Toward an innovative Poland:

The entrepreneurial discovery process and business needs analysis

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Contents

List of Abbreviations

BA	Business angels
BCC	Business Centre Club
BEEPS	Business Environment and Enterprise Performance Survey
BERD	Business research and development spending
BSI	Business support institutions
BTR	Business and technology roadmap
CEO	Chief executive officer
CFO	Chief financial officer
ChC	Champions Club
CIS	Community Innovation Survey
CNC	Computer numerical control
E2020	Europe 2020
EBRD	European Bank for Reconstruction and Development
EC	European Commission
EDP	Entrepreneurial discovery process
EEN	Enterprise Europe Network
EO	Economic Observatory
EQFM	European Quality Foundation Model
EU	European Union
FDI	Foreign direct investment
GDP	Gross domestic product
GIG	Mining Institute
GUS	National Statistics Office
GVC	Global value chain
HIF	Highly innovative firm
ICT	Information and communication technology
IMF	International Monetary Fund
IPR	Intellectual property rights
IT	Information technology
KET	Key enabling technology
KFK	National Capital Fund

KIS	National Smart Specialization
KPO	Knowledge process outsourcing
KSF	Key success factor
KTP	Knowledge Transfer Partnership
KTT	Knowledge and Technology Transfer
M&E	Monitoring and evaluation
MO	Marshal Office
MoED	Ministry of Economic Development (former Ministry of Economy or the Ministry of Infrastructure and Development)
MoSHE	Ministry of Science and Higher Education
NABS	Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets
NBP	National Bank of Poland
NCBR	National Center for Research and Development
NCN	National Centre for Science
NGO	nongovernmental organization
OECD	Organisation for Economic Co-operation and Development
OP	Operational Program
PARP	Polish Agency for Enterprise Development
PC	Performance contract
PKD	Polish equivalent of the NACE classification
PLN	Polish zloty
PPP	Purchasing power parity
PTG	Priority target group
R&D	Research and development
R&D&I	Research and development and innovation
RC	Regional consultant
RDI	Research and development institution
RGA	Regional Growth Agreement
RIM+	Regional Innovation Monitor Plus
RIS3	Research and innovation strategy for smart specialization
ROI	Return on investment
ROP	Regional Operational Program
RTO	Regional Territorial Observatory

RUR	Register of development services
S3	Smart specialization
SIEG2020	Strategy for Innovative and Efficient Economy
SL	Smart Lab
SMEs	Small and medium-size enterprises
SOOIPP	Association of Organizers of Institutions for Innovation and Entrepreneurship in Poland
STEM	Science, technology, engineering, and math
STP	Science technology park
SWOT	Strengths, weaknesses, opportunities, and threats
TFP	Total factor productivity
ToR	Terms of reference
TTL	Task team leader
TTO	Technology Transfer Office
VC	Venture capital
VCA	Value-chain analysis
WB	World Bank
WG	Working Group

List of Boxes

List of Figures

List of Tables

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The report was completed in December 2015.

Preface

This report presents the findings of a project conducted by the World Bank during 2014–2015 at the request of Poland's Ministry of Economic Development.

The key objective of the project was to help Poland enhance the impact of the more than 10 billion euro that it will invest in innovation by 2020, largely financed by the European Union. Such funding is likely to diminish after 2020. It will therefore be critical for Poland to spend it efficiently, to gradually shift from a growth model based on imitation to a growth model based on innovation and sustain a fast pace of income convergence with the West.

To invest more effectively, Poland needs to better prioritize its innovation spending and focus it on economic activities with the largest innovation potential. The best way to achieve this is to move away from an old-fashioned, top-down, supply-driven, bureaucratic innovation policy that tends to perpetuate the status quo and to adopt a new, bottom-up, demand-driven policy that puts business in the driver's seat of innovation policy making and helps discover new areas of growth.

The World Bank project summarized in this report contributes to this objective by proposing a pioneering approach to engaging the private sector, as well as science, public administration, and civic society, in co-creating innovation policy, selecting priorities for public innovation spending, and adjusting public support instruments to the real needs of Polish enterprises.

The new approach, called the entrepreneurial discovery process (EDP), consists of (i) face-to-face interviews with the top management of mostly small and medium-size enterprises (SMEs), which help to understand the real drivers and constraints to enterprise innovation that are hard to detect through standard surveys; (ii) Smart Labs, which are a series of business-friendly, time-efficient workshops that help assess the innovation potential of a specific economic activity; (iii) innovation maps, which help tease out information about technological trends perceived by the private sector; and (iv) crowdsourcing, online surveys that reach enterprises that usually do not interact with the public sector.

The EDP designed and tested within the project helped produce new, bottom-up, and heretofore often unavailable information about the needs, ambitions, strengths, and potential of the enterprise sector.

For instance, it helped identify companies with large innovation-based growth potential, so-called "champions," which—if properly supported by the public sector—could become national, European, or perhaps even global leaders and key drivers of growth. The Polish "champions" are characterized by above-average revenue growth rates; high expenditure on research and development (R&D); a high percentage of export sales; a large proportion of science, technology, engineering, and math (STEM) employees; and—above all—a specific "growth mind-set" among top management, which considers innovation the key source of their company's competitive advantage. The proposed EDP also helped identify "sleeping beauties," companies that do not yet seem to fully leverage their growth potential and could grow much faster if they were "awakened" through, for instance, improved management practices, better access to "smart" financing, and support for exports. The project also found that many SMEs did not seem to be well networked, were often wary of cooperating with peer companies in the same sector, and seemed to have a low level of social capital, which might be a key barrier for innovation development. Finally, it showed that there was a large scope for improvement in the quality of enterprise support among public institutions.

The report concludes with policy recommendations on how to implement the EDP; use it to validate, modify, or eliminate innovation policy priorities (so-called "smart specializations"); and make it sustainable. It provides ideas on how to build social capital in the private sector, reform business support institutions, and help coordinate national and regional smart specialization policies. Finally, it suggests how to adjust public support instruments to the needs of Polish enterprises, encourage the public sector to be more proactive, and ensure that innovation spending will have a real impact.

Executive Summary

Poland is the European growth champion. Since 1989, it has more than doubled its gross domestic product (GDP) per capita, coming in ahead of all European peers. It was the only EU economy to avoid the 2008–2009 global financial crisis. It has also grown faster than all its global peers, including the so-called Asian Tigers. Quality of life improved in tandem. Poland has never done so well before. It is now entering its new Golden Age.

But past success does not guarantee future success. With only two-thirds of the level of income of the euro zone, Poland is still far from full convergence with the West. Although midterm growth prospects are positive, becoming a fully developed economy will be a challenge: only a few countries in the past have succeeded in doing so, including Japan, Singapore, Taiwan, South Korea, and Ireland. Poland's longer-term growth prospects will depend on its ability to further reform higher education, stem demographic decline, and—above all—enhance innovation.

Poland needs to innovate to invigorate its growth. Outside oil-based economies, there are no countries that have ever become rich without innovation. Poland needs to follow in the footsteps of innovators. It will need to do much more to raise its research and development (R&D) spending and innovation potential. Given the still large difference in labor productivity levels (Poland's GDP per hour amounts to around half that of Germany), Poland should continue to support innovation new to the firm and to the country (technology absorption) by further improving the business climate, access to financing, infrastructure, and availability of skills. However, to raise its current growth rate and fully catch up with the West, Poland will need to start shifting to innovation new to the world, producing original products and services developed by the country's new global champions. This will be a long and difficult process because technological innovation does not yet seem to be a part of Poland's economic DNA.

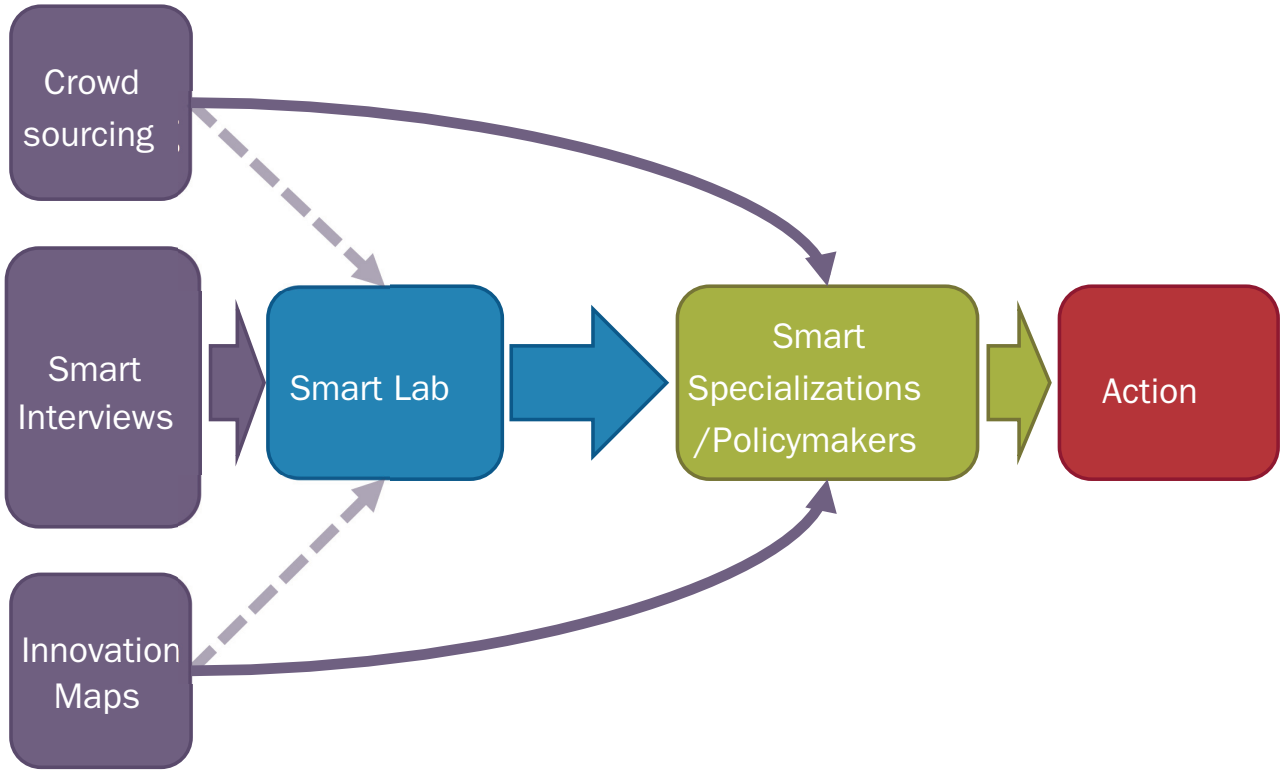
Poland needs to prioritize its innovation spending. In line with the new smart specialization policy promoted by the European Commission (EC), in the new 2014–2020 budget perspective all EU member states are required to focus their innovation support policies on business areas with the largest economic and scientific potential, based on endogenous strengths and comparative advantages. This is a necessary condition to access the innovation-related funding from the EU.

The entrepreneurial discovery process (EDP) is the key part of the new smart specialization framework and research and innovation strategies for smart specialization (RIS3s). The aim of the EDP process is to help countries and regions to identify, validate, and modify priorities for their innovation spending, the so-called "smart specializations," based on a bottom-up process involving the private sector, science, business support institutions, nongovernmental organizations (NGOs), public administration, and society. The EDP process should help the government "listen" to companies to identify new technological trends and new business opportunities and adjust public innovation policies and instruments accordingly. It should thus help the authorities shift from "supply-driven" to "demand-driven" policies. Moreover, the EDP process should help eliminate market and coordination failures, helping the private sector reach a critical mass of innovation-based development. Finally, it should also help create new public goods, such as new coordination, networking, and knowledge-sharing opportunities that will strengthen indigenous entrepreneurial discovery. In the end, the rate of return on public investment in innovation should increase and help spur sustained productivity growth.

The World Bank has helped the government of Poland strengthen the smart specialization process. At the request of the Ministry of Economic Development (MoED), the World Bank has designed and tested an EDP "made in Poland" as an element of the *National Smart Specialization* process (*Krajowa Inteligentna Specjalizacja*, KIS). The three main goals of the Bank project were to: (i) identify and assess Polish enterprises' needs in terms of innovation and development potential and provide recommendations on how to adjust the public support system accordingly, (ii) help meet the EC's ex ante conditionalities to access EU funding in the 2014–2020 budget perspective, and (iii) strengthen the capacity of the public administration and selected business support institutions (BSIs) to ensure EDP continuity after termination of the project by the end of 2015. The EDP process is part of the government's Action Plan to meet the EU ex ante conditionality.

The proposed EDP process comprises several components. It includes: (i) in-depth interviews with top management of innovation-oriented small and medium-size enterprises (SMEs) selected from within 10 national smart specializations, conducted by seasoned experts; (ii) "Smart Labs," focus groups featuring companies with high growth potential ("champions") selected through interviews, representatives of science and research and development institutions (RDIs), business support institutions, and public administration, which aim to "discover" a business area and prove its innovation and growth potential; (iii) crowdsourcing, a new platform of public–private innovation dialogue; and (iv) innovation maps, a new way to collect and analyze data from the private sector's R&D and innovation grant applications to identify emerging areas of business and technological strengths (Figure 1).

Figure 1. Proposed elements of the EDP process "made in Poland"



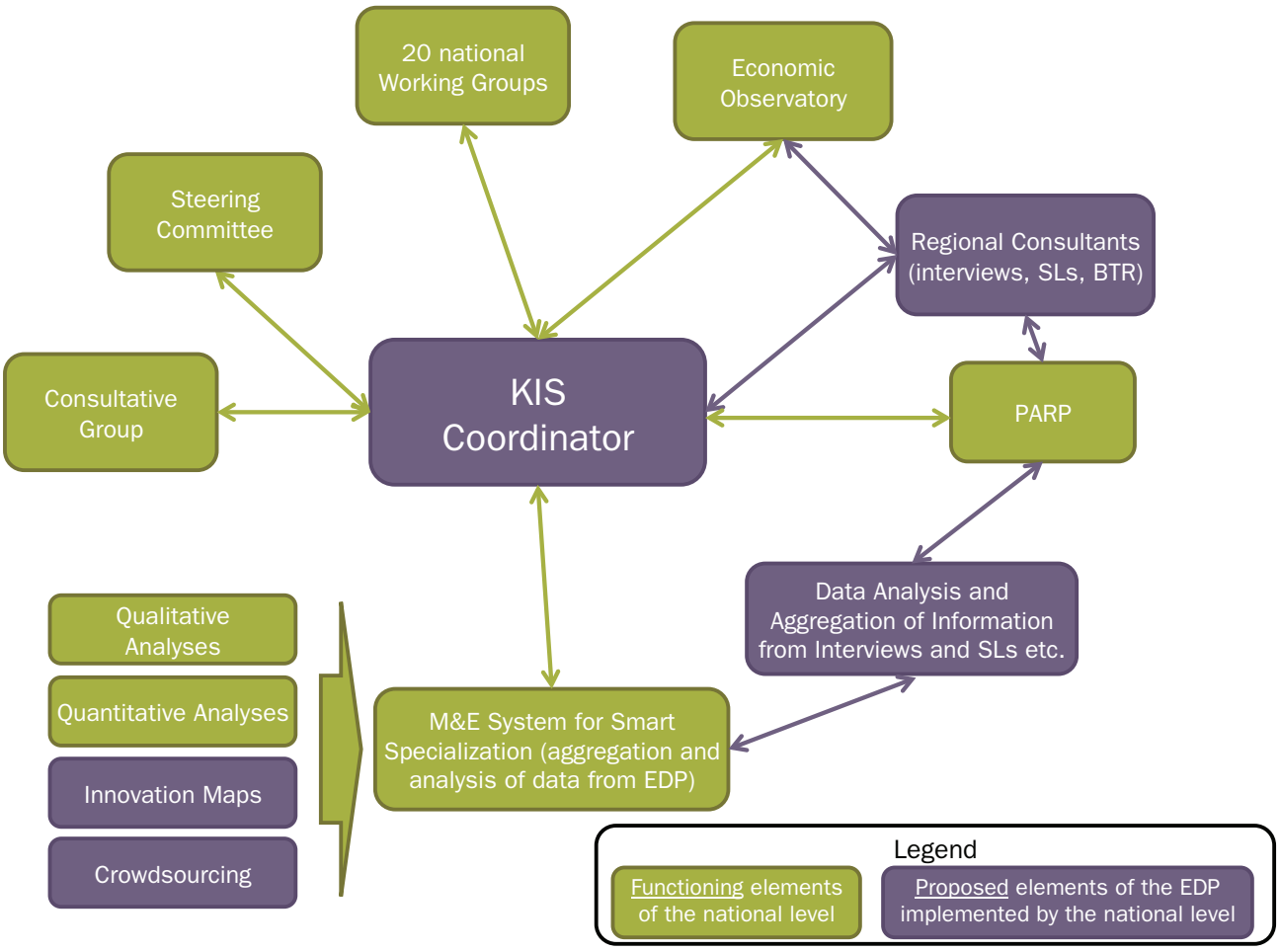
Source: The World Bank.

