO A FULL / IMPORTANT EXTENT
- UNKNOWN

POSITIVE OR NEGATIVE UNINTENDED EFFECT

**CONFIRMATION OF EXISTENCE OF PRE CONDITIONS**

- PRECONDITIONS DID NOT EXIST
- PRECONDITIONS DID EXIST TO SOME EXTENT
- PRECONDITIONS FULLY EXISTED
- UNKNOWN

**CONFIRMATION OF EXISTENCE OF SUPPORTING FACTORS**

- SUPPORTING FACTOR DID NOT EXIST LIMITING EFFECTIVENESS
- SUPPORTING FACTOR DID OR DID NOT EXIST, BUT DID NOT INFLUENCE EFFECTIVENESS
- SUPPORTING FACTOR EXISTED AND POSITIVELY INFLUENCED EFFECTIVENESS
- UNKNOWN

**CONFIRMATION OF RISKS**

- RISK MATERIALISED AND IMPACTED EFFECTIVENESS
- RISK DID OR DID NOT MATERIALISE AND DID NOT INFLUENCE EFFECTIVENESS
- RISK WAS ADEQUATELY MANAGED OR MITIGATED
- UNKNOWN

**CONFIRMATION OF CAUSAL LINKS**

- CAUSAL LINK WAS CONFIRMED AND THE INSTRUMENT IS LIKELY TO BE THE MAIN CAUSE OF THE OBSERVED EFFECT
- CAUSAL LINK IS CONFIRMED AND THE INSTRUMENT IS ONE OF THE CAUSES OF THE OBSERVED EFFECT
- CAUSAL LINK WAS NOT CONFIRMED OR DID NOT MATERIALISE

Prior to the implementation of the ERDF support, there has been a significant infrastructure gap with more developed EU MS, which was recognised as one of the major factors hindering economic and social development. This evaluation has shed light on the importance of the support provided by the Infrastructure for Higher Education instrument for the development of a modern education system, in particular at the MSc and PhD level.

The combined support provided by the ERDF OP DEP, OP IE and ROPs decidedly moved the needle in relation to the supply of educational programmes in selected priority areas, as well as with regard the quality of the education being provided by beneficiary institutions. This in turn led to increased numbers of graduates on the labour market with advanced degrees, and more robust skillsets. At the same time, the higher education sector in Poland became an increasingly appealing destination for foreign students and researchers. As such, the OP Infra & Env intervention stimulated the chain reaction in HE system: new infrastructure – new teaching and research opportunities – higher quality of education and research – stronger competitive position on the EU market.

It is worth highlighting that the changes brought about by the ERDF took place in the context of a number of reforms of Science and Higher Education system in Poland. Several waves of reforms were implemented in 2010-11, 2014 and recently a fundamental change of law in 2019. Arguably, infrastructure investments of the OP Infra & Env laid down foundations for successful implementation of reforms. Additionally, reforms were backed up with gradual, but significant financial support from budgetary resources. This might also strengthen the sustainability of the effects of public interventions under the OP Infra & Env.

The OP Infra & Env demonstrated strong additionality effects of the ERDF support. Before the accession to the EU, only 5% of HE expenditure was invested in infrastructure. Public HEIs were only able to invest in relatively small infrastructure projects within the annual budget between 5 and 10 million PLN. In that context, the OP Infra & Env intervention has provided significant financial support for concentrated investments ranging between €4.1 million and €67 million per project. Additionally, this policy instrument stimulated important learning processes among HEIs related to the implementation of modern management practices for HEIs infrastructure.

In terms of availability and reliability of data, the case study analysis was based on combination of quantitative and qualitative data, both from primary and secondary sources. The sources included: programming documents, OP Infra & Env implementation report and evaluation reports commissioned by Polish authorities, quantitative analyses of databases of projects and beneficiaries, as well as the stakeholder interviews.

## 3.3. Policy instrument: Wielkopolska Centre for Advanced Technologies (major project) implemented under the Operational Programme Innovative Economy (OP IE)

### *3.3.1. Overview of the Operational Programme Innovative Economy*

The OP IE presented in Section 3.2.1 provided support for research infrastructure (RI) major projects. The Wielkopolska Centre for Advanced Technologies (WCAT) was one of the six RI investments carried out in the framework of this programme. The OP IE constituted the main source of funding for this type of investments in Poland during the 2007-2013 programming period. While the total EU contribution accounted for €406.8 million, the EU ERDF contribution for the WCAT equalled €53.8 million for a total investment of €63 million. The two main categories of costs concerned building and constructions (€28.7 million), plant and machinery, including scientific research equipment and other items of labware (€20.3 million). Comparatively, the financial assistance provided within the OP Infra & Env amounted to a total of €127.4 million supporting two other RI major projects.

### *3.3.2. Theory of change of the WCAT (major project)*

The project supports the construction and equipment of a new physical R&D infrastructure, in view of launching new research programmes and new methods to conduct research, and unifying the know-how and research potential of local scientific research and higher education institutions. The WCAT is an interesting example of an ERDF supported research infrastructure project for several reasons:

- The WCAT is multidisciplinary in nature, in light of ensuring the necessary stability for the sustained development of such complex and large-scale investment. The research teams have at their disposal high-quality research equipment and laboratories and are becoming increasingly involved in carrying out R&D projects.
- From its inception, WCAT's mission has been to closely cooperate with industry. Fundamental and applied research is viewed as the basis of knowledge and technology transfer and the bridge between research and business.
- The WCAT investment is included in the Polish Research Infrastructure Roadmap. Recently, it has adopted a new 2.0 strategy and submitted a proposal for inclusion of new research areas on the aforementioned roadmap.
- Finally, the WCAT is also part of the Epicur Alliance - the European Partnership for Innovative Campus Unifying Regions which is one of the first pioneer "European Universities" funded within the Erasmus+ programme.

The idea for the creation of WCAT dates back to 2004 and the first Steering Group (SG) meeting took place in 2006. It was initially chaired by internationally renowned scientist and innovator in the area chemistry Prof. dr hab. Bogan Marciniec, who is the initiator of WCAT and the Centre's first Director. The vision of WCAT is to unite existing organisations (i.e. universities, research institutes and science-technology park) to act as one independent entity, with the capacity of generating synergies by combining the work of the best scientists. In this sense, the WCAT's design was inspired by the Fraunhofer Society.

In 2008 approximately 92 entities made up the backbone of the scientific research and development potential of the Wielkopolska region. Whilst being very different, many of them co-operated in various research fields. The universities and scientific research institutions had mostly outdated equipment, which made it extremely difficult to conduct advanced research in response to the socio-economic needs. The significant obstacle for research implementation was the fragmentation of the existing research base, which resulted in inefficient use of facilities. The dispersion of specialised research equipment also caused difficulty in conducting large, often multidisciplinary projects with an international dimension. This said, the development and modernisation of high-specialised laboratories and equipment facilities was viewed as essential to follow the developments in technology.

The project was aimed at overcoming development barriers to scientific progress, by creating a multidisciplinary and integrated centre in co-operation with various research institutes. As such, the project was intended to bring together five higher education institutions from Poznań (Adam Mickiewicz University, University of Technology, University of Life Sciences, University of Medical Sciences, and University of Economics), four institutes of the Polish Academy of Sciences (Institute of Bioorganic Chemistry, Genetics of Plants, Human Genetics, Molecular Physics, in addition to two R&D Institutes (Natural

Fibre, Plants and Herbal Products), Poznań Science and Technology Park of Adam Mickiewicz University Foundation, and the City of Poznań.

In light of the aforementioned challenges, the project's general objective was to consolidate the research community around the main research areas using joint research infrastructure. Additional objectives of WCAT were:

- To create a multidisciplinary research centre in the domain of high - tech materials, biomaterials and nanomaterials, capitalising on the latest scientific achievements in related fields of chemistry, chemical technology, physics, medicine, biotechnology and agricultural sciences;
- To carry out research and development work directed to industry;
- To ensure diffusion of scientific results, and building innovation culture in terms of starting new firms based on advanced technologies; and
- To attract scientists from Poland and all over Europe and create opportunities for the new generation of Polish scientists.

The thematic range of research projects encompasses:

- Specialised chemical reagents (fine chemicals);
- Highly processed organic, metalloorganic (with organosilicon) and inorganic specialised chemicals;
- Biologically active substances;
- Biochemicals, biologically active compounds and highly processed substances of plant origin;
- Agrochemicals – new non-hazardous products, new environmentally-friendly technologies;
- Materials and nanomaterials; and
- Nano-composites and polymer composites as hybrid organic-inorganic materials for commercial applications.

The target markets of the WCAT are in particular the pharmaceutical sector, cosmetics, plastic, bio tech and nanotech. The project application provided a listing of companies who signed 'letter of collaboration', in addition to a list of entities on specific research areas where collaboration with the WCAT consortium already existed and other potential industrial partners.

The WCAT is located in the proximity of new campus of Adam Mickiewicz University and Poznań Science and Technology Park, so as to facilitate knowledge and technology transfer. Another important aspect of the WCAT project is the diffusion of scientific results, and the building of an innovation culture in Poland in terms of starting new firms based on advanced technologies.

The responsibility for co-operation with the private sector falls mainly within the team of the WCAT, as well as the Poznań Science and Technology Park. At the time of launch, it was planned that the Park will play the key role in the transfer and the commercialisation of technology with a system of incubators for innovative spin-off type companies (not part of the current investment) which is a necessary link for the effective transfer of technology of new materials into practice, particularly for technological- industrial parks and for high-tech industries.

The following been initially identified as the main revenue streams of the WCAT:

- R&D funds or grants (both national and international);
- Partners own budget; and
- Collaboration with industry.

The expected structure of income was consistent with a brake-even approach, covering at least the operational cost of the WCAT in order to avoid classification as an income generating project. In this structure, approximately 47% of the operational costs foreseen in 2015 was expected to be provided by the WCAT members of the consortium, and 38% of costs would be covered from 25 research projects (26% from international and EU grants and 12% from national grants). The remaining 15% would be generated by research projects carried out in co-operation with the industry.

The following figure presents the ToC of the WCAT. It is meant to illustrate the intended results of this major project as well as the underpinning linkages among them. While there are no major changes in the ToC in general, it is worthwhile noting the change in the overall purpose of investment, which has evolved from supporting only basic research towards placing a greater focus on the provision of research services on commercial basis.

A key feature of this new R&D infrastructure is to induce a multidisciplinary approach to research programmes in the field of high-tech materials, bio and nanomaterials, capitalising on the knowledge of the research institutes and universities in the fields of chemistry, chemical technology, physics, medicine, biotechnology and agricultural sciences.

The support was made available to conduct investments mainly for:

- Building and construction of four new facilities, i.e. Centre of Chemical Technologies and Nanotechnologies, Centre of Industrial Biotechnology with Greenhouse, Centre of Medical Biotechnology with Animal House and also Centre of Material Science including Regional Laboratory of Unique Equipment. The latter undertakes tasks commissioned by all of these units, as well as other research and development institutions and small and medium-size companies.
- Plant and machinery, including scientific research equipment and other items of lab ware.

The direct planned outputs included the construction of research facilities (19.635 $m^2$) which would be equipped with some 225 research apparatus and lab ware.