The proposed EDP has been tested thoroughly. As part of the project, the Bank conducted more than 630 face-to-face interviews with firms in five regions, four of which were chosen by the MoED (Dolnoslaskie, Zachodniopomorskie, Swietokrzyskie, and Slaskie) and one (Lubuskie) that volunteered to join the project in July 2015. Bank experts conducted more than 500 of these interviews, and regional consultants selected by the Bank and working under its supervision conducted an additional 130 interviews. The Bank also organized a number of Smart Labs (SLs) in each of the four regions and one national-level Smart Lab. It prepared a "business and technology roadmap" (BTR) as an element of the Smart Lab process and a blueprint for how to create public goods for national and regional smart specializations. The Bank collected information from more than 40 companies through crowdsourcing and helped the National Center for Research and Development (NCBR) create a pioneering innovation map based on applications for R&D support submitted by the private sector during 2007–2013 and within the ongoing "fast track" R&D matching grant program. The Bank also organized two Champions Clubs, a new networking and knowledge-sharing platform for the "champion" companies identified through the EDP. To ensure the sustainability of the EDP going forward, the Bank held workshops for BSIs in each of the regions to discuss the parameters of their participation in the EDP and trained more than 40 regional consultants, whom the Polish government will be able to leverage to continue the EDP beyond the Bank's involvement.

The proposed EDP is one of the elements of a national smart specialization policy. In response to the new EU policy and with a view to meeting the ex ante criteria for accessing EU funding, the MoED has developed a system of identifying, modifying, and monitoring national smart specializations as part of the "Program of Enterprise Development." The MoED selected 20 smart specializations that aim to enhance competitiveness and labor productivity growth based on R&D and innovation. The list of smart specializations is expected to be constantly monitored and updated based on the results of the proposed bottom-up EDP process.

The proposed EDP complements the existing national EDP institutional framework. The *National Smart Specialization* (KIS) document designed an institutional framework for management of smart specialization policy at the national level, including a country-level EDP framework. The proposed bottom-up approach contributes additional elements to the EDP system to further enhance its efficiency, quality, and sustainability (see Figure 2).

Figure 2. Envisaged institutional setup of the national EDP



Source: Ministry of Economic Development and the World Bank.

NOTE: BTR = business and technology roadmap; EDP = Entrepreneurial discovery process; M&E = monitoring and evaluation; PARP = Polish Agency for Enterprise Development; SL = Smart Lab.

The proposed EDP, although optional for the regions, can complement each region's own EDP. The regions have taken various approaches to developing the EDP process, depending on the local endowments and decisions of stakeholders. They are also at various stages of development: some EDPs (as in the case of Wielkopolskie) have already been approved by the European Commission, while in other regions the EDPs are still being developed. Most

regional EDPs differ in terms of institutions, processes, and objectives. That said, such heterogeneity can be considered a strength because—provided that there are strong impact and evaluation frameworks—it will allow for testing various approaches to entrepreneurial discovery, learning from one another, and creating optimal EDPs. Although the proposed EDP process is fully optional for the regions, which are autonomous in their decision making, it is meant to complement their efforts by providing alternative methods of conducting the EDP across all the proposed elements.

The EDP provides a new mechanism for coordinating the national innovation policy and for collaboration between the national and regional levels. Poland is one of only a few EU countries that decided to develop both national and regional EDPs, meaning that aside from the national EDP, all 16 voivodships have also developed their own EDPs. As a result, there are now 20 national and 81 regional smart specializations. Given such a large number of smart specializations, their partly overlapping scope, and the diverse institutional setup at the national and regional levels, robust cooperation between the regional and national levels will be key, including thematic, institutional, and process cooperation.

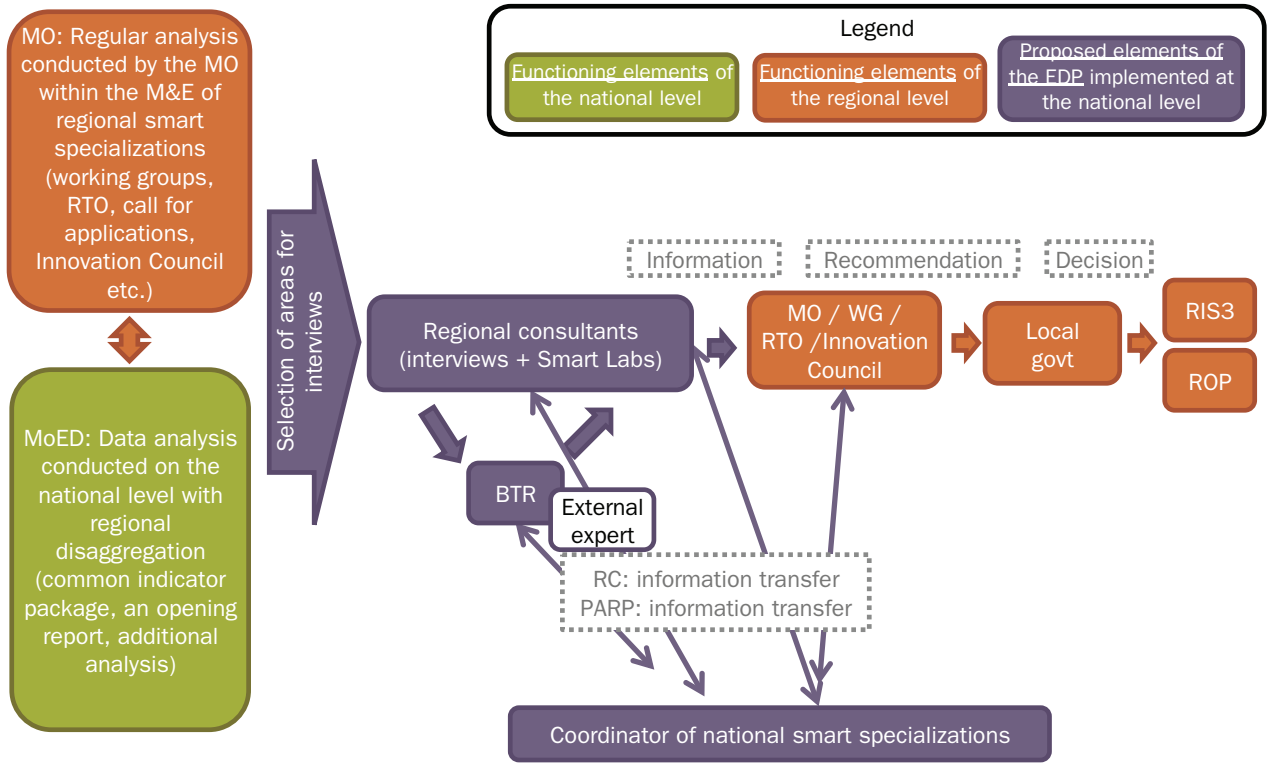
Thematic cooperation should aim at a number of objectives. It should help: (i) identify interregional smart specializations (S3s), (ii) detect synergies between the national and regional S3s, and (iii) allow for modification of smart specializations at the national and regional levels. As to the latter, some national S3s are the same as the regional ones. The proposed EDP will help verify and assess the potential of national S3s and might also provide data useful for regional EDPs. Given the large number of national S3s, it might be useful to consider merging some national specializations that have a similar scope. Finally, new national smart specializations could be identified based on input from regional EDPs and interregional collaboration.

Institutional collaboration requires joint work between the main EDP counterparts. EDPs in Poland function in a diverse set of institutional frameworks on both the regional and the national levels. This means that similar EDP functions are fulfilled by different actors. Therefore, EDP coherence requires a good understanding of these differences and a robust information flow among all stakeholders. The national group for monitoring and evaluating RIS3s, which has already proven to be an effective mechanism of national–regional collaboration, could also become a key platform for EDP cooperation. Interactive and workshop-like group meetings can aim to: (i) efficiently share knowledge gathered through EDPs at the national and regional level, (ii) leverage insights delivered by the regional EDP consultants, and (iii) advise on areas of collaboration in selected smart specializations. This group should have access to data from the National Statistical Office (GUS), tax offices, the National Bank of Poland, the European Commission, academia, and the private sector.

Cooperation related to the EDP process will be especially important. Given that each region has its own unique EDP process with a specific institutional arrangement, it will be important to be flexible in accommodating each EDP and to promote best practices across the country. The modular character of the EDP proposed in this report allows for the comparison of various EDPs in achieving the objectives of the smart specialization policy, enhancing synergies across regions, and exchanging information about the best functioning and most effective EDP solutions. One of the premises of EDP cooperation is that information gathered by national and regional EDPs should be publicly available to enhance knowledge sharing.

Cooperation on EDPs should help regions reach a number of objectives. It should help them to: (i) access national databases for data tailored to their regional needs and share their own data with national authorities; (ii) access otherwise unavailable information on the potential to develop various business areas, including existing and emerging smart specializations; and (iii) in consultation with the MoED, direct the national EDP toward the areas of the largest regional relevance. Figure 3 shows the proposed interaction between the regional (orange) and national (purple and green) EDPs (discussed in more detail in Chapter 4).

Figure 3. National–regional cooperation on EDPs—regional perspective



Source: The World Bank.

NOTE: BTR = business and technology roadmap; M&E = monitoring and evaluation; MO = Marshal Office; MoED = Ministry of Economic Development; PARP = Polish Agency for Enterprise Development; RC = regional consultants; ROP = Regional Operational Program; RTO = Regional Territorial Observatory; SL = Smart Lab; WG = working group.

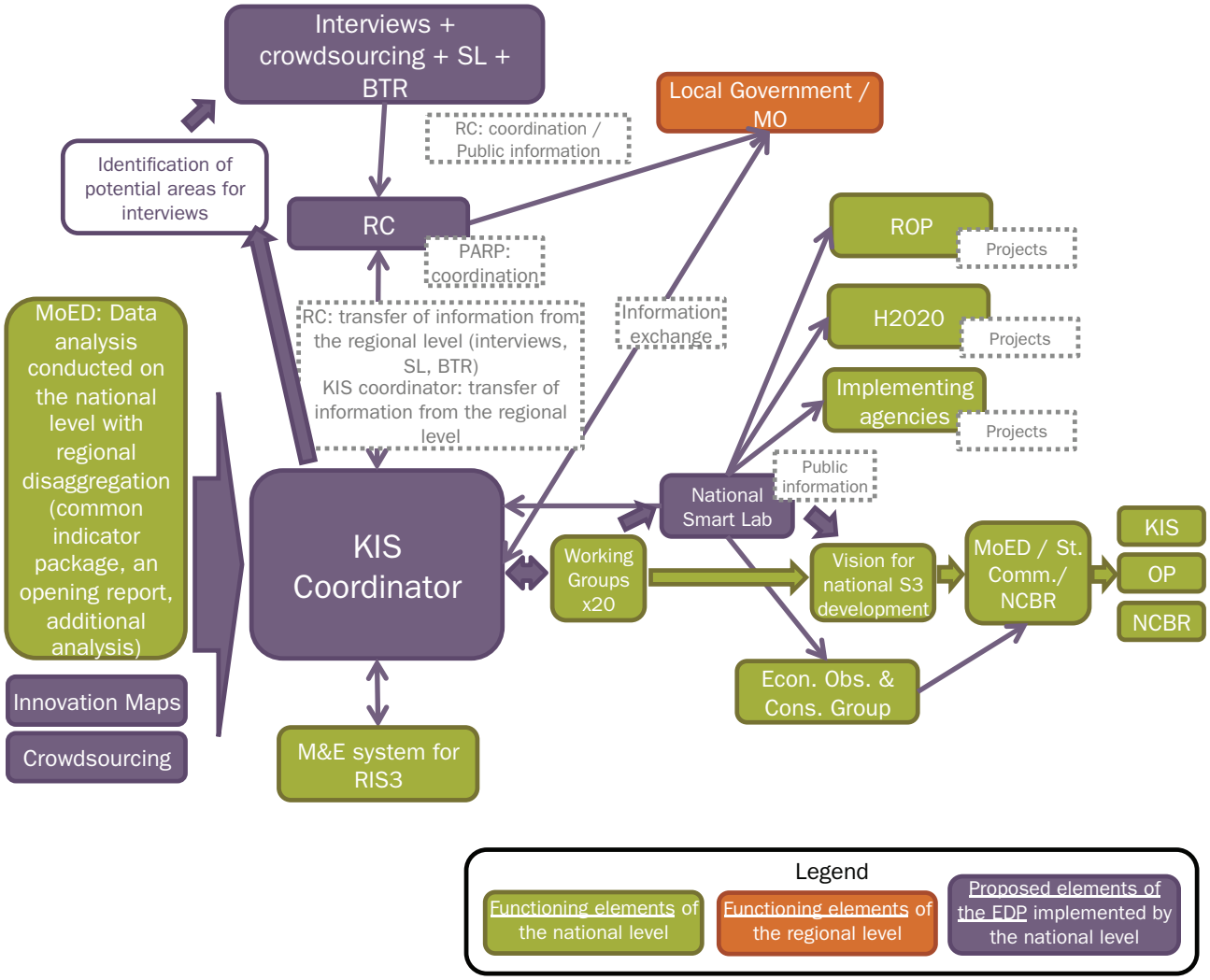
From the national perspective, the suggested EDP cooperation process should: (i) help maintain dialogue with the regions and share their EDP experience, (ii) share results of the national EDP, and (iii) learn from the bottom-up EDPs conducted by the regions. The methodology for research and analysis, company interviews, Smart Labs, and BTRs will serve as an instrument to achieve these objectives. Regional consultants could play a crucial role in national–regional cooperation. Their role would be to conduct the national EDP process in close cooperation with each of the regions (Figure 4).

Smart interviews

Firm-level interviews are at the core of the proposed EDP. Interviews aim to identify key drivers for and constraints on SME innovation, identify the key attributes of companies that could benefit the most from public intervention, and take stock of key business and technological trends, as perceived by the companies. The interviews are conducted by seasoned experts with relevant professional experience. Unlike most surveys conducted by the national statistical office and international institutions, the interviews are conducted face to face with the company's top management and/or owners. They usually take about 2 to 2.5 hours and are based on a questionnaire with quantitative and

qualitative questions. Each interview is summarized in a "one pager" by the interviewing expert. The experts separate the interviewed firms, based on their expert judgment and a number of key innovative attributes, into five categories: "champions," "emerging champions," "sleeping beauties," "steady state," and "declining" (see the definitions in Box 22). At the end of each interview, the firm receives feedback from the expert. Data from each interview are aggregated and analyzed for policy insights.

Figure 4. EDP process cooperation—national perspective



Source: The World Bank.

NOTE: Econ. Obs. & Cons. Group = Economic Observatory and Consultative Group; GIG = Mining Institute; H2020 = Horizon 2020; OP = Operational Program; St. Comm.= Steering Committee. Other abbreviations are the same as in Figure 3.

There are a number of benefits of firm-level interviews. The interviews help:

- Identify differences between national smart specializations in terms of R&D intensity, companies' needs, and firms' focus on innovation as the key driver of competitiveness
- Provide early evidence for verifying/modifying smart specializations
- Identify firms with the most innovation-based growth potential and the greatest need for public support (e.g., "champions" and "sleeping beauties")

- Select priority firms for the Smart Lab part of the EDP and identify endogenous strengths in the economy
- Identify firms' biggest barriers to growth and their most pressing needs, as well as recommend how to adjust the public support system accordingly
- Identify emerging business and technology trends that the public sector can act upon
- Assess the quality of the public support system
- Provide an indirect way of increasing the companies' competitiveness, based on the experts' feedback
- Enhance the proactive attitude of the public sector, give it access to firms that do not normally interact with the public sector and reduce the risks of innovation policy being driven by vested interests

The main findings from the firm-level interviews are the following:

- National smart specializations are different in terms of number of firms with high growth potential, R&D intensity, and company needs; the differences are more pronounced at the level of meta-specializations.
- Firms with the largest innovation-based growth potential ("champions") are characterized by high revenue growth rates, investment in R&D, large export intensity, high proportion of STEM (science, technology, engineering, mathematics) employees, strong growth mind-set of the company's management, and extensive networking with clients, suppliers, and other partners.
- The main barriers for firms' innovation-based development include access to financing, access to new markets, availability of skilled R&D personnel, mental barriers among owners (focused on short-term profits), risk-averse customers, management skills, a low level of networking, and weak support from the public sector.
- The interviews identified a large number of firms with high growth potential: "champions" and "sleeping beauties" that could benefit the most from public support. "Champions" have different needs than "sleeping beauties" and other types of firms. The public sector should adjust support instruments to their needs.
- Most firms are not sufficiently networked, especially internationally. Many firms lack up-to-date and comprehensive knowledge about key business and technology trends in their business area and rarely use the broad range of information available about the market and innovation.
- Most firms are skeptical about cooperation with the public sector. They generally do not cooperate with BSIs and RDIs and appear concerned with the quality of their services. They need more proactive approaches from public-sector stakeholders to build networks and trust.
- Firms are aware of the available public innovation support programs, but lack details on which support instruments to access and how. It would be useful to create a "one-stop shop" for all public support instruments.
- Firms generally share similar innovation drivers and constraints across all smart specializations, suggesting a need for horizontal support policies.

Going forward, interviews could be used in modified ways. Although the interviews provide a tested way to audit companies, based on international good practice and a rigorous and replicable methodology, national and regional authorities can adjust the interview process to their needs. The questionnaire could be shortened to, for instance, focus only on the key barriers to innovation-based growth and require only about an hour-long interview, complemented by additional modules (such as on the quality of management practices) or a deep dive into specific parts of the company's business. Moreover, the interviews could focus more on the strategic feedback from the experts to increase firms' capacity to conduct an innovation process.

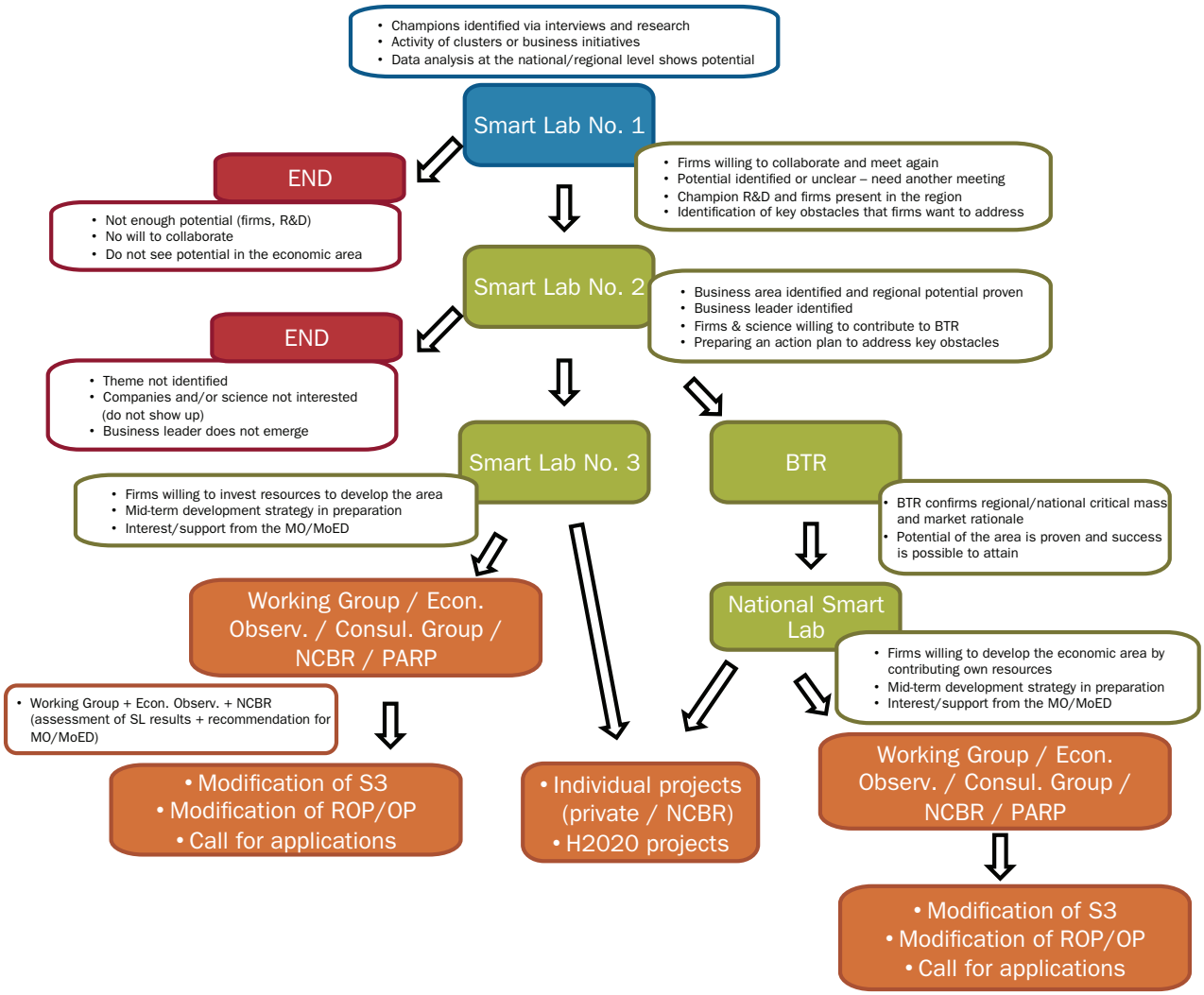
The quality of the interviewing experts and the post interview analysis will be key. Interaction with the top management of a company and the need to provide feedback require that the interviewing experts are credible partners with substantial professional experience and a comprehensive understanding of the public innovation support system. It is also critical to ensure that the information from the interviews is properly analyzed and used in policy making.

Smart Labs

Smart Labs (SLs) are expert groups built around firms in a selected business area. Smart Labs in principle comprise up to 10 "champion" companies selected during the interviews representing an economic area with a perceived endogenous strength (e.g., smart buildings, recycling, or computer numerical control [CNC] machines). SLs also include representatives of RDIs, universities and science entities, BSIs, and local authorities. The SLs have up to 20 participants and follow practices modeled on business focus groups. They are led by an experienced business expert (the World Bank experts led SLs in the initial stage; future SLs should be led by a regional consultant, possibly with help from local business angels and BSI experts) and usually last about four hours.

Smart Labs are a key proposed element of the EDP and smart specialization policy. The main aim of Smart Labs is to help validate, specify in more detail, and/or modify existing smart specializations and identify emerging ones. Smart Labs are designed to quickly test the potential of a business area and prepare a midterm strategy for its development. This is achieved in several steps (see Figure 5). SLs may be organized through regional, interregional, or national initiatives. The whole process should, in principle, take no longer than six months and be repeated for all new areas of interest. At every stage the SL can result in a "by-product" in terms of individual or joint research and development and innovation (R&D&I) project applications to regional EU-funded operational programs (OPs), sectoral OPs (managed by NCBR), national OPs (managed by the Polish Agency for Enterprise Development [PARP]), and the EU-wide Horizon 2020 program.

Figure 5. The proposed Smart Lab process



Source: The World Bank.

The main benefits of Smart Labs:

- They are a fast, flexible, and efficient way to assess the R&D/innovation-based potential of a selected economic area and thus help validate, deepen, or modify existing smart specializations.
- Participation in SLs is driven by a bottom-up process of selecting companies with high growth potential, minimizing the power of vested interests. Thanks to the careful selection of participants, the quality of outputs tends to be high.
- SLs apply a mezzo perspective that concentrates on a business area and not on individual firms.
- The SL process is stage-driven and aims to work like a filter that selects the most promising areas. The process can be halted after each stage.
- SLs are not formally institutionalized to reduce the risk of bureaucratic inertia and mission creep.
- SLs are business-oriented and business-friendly to help sustain interest of the private sector.
- SLs help initiate collaboration between the private sector, public sector, and academia.
- SLs help identify emerging business and technology trends and thus give rise to new smart specializations.
- SLs help generate ideas for R&D and innovation projects to be submitted to regional, national, and international calls for proposals (Horizon 2020).
- SLs help reduce coordination failures among the participating companies, which are too small to promote ideas and technologies on their own.
- Through BTRs, SLs help align the private sector's development vision and investment plans with smart specialization priorities.
- They help identify key growth bottlenecks and adjust public policy accordingly

Smart Labs can provide a useful format for industry-level value-chain analyses. SLs can help identify the elements of the value chain with the highest added value and ways of moving there. This approach was tested during the project. For instance, the nanotechnology Smart Lab in the Slaskie region helped identify the main development challenges for this young sector. Challenges include difficulties with the regulatory process (certification, registration, and security confirmation) and a preponderance of companies that produce component parts rather than final products, where there is more added value. The Smart Lab concluded that there is a need to: (i) concentrate on connecting the nanotechnology industry with other sectors that can use its products and bring them to the final stages of the value chain, (ii) update the regulatory system in line with Western European good practices, and (iii) promote further internationalization of the nanotechnology industry (see Chapter 4 for more details).

The case of Smart Labs on "CNC machines" has proven that a bottom-up EDP is possible. The Smart Lab process was initiated after a number of interviews in the Dolnoslaskie region showed that the area of CNC material processing has significant business and innovation potential. That finding was then discussed and deepened during two regional Smart Labs, which were followed by preparation of a BTR together with a business leader who emerged during the SLs. The subsequent national Smart Lab corroborated the findings of the BTR and the overall potential of the CNC area in Poland, and the national smart specialization working group took over the process. In a final step, the findings of the Smart Lab process helped verify the national smart specialization no. 17 on "automation and robotics of technology processes" and shape its vision of development.

Smart Labs focused on CNC showed that the process can also help meet additional objectives. Aside from its main focus on smart specializations, the Smart Lab process on CNC machines: (i) helped create a new network of firms, scientists, BSIs, and public-sector officials focused on the development of the CNC area; (ii) generated new knowledge among the stakeholders and firms in related industries (through the BTR and other SL results, including a strengths,

weaknesses, opportunities, and threats (SWOT) analysis and key success factors, which will be made public); (iii) helped guide public and private technology and business development strategies; and (iv) is likely to generate new R&D&I projects to be submitted to regional, national, and international innovation programs.

Business and technology roadmaps (BTRs) help verify the potential of selected business areas. A BTR is a short (about 50 pages) business-style document that can be delivered in around three months and at a relatively low cost. Its objective is to: (i) analyze the business and scientific potential of a specific economic activity (for instance "CNC machines," as undertaken in the project) to verify/modify existing smart specializations or identify new ones; (ii) assess the main business and technology trends in a specific economic activity; (iii) describe the main market players in Poland, Europe, and worldwide; and (iv) provide a roadmap of R&D and innovation investment, with corresponding budgets, that could help create a critical mass of innovation-based development for the selected business area. The BTRs should be made public, in order to share knowledge among all Polish market players and guide their investment decisions, as well as to help firms align their development plans with smart specializations. BTRs should be prepared by external experts supported by selected firms and academia, with costs shared between the public and private sectors.

Going forward, SLs can complement working groups at the regional and national levels. The added value of SLs lies in their flexible format, fast turnaround, quick results, and limited life span. As such, they could be a useful instrument to quickly assess the innovation-based development potential of a large number of existing and/or emerging regional and national business areas and provide timely input into the existing EDPs at the regional and national levels. Unlike the working groups, SLs are not meant to become permanent institutions, unless the participants decide to transform them into cooperation networks, clusters, or knowledge-sharing platforms.

High-quality participants, experts, and immediate feedback are key. SLs are likely to be successful only if they feature participants (entrepreneurs and scientists) who rise high above the industry average. They should be moderated by experienced professionals who carry credibility among the private-sector participants. Finally, all participants, and especially the private sector, expect timely and productive feedback after each of the SLs, in the form of meeting summaries, clear action plans, and a vision of how the SL can provide added value going forward.

Innovation maps

There has been little effort so far to analyze data from the private sector's R&D and innovation-oriented grant applications, both at the national and regional levels. Public-sector institutions at the national and regional levels have collected thousands of applications for R&D support from the private sector since the EU accession in 2004. Yet, even though such applications provide excellent bottom-up information about the new emerging business and technology trends perceived by the private sector, there has been no systemic effort to leverage the data to inform public innovation policy and complement other analyses, including foresight exercises. Given that each grant application requires the applying firm to co-finance the project, the information in the applications is likely to be more credible than the firms' official declarations (firms are "putting money where their mouth is").

Innovation maps help uncover critical bottom-up information embedded in firms' R&D applications for public support. The idea of an innovation map is to collect and analyze data from thousands of grant applications submitted annually to national and regional innovation support institutions. For instance, NCBR accepts more than 1,500 grant applications per year. From 2007 to 2013, as part of the "Innovative Economy Operational Program," NCBR collected more than 13,000 grant applications across all of its support programs. The objective of the data analysis is to create "innovation maps" built along a business/technology matrix, combining the business area of a grant application (Organisation for Economic Co-operation and Development [OECD] classification) with the technological classification (NABS 2007), to identify business and technology trends and new areas of competitive strengths based on the preferences revealed by the private sector.

Innovation maps have the following benefits:

- They can complement the top-down foresight programs, macro and sectoral data, and innovation surveys with a bottom-up approach.
- They can help verify/modify/create smart specializations selected at the national and regional levels based on the revealed preferences of the private sector and thus help better prioritize public support for innovation and enhance its efficiency.
- They can help monitor business and technology trends in real time, based on an online, standardized, and automated system of submission of enterprise grant applications.
- They can provide credible and granular information: grant submissions are based on the statistical code of a project, not of a firm (where there are many). The data can be analyzed with respect to the status of the applicant (private vs. public sector), whether it has been accepted or rejected, and show the regional distribution of applications around the country.

Innovation maps produced within the project helped identify key priorities for business innovation spending. NCBR, with the support of the Bank, has produced the first set of innovation maps (see Chapter 4) based on more than 1,000 applications received so far within the new, open-ended, "fast track" innovation support program started in April 2015. The innovation maps showed that "health & medicine" (NABS 7) is the key technology that the private sector wants to invest in; "electronics and IT engineering" is in turn the key business area of declared investment (OECD 2.2), followed by "mechanical engineering" and "material engineering." The maps also showed that most applications were received from the Mazowieckie and Slaskie regions.

Going forward, innovation maps should become a default option for all innovation support institutions. Following the NCBR's example, which has now decided to use innovation maps in all of its application processes, other public support institutions at the national level, such as PARP or the Ministry of Economic Development, and at the regional level (ROP/RIS3 units in each of the regions) could produce their own innovation maps to support policy making. Innovation maps should ideally aggregate data from a number of support programs to reach a critical mass of information. Given the small administrative and technical effort required, there are no obvious barriers preventing innovation maps from being used universally around the country. The resulting innovation maps should also be available to the public (posted on the respective websites) to help guide the developmental visions of the private sector. The Ministry of Economic Development could, for instance, aggregate standardized data from all support institutions and produce a comprehensive national innovation map.

Crowdsourcing

Crowdsourcing is a new platform to directly engage SMEs in innovation policy making. Crowdsourcing allows authorities to reach out to a large number of SMEs that cannot be directly engaged through the limited number of interviews and Smart Labs. It is modeled on international benchmarks, such as the U.S. Open Government initiative, and a review of the literature, but adjusted to the specific conditions in Poland. Crowdsourcing is meant to be a cost-effective, flexible, and fast way to establish a systematic dialogue between the private and the public sectors. It aims to seek the private sector's feedback on, for instance, priority areas for policy intervention, barriers to innovation-based growth, emerging business and technological trends, or the efficiency of public support policy, on an ongoing basis. Crowdsourcing can also be used to help identify firms that could later be interviewed within the EDP and invited to Smart Labs. Crowdsourcing thus complements the other elements of the EDP process.

Analysis of data received through crowdsourcing is largely in line with the analysis produced through firm interviews. More than 70 percent of the respondents in the Bank-administered firm survey believed that the application

process for innovation public support was too long and too complicated, which is consistent with the information gained in the interviews. The quantitative data also seemed to match the data set collected during firm interviews. The most important constraints for SMEs included access to financing, legislation, and availability of hard and soft skills. The crowdsourced companies relied on internal company resources, customers, and the Internet to foster innovation.

Going forward, proper incentives for firms to participate in crowdsourcing and commitment from the public sector will be key. So far, the public sector has used surveys to reach out to companies on an ad hoc basis; only a few companies have been exposed to the public sector's surveys, if at all. As a result, both a low level of trust and a low level of dialogue have been established. To change this, it will be important for the public sector to start using online surveys on a regular basis and thus create a new cultural norm. To make it work, firms will need incentives to participate in the surveys. These could include, for instance, information on how the participating companies compare with their industry peers or access to technology/business newsletters from the BSIs. Many firms did not fill out the survey because they believed it would not have any impact. Changing this perception is therefore crucial. Making crowdsourcing successful will likely be a slow process, but it needs to start now.

Conclusions and recommendations

The proposed EDP, "made in Poland," appears to meet the project's main objectives:

- It offers a new way to conduct innovation policy based on a bottom-up process of entrepreneurial discovery, which helps to monitor/validate/modify and/or eliminate existing smart specializations. The proposed EDP engages the whole set of stakeholders and puts companies at the very center of innovation policy.
- It helps identify new smart specializations by collecting and analyzing firm-level data about emerging technological and business trends and areas with innovation-based growth potential.
- It helps distinguish enterprises' deeper needs and their innovation potential, and it proposes how to adjust public-sector support instruments accordingly.
- It helps reinforce linkages between regional, interregional, and national smart specialization policies.
- It helps ensure the sustainability of the EDP process going forward.
- It is likely to be in line with the ex ante conditionality of the European Commission (subject to the independent decision of the EC).

Responses to the project objectives

Detailed project objectives	Report coverage
Matrix of identified business needs/constraints	Chapter 4.1
Proposals on how to engage entrepreneurs in the creation of innovation policy and how to assure their participation in the EDP	Description of each element of the proposed EDP in Chapter 3.
Recommendations about how to implement the outcomes of the project within current EDP at the national level	Chapters 3.4, 4.7, 5
Gap analysis of how BSIs currently respond to private sector's business needs	Chapter 4.6
Recommendations on how to improve the efficiency of BSIs	Chapter 4.6
Proposals to foster the relationship between SMEs and knowledge institutions	Chapters 3.3, 4.1, 4.2, 4.4, 4.6

Source: The World Bank.