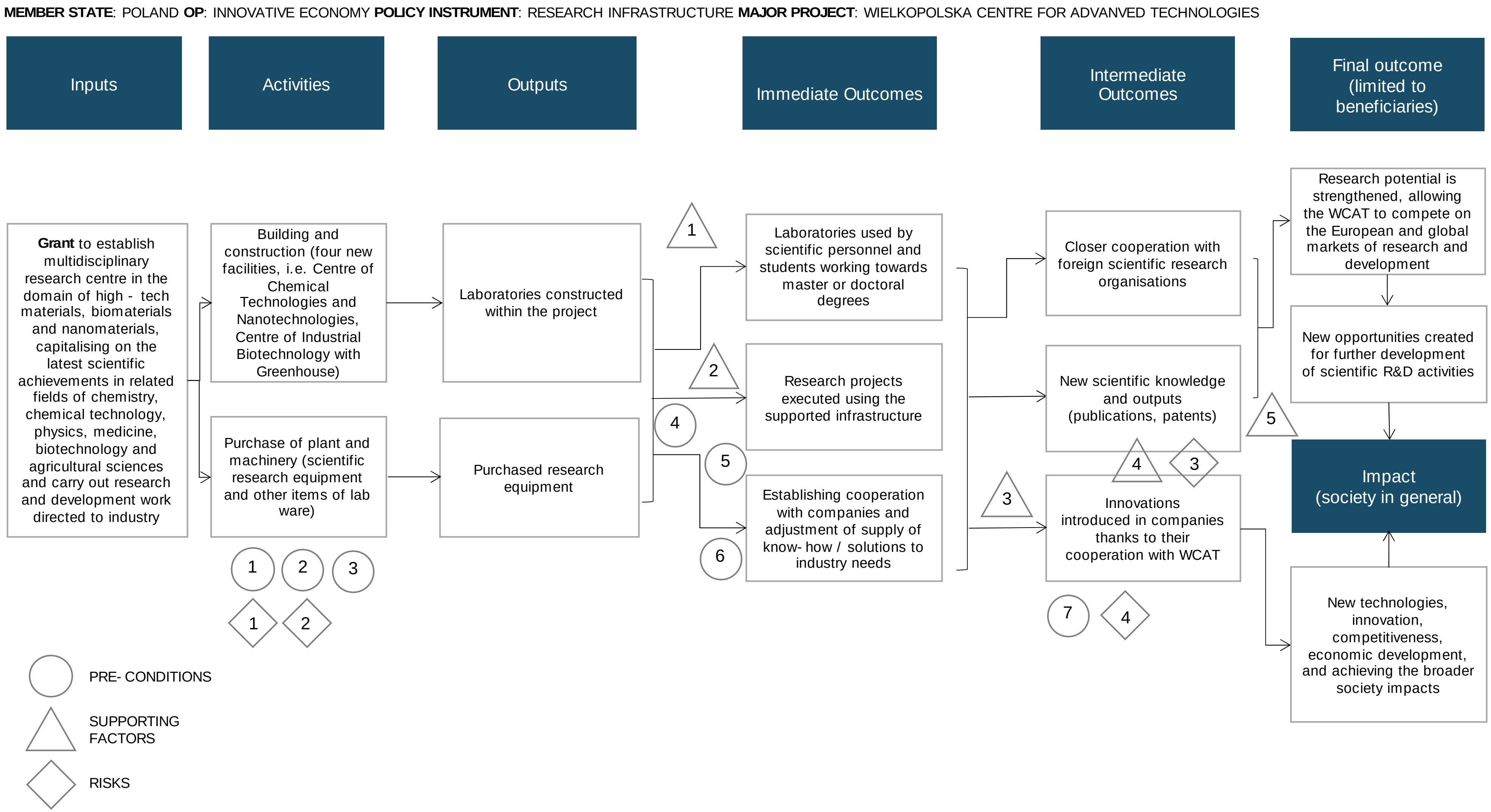
One of the foreseen immediate outcomes was the access to laboratories constructed within the project by scientific personnel and students. The target was that the RI would be used by 300 scientists and 100 students by 2020. It was also envisaged that 25 – 35 R&D projects will be carried out until 2023. Also, some 35 companies would benefit from services using supported research infrastructure of WCAT.

In a longer perspective, the project would lead to the following intermediate outcomes. Firstly, enhancing collaboration with foreign scientific research organisations. It was planned that some 20 international R&D projects are completed by 2020. Secondly, new scientific knowledge measured by the number of publications and patenting activity. This includes 150 – 250 publications, 30-80 patent applications including European Parent Office and 15-30 granted patents by 2023. Thirdly, the introduction of 30-50 innovations in enterprises as a result of collaboration with the WCAT by the same year.

The desired final outcome for the beneficiaries is that research potential is strengthened, allowing the WCAT to compete on the European and global markets of research and development. By using supported infrastructure, new opportunities are created for further development of scientific R&D activities. Also, the impacts on innovation activities in the production of goods and/or services that results from the RI, competitiveness and regional development are expected. Ultimately the broader society constitutes a group of final beneficiaries of the project, which is intended to contribute to improving health care, environmental protection and food safety.

As illustrated in Figure 14 there was a number of pre-conditions that had to be in place in order to ensure successful implementation of WCAT. There were also a series of supporting factors essential for successful pursuit of multidisciplinary research activities focused on fostering collaboration with the industry as well as several  risks that would need to be mitigated if occurred. The results of contribution analysis of WCAT investment are presented in the subsequent parts of the report.

**Figure 14 ToC for the research infrastructure**




*Source: Evaluation team on the basis of primary and secondary data collected*

**Pre- conditions**

1. Spatial planning and planning documentation are ready and there are no unresolved property ownership rights
2. Beneficiary capacity to ensure coordination of construction work
3. Capacity of equipment and instrumentation manufacturers
4. Availability of scientists and qualified personnel, including graduates and doctoral students, postdoctoral fellows, trainees, and young scientists
5. Projects not having an excessively scientific character
6. Market demand for R&D results
7. Adequate institutional funding for the RIs

**Supporting factors**

1. Experienced managers of the RIs
2. Applied research and perceived compatibility with the researcher's academic career
3. Demand and motivation on behalf of users to use the capacities and services of RIs
4. Knowledge and technology transfer (i.e. mechanism of commercialisation, and availability of risk capital to ensure market exploitation)
5. Improvement in the quality of research (i.e. more and better research)

**Risks and threats**

1. Legal risks associated with the requirements for research infrastructures (major projects)
2. Changes in the organisational structure of the consortium
3. Lack of knowledge-based businesses and entrepreneurial culture
4. Increased competition on the national and international research markets

### *3.3.3. Contribution analysis of the WCAT (major project)*

#### ***Verification of intended intervention implementation***

To a large extent, the implementation of the project took place according to original intended plans. However, it is worth noting some deviations from the work plan which occurred during the implementation stage. These changes have influenced the structure of consortium and sources of funding allowing the provision of R&D services on a commercial basis.

The delivery of project results to recipients was planned to immediately take place after the completion of the buildings and equipping the Centre in 2015. The legal requirement that only one entity (i.e. leader of the consortium, namely Adam Mickiewicz University) be the direct project beneficiary has had an influence on the implementation of the planned investment. This created a potential risk that the investment would not take place and has resulted in a delay in the operational phase which was launched in January 2016. Consequently, the structure responsible for the maintenance and operation of the infrastructure and for retaining the project's sustainability is not the WCAT Consortium consisting of Poznań universities and scientific institutes as initially planned, but the Foundation of Adam Mickiewicz University.

At the initial phase, it was foreseen that the WCAT facilities would be dedicated only to conducting basic research activities without tangible or measurable economic implications. Since the WCAT also allowed to carry out economic activities, it was necessary to ensure that the grant from the ERDF did not constitute State Aid. During the implementation, a threshold of 20% was introduced to the EC legislation allowing the provision of research services on commercial basis. In the context of changes regarding the structure of consortium, the project leader obtained a positive decision on the project's amendment which allowed diversifying the sources of funding.

As noted during the interviews carried out as part of this evaluation, the WCAT budget had been originally estimated at €70 million but due to a difference in the exchange rate, the final budget rose to only €63 million.

### *Achievement of intended effects at the level of the expected threshold*

The inputs allocated for building and construction as well as scientific research equipment and other items of lab were effectively used. The direct outputs of the project were the **construction of laboratories and purchasing of the research equipment**.

In the framework of the project, a number of laboratories and facilities were financed:

- Building A: Centre of Industrial Biotechnology with A1 – Greenhouse: 599.5 m2 Centre of Medical Biotechnology with A2 - Animal House total: 5,845.8 m2;
- Building B: Centre of Chemical Technologies and Nanotechnologies: 6,950.1 m2;
- Building C: Centre of Material Science including Regional Laboratory of Unique Equipment: 2,827.7 m2; and
- Building D: Scientific and technical premises: 2,147.9 m2.

The total surface area of constructed research facilities accounted for 20.424,0 $m^{2,}$ which is higher than the original target of 19.635,0 $m^2$. Also, some 225 scientific research equipment and other items of lab ware were purchased as it had been initially foreseen by the project. To better illustrate the types of investments undertaken, we provide some examples of laboratories and facilities funded within the project.

In the area of **material science**, equipment in the Laboratory of Microscopy and Nanomechanical Measurements allows a comprehensive study of physical parameters of materials surfaces. It also enables investigation of local mechanical properties of materials and fibres. Mass Spectrometry Laboratory is equipped with a series of state-of-the-art mass spectrometers in different hardware configurations. The lab enables qualitative and quantitative analysis services, development of methods as well as new applications designed to meet the rapidly evolving needs in the field. NMR Spectrometry Labs feature the fully integrated high-performance NMR spectrometers which can be used in a series of research applications such as structural biology, small molecule identification and material science.

In the area of **chemical technologies and nanotechnologies**, the Laboratory for Special Condition Syntheses is equipped with a series of Anton Parr reactors permitting running processes under high pressure and in high temperatures. The instrument unique in the country is a laboratory fluidal reactor permitting investigation and optimisation of processes in the fluid phase, under high pressure and in high temperatures, with the use of nitrogen, carbon oxide or hydrogen. Thermal Analysis Labs are equipped with apparatuses and instruments for investigation of phase transitions in the temperature programmed conditions. Electrochemistry, Thermal and Mechanical Processing labs offer the equipment for construction and characterisation of electrode systems and chemical sources of current, apparatuses for refinement, disintegration, sifting and fractionation of solid-state samples.

In the area of **biomedical biotechnology**, the infrastructure is divided into three main parts, including Molecular Biology Block, Cell Biology Block, and Animal Facility. All of them are organised to perform all main areas of biomedical research starting from the molecular and cellular aspects of patho-mechanism and therapeutic strategies of human diseases to in vivo studies with use of different animal models in pre-clinical trials.

The **Regional Laboratory of Unique Equipment** has highly specialised equipment which is available for use by the scientific community and small and medium enterprises from the region as well as R&D centres of Polish and international companies. Also, the **Service and Technical Facilities** located at the WCAT allow co-operation with companies.

The results of interviews carried out as part of this evaluation indicate that **outputs** had been achieved according to initial plans. As such, no major deviation from the ToC has been identified. This said, it was acknowledged that there have been some delays in the launch of the Animal Facility which was only officially inaugurated in December 2018. The interviews also pointed out that the use of plastic processing equipment is also slightly different as compared to initial plans, which reflects recent developments in the field of additive technologies.