The EDP also tries to meet additional objectives. It helps:

- Identify the characteristics of firms with high innovation-based growth potential (for the purposes of the project, called "champions" and "sleeping beauties"; see the definitions in Box 18)
- Introduce a new scoring system to assist in identifying firms with high innovation-based growth potential
- Identify emerging business and technology trends
- Reduce coordination failures in the private sector, where small companies on their own are unable to develop their innovative ideas without cooperating with others
- Access new information from firms that up to now have not taken part in the smart specialization process and have not been leveraging public sector resources
- Generate new R&D&I project ideas from participating stakeholders
- Provide a new platform for enhanced dialogue with the business sector
- Provide a new way for firms to network
- Offer a direct way of increasing the participating firms' innovation capacity by providing interview feedback and follow-up knowledge sharing and training with the BSIs
- Enhance knowledge and technology absorption by producing publicly available industry business and technology roadmaps

The proposed EDP can productively complement regional EDPs. The EDP is not mandatory for any of the regions, which are autonomous in their decision making. There is also no "one-size-fits-all" model to carry out EDP. However, every region is expected to develop a fully functioning EDP that meets the objective of the EC's smart specialization policy. The proposed EDP can help regions achieve this objective by complementing the efforts of the regions that have already developed EDPs and by contributing to the design of EDPs that are still being developed by other regions. The modular framework of the proposed EDP elements should facilitate its adoption.

The EDP can help enhance the efficiency of public innovation policy. It can achieve this in a number of ways. First, as one of the first systemic attempts in Poland to involve the private sector in the development of the country's innovation priorities, it can help find an optimal balance between top-down and bottom-up innovation policy making. Second, it can help concentrate scarce resources, reach a critical mass of investment, and build trust between the private and public sectors along the same vision of innovation-based development. Third, it promises to enhance cooperation, collaboration, and knowledge sharing among all public-sector stakeholders and between the national and regional levels of public administration. Finally, it provides a robust instrument for monitoring and evaluation of the impact of public policies on enterprise innovation.

However, a number of conditions will need to be met for the EDP to function properly. First, a successful EDP will require a significant increase in the capacity of innovation support units at the national and regional levels. Second, it will be critical to improve the efficiency of BSIs, including by increasing their capacity, clarifying objectives, and introducing strong incentives. Third, the EDP will need to be supported by a strong monitoring and evaluation (M&E) system and systemic feedback from and to policy makers. Finally, it will also need an improved business environment, enhanced quality of innovation, and entrepreneurship education, as well as strong leadership across all levels of public administration and in the private sector. Table 1 summarizes the main recommendations.

TABLE 1. Main recommendations

Short term	Medium term
• Implement the proposed elements of the EDP to complement the existing national-level process • Create a well-staffed and well-funded EDP coordination unit at the MoED • Introduce a robust national-regional EDP cooperation system • Hire top-quality consultants to conduct national EDP • Designate a key institutional partner for the national EDP • Develop a standardized blueprint for information sharing for all the regions, for voluntary, but recommended use • Introduce professional investment panels as a default option for all relevant innovation support instruments • Introduce innovation and management practices training programs for innovative SMEs • Adjust public support instruments to the specific needs of enterprises, especially those with high growth potential	• Invest in capacity building of innovation support institutions • Consider reducing the number of national smart specializations, including by merging them where appropriate • Introduce clear guidelines for performance management of business support institutions; consider developing a nationwide ranking • Introduce "open data" across the innovation system: all information collected during the EDP process should be made public by default • Introduce rigorous impact evaluation methods on most innovation support instruments • Expand demand-led innovation: use public procurement to drive innovation, especially among SMEs • Open up to the world: introduce English in calls for proposals, invite international experts • Lead by example: encourage administration to become a leader in the use of technology

Source: The World Bank.

The report is organized into the following sections: *Section 1* introduces the project rationale; *Section 2* provides background on "WHY" Poland needs innovation to grow; *Section 3* focuses on "HOW" innovation can be fostered through the entrepreneurial discovery process; *Section 4* concentrates on "WHAT" the preliminary findings from the survey and Smart Labs sessions are; *Section 5* concludes on "SO WHAT" policy recommendations. The electronic version of the report is available at www.worldbank.org/poland/innovation/edp.

1 Introduction

Despite spectacular economic performance since the beginning of transition in 1989, Poland is a regional laggard in terms of innovation outputs. The levels of total and private R&D spending are below the European average and regional peers. The innovation outputs are also underperforming. The economy's exports are mostly based on low-tech rather than high-tech industries. Poland continues to compete largely on price rather than on the quality of its products and services.

Innovation will be key to help sustain fast growth and catch up with the West for the first time in Poland's history. The question is not whether Poland will stop growing without innovation (it will likely not, at least not any time soon) but whether the growth rate can be further enhanced owing to more innovation. While Poland moves closer to the global technology frontier, the role of innovation and R&D is likely to increase gradually, in line with the experience of more developed countries, where R&D spending and innovation outputs were a key driver of increasing incomes. Expanded technology absorption and more robust frontier innovation could help increase Poland's potential growth rate to closer to 4 percent per year and help sustain rapid income and quality-of-life convergence with Western Europe.

The European Commission adopted a new "smart" innovation framework to maximize the contribution of innovation to economic growth and social welfare. This shall be accomplished by prioritizing public support for innovation to economic activities (defined as "smart specializations") that promise to have the largest developmental potential based on existing competitive advantages and endogenous strengths. Research and innovation strategies for smart specialization (RIS3s) are the main elements of the new innovation framework, and their role is to help identify national and regional economic smart specializations. The European Commission has made the development of RIS3s a key criterion for accessing EU Structural Funds during 2014–2020.[1]

The "entrepreneurial discovery process" (EDP) is a key element of the new smart specialization framework. The aim of the EDP is to help countries and regions identify, validate, and modify smart specializations based on a bottom-up approach involving the private sector, science, business support institutions, NGOs, public administration, and society. The EDP should help maximize public–private entrepreneurial discoveries; provide for systematic observation, detection, and evaluation of new business and technological trends; and encourage firms to share their market and technology knowledge with policy makers. It should also support the early growth of the selected activities, disseminate knowledge to generate more discoveries, and build a critical mass of innovation. Lastly, the EDP should help governments identify new business needs and opportunities and adjust public innovation policies and instruments accordingly.

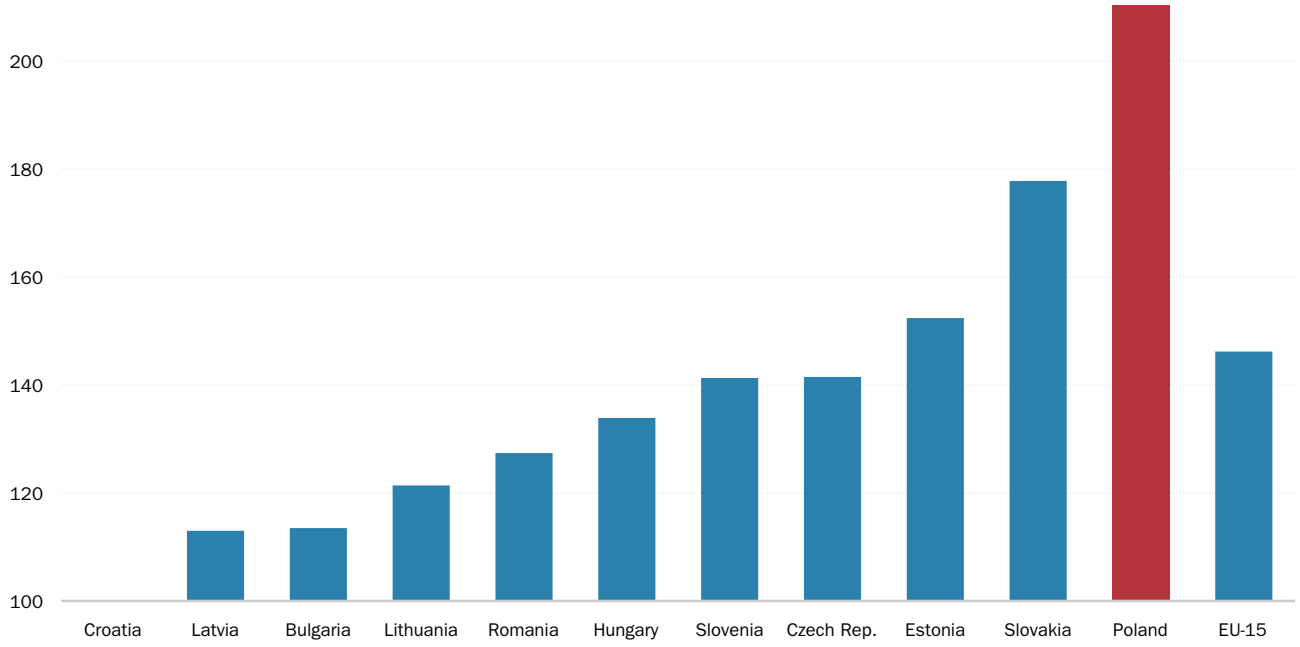
This report summarizes the results of the World Bank project requested by Poland's Ministry of Economic Development to design and test the EDP for Poland. The report presents the findings based on the project's activities undertaken between June 2014 and December 2015, including more than 500 in-depth firm interviews conducted by Bank experts (and an additional 130 conducted by regional consultants working under the Bank's supervision), 20 Smart Lab meetings, four workshops with business support institutions, multiple training workshops for regional consultants, and extensive consultations with the national and regional stakeholders.

[1] European Commission (2011).

2 "WHY"—Why Poland Needs Innovation to Grow

Poland is Europe's growth champion since 1989. It has more than doubled its GDP per capita since the beginning of post-socialist transition, coming ahead of all other new EU member states and the EU-15 (Figure 6). It has also fared well relative to its global peers: since 1995, Poland has grown faster than all large economies at a similar level of development, as reflected in average growth in GDP per capita.[2] Exports have increased more than 25-fold since the beginning of the transition and exceeded $250 billion in 2015. After 23 years of uninterrupted growth from 1992 to 2015, including during the 2008–2009 global financial crisis, when it was the only EU economy not to sink into a recession, Poland is close to beating the historical growth records of South Korea and Japan.

Figure 6. Change in GDP per capita between 1989 and 2014 for Poland, EU-10, and EU-15, 1989 = 100



Source: Author calculations based on EBRD and Eurostat.

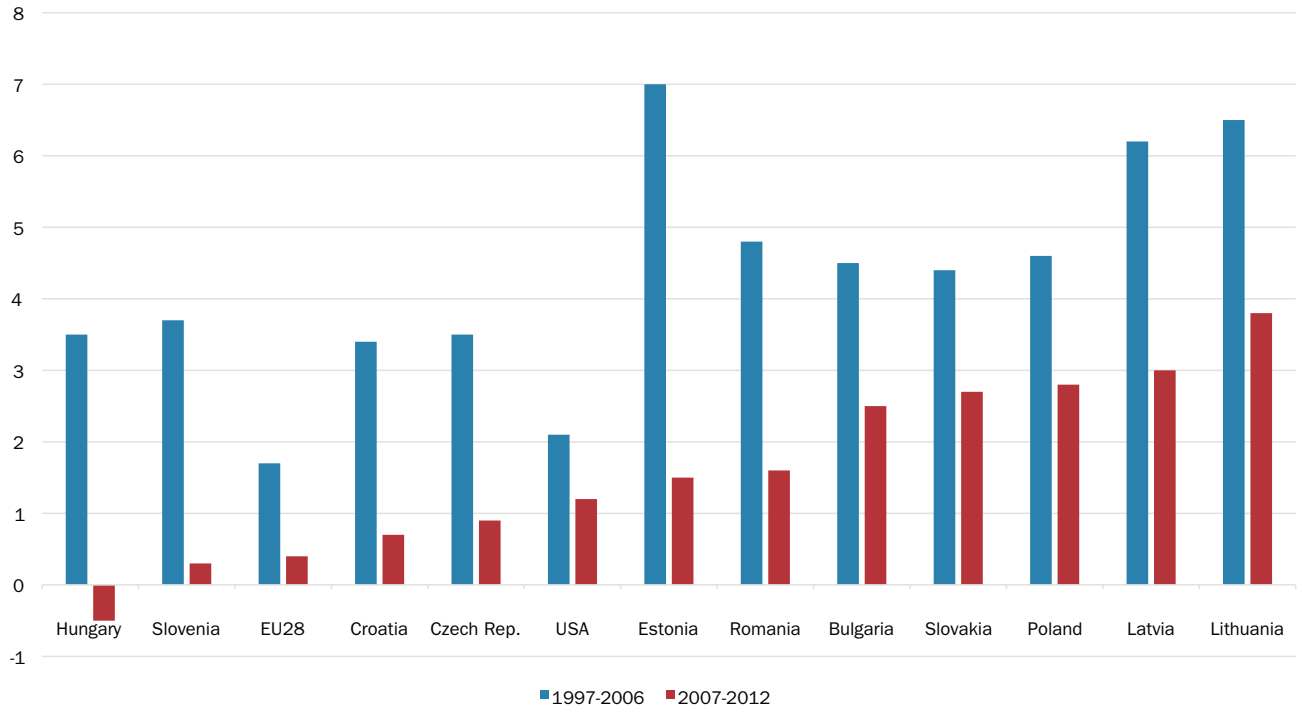
As a result, income levels and quality of life have never been higher. In 2015, the level of income adjusted for purchasing power parity (PPP) per person exceeded $26,000 and reached 66 percent of the level of income in the euro zone, the highest absolute and relative level since 1500 A.D.[3] The quality of life has increased in tandem, as reflected in international well-being ratings such as the OECD Better Life index, where Poland does better than what its income level alone would suggest. Poland seems to be on the cusp of a new Golden Age.

Poland's growth has largely been driven by labor productivity. Between 1997 and 2006, Poland's labor productivity increased at an average annual rate of 4.6 percent, above most regional peers, and more than twice as fast as in the United States (Figure 7). Between 2007 and 2012, rapid productivity growth continued, albeit at a slower pace of

[2] Data on average GDP growth per capita during 1995–2014 from the World Bank's World Development Indicators.
[3] Piatkowski (2013).

2.8 percent per year, largely because of the negative impact of the global crisis. Nonetheless, labor productivity still grew faster than among most peers, and much faster than in the EU-28 and the United States.[4]

Figure 7. Growth of labor productivity (GDP per person employed), 1997–2012 average



Source: Conference Board TED database.

NOTE: countries sorted from the slowest to fastest productivity growth during 2007–2012.

Growth in labor productivity has been led by increases in TFP. Total factor productivity (TFP) measures growth in labor productivity that cannot be accounted for by increases in capital intensity. It is thus a measure of "pure" productivity, which reflects changes in the quality of human capital, management practices, technological innovation, and other productivity enhancing factors. Since 1996, TFP growth represented almost two-thirds of total GDP growth, better than in the Czech Republic, Hungary, Germany, and southern Europe (Figure 8).

Robust productivity growth does not seem to have been driven by R&D. In 2014, R&D spending amounted to only 0.9 percent of GDP, placing Poland at the tail end of EU rankings.[5] Business R&D spending (BERD) was particularly low, at only 0.3 percent of GDP and one-third of total R&D spending. These results put Poland behind all peer countries and far below the EU-28 average (Figure 9). A combination of the low level of innovation and high economic growth rate represents an interesting puzzle (Box 1).

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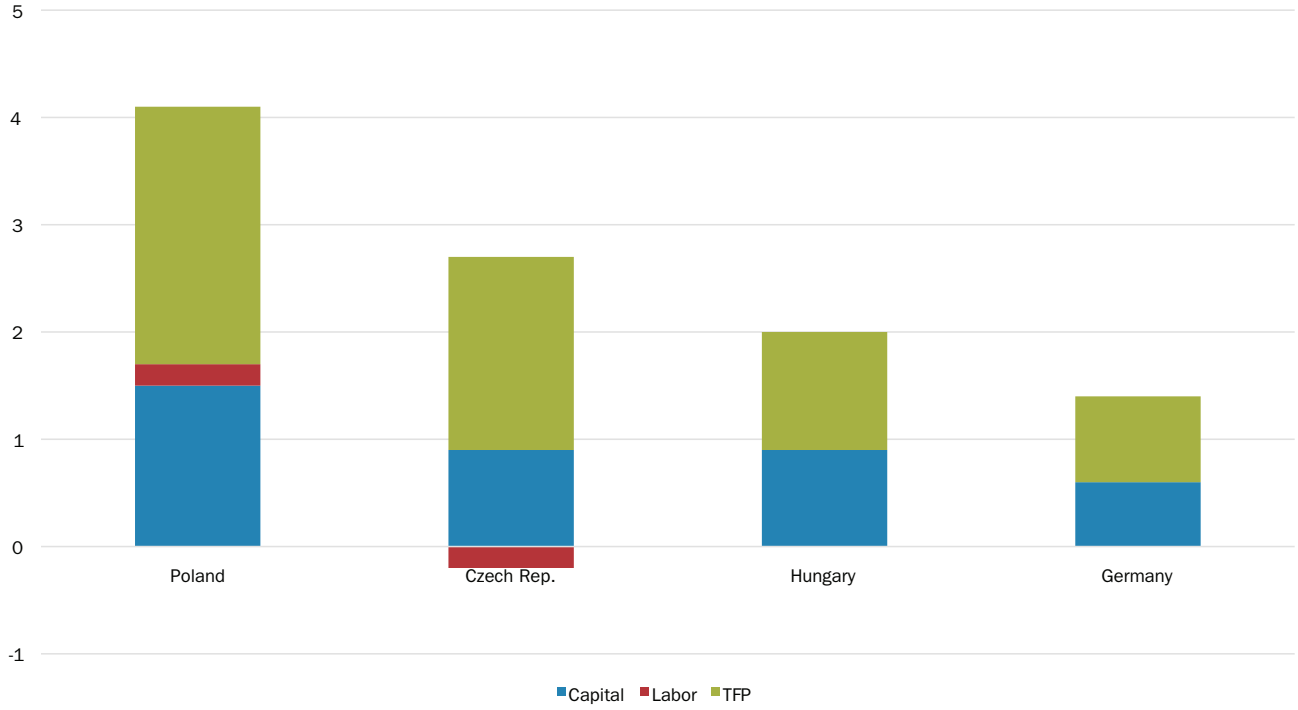
[4] Unlike in many emerging markets, Poland's growth has not been driven by the sale of natural resources or financial leverage. Poland is a net energy importer: in 2012, energy imports represented 26 percent of energy use (World Bank's World Development Indicators). Its public and private debt levels are below the European average: in 2014, general government debt amounted to around 50 percent of GDP, compared to the EU-28 average of almost 90 percent of GDP; private-sector debt amounted to 78 percent of GDP versus 113 percent in Hungary, 82 percent in the Czech Republic, and 110 percent in Germany (Eurostat).

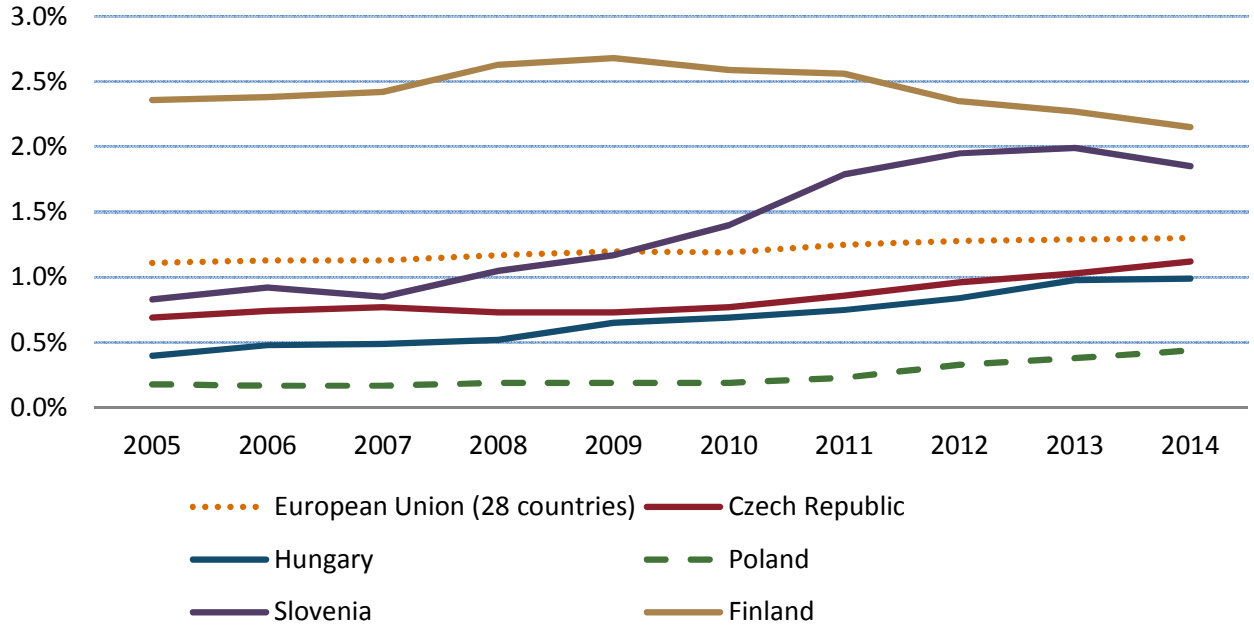
[5] Data from Eurostat.

Figure 8. Contribution of TFP to GDP growth in selected EU countries, in percentage points, 1996–2013



Source: The World Bank based on Bogumil and Wieladek (2014).

Figure 9. Private R&D (BERD) as percentage of GDP in Poland and selected EU economies

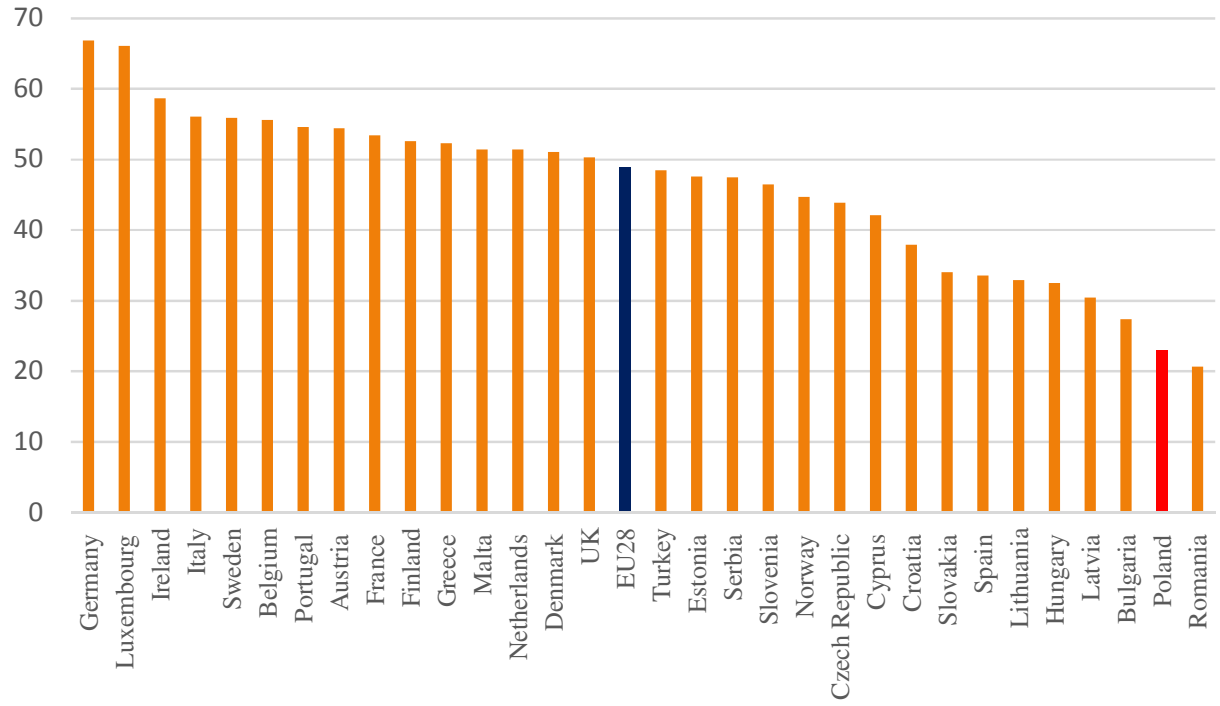


Source: The World Bank based on Eurostat.

Poland is a regional laggard in terms of innovation output. The 2015 Innovation Union Scoreboard ranks Poland fifth from the bottom among EU countries and classifies it as a "moderate innovator." The share of innovative enterprises among all industrial enterprises is the second lowest in the EU (23 percent of the total), ahead of only Romania

(Figure 10). The national statistical office shows that the share of innovative companies actually declined from 23.7 percent in 2006 to 17.1 percent in 2013.[6]

Figure 10. Share of innovative enterprises in the EU-28, 2012, in % of total



Source: Eurostat (2012).

BOX 1

POLAND—A GROWTH CHAMPION DESPITE LOW INNOVATION

The combination of Poland's high growth and low innovation is a puzzle. There are a couple of possible explanations.

First, Poland may belong to a small category of countries that can grow without innovation or R&D. This has been the case for Spain, Slovakia, and Ireland, which have achieved high incomes while investing only small amounts in R&D (Spain invested less than 1.2 percent of GDP in R&D during 2002–2012; Ireland invested 1.3 percent of GDP, and Slovakia only 0.6 percent). However, the vast majority of all other successful countries have invested substantial amounts in R&D.

Second, at Poland's level of development, technology absorption, especially facilitated by large FDI, can provide a productivity boost that is larger and more sustainable than what is usually assumed.

Third, private sector's R&D spending may simply be underreported. This is because many companies, especially small ones, (i) find it difficult to properly classify R&D spending among other types of investment, (ii) are worried about tax inspection questioning their R&D accounting, and (iii) believe that accounting for R&D spending may be unprofitable from a tax point of view—R&D investment needs to be capitalized and then gradually amortized as opposed to classifying it as other operational costs that can be written off against the tax base right way. Poland's fiscal incentives for enterprise R&D have so far been among the least generous among OECD countries.

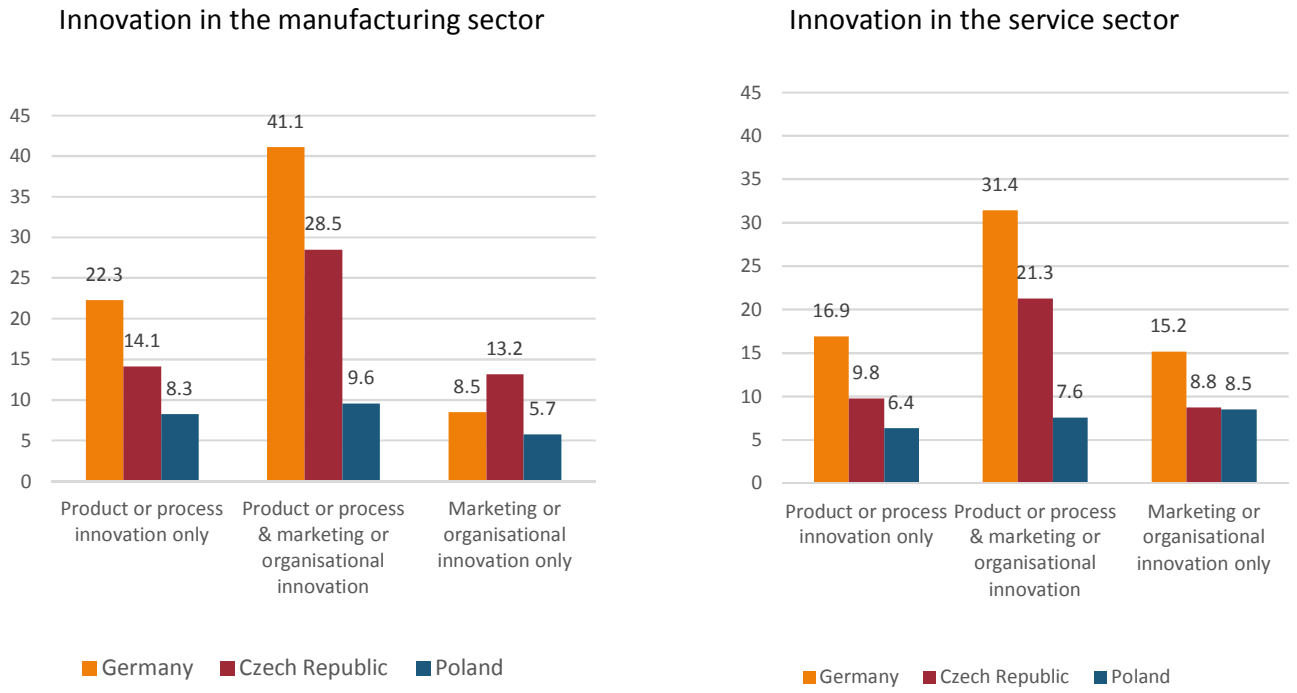
Innovation may be similarly underreported. This is because the standard Oslo Manual definitions of what represents a product, process, marketing, and organizational innovation may not be sufficiently clear to the surveyed companies, especially when unaided by clear examples and explanations (EBRD, 2014). Further research is needed to explain this puzzle.

Source: The World Bank.

[6] GUS (2015). Caution should be exercised, though, as to the quality of the data: it is usually quite difficult for the respondents to assess whether their companies have been innovative. The firm-level interviews conducted within the Bank project confirmed that only a few firms understood the definitions of innovation included in the Oslo Manual.

Polish enterprises seem to be particularly struggling with product and process innovation. Poland achieves poor results in innovation across both the manufacturing and service sectors, relative to peer countries such as Germany and the Czech Republic (Figure 11). In particular, only 8 percent of manufacturing firms introduced product or process innovations, versus 14 percent and 22 percent in the Czech Republic and Germany, respectively. Organizational and marketing innovation also lags, although less so.

Figure 11. Share of innovative enterprises in manufacturing and service sectors in Poland, the Czech Republic and Germany, 2010-12



Source: Author calculations based on OECD (2015a).

Despite low R&D and innovation spending, Poland's growth prospects remain surprisingly positive. According to the International Monetary Fund (IMF), in 2016 and 2017, Poland is projected to grow at around 3.5 percent per year and be among the top three most dynamic EU economies.[7] It is also projected to grow 2 percentage points faster than the euro zone. In the longer term, Poland's GDP is projected to expand at 3.6 percent per year until 2020, above all regional peers and the euro zone average (Figure 12). As a result, Poland's level of income per capita PPP would exceed 70 percent of the euro zone level by 2020, the highest relative level on record.[8]

Short- and medium-term growth is likely to continue to be driven by technology absorption and high price competitiveness. Poland's productivity per hour amounts to less than half of that in Germany and only 40 percent of that in the United States.[9] This suggests that there is still large scope for productivity growth based on technology absorption, FDI, and nontechnological improvements. Based on past trends, price competitiveness is also likely to remain high, as reflected in low real unit labor costs, which have been consistently falling since 1996 (Figure 13).

But more innovation could help raise the growth rate in the medium term. Although detailed analyses are needed, more robust innovation could likely help increase the potential GDP growth rate, which the National Bank of Poland (NBP) estimates to amount to around 3.0 percent during 2015-16,[10] to closer to 4 percent and thus help to further raise the pace of income convergence.

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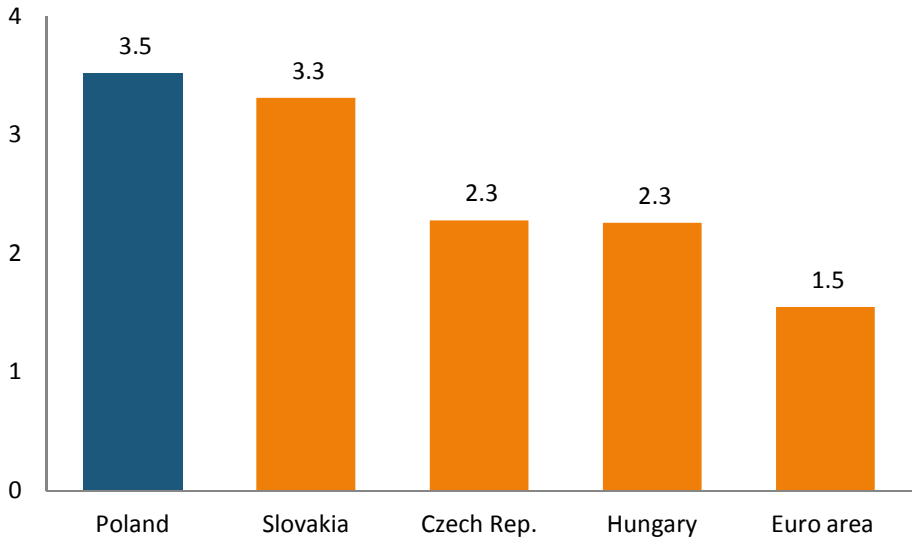
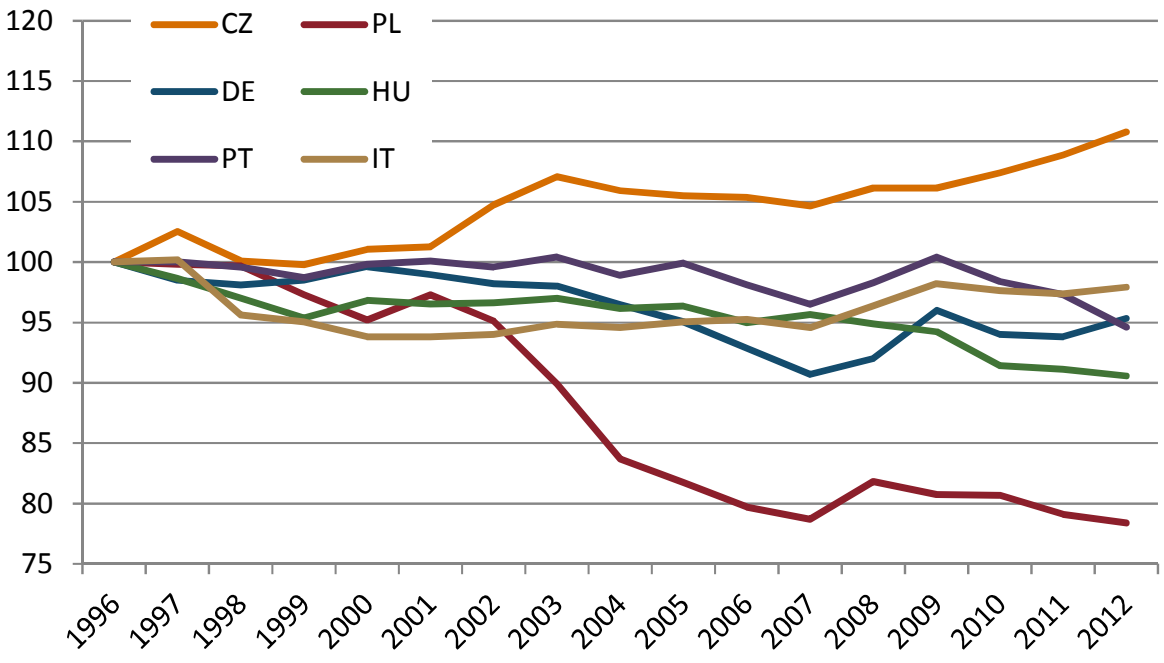
[7] IMF (2016).
[8] Piatkowski (2013).
[9] http://stats.oecd.org/Index.aspx?DataSetCode=PDB_LV
[10] NBP (2015).