According to the latest available data, the following **immediate outcome** has been achieved within the WCAT project. In 2019, 305 scientists and 200 students working towards master or doctoral degrees used the new RI which represent 102% and 200% of the original targets. An in-depth analysis regarding the research projects, executed with using the supported infrastructure and establishing cooperation with companies shows a more nuanced view. On the one hand side, the planned KPIs have been realised. By the end of 2010, 53 research projects using the supported infrastructure have been carried out which represents 212% of the original target and 121 companies used the services provided by laboratories located at the WCAT which represents 346% of the original target. Established in 1989, a company Unisil is a good example of innovative company closely collaborating with the WCAT. Unisil is the only Polish company producing silicon-hydrogen compounds, and recently launched the production, as the first company in Europe, and second in the world after Hybrid Plastics, of specialised category of compounds, known also as silsesquioxanes which constitute the basis for the development of innovative materials.

On the other, R&D projects have been overly focused on basic research and there has been a significant number of low budget services provided to enterprises which is something that the WCAT project sought to address. This said, these two immediate outcomes have been achieved to some extent.

Public investments to support research infrastructure projects are characterised by a long-time horizon. Consequently, it generally takes quite a long time – normally several years – before intermediate outcomes and socio-economic impacts become detectable. Our analysis has been carried out four years after the operational phase of WCAT was launched (i.e. January 2016). Based on desk research and results from consultations with the relevant stakeholders, we seek to indicate the most likely potential longer-term effects despite the fact that many of these have not been generated as of now.

The two following **intermediate outcomes**, namely Closer cooperation with foreign scientific research organisations and New scientific knowledge and outputs measures by the publication and patenting activity have been also achieved to some extent. By 2019, 12 international research projects have been carried out with use of the supported infrastructure which represents 60% of the original target.

Adam Mickiewicz University which is the main academic institution in the region and one of the top Polish universities, is carrying out 22 research projects funded within Horizon 2020. This is however not a direct effect of the WCAT and there is still a room for intensifying activities related to internationalisation. The level involvement of other academic institutions in Horizon 2020 research projects has also varied (Institute of Bioorganic Chemistry of Polish Academy of Sciences – 30 projects, Institute of Molecular

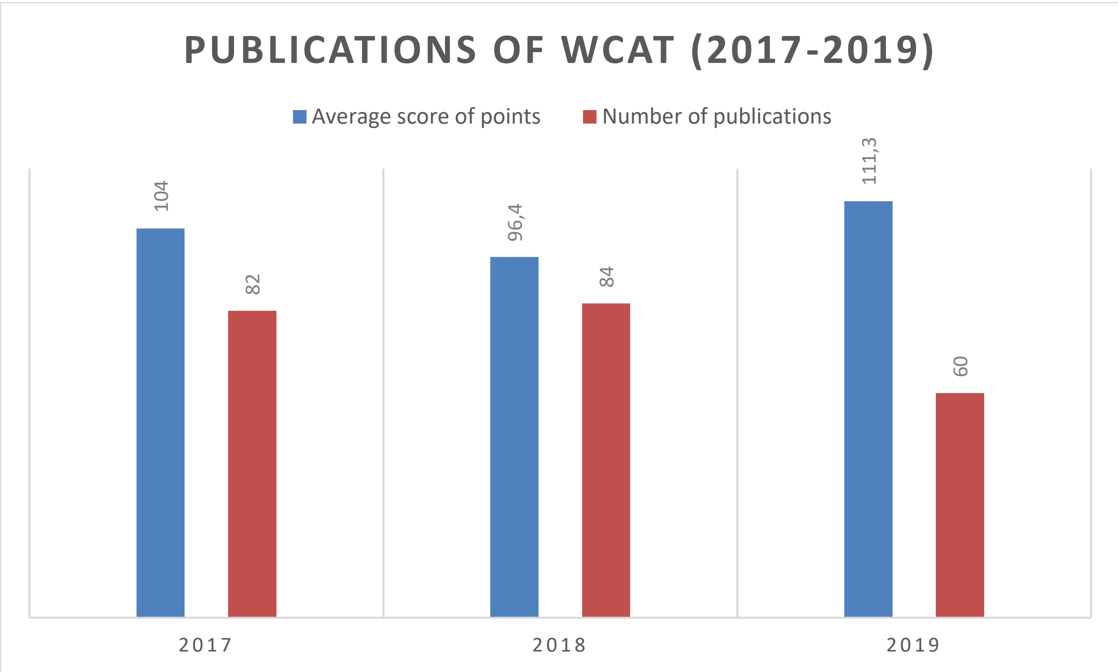
Physics of Polish Academy of Sciences – 1 project, Institute of Plant Genetics of Polish Academy of Sciences – 1 project, Institute of Plant Protection, National Research Institute – 1 project, Karol Marcinkowski Medical University – 4 projects, Poznań University of Life Sciences – 4 projects, Poznań University of Technology – 8 projects).

Regrading new scientific knowledge and outputs, by 2019 240 publications have been prepared within projects using the research infrastructure of WCAT which represents 160% of the original target. Also, 13 EPO applications have been submitted until 2019 and 11 obtained patents as results of projects undertaken with use of the supported infrastructure, which represent 43.3% and 73.3% of the original targets respectively.

According to the available publication data for the period 2017-2019, we observe a slight upward trend in the average score of publications published by researchers using WCAT infrastructure to carry out their research. The best publications are scored for 200 points, whereas good publications are those in the range of 140 and 100 points.

Regarding the last intermediate outcome, namely Innovations introduced in companies as a result of co-operation with WCAT the desired effects have not been achieved. It is planned that by the end of 2023 some 30-50 innovations will be introduced.

**Figure 15 Publications of WCAT 2007-2019**




*Source: Authors based on data provided by the WCAT*

With regards to **impacts**, it is confirmed that none have been observed as of now. This said, the WCAT plays a significant role in linking the scientific research institutions. We can anticipate that research potential will be strengthened, which will allow to compete on the European and global R&D markets. WCAT's strategy is to concentrate on the research areas in which it has comparative advantages, and focus on multidisciplinary activities particularly in innovative niche areas. The consulted stakeholders pointed to some challenges in undertaking collaborations with the regional scientific community, and emphasised that the WCAT brings the best specialists in the fields of natural and engineering sciences working with the key institutions of the region, in the country and in collaboration with other European countries.

While it may be still too early to observe effects in terms of new opportunities created for further development of scientific R&D activities thanks to the intensification of research activities, the interviews pointed out to future potential positive spill-overs which are likely to contribute to the strengthening of the scientific research potential. The existing evidence indicates that there is a scope for undertaking additional research projects.

One type of effect that must be addressed is the impact on the local economy. There are approximately 67 companies which are frequently collaborating with the WCAT and/or using its services, and we have managed to find a match with the economic database (ORBIS) for 62 of these companies. The analysis of turnover during the period 2010-2018 (or latest available until 2013) based on the valid data for 33 companies shows an increase (118%), while only two companies underwent a decrease (-11% and -61%). Although it is impossible to directly draw connections between the supported infrastructure and economic performance of companies co-operating with the WCAT, the stakeholders consulted did point to the potential spill-over effects on companies' innovativeness which is critical for their success. Further, according to the interviews, the co-operation with companies like Unisil (the only Polish producer of organofunctional silanes and recently also silsesquioxanes) and STER GROUP (specialised in equipping public transport vehicles focusing on the bus and rail industry) is likely to generate the introduction of innovation in companies as foreseen by the project.

Impact on innovation activities resulting from the WCAT seems to be slowly emerging and is likely to increase in the coming years given the innovation potential of the region. This said, we are not in a position to give well-founded judgements regarding the societal implications of these activities. We should also mention at this point that that the WCAT has a significant role to play in Poznań's future economic and social development. In the long-term, it seems natural that the WCAT will be merged with the Poznań Science and Technology Park, and act at one independent entity.

A table is presented in ANNEX III containing the data collected for each of the expected effects and the assessment of the expected threshold for each one of these.

Based on the existing evidence complemented by in-depth interviews with the relevant stakeholders, the evaluation found no unintended effects observed as result of the WCAT investment.

### *Verification of assumed pre-conditions*

At the level of activities, it is found that the three assumed pre-conditions were ensured. The construction was divided into two parts and both are considered to have gone relatively well. The investment was completed within the period of 36 months and won the 1st degree award in the category Modern Technology Objects in the Construction of the Year 2013 competition organised by the Polish Association of Construction Engineers and Technicians.

Regarding the capacity of equipment and instrumentation manufacturers, it was only noted that it would have been possible to obtain more advantageous financial offers if there was no significant increase in demand for specialised equipment recorded in Poland and other more recent EU Member States.

For immediate outcomes to materialise, a number of pre-conditions were required. Since the launch of WCAT, some 40 scientists and technical personnel have been employed to operate the created research infrastructure. Consequently, this allowed the scientific personnel and students to use the newly created RI. Since the launch of operational phase, 25 research posts have been created and the number of jobs created (FTE) accounted for 127. Some 58 young Polish scientists (up to 30 years old) have been also employed in scientific projects implemented at the WCAT. There were however some concerns raised during the interviews about internal critical mass to carry out R&D projects and engage in industry collaboration. This said, the availability of scientists and qualified personnel was ensured to some extent.

The pre-condition of ensuring a balance between the different types of research undertaken was not fully met. The analysis of research projects carried out on the basis of supported infrastructure, shows that a large majority of projects was related to fundamental research. Out of 53 research projects, 43 basic research projects were funded by the NCN, nine projects applied research projects by NCBR, in addition to one project funded by the Ministry of Science and Higher Education. It was noted during the interviews that the projects funded by the NCBR represents approximately 35% of the total value of all research projects.

Likewise, the market demand for R&D results was ensured to some extent. The annual operational costs of WCAT are estimated at 10 million PLN. Half of the costs is covered by Adam Mickiewicz University, while 15% comes from provision of R&D services, another 15% from fees for the access to research infrastructure, and the remaining 20% comes from institutional funding.

The interview results also indicate that that there is a significant number of low budget services provided to economic operators. The WCAT provides annually some 350 services. There is widespread recognition that the main source of financial resources will be publicly-funded research and European Commission grants. There is clearly a potential for intensifying the co-operation with industry in the future. Currently, the provision of research services on commercial basis ranges between 5% - 7% of the allowed threshold of 20% for this type of services.

Low institutional funding, insufficient coverage of operational costs by competitive funding grants, and insufficient income generated from R&D services and access to research infrastructure have been the main challenges faced by the WCAT. It is interesting to note that there has been some recent changes in the institutional funding, notably the Research Infrastructure Maintenance Support Programme (pl. PANDA) overseen by the Ministry of Science and Higher Education.

In the first edition of competition PANDA 1 (2015), it was possible to obtain a maximum amount of 2 million PLN and no more than 50% of maintenance costs of research infrastructures funded within the OP IE. The support provided to the WCAT accounted for 1.9 million PLN. PANDA 2 provided support for the maintenance of research projects funded within the OP IE with the budget of at least 50 million PLN. The year 2017 was marked with a change of how the co-efficiency rate of commercialisation which determined the level of funding was calculated. In practice, the income of the applicant generated with use of supported infrastructure by external entities was divided by the income of all projects participating in PANDA 2.

As a result the financial support provided to the WCAT fell from approximately 3 million PLN in 2016 to 1 million PLN in 2017. Comparatively, 40% of all the granted supported in 2017 (ca. 20 million PLN) was provided to a single research institution, namely the Central Mining Institute (GIG). The criteria were later changed introducing the limit of support to 8 million PLN. In preparation of the new programme successor to PANDA programme, there are plans to introduce other criteria to take into account investments such as the WCAT. This means that the level of involvement required in informing the design of more optimal national support programmes, has been an additional challenge for managers of research infrastructure projects. Based on the existing evidence, it can be concluded that ensuring adequate institutional funding for the RI was a pre-condition which was only fulfilled to some extent.

### *Verification of supporting factors*

The analysis carried as part of this evaluation found that that there was a commendable effort of the whole team of WCAT engaged in the establishment of WCAT managed by experiences professions. This was an important supporting factor which has taken place and positively influenced the effectiveness of investment.

As noted by the recent Peer Review of Poland's Higher Education and Science System (Directorate-General for Research and Innovation 2017) doctoral training is a key challenge in Poland's HE and science system. There has been a lack of robust system of formalised doctoral training and appropriately organised supervision of PhD candidates. Also funding formula and the national system of evaluation of scientific units incentivise the expansion of doctoral training rather than quality provision. Poland's HE and science career system manifests a number of weaknesses, such as a delay in acquiring sufficient opportunities and resources to conduct independent research; academic inbreeding in recruiting junior staff; and low remuneration of academics and lack of flexibility in rewarding talent. Increasingly more attention has been paid to applied research in several waves of reform implemented in the research, higher education and innovation system. As noted during the interviews, the stability offered by classic research careers at HEIs in comparison with the WCAT has posed an additional challenge. Based on the existing evidence, it can be stated that the applied research and perceived compatibility with the researcher's academic career took place to some extent.

The level of demand for research carried out using the supported infrastructure could have been higher, which confirms that the market conditions were rather optimistic at the planning phase of investment. The results of analysis carried out as part of this case study indicate that the demand and motivation on behalf of users to use the capacities and services of RIs did not take place limiting the effectiveness of investment.

The WCAT is located in the proximity of new campus of Adam Mickiewicz University and Poznań Science and Technology Park, so as to facilitate knowledge and technology transfer. However, such activities are limited due to a lack of new project / business ideas.

There was an unsuccessful attempt to apply for a competition BRIdge Alfa launched in 2016 by the NCBR - to strengthen the mechanisms of commercialisation of Polish scientific and research projects, and increase their chances of market success. It was foreseen that BRIdge Alfa would be a combination of funds and business experience of private investors with public funds and the supervision of the NCBR in the Venture Capital formula. There seems to be a need for capital to ensure market exploitation and have the right mechanism in place for raising risk capital. This said, the knowledge and technology transfer (i.e. mechanism of commercialisation, and availability of risk capital to ensure market exploitation) was a support factor that did not take place.

Taking a relatively short duration of the operational phase, it is too early to appraise whether the improvement in the quality of research (i.e. more and better research) took place or not.

### *Verification of risks*

The two following inter-related risks (i.e. Legal risks associated with the requirements for research infrastructures (major projects) and Changes in the organisational structure of the consortium) did end up materialising and were adequately managed.

The risk assoiated with the lack of knowledge-based businesses and entrepreneurial culture materialised and had a negative influence of the effectiveness of investment. This is a persisting structural challenge for all Polish regions and not specific to Wielkopolska which can be considered among the most developed regions in Poland.

Finally, the risk of growing competition on the national and international research markets was confirmed but it did not have an influence on the overall effectiveness of WCAT investment. A concrete example was a foreign-based company which had initially started co-operation with WCAT, but subsequently its management took a decision to start collaboration with another research centre elsewhere because of better proximity to clients.

### 3.3.4. General assessment of the WCAT (major project)

On the basis of the elements presented in the previous section (see section 3.3.3) the evaluation team has been able to conduct a general assessment of the policy instrument, as well as of the individual causal claims identified in the original ToC.

Figure 16 presents the results of the ToC testing and of the related causal packages of the different expected results of the WCAT investment. The gathered evidence confirm that some pre-conditions fully existed but there is also a number of pre-conditions which were in place only to some extent which have influenced the achievement of the desired outcomes of the WCAT investment.

The CS found that having experienced managers of the newly established RIs was a supporting factors that took place and positively influenced the effectiveness of investment. Based on the existing evidence, it can be ascertained that another support factor of applied research and perceived compatibility with the researcher's academic career took place to some extent due to challenges in Poland's HE and science career system. The other support factors, i.e. demand and motivation on behalf of users to use the capacities and services of RIs as well as knowledge and technology transfer mechanisms did not take place limiting the effectiveness of investment. Taking a relatively short duration of the operational phase, it is too early to appraise the improvement in the quality of research and its contribution to achieving the desired final outcomes.

The gathered evidence confirm that some anticipated as well as unforeseen risks occurred during the implementation. Legal risks associated with the requirements for research infrastructures (major projects) changes in the organisational structure of the consortium) did end up materialising and were adequately managed. The lack of knowledge-based businesses and entrepreneurial culture which is a structural challenge for all Polish regions materialised and affected the effectiveness of investment. Increasing competition on the national and international research markets was confirmed but it did not have an influence on the overall effectiveness of WCAT investment.

The combination of these causal claim factors explains why some expected results materialised while others did not influencing the overall level of success of the instrument. In the majority of the observed results, we found that the WCAT investment is in all likelihood the main cause of the observed effects. The grant for the WCAT investment provided support for buiding and construction and purchase of scientific research equipment but did not include the funding for carrying out research projects. This said, the availability of RIs did not automatically trigger the co-operation with the industry and dedicated efforts are required in this regard. The WCAT investment without dedicated funding for undertaking R&D activities was rather a contributory cause to establishing co-operation with companies.

The causal link did not materialise between efforts undertaken to foster co-operation with industry, and innovations introduced in companies. It is also confirmed that none of the final outcomes and impacts have been observed as of now.

With regards to additionality of ERDF support, it needs to be acknowledged that governmental support for scientific research activities channelled through the Ministry of Science and Higher Education. According to the legal act on funding higher education institutions which was in force during the 2007-2013 programming period, there were the following six ways of financing R&D activities:

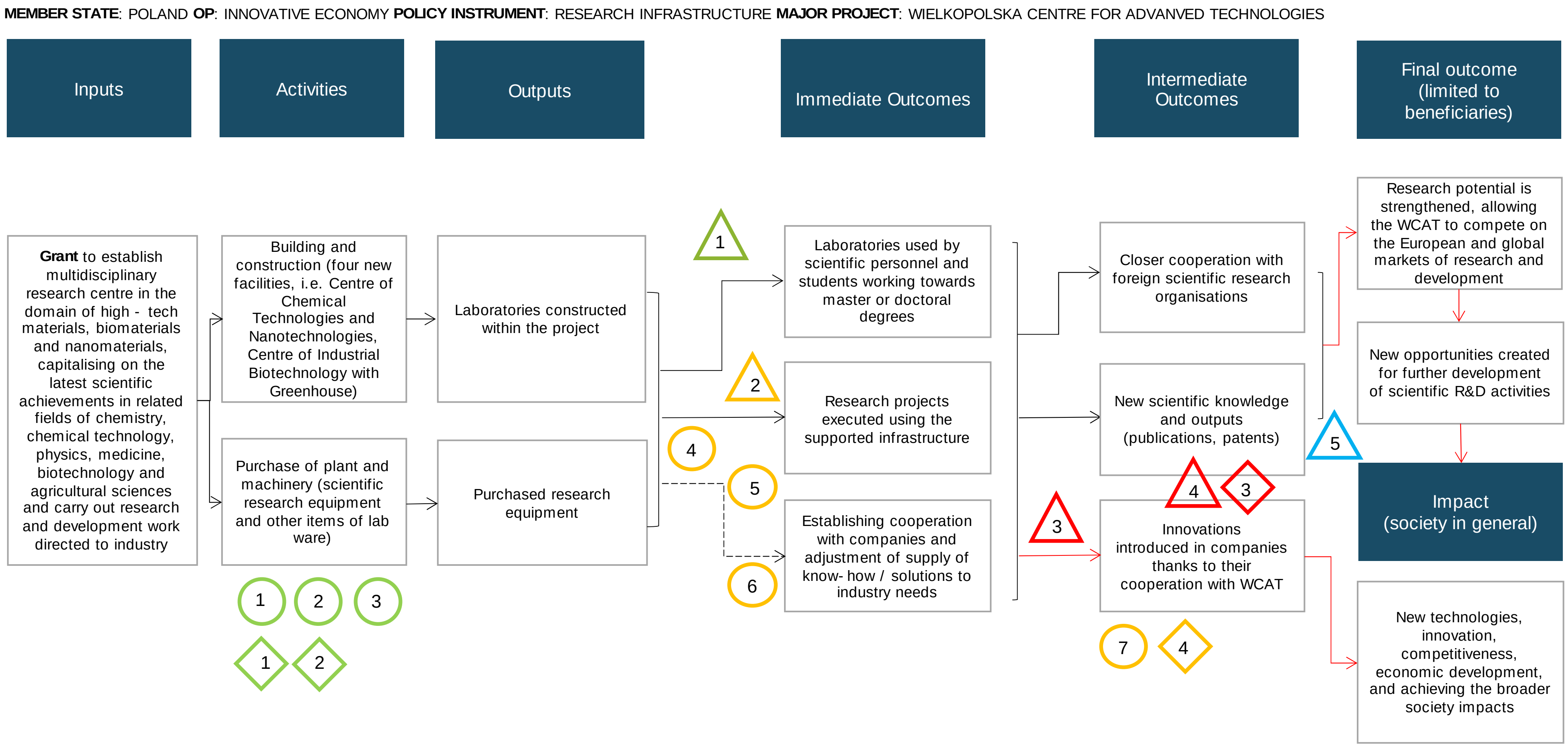
- Core funding for statutory R&D activities, i.e. institutional funding provided to research entities, units and university departments for covering the costs of their own research activities. Schools at university level could not use those funds to finance their educational or training activities.
- Investments in R&D infrastructure, such as buildings and equipment.
- Peer-reviewed research grants based on research proposals, presented by research teams or individual researchers. Applications were evaluated by an appropriate group of the Committee twice a year. Research projects should deal with new scientific problems and must not be financed from the state budget in any other form.
- Subsidies for R&D programmes of national importance commissioned by enterprises, state administration or local authorities. The funding was allocated for the implementation of projects and the utilisation of research results.
- Subsidies for international scientific and technological co-operation resulting from inter-governmental agreements.
- Subsidies for selected R&D support activities (e.g. information services).

To give a better idea about the available national funding for research infrastructure, some 196.3 million PLN was allocated in the budget for science in 2007 which represented roughly about €51.2 million at that time. This said, the major research project of WCAT would have not been possible without the ERDF funding or would have been realised on much smaller scale.

The assessment is based on the quantitative data, which was complemented by desk research, in addition to a series of interviews carried out with the relevant stakeholders. The availability of quantitative data has been generally quite good except some expected intermediate outcomes and impacts which not occur given a limited duration of the operational phase. The analysis of these aspects is primarily based on the results of interviews and own assessment.

In terms of reliability, the case study authors used the official monitoring data provided by the representatives of WCAT. The assessment of improvement in the quality of research is based on the analysis of publication data. The data on the participation in H2020 projects was used in the assessment of co-operation with foreign research institution. Based on ORBIS data, we analysed changes in turnover of companies, which are frequently collaborating with the WCAT and/or using its services. The results of this analysis can be only considered as supporting evidence.