Figure 12. Projected GDP growth rates for Poland, peer countries, and the euro zone, 2016–2021



Source: IMF (2016).

Figure 13. Real unit labor costs, 1996–2012, 1996 = 100

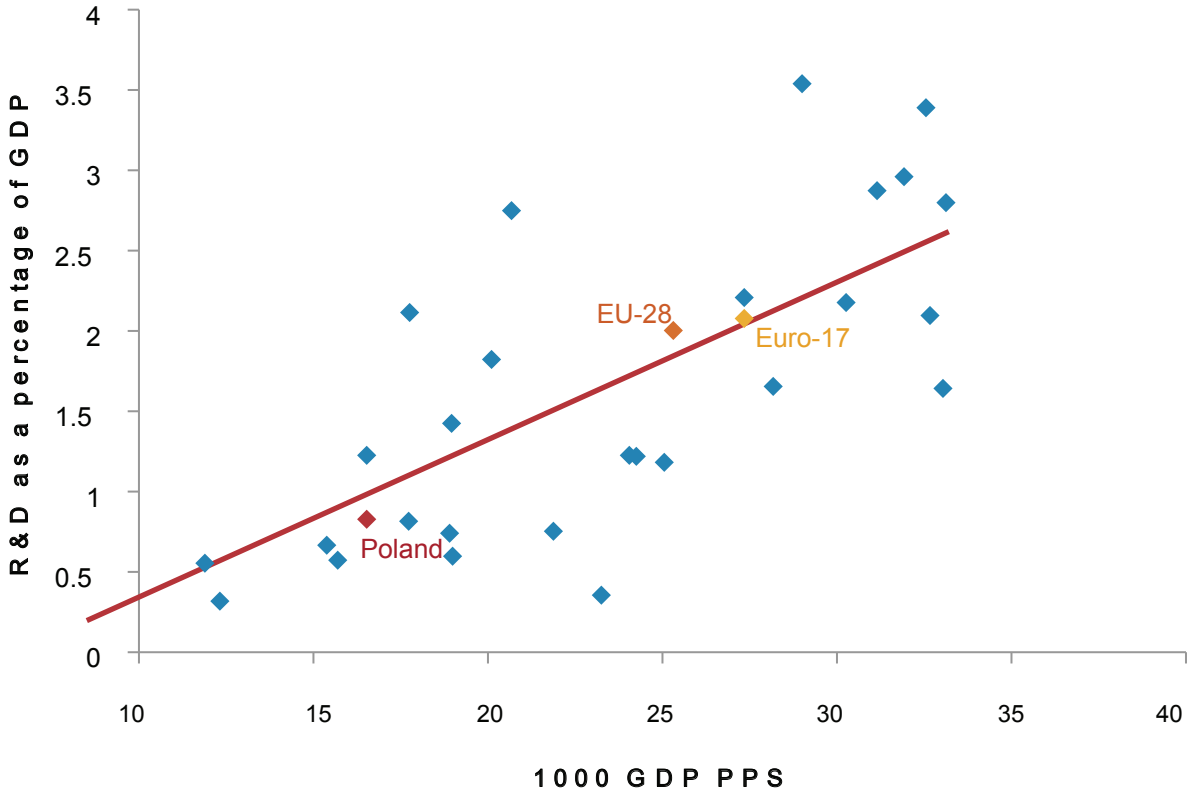


Source: The World Bank based on Eurostat.

Innovation will be key to fully catch up with the West. As Poland moves closer to the technology frontier, the role of innovation and R&D is likely to gradually increase. This would be in line with the experience of more developed countries, where R&D spending and innovation increased together with incomes (Figure 14). In fact, there is hardly any country that has ever managed to catch up with the West without large investment in R&D and a high level of innovation, including Japan, Taiwan, and, more recently, South Korea. As an illustration, assuming average per capita income growth at 3 percent for Poland and 1.5 percent for the euro zone, an additional half a percentage point of GDP growth per year driven by innovation would allow Poland to catch up with the euro zone level of income per capita PPP in 2036, eight years earlier than in the baseline scenario. Without innovation, the full convergence might not be possible

at all, and Poland could get stuck in a low-growth, no-innovation equilibrium and never break through to the elite club of the world's developed countries.[11]

Figure 14. R&D spending versus GDP per capita, 2012



Source: The World Bank based on Eurostat.

But higher innovation is not automatic and requires a fundamental change in business mind-sets. Polish enterprises on the whole do not yet seem to consider innovation as the key element of competitiveness, as shown in the Bank's enterprise survey discussed later in the text and as confirmed by other studies.[12] This may be for a number of reasons. First, the lack of an innovation history may restrict the set of choices Polish firms face: in the same way that people like songs that they have already heard, Polish companies seem to prefer to stick to drivers of competitiveness that they already know and eschew R&D innovation, which they do not have much experience in. Second, there are not enough examples of companies that have become successful due to innovation. Third, given the large size of the domestic economy, competitive pressures may be weaker than in smaller countries, where SMEs have no choice but to innovate to be able to expand their markets and grow. Finally, the traditional educational system may not generate a sufficient number of graduates with entrepreneurial mind-sets.

High price competitiveness may blunt incentives for enterprises to innovate. Polish companies benefit from very competitive labor costs relative to labor productivity, high-quality human capital, flexible labor markets, a competitive nominal exchange rate, an increasingly conducive business climate, and one of the lowest tax rates in Europe. In this kind of environment, firms do not innovate because they do not yet need innovation to survive.

But high price competitiveness will not last forever. Labor productivity cannot increase endlessly without more R&D and innovation. Labor costs also cannot continue to grow slower than productivity, especially in the environment of an impending demographic decline and aging population. The exchange rate is not likely to remain weak, either.

[11] PARP (2013), Zadura-Lichota (2015) and Kapil, Piatkowski, Radwan, Gutierrez (2013).
[12] See, for instance, Hausner et al. (2013).

Finally, Poland's competitiveness in international markets will be increasingly challenged by emerging champions in other parts of the world, including China in particular, whose exports are rapidly becoming more sophisticated.

The generous 2014–2020 EU budget is possibly the last chance to change Poland's DNA and help companies start innovating. Although Polish companies still have some time left to grow based on price competitiveness and imports of foreign technology, they now have a unique opportunity to learn how to innovate before the EU funds run out and price competitiveness declines. This chance should not be missed. Otherwise, Poland's growth could stall, and the country may never catch up with the West.

The public support system will need to fundamentally change to help Polish enterprises develop and be competitive internationally. The existing public innovation support system does not seem to provide sufficient incentives for companies to engage in R&D and innovation. This is due to risk aversion, suboptimal selection processes, and weak impact and evaluation systems. In addition, public support institutions often do not have clear objectives, robust incentive systems, and strong performance evaluation frameworks. The innovation system also struggles with identifying companies and economic activities with the highest potential for innovation-based growth. Finally, there has also been a disconnect between the objectives of public support programs and the results. For instance, funds were spent on technology absorption rather than innovation, on large enterprises rather than SMEs, and on R&D in low-tech rather than R&D in high-tech.[13] As a result, the huge expenditures on innovation during the last EU budget period (2007–2013) had a mixed impact. This needs to change.

[13] Kapil, Piatkowski, Radwan, Gutierrez (2013).

3 "HOW"—The Role of the Entrepreneurial Discovery Process in Enhancing Innovation

3.1 The concept of smart specialization, RIS3, and EDP

The European Commission adopted a new "smart" innovation framework for the 2014–2020 financial perspective. The new framework is based on the concept of smart specialization (see Box 2) developed by Foray, van Ark, and others[14] and based on earlier research by Rodrik and Hausmann.[15] The smart specialization framework is a key instrument for achieving the objectives of the Europe 2020 strategy (E2020) to promote "smart, sustainable and inclusive" growth.[16]

The main objective of the new "smart" innovation framework is to maximize innovation's contribution to economic growth and social welfare. This should be achieved by prioritizing public support for innovation on economic activities (smart specializations) that have the largest developmental potential based on existing comparative advantages and endogenous strengths. Smart specialization is not about selecting priorities from the top down, but about stimulating a dynamic, ongoing, and bottom-up entrepreneurial process of discovering new specialization areas that the public sector could support to accelerate economic growth. Smart specialization policy is not about "where to invest," but about "how to help firms to discover where to invest and how to implement the policy according to what has been discovered."[17]

BOX 2

DEFINITIONS OF SMART SPECIALIZATION

"Smart specialization is an innovative policy concept which emphasizes the principle of prioritization in a vertical logic (to favor some technologies, fields, population of firms) and defines a method to identify such desirable areas for innovation policy intervention."

Source: Foray and Goenaga (2013).

"Smart specialization is a new form of industrial policy, which builds on the idea of economic specialization and the ability of a country/region to build a competitive advantage on unique, locally based expertise that can be applied in a new and innovative manner. Smart specialization is a dynamic process, where the national or regional specializations are selected from among many potential economic activities identified in an ongoing process of entrepreneurial discovery. The smart specializations are constantly monitored and evaluated: some specializations are constantly developed, while others are allowed to die."

Source: The World Bank based on EC's RIS3 Guide.

Research and innovation strategies for smart specialization (RIS3s) are the main element of the new innovation framework. The European Commission has made the development of RIS3s, innovation strategies based on the smart specialization concept, a key criterion for accessing EU Structural Funds during 2014–2020.[18] RIS3s should help identify the national and regional economic smart specializations based on the existing strengths and capabilities that could be leveraged by innovation. It should help concentrate scarce resources, avoid fragmentation and duplication, and achieve a critical mass for an innovation-based economic change. An RIS3 should help trigger structural transformation of a national or a regional economy by generating clusters of firms with enough spillover effects and economies of agglomeration to transform the region from "periphery" to a "center." Prioritization of business areas that are not identified as economic sectors in the traditional sense then becomes a core element of an RIS3.

[14] Foray and Van Ark (2007); Foray, David, and Hall (2009).
[15] Rodrik (2004); Hausmann and Rodrik (2003).
[16] European Commission (2010).
[17] Foray (2011).
[18] European Commission (2011).

RIS3s should actively engage key stakeholders, identify principal challenges, and provide an action plan. The business community, academia, administration, and society at large should collaborate to develop an RIS3. The RIS3 should also indicate key challenges facing the region and its endogenous potential based on SWOT analysis. Each RIS3 should be accompanied by an action plan that (i) establishes governance structures and processes, (ii) develops robust M&E systems to enable just-in-time decision making similar to the one applied in the private sector, (iii) focuses on specific programs and projects to help achieve the desired outcomes, and (iv) outlines available budgetary resources for R&D&I. Finally, the RIS3 should explain how it will help to ensure the socioeconomic transformation of each region and of the country as a whole. Box 3 presents a definition of RIS3.

BOX 3

DEFINITION OF RIS3—RESEARCH AND INNOVATION STRATEGY FOR SMART SPECIALIZATION

RIS3 is an integrated, place-based economic transformation agenda that:

- Focuses policy support and investments on key national/regional priorities, challenges, and needs for knowledge-based development, including ICT-related measures;
- Builds on each country's/region's strengths, competitive advantages, and potential for excellence;
- Supports technological and practice-based innovation aiming to stimulate private investment;
- Gets stakeholders fully involved and encourages innovation and experimentation;
- Is evidence-based and includes sound monitoring and evaluation systems.

Source: European Commission (2012a).

The "entrepreneurial discovery process" (EDP) is the basic element of the RIS3 and the smart specialization framework. Within the EU innovation framework, an RIS3 should be focused on a *process* that systematically identifies, validates, and modifies priorities for public policy rather than on a one-off choice of smart specializations per se. The EDP allows for this continuity. Although there are many definitions of EDP (see Box 4), the main objective is to identify new areas of growth with the highest developmental potential that should become the priority for public support. The EDP should help select smart specializations based on a bottom-up approach driven by market and technological opportunities discovered by firms rather than the traditional top-down approach of the public sector.

The EDP should place business at the center of the innovation process. Through this process, the government should "listen" to firms and design innovation support accurately adapted to firms' growth potential. The choice of policy priorities should "involve an interactive process, in which the private sector is discovering and producing information about new activities and the government assesses potential and then empowers those actors most capable of realizing the potential."[19] The EDP should also help (i) remove barriers for cooperation between public and private sectors, (ii) identify firms that promise to benefit the most from public support, and (iii) adjust the public support instruments to the needs of the priority firms.[20]

The EDP should promote smart specializations focused on new activities between sectors rather than specific industries. The idea is to identify new (undiscovered) business areas rather than whole sectors, as the latter could transform smart specialization into an old-fashioned industrial policy. These new areas should be found at the intersections of economic sectors, which should develop faster thanks to their novelty, diversity, and innovation that creates new products and services as well as new marketing and organizational solutions. This could also involve revamping traditional sectors by mixing them with new economic areas or focusing on their particular elements from a new viewpoint. The new business areas should not be to too general in order not to become a horizontal policy, nor too detailed, because they should have enough potential to impact a regional or national economy. (See Box 5 for characteristics of EDP goals and processes.)

[19] See http://s3platform.jrc.ec.europa.eu/documents/10157/63241/Foray_130124.
[20] See http://www.visionary.lt/entrepreneurial-discovery-of-smart-specialisation.

BOX 4

DEFINITIONS OF THE ENTREPRENEURIAL DISCOVERY PROCESS (EDP)

"The entrepreneurial discovery process (EDP) aims to identify areas with the potential to achieve critical mass based on local (endogenous) resources, e.g. qualified labor, natural resources, clusters, R&D expertise, etc. Stakeholders representing the quadruple helix (business, R&D, society, administration) should be empowered and actively participate in the process of discovering viable potential areas. Smart specialization should not be mistaken for the economic specialization or economic strength of a country/region. While the latter is an important element in the development of smart specialization, it is not sufficient or necessary. Smart specialization emerges where there is the potential to combine R&I and industry, where there is an ambition for excellence and where market niches are identified. Areas selected as smart should create exceptional added value (return on investment above the average growth path of a country/region) and later spill over to other sectors of the economy, thus enhancing overall performance and productivity."

Source: The World Bank, based on the EC's RIS3 Guide.

"The entrepreneurial discovery process is a learning process to select research, development and innovation (R&D+I) as well as non-technological activities in which a region can hope to excel. . . . [I]t's a vision about opportunities in existing or emerging sectors. The concept suggests that entrepreneurs and public stakeholders are exploring, experimenting and learning what an industry or even better players in a market niche should do in the field of R&D+I and non-technological innovation to build unique competitive advantage. This concept can be applied in all regions. For instance, traditional regions can modernize their agro-food or tourism sectors by investing in ICT, design, or new distribution channels, while industrial regions can stimulate cooperation on the frontiers of two sectors/clusters, such as health and ICT, design and furniture or support the diversification of SMEs. . . . This requires that regions collect and analyze data regarding markets, technologies, skills, knowledge transfer, capabilities, institutional agility, business models, global competition by sectors and by groups of regional enterprises and investing accordingly, instead of scattering their support."

Source: EU Know Hub, http://www.know-hub.eu/knowledge-base/videos/entrepreneurial-discovery-process.html.

"EDP is the process of systematically scanning for technological, political, and regulatory, social, and demographic changes to discover opportunities to produce new goods and services. It is a way to recognize and define a market need, going through three stages discovery, evaluation and exploitation."

Source: Allen and Meyer (2006).