**Figure 16 CA ToC for the research infrastructure testing**




*Source: Evaluation team on the basis of primary and secondary data collected*

## FIGURE LEGEND

**ACHIEVEMENT OF INTENDED EFFECTS**

- TO NO EXTENT
- TO A LIMITED EXTENT
- TO A FULL / IMPORTANT EXTENT
- UNKNOWN

POSITIVE OR NEGATIVE UNINTENDED EFFECT

**CONFIRMATION OF EXISTENCE OF PRE CONDITIONS**

- PRECONDITIONS DID NOT EXIST
- PRECONDITIONS DID EXIST TO SOME EXTENT
- PRECONDITIONS FULLY EXISTED
- UNKNOWN

**CONFIRMATION OF EXISTENCE OF SUPPORTING FACTORS**

- SUPPORTING FACTOR DID NOT EXIST LIMITING EFFECTIVENESS
- SUPPORTING FACTOR DID OR DID NOT EXIST, BUT DID NOT INFLUENCE EFFECTIVENESS
- SUPPORTING FACTOR EXISTED AND POSITIVELY INFLUENCED EFFECTIVENESS
- UNKNOWN

**CONFIRMATION OF RISKS**

- RISK MATERIALISED AND IMPACTED EFFECTIVENESS
- RISK DID OR DID NOT MATERIALISE AND DID NOT INFLUENCE EFFECTIVENESS
- RISK WAS ADEQUATELY MANAGED OR MITIGATED
- UNKNOWN

**CONFIRMATION OF CAUSAL LINKS**

- CAUSAL LINK WAS CONFIRMED AND THE INSTRUMENT IS LIKELY TO BE THE MAIN CAUSE OF THE OBSERVED EFFECT
- CAUSAL LINK IS CONFIRMED AND THE INSTRUMENT IS ONE OF THE CAUSES OF THE OBSERVED EFFECT
- CAUSAL LINK WAS NOT CONFIRMED OR DID NOT MATERIALISE

The **WCAT** and research projects carried out with the supported infrastructure have not only created new opportunities for pursuing research careers and developing curricula, but it also spurred the development of a new generation of researchers and students as well as contributed to establishing multidisciplinary research teams. Prior to the implementation of the ERDF support, the scientific research and HEIs involved in the centre had outdated equipment, which made it extremely difficult to conduct advanced research.

The operation of major research infrastructure projects was far more complex than either the managing authorities or the direct beneficiaries initially envisaged. The process is not simply a technical one of construction and equipping facilities with specialised research equipment. It is changing the legal framework, the market trends, the policy mix in which the research infrastructures operate.

In summary, the project was not implemented as intended but was adapted, pre-conditions were verified but it was found that some of them only existed to an extent, some support factors did not take place, whereas the majority of risks were adequately mitigated. Taking into account that threshold levels of all intended results were not fully achieved partly due to a relatively short period of implementation and some of the above-mentioned factors which occurred during the implementation, it can be concluded that the project could have been more effective and some of the assumptions around the market conditions were too optimistic at the planning phase of investment. The WCAT investment is likely to be the main cause of some of the observed effects and it is found to be a contributory cause to establishing co-operation with companies. The results of analysis points also to a number of links for which causality could not be confirmed.

The CS put a spotlight on the need for continuous improvement of internal capacity. The analysis also pointed out to an untapped potential for development of closer co-operation with the industry. The involvement required in informing the design of more optimal national support programmes for research infrastructure has been an additional challenge for managers of WCAT. For developing further international research collaboration, it will be of the utmost importance to ensure high quality research. Since the WCAT has not generated sufficient IP, securing own financial resources in projects requiring such investment to ensure continuous development of research equipment is challenging. Overall, the WCAT played an important role in establishing multidisciplinary research teams. It has also managed to successfully mitigate challenges encountered during the implementation and achieved some good results in a relatively short period of time (i.e. the operational phase was launched in January 2016).

# 4. GENERAL FINDINGS AND LESSONS LEARNT

## 4.1. Key achievements of ERDF support in the Member States (i.e. effectiveness)

Poland, along with a number of other Central Eastern European Countries, faced similar challenges when preparing the ERDF OPs 2007-2013. First and foremost, there was a need for structural adjustments concerning the scale and limited propensity among the business sector to carry out this type of investments. Secondly, the existence of outdated equipment was a consequence of chronic and long-term under-funding in research infrastructures, in addition to the fragmentation of the research base. This resulted in an inefficient use of research facilities, as well as in a lack of adequate conditions to conduct large R&D projects with an international dimension. Thirdly, weak science-industry collaboration and limited support for this type of activities was identified as one of the major challenges for Poland's innovation system.

**Collaborative R&D projects** were funded by the OP IE, Measure 1.3.1, which offered non-reimbursable grants to finance R&D intended to address industrially relevant or societal challenges. These grants were initially offered to consortia of scientific organisations (2008-2011), but the design of this instrument later evolved to support science-industry consortia (starting from 2012) with mandatory involvement of private sector partners. The evaluation found that the activities of collaborative R&D instrument were successfully implemented and led to increased number of collaborative R&D projects. Supported science-industry projects provided access to new ideas and competences to partners involved, and also supported the strengthening of capacities to conduct research projects and engage in collaborative research activities, particularly among the research institutions involved in the grants and projects (e.g. interviewees from scientific and industrial organisations confirmed the important role of Measure 1.3.1 in promoting good practices and establishing organisational standards for R&D project management and intellectual property management). Interviewees from scientific organisations also confirmed the importance of the grants with regards to involving a young generation of scientists in industrially applicable R&D.

The industrially-oriented projects helped scientific partners acquire knowledge and skills, focus on R&D topics of relevance for industry and generate tangible results in terms of publications and patent applications. They also strengthened partners' ability to work with other partners. The support has led to increased supply of industrially relevant skills, changing mindsets of scientists and increased willingness to pursue applied R&D.

However, the evaluation found that the commercialisation / uptake of new products and processes generated by the projects remained extremely low. As such, the evaluation confirmed the existence of a major gap in terms of the successful translation of the collaborative research results into practical innovations leading to positive spill-overs for project stakeholders and their respective territories. Further, the supported projects did not lead to the development of sustained collaborations among involved and supported partners. R&D expenditure was mainly limited to the initially agreed project co-funding, and not many follow-up orders for contract R&D or joint R&D initiatives were pursued after completion of projects supported within Measure 1.3.1. In many cases, the industrial partners indicated having a lower propensity to engage with research organisations after this experience, and preferred to develop their internal research capacities moving forward. In other words, the instrument did not successfully lead the development of a stronger ‘open innovation’ culture within the business organisations involved in the supported projects. As such, improvements of competitiveness of local industry did not come as a result of successful commercialisation of R&D results of the projects, but rather of improvements in R&D management, increased interest in pursuit of innovation strategies and enhanced understanding of new technologies and international technological trends, motivating further initiatives (in-house R&D funded from own sources or through non-collaborative grants).

The CS found that the effectiveness of instrument was significantly impacted by the limited policy capacity of the implementing authorities, the lack of adequate IPR framework, as well as the absence of sustained interest and capacity of industrial partners to carry out innovation on the basis of research project results. While the design of the intervention was amended upon its initial launching in order to capitalise on the experience gained during its initial phase, the instrument did not fully succeed in putting in place the right incentive and burden-sharing framework for research partners and industrial partners to remain fully committed and engaged throughout the projects and beyond. This seriously hampered the instrument’s ability to generate short-term economic, social and environmental results at the country level. For instance, the evaluation has shown that many of the beneficiaries of the instrument were primarily uninterested in commercial implementation of their R&D results, but rather embarked on the projects with ambitious scientific objectives.

The access to other support measures targeting industrial R&D stakeholders and the sustained public support for collaborative R&D over time are supporting factors which have positively influenced the effectiveness of the collaborative R&D project instrument. However, the lack of prior experience and limited role played by technology transfer offices, technology brokers or relevant departments of scientific organisations are the supporting factors which did not take place and influenced the success of the instrument. In addition, some of the anticipated risks did occur during the implementation of support for collaborative R&D projects, which also influenced the capacity to reach intended results (i.e. inherent risks of collaborative and applied research projects, and industrial partners disengage from project given the need for short-term results).

Overall, Measure 1.3.1 and the support it provided for collaborative R&D was an important learning process for scientific and industrial organisations. It was one of the first collaborative R&D support schemes implemented in the country since the 1980s. As such, adequate design and results were subject to some degree of initial trial and error. The funding scheme could be considered a large-scale pilot exercise that contributed to enhancing the maturity and robustness of the approach to supporting science-industry co-operation in the Polish innovation policy mix. In the subsequent ERDF programming period (2014-2020), more tailored approaches were adopted which were able to capitalise on the mistakes and successes of the previous period.

The **HE infrastructure investments** policy instrument was designed and implemented within the OP Infra & Env, in light of developing modern academic centres in Poland. The instrument provided support for the building and construction of such centres, as well as educational/research equipment, including IT infrastructure.

The evaluation clearly demonstrated the success of the instrument in terms of enhancing the supply of higher education in key areas/fields, as wells as in terms of improving the quality of the education being provided. These results are best illustrated by data on the number of new or rebuilt laboratories - 2,167 (1,085 at universities, 724 at technical universities, 257 medical universities, and 101 in other HEIs) with a total area of 117,363 m².

OP Infra & Env provided support to four out of the 13 most frequently chosen fields of study for full-time first cycle studies and uniform master studies. There was a steady and significant growth trend in students' choice of strategic (supported) faculties starting from the academic year 2008/2009 to 2015/2016, while in parallel, enrolments at the national level underwent decreases in the same period. The most recent data indicates that the share of students pursuing technical and natural sciences studies continues to increase nationwide and reached 28.5% in 2018. The investments also led to unexpected positive impacts on the networking potential of the supported institutions, and in particular, their capacity to attract students and researchers from abroad.

The supported HE infrastructure has provided a foundation for building the education supply corresponding to the needs of the labour market, albeit the potential of strengthening co-operation with industry was not fully exploited as part the implementation of this instrument, due to existing restrictions concerning this type of support and a general low readiness level of beneficiaries and economic operators to engage in this form of collaboration. In addition (and to a certain extent as a result of further involvement of the private sector in the instrument), there is limited evidence regarding the impact of the measure on the availability of an improved and stronger pool of skills for the local business community and employers. As such, the evaluation has not confirmed the existence of direct causal links between the measure, and the improved access to skills for the private sector, particularly innovative firms.

Overall, the support provided for **HE infrastructure investments** was critical for the implementation of modern education system in Poland, in particular on the MSc and PhD level. While, State Aid-related issues did play an important role in the implementation of the instrument, these rules influenced the capacity of beneficiary institutions to engage in commercial practices through the newly built or modernised infrastructure financed, rather than their capacity to successfully complete the infrastructure projects. In the case of this particular instrument, the evaluation found that the additional support provided by the OP outside of the instrument, as well as that provided by other national and regional ERDF OPs, played a major role in achieving the instrument's intended results.

The general objective of the **WCAT** (major project) was to consolidate the research community in the Wielkopolska region around the main research areas. The investment was intended to create a multidisciplinary research centre in the domain of high - tech materials, biomaterials and nanomaterials, capitalising on the latest scientific achievements in related fields of chemistry, chemical technology, physics, medicine, biotechnology and agricultural sciences and carry out research and development work directed to industry were among other project's objectives. The inputs allocated for building and construction as well as scientific research equipment and other items of lab were effectively used. The direct outputs of the project were the construction of laboratories and purchasing of the research equipment.

The operation of major research infrastructure projects was far more complex than either the managing authorities or the direct beneficiaries initially envisaged. The process was not simply a technical one involving the construction and equipment of facilities with specialised research equipment. The projects also required changing the legal framework, the market trends, the policy mix in which the research infrastructures operate.

The analysis of research projects carried out on the basis of supported infrastructure, shows that a large majority of projects was related to fundamental research. According to the available publication data for the period 2017-2019, the average score of publications published by researchers using WCAT infrastructure to carry out their research witnessed a slight upward trend.

The infrastructure has not led to an increase in collaborative activities and projects between the university and the local business and industrial sector. Currently, the provision of research services on commercial basis ranges between 5% - 7% of the allowed threshold of 20% for this type of services. Further, the collected data by the evaluation team shows the planned targets until 2023 corresponding to patenting activity, innovations introduced in companies and co-operation with foreign research entities have not been achieved yet.

The evaluation showed that the lack of demand and motivation on behalf of users to use the capacities and services of research infrastructure, as well as very limited knowledge and technology transfer capacities, strongly limited the instrument's capacity to generate intended results. In addition, the lack of knowledge-based businesses and entrepreneurial culture and increased competition coming from the national and international research markets also reduced the impact of the infrastructure.

When it comes to the positive results of the instrument, it was found that having experienced managers of the newly established RIs is a key supporting factors behind success of such in the effectiveness of investment. The grant for the WCAT investment provided support for building and construction and purchase of scientific research equipment but did not include the funding for carrying out research projects. Further, the availability of RIs did not automatically trigger the co-operation with the industry and dedicated efforts are required in this regard. The WCAT investment without dedicated funding for undertaking R&D activities was rather a contributory cause to establishing co-operation with companies.

Although it is impossible to directly draw connections between the supported infrastructure and economic performance of companies co-operating with the WCAT, the stakeholders consulted did point to the potential spill-over effects on companies' innovativeness which is critical for their success. The analysis of economic data of companies frequently co-operating shows a positive change in their turnover. The WCAT impact on innovation activities resulting from the WCAT seems to be slowly emerging and is likely to increase in the coming years given the innovation potential of the region. The WCAT has a significant role to play in Poznań's future economic and social development.

The **WCAT** and research projects carried out with the supported infrastructure have not only created new opportunities for pursuing research careers and developing curricula, but they have also spurred the development of a new generation of researchers and students and multidisciplinary research teams. Prior to the implementation of the ERDF support, the research and HEIs involved in the centre faced a lack of modern equipment, which made it extremely difficult to conduct advanced research. However, given the relatively recent implementation of the operational phase of the project, it is still too early to appraise the improvement in the quality of research and its contribution to achieving the desired final outcomes (i.e. the operational phase was launched in January 2016).

The CS shed light on the need for continuous improvement of internal capacities. The analysis also pointed out to an untapped potential for development of closer co-operation with the industrial sector. The involvement required in informing the design of more optimal national support programmes for research infrastructure has been an additional challenge for managers of WCAT. In order to develop further international research collaboration, it will be of the utmost importance to ensure high quality research. Since the WCAT has not generated sufficient IP, securing own financial resources in projects requiring such investment to ensure continuous development of research equipment is challenging.

## 4.2. Relevance

The findings of the present case study suggest that the provided ERDF support clearly responded to the needs of RTD system in Poland, and the distribution of funding across different policy instruments is found to be in line with the priority needs of the country (i.e. the very important need for the national research system to catch with the rest of Europe on the basis of more advanced and cutting edge infrastructure). The main rationale behind the prioritisation on infrastructure investments was to create conditions necessary for conducting advanced research in response to the socio-economic needs and developing modern education system. The evaluation has shown however that there is complementary mix of policy instruments supported across different ERDF OPs, and that strong synergies existed among these different policy measures and OPs. For instance, the OP IE supported a variety of different policy instruments, whereas ROP Mazowieckie and ROP Podkarpackie are exclusively focused on infrastructure investments for research, and the OP Infra & Env on infrastructure for education.

The OP Innovative Economy included a large portfolio of measures addressing multiple priorities, going beyond RTD activities and infrastructures support and intended to comprehensively support innovation, industrial modernisation, science-industry cooperation, entrepreneurship, and internationalisation of the economy. Dedicated instruments were implemented for each of the identified barriers, including: private sector's propensity to invest in industrial R&D; the need to increase science-industry cooperation and cluster initiatives; scientific research focused on industrially applicable topics; overhaul and improvements of infrastructural bases for science and industry; increasing the availability of equity instruments and entrepreneurship support; and promoting internationalisation of Polish companies. The OP Infrastructure and Environment aimed at increasing number of students in priority fields of study and improving the quality of education through the use of ICT by providing support for modernising higher education institutions infrastructure. The major projects were identified based on the analysis of RTD and higher education infrastructure needs, offering investments in the key academic centres in Warsaw, Gdańsk, Poznań, Wrocław, and Katowice.

The main thematic foci of the ERDF support are found to be in line with national priorities and needs. This is illustrated by the strong levels of support provided to engineering and technology, as well as life sciences (e.g.  Medical and Health Sciences). More than half of the RTD funding was concentrated on applied/industrial research, while experimental development activities accounted for a relatively small share (5.6%).

Despite the existence of a significant, intentional, and relevant thematic focus of ERDF on a select number of fields and themes, the geographical targeting of the ERDF investments is more limited. The analysis of the selected policy tools showed that ERDF investments were not necessarily guided by geographical targets, or the intention to support specific regions over others. As a result, projects were mostly selected on the basis of their research and innovation merit, leading to a concentration of support in leading centres and universities where the country’s strongest regional research ecosystems already existed. Overall the concentration of RTD investments reflects the existing regional scientific research base and economic potential. The RTD investments in Mazowieckie, Malopolskie, and Wielkopolskie accounted for approximately €1.7 billion which represented more than half of total RTD investments in the country.

## 4.3. Efficiency

The evaluation shows that the volume of financial support provided by the ERDF to support RTD activities and infrastructures was sufficiently high in order to 'move the needle' for the country's research system. RTD was not only one of the fields which benefitted the most from the ERDF support (i.e. the data analysis at the MS-level shows RTD investments in Poland accounted for more than €3 billion representing more than 21% of the total ERDF contribution); but ERDF RTD investments were also very significant in comparison to the existing national and regional policies and programmes in support of RTD. Yet, while the level of funding was sufficiently concentrated to make a perceptible difference in the overall level of quality of the national research and higher education system; this was not found to be the case when it came to supporting the development of a more vibrant and innovative private sector. Investments were overwhelmingly focused on supporting infrastructure in research and higher education organisations, where the focus on enhancing collaboration with the private sector (in light of generating positive innovation spill-overs) was either overseen or did not materialise as expected.

## 4.4. Sustainability and replicability

Sustainability refers to continuation or follow-up of the activities and results developed in the project. In the context of RTD policy, this often times includes valorisation of the results and outcomes. Replicability on the other hand, is the potential for the application of the project results or elements such as methods and tools developed, in other regions or in other areas of activity.

The case study found that in the case of **collaborative R&D,** the dimensions of sustainability can be described at three levels:

- The sustainability of the results of the collaborative research projects themselves was limited. As previously mentioned, not many of the research results were translated into commercial applications, or gave way to the introduction of new or considerable improved products or services. This lack of sustainability was mainly derived from the lack of interest and resources on behalf of the private sector to take up the results of the research projects, and further develop them into tangible innovations.
- The sustainability of the newly develop research partnerships also appears to have been short spanned. Not many follow-up orders for contract R&D or joint R&D initiatives were pursued after completion of projects, and there were no reported cases of subsequent collaborations among the project partners after the end of the supported projects. In some cases, the experience of participating in the ERDF-supported projects may have even dissuaded industrial partners from engaging in subsequent projects of a similar nature.
- The sustainability of the observed capacity and behavioural effects among the beneficiary community has been ensured. The policy instrument stimulated important learning processes among scientific and industrial stakeholders and played key role in the transformation of Polish innovation system. Many of these

increased capacities are reported to have played an important role in the implementation of subsequent support measures under the current programming period (i.e. 2014-2020).

The funding mechanism designed to increase the likelihood of generating project proposals corresponding to the actual needs of enterprises can be transferable to other regions. It is worth remembering that collaborative R&D depends on high levels of government support over long periods of time, as well as the presence of advanced research centres and knowledge-based businesses and entrepreneurial culture. It is most likely that only the more advanced regions will have capacity to launch and sustain such policy instruments in the long term.

The OP Infra & Env has adopted a relatively narrow focus on new or modernised **HE infrastructure investments** and directly related equipment. It is widely recognised that public financial resources are needed for these sizeable infrastructure investments. Financial sustainability of the supported infrastructure is not threatened in the short term. However, as is the case for the WCAT major project, further financial and operational sustainability could be enhanced through the diversification of sources of revenue (e.g. through the provision of contract research services).

The present CS found that the OP Infra & Env intervention stimulated the chain reaction in HE system: new infrastructure – new teaching and research opportunities – higher quality of education and research – stronger competitive position on the EU market. In terms of transferability, this policy instrument offers an interesting example of the types of synergies which can and should be developed other OPs in light of reaching common goals.

When planning the **WCAT** 47% of the operational costs was expected to be provided by the WCAT members of the consortium, and 38% of costs would be covered from research projects. The remaining 15% would be generated by research projects carried out in co-operation with the industry. Currently, half of the costs is covered by a single entity, namely Adam Mickiewicz University, 20% through the institutional funding, and 15% from provision of R&D services and access to research infrastructure each. The revenues generated from commercialisation do not cover operational costs of this type of investments and the public financial resources are required; however, there is clearly a potential for intensifying the co-operation with industry in the case of WCAT.

Particularly, the experience of WCAT provide valuable lessons for the creation and management of large multidisciplinary research centre in high-tech domains. While it might be still too early to evaluate full intermediate effects and impacts, the WCAT represents also an interesting case in terms of fostering collaboration with the industry. The WCAT's design inspired by the Fraunhofer Society can be a model for other research projects in Poland and elsewhere in Europe when it comes to guaranteeing the necessary stability for continuous development of such complex and large-scale investment. The research infrastructure investments are particularly relevant in regions with the necessary research potential, the knowledge-based business, entrepreneurial culture and capability to make long-term financial commitment.

## 4.5. Coherence

Complementary interventions were planned in different national OPs (OP Infrastructure and Environment: infrastructure for higher education; OP Development of Eastern Poland: provided additional funding for investments related to RTD infrastructure in the selected low-income regions of the country, bordering the external frontiers of the EU) as well as regional OPs for 16 Polish regions. The OP Innovative Economy was intended to be the core support programme for activities directly related to RTD activities and research infrastructure as opposed to infrastructures implemented to support education. In the programming documents the list of synergies was rather broadly defined and there was a lack more detailed information about the foreseen complementarities and synergies. To eliminate the possible overlapping of interventions the Managing Authority developed and implemented document establishing a demarcation line between the OPs. The criteria set out in this document were mainly based on the territorial scope of activities, project values, type of beneficiary, etc. There were no formal mechanisms or procedures to ensure coordination and complementarity between national and regional programmes. In practice, experts reviewing proposals were expected among others to evaluate the novelty of proposed infrastructures, analysing regionally available infrastructures financed from other sources. There were also no direct mechanisms put in place to ensure synergies with FP7 / H2020.

The RTD investments are found to be coherent in general, even though there was clearly a scope for further maximising the synergies and complementarities. This said, in the case of the infrastructure for higher education instrument, the complementarities between the OP supporting this instrument, and other ERDF OPs, was found to be one of the drivers of success of the instrument.