Vertical, smart specialization policies need to be complemented by strong horizontal policies. Focus on specific new business areas should not imply lack of emphasis on growth-enhancing horizontal policies, particularly those that promote firm entry and start-ups, access to financing, and fast and cheap exit. For entrepreneurial discovery to be efficient, much depends on the ease of market entry for new firms and opportunities for expansion of the existing firms. There is a strong link between government regulation and the strength of entrepreneurial discovery.[21] Hausmann and Rodrik (2003), for instance, recommend subsidizing the entry of firms into new markets, as the information about the new markets generated by first-movers is likely to spill over quickly to other firms and create large positive results. A conducive business environment is a basic condition for strong entrepreneurship and robust discovery. Horizontal policies are particularly important in the case of regions and countries with unclear specializations and where information on endogenous strengths is lacking.[22]

[21] Klinger and Lederman (2011).
[22] Aprahamian and Correa (2015).

BOX 5

EDP PROCESS—GOALS AND IDENTIFICATION OF NEW ACTIVITIES (BUSINESS AREAS)

Goals of the EDP process:

1. Maximize public–private entrepreneurial discoveries;
2. Provide operational facilities for continuous observation, detection, and evaluation;
3. Encourage firms to share their market and technology knowledge with policy makers;
4. Support early growth of the prioritized activities;
5. Diffuse knowledge to generate more experiments and discoveries and build critical mass of innovation.

Source: Foray and Rainoldi (2013).

Examples of the EDP criteria to identify "new activities":

1. Aim at experimenting and discovering opportunities;
2. Have the potential to generate learning spillovers;
3. Are likely to generate desirable structural changes;
4. Need public funding to emerge and grow (have scale and agglomeration economies, can fail because of coordination failures).

For example, in the case of the pulp and paper industry, what needs to be prioritized is not the sector as such, but the activity of exploring the potential of nanotechnology to improve operational efficiency. In the case of the plastics industry, the process should not support the industry as such, but rather the exploration of how firms can diversify from the car industry to the medical sector.

By focusing on "new activities," the government (i) improves the general performance of a sector, (ii) builds capabilities, and (iii) looks for unexplored niches.

Source: Foray and Goenaga (2013).

3.2 Smart specialization and EDP in Poland

Poland has developed separate RIS3s at the national and regional levels. The main objectives of the strategies have been to (i) enhance the impact of public innovation support based on the lessons learned from the previous EU 2007–2013 financial perspective, (ii) prioritize public investments, and (iii) ensure access to EU funds. As of the end of 2015, all Polish regional governments had developed their own RIS3s. Some of them were voluntarily submitted for the review of the European Commission as a part of a mandatory package related to the ROPs. The EC accepted all regional and national operational programs in February 2015, which opened the door for EU support in the new budget perspective. However, the EC's decision in many cases was conditional and required the regional and national authorities to prepare action plans demonstrating how shortcomings identified by the EC, including incomplete EDPs, would be eliminated by the end of 2016.

At the national level, the Ministry of Economic Development created the *National Smart Specialization* (KIS) document. The KIS supplements the Enterprise Development Program, which in turn operationalizes Poland's flagship Innovation and Effectiveness Strategy: Dynamic Poland 2020 (SIEG2020). The KIS indicates 20 national smart specialization areas (see Box 14) and an institutional framework to develop them. That includes a separate working group for each of the specializations, an Economic Observatory (EO), and several additional bodies. Smart specializations are more specificially defined in an appendix to the KIS.

There are differences in the quality of RIS3 at the regional level. The process of preparation of the RIS3s began in many regions on the basis of an old style top-down process, with little involvement from other stakeholders, especially

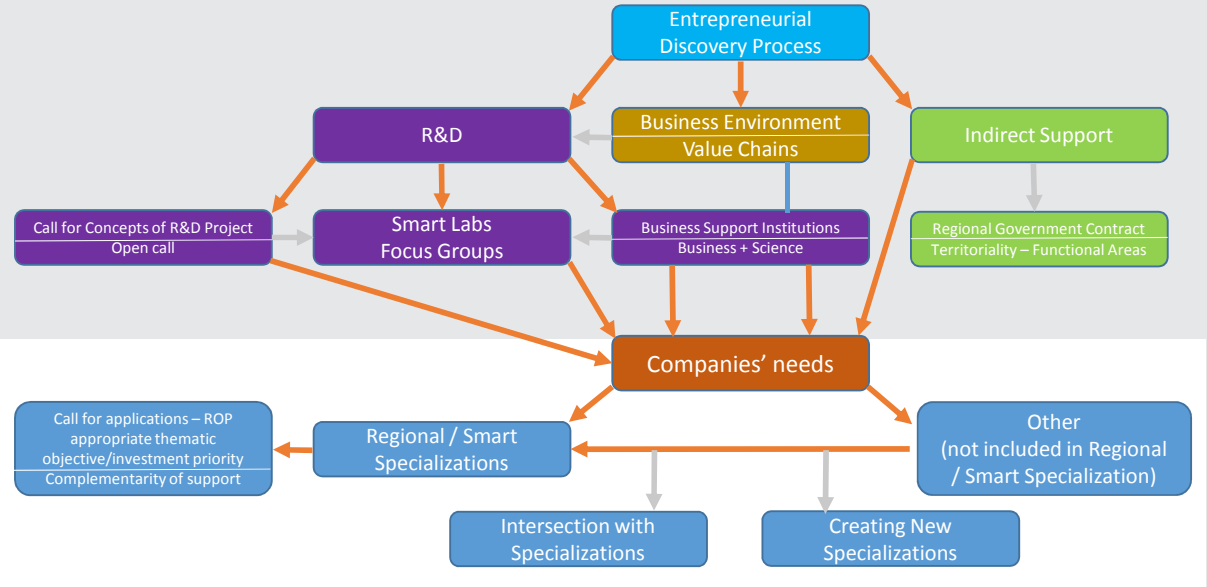
from SMEs which are not the "usual suspects" and do not represent the incumbents. In a number of cases, the evidence supporting the choice of regional smart specializations left scope for improvement. In general, there is no single model of PPO in Poland, as shown in the selected regional EDPs below (Boxes 6-11). Other regions outside of Poland, such as Tuscany in Italy, have still different approaches (Box 12). In short, there is no "one size fits all" model of EDP.

BOX 6

EDP IN ZACHODNIOPOMORSKIE

The Zachodniopomorskie region has started to experiment with its own entrepreneurial discovery process (EDP) based on a bottom-up selection of regional smart specializations (Figure 15). The innovation ecosystem is divided into three areas: (i) business; (ii) business environment, including RDIs; and (iii) the support system encompassing regional authorities, business support institutions (BSIs), clusters, and so forth. The private sector should have a leading role in deciding which areas of regional economy have the biggest potential and could become a smart specialization. Entrepreneurs can (i) submit business ideas about R&D projects in an open and ongoing call for proposals and indicate where they see the future of their business; (ii) participate in meetings with individual BSIs and RDIs to discuss possible synergies and identify areas where they could collaborate and develop future products and services; and (iii) participate in Smart Labs, based on the template tested by the World Bank, where entrepreneurs meet with other innovation stakeholders to verify information obtained from R&D project proposals and meetings with BSIs/RDIs and to discuss the developmental potential of their activity. The EDP is also meant to help identify firms' needs and growth barriers and to adjust the public support system.

Figure 15. The EDP model in Zachodniopomorskie



Source: The World Bank based on the Marshal Office of the Zachodniopomorskie Region.

BOX 7

EDP IN SLASKIE

The Slaskie region has been looking for its technological specializations since it developed its first innovation strategy for the years 2003–2013, when it decided on its first areas of specialization and cooperation networks started. This search was continued during a technological foresight process, the results of which were published in 2006. There the main technological areas for the region were identified, on the basis of which a Technology Development Program was developed for the years 2010–2020. During the implementation of the program, technology audits were initiated for companies in the region. Some 1,400 firms were audited in two stages. This process led to the development of the Regional Innovation Strategy, in which the areas of specialization were further discussed during conferences, workshops, and seminars with regional stakeholders. The main feature of Slaskie's approach is the concentration on technological, not economic, specialization areas. For each specialization area, an observatory was established to lead and coordinate different initiatives and provide the analysis and research needed to develop the specialization. These are complemented by regional competence centers and strategic development visions with roadmaps for each specialization.

Source: The World Bank based on the Marshal Office of the Slaskie Region.

BOX 8

EDP IN DOLNOSLASKIE

In 2015, the Dolnoslaskie region approved the strategic document *Strategic Framework for Smart Specializations*, which elaborated on smart specializations preliminarily identified in the RIS3 strategy for the years 2012–2020. The choice of the specializations was based on an analysis of key economic sectors, the most innovative sectors, and fast-growing sectors. Additionally, the demand for innovation was checked on the basis of the company applications to the Regional Operational Program. The analysis helped identify economic potential for smart specializations. They were compared with the main science and technology areas chosen on the basis of their publication intensity, patent activity, and participation in international research teams and industry consortia. The results of the analyses of the economic and scientific potential were used to suggest key technology areas in the leading sectors. They later underwent a public consultation process with various regional councils, clusters, and industry representatives. When the areas of specialization were finally agreed upon, working groups for each specialization were established to develop a strategic vision for the development of each specialization.

Working groups (WGs) play a key role in the implementation of regional smart specialization policies. Each WG comprises innovative entrepreneurs from the region, business support institutions, R&D units and universities from Dolnoslaskie, and the regional government.

Working groups are expected to convene at least once every quarter. WGs aim to become platforms for exchange of knowledge, experience, and opinion in economic and technological areas. They also aim to discuss new and emerging growth opportunities in the region and propose directions of public intervention in innovation support.

The EDP is complemented by individual meetings with entrepreneurs and R&D units to identify scientific and technology areas with high business potential.

The operation of working groups will be monitored through progress indicators to help achieve the goals stated in the strategy as well as help identify emerging areas that might turn into new regional smart specializations.

All key stakeholder groups—business, science, BSIs, and the regional government—have a role to play in the monitoring system. A special role falls to the regional government, which initiates, coordinates, and finances activities of other actors in this context. It is also ultimately responsible for monitoring and evaluation of the effects of the intervention.

Source: The World Bank based on the Marshal Office of the Dolnoslaskie Region.

BOX 9

EDP IN SWIETOKRZYSKIE

The selection of regional smart specializations through the EDP in the Swietokrzyskie region was based on a review of the existing economic and scientific data and potential (including existing R&D infrastructure), analyses of the financed R&D projects, granted patents, and interviews and workshops with stakeholders of the innovation system. The process resulted in the selection of four main smart specializations in the region and three supporting specializations, which are now being developed by individual consortia. Each consortium is made of key regional innovation players, including business associations, business support institutions, and universities. Members of the consortia are appointed by the Marshal Office on the basis of a candidate's application—usually there are about 10 members in each consortium. A business support institution heads each consortium. The consortia are responsible for the development of a vision for each smart specialization: its operationalization, monitoring and evaluation, and stimulation of collaboration between enterprises and science.

Source: The World Bank based on the Marshal Office of the Swietokrzyskie Region.

BOX 10

EDP IN WIELKOPOLSKIE

The Wielkopolskie region has never had any strong specializations; it was therefore decided to start the entrepreneurial discovery process with research and analyses. These included:

- A statistical analysis of the general level of innovation and competitiveness of the region, also in the international context
- An analysis of economic concentrations in the region based on location quotients and shift-share analyses
- An analysis of scientific potential, including bibliometric analysis for main areas of science, patents and patent applications, areas with strong business–science cooperation, national and international grants, and so forth
- A survey of companies' innovation needs in 29 business sectors
- An export analysis of the main goods
- An analysis of the main technological and societal challenges
- An international benchmarking: Wielkopolskie was the subject of a dedicated Regional Innovation Monitor Plus (RIM+) report by Technopolis, a consulting firm, and took part in research on smart specialization performed by Fraunhofer ISI for the European Commission.

The results of this comprehensive research were supported by a panel discussion that included innovation policy experts with the knowledge of the regional economy. In addition, qualitative interviews led by experts were conducted with innovative companies and scientists representing the preliminary areas of specialization to better understand the real economic sectors behind the statistics. The interviews also helped identify members of working groups whose task was to verify and diagnose each specialization and develop a strategic vision for its development. The working groups defined each new specialization and recommended directions for future development based on innovation, R&D, and new technologies. They also identified developmental milestones for each specialization and areas of inter-sectorial innovation that could create synergies between the selected specializations. Finally, the specializations were tested in a pilot smart specialization competition for R&D vouchers.

The Regional Innovation Strategy for Wielkopolskie combines specialization-specific and horizontal activities in six strategic programs. It was accepted by the regional parliament and the European Commission as fulfilling the ex ante conditionality. The development of the strategy also included an institutional learning process based on an interdepartmental team, which included departments responsible for the implementation of the regional development strategy and of the operational program.

The implementation of the regional RIS3 and the Regional Operational Program as well as the results of each smart specialization process will be monitored by Wielkopolskie Smart Specialization Forum, whose membership includes a wide range of regional stakeholders from the public and private sectors and academia.

Source: The World Bank based on the Marshal Office of the Wielkopolskie Region.

BOX 11

EDP IN POMORSKIE

The Pomorskie region has developed its own bottom-up EDP model based on an open competition for proposals from the private sector for smart specializations. The ideas for smart specializations are assessed by a board of independent experts, who provide their recommendations to the regional authorities.

The Pomorskie EDP began in late 2013 with a consultation process to encourage innovation stakeholders to form informal partnerships. At the same time, the authorities conducted an analysis to better describe the economic profile of the region. In May 2014, the regional authorities announced an open competition for the region's smart specializations. During the two-month period, applications could be submitted by informal partnerships of companies, research organizations, NGOs, and so forth. The applications had to include a description of the envisaged smart specialization and its potential, a strategy for its development, as well as a standardized description of envisaged R&D activity and large-scale (flagship) projects. In this first phase of the competition, 30 applications were submitted, out of which 28 passed a formal and substantive assessment. There was an element of dialogue during the phase of the substantive assessment—partnerships had a chance to improve their applications after obtaining initial comments from the experts. Partnerships were encouraged to look for synergies, merge and prepare a smaller number of more detailed ideas, and submit applications to the second phase of the application process. In the second phase of the process, seven applications passed the assessment by the board of independent experts. The winning partnerships did not have to formalize their status. Their sizes varied from 20 to 100 participants. Finally, in the last stage of the process, held in March 2015, four regional smart specializations were selected by the regional authorities. These were the following:

- Technologies for offshore and harbor logistics
- Interactive technologies in the information-rich environment
- Eco-effective technologies for production, transmission, distribution, and consumption of energy and fuels
- Medical technologies for civilizational and aging diseases

Each specialization is supported by at least one partnership, and further negotiations will take place between partnerships and the authorities to more specifically define the scope of specializations and public support instruments.

The smart specialization selection process should be repeated regularly, offering an opportunity for other potential specializations to be assessed. A monitoring and evaluation system has also been put in place to verify progress of the selected specializations.

Source: The World Bank based on the Marshal Office of the Pomorskie Region.

BOX 12

THE EDP IN TUSCANY, ITALY

Entrepreneurial discovery in Tuscany consists of five phases:

1. **Opportunity scanning**: This phase (taking up to six months) analyzes available information about the region's strengths and identifies opportunities where the region could develop based on a series of workshops with the local stakeholders. The goal of this stage is to prepare roadmaps to set goals for development in a given area and agree on milestones to achieve them.
2. **Analysis and evaluation** by a team of independent experts (three months): The roadmaps are evaluated by a group of independent (non-Tuscany) experts, including on the synergies among roadmaps for a number of new activities.

(*continued*)

BOX 12

3. **Thematic workshops**: Two plenary and eight thematic workshops are organized (within two months) to discuss the roadmaps with a broader audience. The workshop proceedings are webcasted, and the results are posted online. The eight themes identified during the ongoing process were:
   - "Made in Italy"
   - Smart cities
   - Agribusiness
   - Emerging clusters
   - Human capital
   - Green economy
   - Tourism
   - Intensive sectors of the capital
4. **Rationalization and drafting of the preliminary version:** The input from the previous stages is gathered and analyzed (three months) and a preliminary version of the Tuscany RIS3 is presented.
5. **Final version**: The final version of the RIS3 is prepared. During this stage, two additional workshops are held to discuss the governance framework of the RIS3 process.

Source: http://s3platform.jrc.ec.europa.eu/workshop-edp

Regional RIS3s could benefit from more sophisticated analysis to identify regional competitive advantages. Many analyses miss key economic output indicators, starting from productivity levels and growth rates or sectoral information on export patters and growth rates (see Box 13 for an example of a national-level productivity analysis). Regional RIS3s also tend to use rudimentary and sometimes outdated data from the National Statistics Office (GUS). Moreover, many strategies are generic on the action plans and implementation mechanisms. Finally, there is little emphasis on rigorous monitoring and evaluation frameworks and avoidance of conflicts of interest in evaluation.[23]

As part of the RIS3 process, the central government identified a list of 20 national smart specializations. The MoED, the lead ministry in the RIS3 process, selected smart specializations based on a set of methods, including industrial foresight; political, economic, social, and technological factors (known as PEST analysis); statistical analysis; and public consultations (see KIS for details). The selected smart specializations include, for instance, "healthy food," "medical engineering," and "intelligent creative technologies" (see Box 14 for the full list). The public support system will allocate extra points in the grant application process for projects that fit into smart specializations and reserve public innovation funds for smart specialization projects only.