## 4.6. EU added value

National and regional budgets were considered not sufficient to offer financing for sizeable RTD investments and related infrastructure. The use of EU funding was planned to function as a trigger for a transformation of the higher education system, but also in wider context economy and the Polish innovation system. It is most likely that that the investments would not have been undertaken without the EU support or at least the intensity of investment would be much lower due to budgetary limitations. The case study found that there is also a clear EU added value in relation to the selected policy instruments / major project.

The evaluation did not find that the ERDF support for RTD activities and infrastructure genereated significant EU-wide effects; or led to an increase in the levels of cooperation between regions and Members States in the EU. This said, infrastructure investments are foudn to have considerably increased the appeal of the Polish research and highe educations system, leading to increased levels of collaboration with EU counterparts, as well as an influx of foreign students.

# Annexes

## ANNEX I. OVERVIEW OF EVIDENCE COLLECTED ON EXPECTED EFFECTS OF THE COLLABORATIVE R&D INSTRUMENT

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| **Outputs** | Grant applications | No | The managing authority received a very high levelof grant applications and selection rates were low. | TO A FULL EXTENT |
| | Collaborative R&D projects launched and implemented & funding is disbursed | Yes<br><br>200 collaborative projects to be funded | Altogether, 192 projects were funded (MRR, 2017), which is slightly below the intended goal of 200 projects (MRR, 2012, p. 192). | TO A FULL EXTENT |
| **Immediate outcomes** | Collaborative research leads to intended (commercially/industrially relevant and applicable) results (i.e. new product / process) | Yes<br><br>185 R&D project results to be implemented | All projects concluded with new product and process development albeit not always successfully commercialised / implemented. The commercial / industrial relevance of these results appears to be in many cases limited. The target was to have 185 results implemented (MRR, 2012, p. 192), but as of 2020, it is difficult to confirm that the target has indeed been met. The the commercialisation/implementation was interpreted broadly. For example, in order to comply with the target of 185 implemented results, beneficiaries were allowed to openly disseminate results and make them freely available to all interested companies. | TO A LIMITED EXTENT |
| | Intellectual property stemming from projects is protected and made available / disseminated to industrial partners | Yes<br><br>205 patent applications to be filed based on project results | Patent applications were indeed submitted by project participants. Patent protection was usually only limited to the Polish market, with no funding allocated for international protection. For many projects, ownership of intellectual property was made available to industrial partners in return for their contributed co-funding, but these companies were frequently uninterested in maintaining/extending the patent protection. The majority of these patent applications were however submitted by single applicants, and the occurrence of science-industry applications was marginal.<br><br>However, beneficiary reserach organisaations were not always in a position to commercialise R&D results due to limited financial resources and a lack of marketing skills (Re-Source, 2014, p. 4). | TO AN IMPORTANT EXTENT |

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| | Improved knowledge of partner organisations and increased ability of applicant and beneficiary partners to cooperate | No | Project beneficiaries were able to acquire knowledge, and discover new interesting technological topics both during the grant preparation phase as well as well as during implementation. Many scientific partners had no expertise in industrial collaboration and used collaborative R&D projects to learn about the needs of their business partners, organisation and decision-making processes within industrial companies, or specific terminology, approaches to promotion, commercialisation and negotiations. Strengthened ability to work with other partners and coordinate innovation efforts was confirmed by interviews, with particularly strong evidence for scientific organisations and more limited occurrence among companies (some of which seemed disillusioned with projects managed by scientific partners and decided to pursue inhouse R&D instead). This was accompanied by an increased understanding of needs of industry and R&D potential of scientific organisations. | TO AN IMPORTANT EXTENT |
| | Uptake of good practices in R&D project management and IPR management | No | Promotion of good R&D management practices are one of the most fundamental outputs of the support measure, influencing future activities of both scientific and industrial beneficiaries. Interviewees from scientific and industrial organisations confirmed the important role of Measure 1.3.1 in promoting good practices and establishing organisational standards for R&D project management and intellectual property management. The policy instrument required the use of the use of certain planning and reporting requirements by the beneficiaries, i.e. requiring to carefully plan the R&D project activities, deliverables and costs, alongside the development of dedicated legal documents such as consortium and technology transfer agreements. This was confirmed by the mid-term evaluation of the instrument (Re-Source, 2014, p. 6). | TO AN IMPORTANT EXTENT |
| | Access to new ideas and competences | No | Supported science-industry projects provided access to new ideas and competences. They also acted as “eye openers” for many companies, which gained access to new ideas and became aware of new technologies, while scientists were also able to explore the needs of business partners and develop skills needed for industrially oriented, applied R&D. | TO AN IMPORTANT EXTENT |
| | Training of young scientists with more applied research skills | No | Interviewees from scientific organisations confirmed the importance of Measure 1.3.1 funding with regards to involving a young generation of scientists in industrially applicable R&D. The intention to involve young researchers was taken into account in the evaluation of project proposals, so most | TO AN IMPORTANT EXTENT |

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| | | | beneficiaries foresaw the hiring of master and doctoral students, young graduates or postdocs. Many of these researchers participated in 2020 in the interviews for this report, outlining their career progress following the initial involvement in collaborative R&D project. | |
| **Intermediate outcomes** | New product and process development finalisation in user-specific context | No | A mid-term evaluation of the instrument commissioned in 2013 indicated that scientific organisations usually initiated R&D projects in response to articulated needs of potential business partners, but these companies were not always interested in acquiring the R&D results. Many R&D results were not implemented in practice after their development, although some instances where this did happen were identified. A mid-term evaluation of the instrument commissioned in 2013 indicated that scientific organisations usually initiated R&D projects in response to articulated needs of potential business partners, but these companies were not always interested in acquiring the R&D results. Scientific partners reported limited interests of industry, changes of strategies of their consortium partners rendering the R&D results useless, or limitations related to insufficient Technology Readiness Levels coupled with lack of funding to continue the technology development. | TO A LIMITED EXTENT |
| | New products and processes implemented in practice | No | As of 2013, R&D results had been successfully implemented by companies in only four cases (Re-Source, 2014, p. 57). Our interviews identified a small number of cases where this happened. | TO A LIMITED EXTENT |
| | Increased supply of industrially relevant researcher skills | No | Involvement in the supported instruments influenced the career pathways of involved researchers. A number of the young scientists involved in the projects went on to work for the private sector. While discussing broader implications of cross-sectoral R&D collaboration in Poland, one can observe a significant increase in the number of corporate R&D personnel with doctoral degrees, increasing from 1,693 R&D experts in 2013 to 2,056 persons in 2015 and as many as 7,933 in 2017 (Eurostat, 2020). | TO AN IMPORTANT EXTENT |
| | Changing mindsets of scientists and increased willingness to pursue applied / collaborative R&D | No | Based on interviews but also observation of the market, OP IE 1.3.1 played a crucial role in redirecting career pathways of many scientists who started appreciating industrially-oriented R&D and started focusing on applied R&D in their subsequent work. | TO AN IMPORTANT EXTENT |

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| | Enhanced knowledge transfer capacities and mechanisms | No | Already in the mid-term evaluation of the instrument, the capacity development of scientists related to R&D management and research commercialisation was presented as one of the key achievements of the ERDF OP (Re-Source, 2014, p. 6). Technology patenting and the use of contractual regulations to govern intellectual property ownership, transfer and licensing, became widespread due to the implementation of projects. Implementing agencies supported scientific partners (with awareness raising, guidance and training) and scientific organisations establishing internal rules and standards. | TO AN IMPORTANT EXTENT |
| | Increased propensity of industry to pursue open innovation | No | interviews suggested that not many follow-up orders for contract R&D or joint R&D initiatives were pursued by industrial partners after completion of projects supported within Measure 1.3.1 which points to the relatively short term nature of any existing increases in R&D spending on behalf of ERDF beneficiaries. Some evidence collected indicated that industrial partners were less willing to engage in collaborative R&D projects after their involvement in this instrument, and preferred to carry out in-house R&D instead. Between 2006 and 2015, intramural R&D expenditures of all business enterprises in Poland have more than tripled, increasing from €499.9 million (2006) to €1,683.6 million (2015) (Eurostat, 2020). Statistical data on R&D expenditures suggest that in the broader economic context, Polish companies have gradually reduced their funding of R&D performed by scientific organisations. These economy-wide results indicate the decreasing importance of open innovations and cross-sectoral collaboration, contradicting the fundamental premises of Measure 1.3.1. | NO |
| **Final outcomes** | Economic benefits from exploiting commercial results of a collaborative project | No | The outcome related to economic benefits from exploiting commercial results of a joint project by either reserach or industrial partners, was not demonstrable through interviews, which provided only limited examples of direct economic benefits derived from the exploitation of results of the collaborative projects. industrial partners derived only minor economic benefits from the project involvement, with indirect or merely potential benefits identified (Re-Source, 2014, p. 6). | NO |

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| | Improved competitiveness of the industrial partner | No | The very limited economic benefits stemming from collaborative projects implied that the influence on competitiveness of inddustrial partners was also low. The companies were able to familiarize themselves with formal R&D project management approaches, they have also learnt how to prepare and implement colllaborative R&D publicly funded projects. | NO |
| **Impact** | Economic development, competitiveness and innovation capacities of the territory | NO | With regards to impacts, broader economic effects in terms of increased employment, the sales and costs generated as a result of the investment were widely observed in the Polish economy during this period. However, establishing a direct link to specific collaborative R&D projects implemented within Measure 1.3.1 is challenging, particularly in light of the intermediate / final outcomes (or lack of) linked to these impacts. Improvements of competitiveness of local industry did not come as a result of successful commercialisation of R&D results of the projects, but rather of improvements in R&D management, increased interest in pursuit of innovation strategies and enhanced understanding of new technologies and international technological trends, motivating further initiatives (in-house R&D funded from own sources or through non-collaborative grants). | TO A LIMITED EXTENT |

## ANNEX II. OVERVIEW OF EVIDENCE COLLECTED ON EXPECTED EFFECTS OF THE INFRASTRUCTURE FOR HE INSTRUMENT

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| **Outputs** | Educational and research infrastructure built or modernised (classrooms and labs with new equipment, ICT infrastructure etc.) | Yes<br><br>Number of constructed, rebuilt or modernised educational infrastructures/facilities (classrooms and labs with new equipment etc.) - 112 objects<br><br>Including newly built objects - 50 objects<br><br>Number of HEIs implemented integrated ICT infrastructure for education - 10 HEIs | Besides a number of supported projects (59), the direct outputs of the instrument were number of constructed, rebuilt or modernised educational infrastructures/facilities (classrooms and labs with new equipment etc.) (128) and number of HEIs implemented integrated ICT infrastructure for education (57).<br><br>New or rebuilt laboratories - 2,167 (1,085 at universities, 724 at technical universities, 257 medical universities, and 101 in other HEIs) with a total area of 117,363 m². | TO A FULL EXTENT |
| **Immediate outcomes** | Additional supply of training (i.e. places for students) in supported faculties/ priority teaching fields | Yes<br><br>Additional number of places in supported faculties/ priority teaching fields - 2000 places | Monitoring data related to the OP shows that all quantitative indicators were exceeded (some of them significantly): additional number of places in supported faculties/teaching fields – 532% | TO A FULL EXTENT |

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| | Use of new and modernised infrastructure and ICT solutions by teachers and students in the framework of university programmes | Yes<br><br>Number of universities that implemented comprehensive ICT solutions for teaching - 10 HEIs<br><br>Number of students using supported infrastructure - 30000 students<br><br>Number of students in natural sciences and engineering using supported infrastructure - 5000 students<br><br>Number of students using created ICT infrastructure - 15000 students | Monitoring data related to the OP shows that all quantitative indicators were exceeded (some of them significantly): number of universities that implemented comprehensive ICT solutions for teaching – 570%, number of students using supported infrastructure – 425%, number of students in natural sciences and engineering using supported infrastructure – 2,292%, number of students using created ICT infrastructure – 857% (including participating in eLearning courses – 1,467%).<br><br>The frequent use of the new infrastructure and ICT solutions by students attending beneficiary institutions was also documented by ex-post evaluations. One of these indicated that the new infrastructure was used by a significant number of students attending HEIs participating in the programme. Where it was possible to indicate the percentage of students taking advantage of new infrastructure, it was evaluated that 32% of overall number of students and 83% of students of faculties directly supported by the project benefit from new facilities. | TO A FULL EXTENT |
| | Quality of education and training and the effectiveness of education processes at beneficiary institutions is improved | NO | Despite the investment character of implemented projects, the consulted stakeholders confirmed in interviews that infrastructural investments have also contributed to increasing the quality of teaching. The implementation of projects had a great impact on the quality of education, primarily due to the possibility of using modern equipment, laboratories and ICT infrastructure, which directly led to the imporvement in the position of Polish universities in international rankings. | TO A FULL EXTENT |

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| **Intermediate outcomes** | Increased number of post-graduate-level graduates | NO | There was a steady and significant growth trend in student's choices of strategic (supported) faculties starting from the academic year 2008/2009 to 2015/2016, while the total number of students was decreasing in the same period. According to one of these evaluations (cf. EGO 2013) the number of students applying in 2012 was 20% higher as compared to 2009 when general number of students in public universities continued to decrease. The percentage of students studying technical and natural sciences (excluding foreigners) was 19% in 2007 and 21% in 2013. The first projects only started in 2010-2011, and three-fourth of them were complted in 2014-2015. This means that a real assessment is only possible within the next 4-5 years. The most recent data indicates that the value of this indicator continues to increase nationwide since 2014 and reached 28.5% in 2018 (Central Statistical Office).<br><br>Changes in the value of this indicator are influenced by many factors that affect its value and complementary projects implemented by higher education institutions. This said, determining their strength seems to be very difficult. | TO A FULL EXTENT |
| | Skillsets of students and young researchers are strengthened through the use of more modern infrastructure and equipment | NO | NO direct evidence, indirectly confirmed by rising number of PhD students in a relevant period.The policy instrument largely contributed to increasing the potential of universities in providing practical education and training. It also improved the access to research equipment which had consequently a positive impact on the development of skillsets of students (Agrotec 2015). | TO A FULL EXTENT |

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| | Increase attractiveness of local Higher Education sector | NO | In relation to networking potential and in particular improved conditions to attract students and researchers from abroad the number of foreign student on Polish Universities may indicate possible impact. This is confirmed by the evaluation study (Agrotec Polska 2015) which found positive effects of the OP Infra & Env on the participation in various types of co-operation with foreign entities (e.g. student exchanges, study visits of scientists from abroad, engaging foreign promoters in Polish doctoral dissertations, increase in the number of foreign PhD students). According to the latest data, nearly 85,000 foreign students from more than 170 countries world-wide are pursuing their education in Polish HEIs in academic year 2019/2020 (Perspektywy 2020). It is an impressive result, considering that in 2005 there were only 8, 000 foreign students in Poland. It contributes to the internationalisation index of Polish HEIs, which has grown significantly over years from approximately 0.5% in 2005 to 5.63% in 2017. | TO A FULL EXTENT |
| **Final outcomes** | Improved access for the labour market to a larger population of well educated students (in particular PhD students) and young researchers | NO | The available quantitative data and results of interviews carried out do not provide clear evidence on impacts, or even some indications of observed changes and the extent to which they can be attributed to the support provided within the OP Infra & Env. | UNKNOWN |
| | Filling skills gaps in the labour market, increasing employment rates and shortening time to entry into labour market for graduates | NO | The available quantitative data and results of interviews carried out do not provide clear evidence on impacts, or even some indications of observed changes and the extent to which they can be attributed to the support provided within the OP Infra & Env. | UNKNOWN |

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| **Impacts** | New technologies, innovation, competitiveness, economic development, and achieving the broader society impacts | NO | Impact on innovation activities resulting from the WCAT seems to be slowly emerging and is likely to increase in the coming years given the innovation potential of the region. The WCAT has a significant role to play in Poznań's future economic and social development.<br><br>Analysis of change in turnover of which are frequently collaborating with the WCAT on the basis of economic database (ORBIS) shows some positive developments. | NO |

## ANNEX III. Overview of evidence collected on expected effects of WCAT (major project)

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| **Outputs** | Laboratories constructed within the project | Yes<br><br>Total surface area of constructed research facilities 19.635,0 m2 | The direct outputs of the project were the construction of laboratories and purchasing of the research equipment.<br><br>Outputs had been achieved according to initial plans. As such, no major deviation from the ToC has been identified. This said, it was acknowledged that there have been some delays in the launch of the Animal Facility which was only officially inaugurated in December 2018. | TO A FULL EXTENT |
| | Purchased research equipment | Yes<br><br>225 scientific research equipment | As above | TO A FULL EXTENT |
| **Immediate outcomes** | Laboratories used by scientific personnel and students working towards master or doctoral degrees | Yes<br><br>300 scientists and 100 students by 2020 | in 2019 305 scientists and 200 students which represent 102% and 200% of the original targets | TO A FULL EXTENT |
| | Research projects executed using the supported infrastructure | Yes<br><br>25 projects by 2020 | in 2019 53 projects which represents 212% of the original target<br><br>R&D projects overly focused on basic research | TO A FULL EXTENT |
| | Establishing cooperation with companies and adjustment of supply to industry needs | Yes<br><br>35 companies using the WCAT research infrastructure by 2020 | in 2019 121 companies used the services provided by laboratories located at the WCAT which represents 346% of the original target<br><br>A significant number of low budget services provided to enterprises | TO SOME EXTENT |

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| **Intermediate outcomes** | Closer cooperation with foreign scientific research organisations | Yes<br><br>20 international R&D projects by 2020 | in 2019 12 international research projects carried out with use of the supported infrastructure which represents 60% of the original target<br><br>Analysis of Horizon 2020 projects | TO SOME EXTENT |
| | New scientific knowledge and outputs (publications, patents) | 150-200 publications by 2023<br><br>30 - 80 patent applications and 15 - 30 granted patents by 2023 | in 2019 240 publications prepared within projects using the research infrastructure of WCAT which represents 160% of the original target<br><br>in 2019 13 EPO applications and 11 obtained patents as results of projects undertaken with use of the supported infrastructure, which represent 43.3% and 73.3% of the original targets respectively<br><br>Analysis of publications WCAT 2017-2019 | TO SOME EXTENT |
| | Innovations introduced in companies thanks to their cooperation with WCAT | 30 - 50 innovation introduced in companies by 2023 | 30-50 planned in 2023 | NO |
| **Final outcomes** | Research potential is strengthened, allowing the WCAT to compete on the European and global markets of research and development | NO | The WCAT plays a significant role in linking the scientific research institutions. The consulted stakeholders pointed to some challenges in undertaking collaborations with the regional scientific community, and emphasised that the WCAT brings the best specialists in the fields of natural and engineering sciences working with the key institutions of the region, in the country and in collaboration with other European countries. | NO |
| | New opportunities created for further development of scientific R&D activities | NO | The interviews pointed out to future potential positive spill-overs which are likely to contribute to the strengthening of the scientific research potential. The existing evidence also indicates that there is a scope for undertaking additional research projects. | NO |

| Effect type | Expected effect | Targets defined by MA | Summary of evidence collected | Level of achievement of threshold |
|---|---|---|---|---|
| **Impacts** | New technologies, innovation, competitiveness, economic development, and achieving the broader society impacts | NO | Impact on innovation activities resulting from the WCAT seems to be slowly emerging and is likely to increase in the coming years given the innovation potential of the region. The WCAT has a significant role to play in Poznań's future economic and social development.<br><br>Analysis of change in turnover of which are frequently collaborating with the WCAT on the basis of economic database (ORBIS) shows some positive developments. | NO |

## ANNEX IV. INTERVIEW LIST

| Stakeholder category | Organisation | Role in the organisation | Name |
|---|---|---|---|
| Implementing Authority of support measure OPIE 1.3.1 (collaborative R&D projects) | Information Processing Centre | (Former) Head of Unit overseeing OPIE 1.3.1 implementation | Anna Stańczyk |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | Textile Research Institute, Łódź | Project team member | Dr. Edyta Sulak (accompanied in the interview by other members of the former project team) |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | University of Life Sciences, Lublin | Project team member | Prof. Krzysztof Olszewski |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | Technical University of Łódź | Project leader, Dean of the Faculty of Chemistry | Prof. Małgorzata Szynkowska |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | Warsaw University of Life Sciences | Project leader | Prof. Jan Rozbicki |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | University of Warsaw | Project manager | Jakub Socha |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | Łódź University of Medicine | (Former) project manager | Mikołaj Gurdała |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | Tele and Radio Research Institute, Warsaw | Project leader | Prof. Elżbieta Czerwosz |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | SILCAR Sp. z o.o., Katowice | R&D manager | Iwona Filo |
| Direct beneficiaries of selected instrument (OPIE 1.3.1) | Onco Arendi S.A. | Director, grants and contracts | Marta Borkowska |
| Implementing Authority for the OP Infra & Env | Ministry of Science and Higher Education and National Information Processing Centre | Former Deputy-minister of Ministry of Science and Higher Education and former Director of National Information Processing Centre | Olaf Gajl |
| Direct beneficiaries of OP Infra & Env | University of Warsaw | Director of the UW Development Office – co-ordinator of 2007-2013 ERDF investments at UW | Grzegorz Bochenek |
| Direct beneficiaries of OP Infra & Env | University of Warsaw | Former Deputy Director of CeNT | Robert Dwiliński |

| Stakeholder category | Organisation | Role in the organisation | Name |
|---|---|---|---|
| Direct beneficiaries of OP Infra & Env | Warsaw University of Technology | Former Deputy Chancellor responsible for coordination of investment projects | Mariusz Wielec |
| Direct beneficiaries of OP Infra & Env | University of Gdańsk | Deputy Chancellor responsible for coordination of investment projects, former project leader | Krystyna Czerwińska |
| Direct beneficiaries of OP Infra & Env | Gdańsk University of Technology | Project Leader - Nanotechnology Centre | Łukasz Patek |
| Direct beneficiaries of OP Infra & Env | Silesian Technical University in Gliwice | Project Leader - Scientific-Educational Centre of New Technologies | Ewa Steiman |
| Direct beneficiaries of OP Infra & Env | Jagiellonian University | Dean of Faculty of Chemistry – former Project Leader | Prof. Piotr Kuśtrowski |
| Direct beneficiaries of OP Infra & Env | Adam Mickiewicz University Poznań | Director Intercollegiate Centre NanoBioMedyczne (former Project Leader | Prof. Stefan Jurga |
| Direct beneficiaries of OP Infra & Env | Warsaw Medical University | Chancellor, former Project Leader Expansion and modernisation of the Centre Biostructure | Małgorzata Rejnik |

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