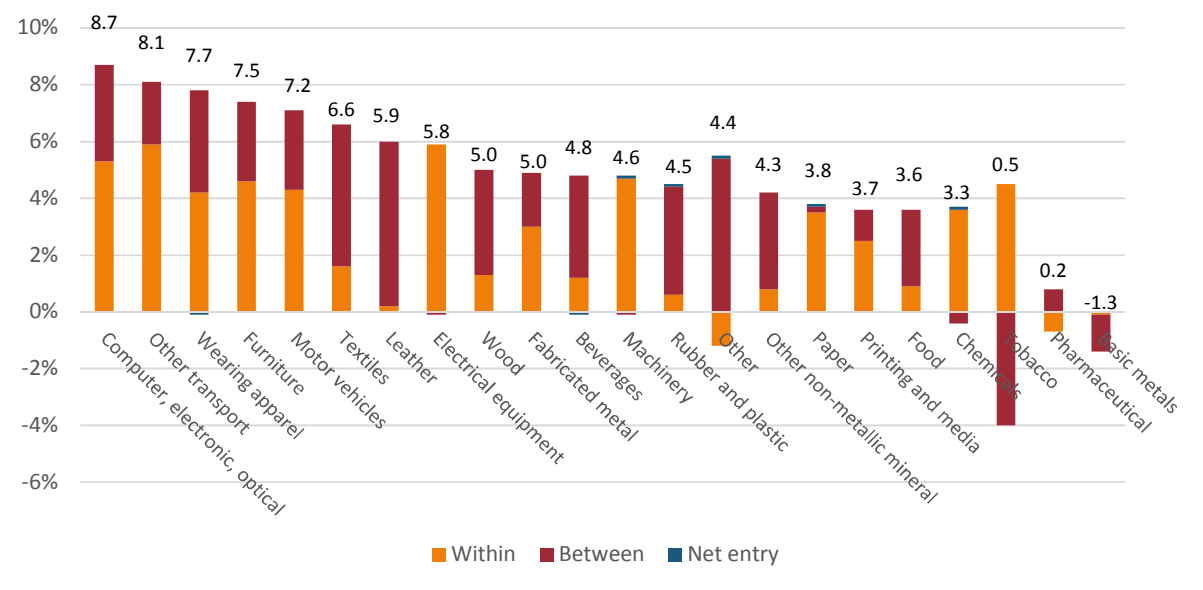
BOX 13

PRODUCTIVITY ANALYSIS AT THE INDUSTRY LEVEL

A pioneering analysis of the F01 enterprise data set made available to the National Bank of Poland by the National Statistics Office (GUS) shows patterns of total factor productivity (TFP) growth, a key measure of "pure productivity," across industries during 2006–2013 (Figure 16). The data show that the industries that boosted their overall TFP the most included "computers, electronics, optical equipment," "other transport," and "wearing apparel." "Electrical equipment," "other transport," and "computers, electronics, optical equipment" were the leading industries in terms of internal productivity growth (as opposed to productivity growth based on changes in the structure of the industry, i.e., faster growth of more productive firms than of less productive firms). Because TFP growth is a strong measure of an industry's productivity potential, policy makers should frequently use such analyses to select and then monitor smart specializations.

[23] World Bank (2014b).

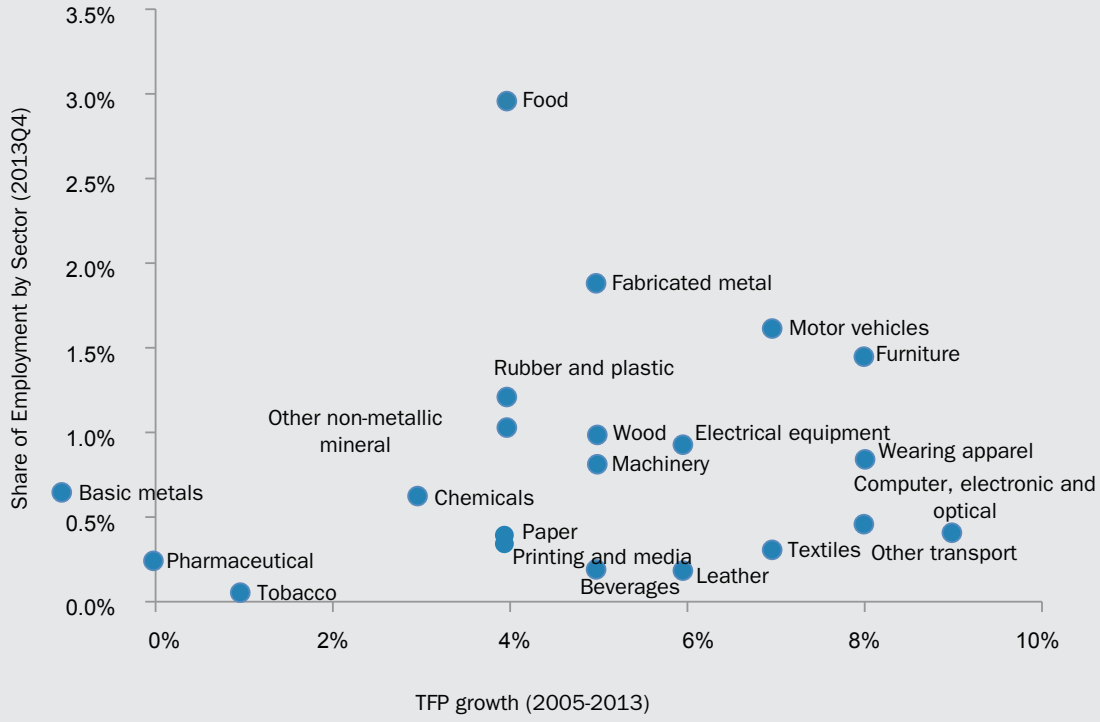
Figure 16. TFP growth across selected industries in Poland, 2006–2013



Source: Albinowski, Hagemajer, Lovo, and Varela (2015).

Size of employment is also key. In an ideal world, policy makers should want to promote industries that increase productivity and have high employment at the same time. The F01 data set shows that the "food" sector had the largest employment, but reported only an average increase in productivity growth (Figure 17). "Fabricated metal", "motor vehicles" and "furniture" where the three industries that combined high employment and fast productivity growth simultaneously.

Figure 17. TFP growth and employment



Source: Albinowski, Hagemajer, Lovo, and Varela (2015).

BOX 14

POLAND'S 20 NATIONAL SMART SPECIALIZATIONS

HEALTHY SOCIETY

1. Medical engineering technologies, including medical biotechnology
2. Diagnosis and treatment of diseases of civilization and personalized medicine
3. Preparation of medicinal products

AGRI-FOOD, FORESTRY, AND ENVIRONMENT BIO-ECONOMY

1. Innovative technologies, processes, and products of the agri-food and forestry-wood sectors
2. Healthy food (of high quality and environmentally friendly)
3. Biotechnological processes and specialty chemicals and environmental engineering

SUSTAINABLE ENERGY

1. High-efficiency, low-carbon, and integrated manufacturing systems; storage, transmission, and distribution of energy
2. Smart and energy-efficient construction
3. Environmentally friendly transport solutions

NATURAL RESOURCES AND WASTE MANAGEMENT

1. Modern technology sourcing, processing and use of natural resources and the production of substitutes
2. Minimize the generation of waste, including that which is unsuitable for processing, materials waste, and energy waste (through recycling and other recovery methods)
3. Innovative technologies and process water recovery and reducing its consumption

INNOVATIVE TECHNOLOGIES AND INDUSTRIAL PROCESSES (HORIZONTAL)

1. The multifunctional materials and composites with advanced features, including nanoprocesses
2. Sensors (including biosensors) and smart sensor networks
3. Smart grids and geoinformation technologies
4. Electronics based on conducting polymers
5. Automation and robotics processes
6. Optoelectronic systems and materials
7. Intelligent creative technologies
8. Innovative technologies in the field of specialized marine vessels, marine and coastal structures, and logistics based on maritime transport and inland waterways

Source: Ministry of Economic Development (2014).

However, the KIS needs to further strengthen its entrepreneurial discovery process. This is an element of the national Action Plan that Poland submitted to the European Commission with a view to completing all requirements needed to ensure access to the EU funding for innovation during the 2014–2020 financial perspective. Poland indicated that it would develop the full concept of the EDP by the end of 2015 and share it with the European Commission in early 2016.

3.3 Proposed entrepreneurial discovery process for Poland

The Ministry of Economic Development has requested that the World Bank help design and test EDP "made in Poland." The EDP process should be aligned with Poland's key strategic documents on smart specializations, including

KIS in particular. The proposed EDP should: (i) involve socioeconomic partners, especially enterprises; (ii) integrate top-down and bottom-up initiatives in the field of research and development; (iii) support evidence-based policy; and (iv) help shift the innovation support system from being supply to demand driven. In response to the MoED's request, the World Bank committed to help design the new elements of the EDP and pilot them in four regions in Poland to assist in identification, monitoring, and modification of smart specializations through direct interactions with enterprises. The Bank also agreed to transfer the project's know-how to local and national authorities to help ensure the sustainability of the proposed EDP after 2015 (Box 15).

BOX 15

OBJECTIVES OF THE WORLD BANK EDP PROJECT REQUESTED BY THE MINISTRY OF ECONOMIC DEVELOPMENT

The main objective of the project is to help design and test the entrepreneurial discovery process (EDP) "made in Poland," a key element of the EC "smart" innovation framework and regional/national strategies for smart specialization (RIS3) in the 2014–2020 financial perspective.

The three main goals of the EDP project are to:

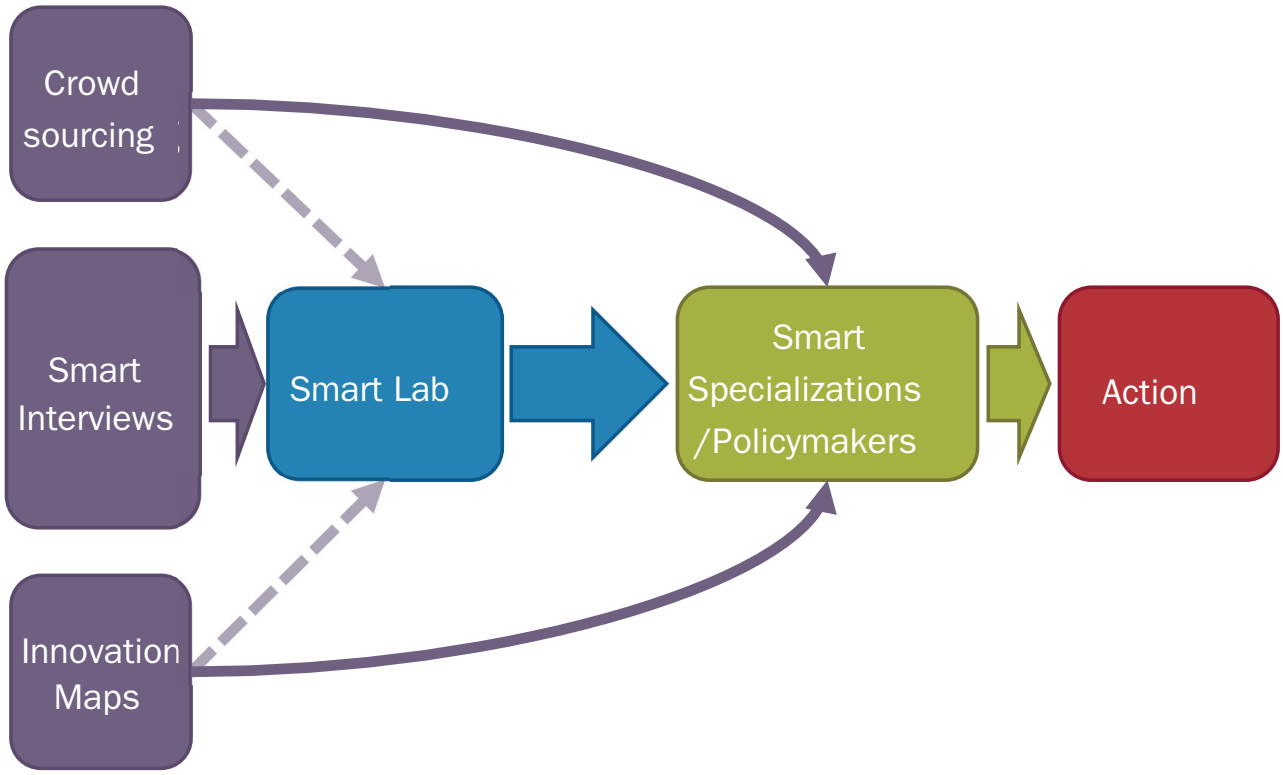
- **Assess the needs of enterprises for innovation and their development potential** on the basis of in-depth interviews with a selected group of enterprises that fit into 10 (out of 20) national smart specializations selected by the MoED. These should then be linked with public intervention strategies to efficiently use the available funds to support Polish companies' innovation in the 2014–2020 EU budget perspective.
- **Help fulfill the EC's ex ante conditionalities related to the EDP.** The project aims to:
  - actively engage the private sector to support innovation efforts and RIS3 policies at the national level
  - contribute to the development of evidence-based policy in respect to identification and development of smart specializations
  - design elements of a system that (i) are complementary to the national M&E system, (ii) deepen the understanding of the current smart specializations, and (iii) support identification of new and emerging business and innovation areas based on technological, sectoral, and business trends
- **Strengthen the capacity of public administration and selected BSIs to ensure EDP continuity.** Methodologies and toolkits developed within the project will be shared with stakeholders. The Bank will also train domestic consultants and selected stakeholders in how to implement the proposed EDP. As a result, the capacity of the support system should be strengthened to enable independent continuation of the project and extension of the pilot on a national scale with coverage of the full range of national smart specializations. When relevant, the project will analyze good practices from other regions in Poland, Europe, and elsewhere and suggest how these could be used in the optimal way. The results of the projects will also be disseminated to the remaining 12 regions that do not participate directly in the pilot project.

Source: The World Bank.

The EDP project helps complement ongoing EDP-related activities of public administration. As such, the World Bank project supports the efforts made by the Ministry of Economic Development, the Ministry of Science and Higher Education (MoSHE), the Polish Agency for Enterprise Development (PARP), the National Center for Research and Development (NCBR), the National Centre for Science (NCN), and the EDP work conducted at the regional level.

The proposed EDP "made in Poland" comprises several components. They follow the principles of smart specialization strategies and the EDP process, are based on the European good practice, and borrow from successful examples of innovation policies around the world. The proposed EDP system for Poland, likely one of the first of its kind in Europe, includes (i) face-to-face firm-level interviews, (ii) Smart Labs, (iii) innovation policy crowdsourcing, and (iv) innovation maps (see Figure 18). Each of the elements of the proposed EDP is described in detail below and main findings and lessons learned are presented in Chapter 4.

Figure 18. Elements of the EDP process "made in Poland"



Source: The World Bank.

Smart interviews

The Bank conducted more than 500 face-to-face interviews with firms. In-depth interviews, mostly with SMEs, took place in four regions of Poland: Dolnoslaskie, Zachodniopomorskie, Swietokrzyskie, and Slaskie (an additional 30 interviews were conducted in Lubuskie, but are not analyzed here). The interviews were conducted by experienced international experts with at least 20 years of relevant experience, who—unlike in traditional online, paper-based, or telephone-based surveys—interviewed companies' top management (chief executive officers [CEOs], chief financial officers [CFOs], owners). Each individual interview took about two to three hours. The interviews were guided by a questionnaire, comprised of a total of 100 quantitative and qualitative questions.[24] The questionnaire was modeled on a good international practice of enterprise and innovation surveys (such as the Eurostat's Community Innovation Survey [CIS] or the EBRD's and World Bank's Business Environment and Enterprise Performance Survey [BEEPS]), but was extended to focus on more qualitative, contextual, and open-ended "why" questions.[25] Box 16 summarizes the interviews' key features.

The firm interviews had a number of main objectives. The main objective was to identify the private sector's innovation and growth constraints, drivers, and needs to inform the public policy and adjust public support accordingly. Table 2 shows the full list of the main and secondary objectives of the interviews

[24] An initial version of the questionnaire included more than 150 questions, but was streamlined during the subsequent stages of the project.
[25] All the analysis presented here is based on a nonrandom sample of interviewed firms, which were chosen from within 10 smart specializations selected by the MoED. As a result, the project's sample of firms is not a statistically representative sample of the population of firms. Further research is needed to confirm the results on statistically representative samples.

BOX 16

SMART INTERVIEWS

Key features:

1. Semi-structured interviews are conducted by seasoned experts, who fill out the questionnaire during the interview and prepare a postinterview summary assessment
2. Interviews last approximately 2 to 2.5 hours and are conducted with a CEO/owner of a company.
3. The interview questionnaire comprises 100 questions (80 quantitative and 20 qualitative questions) based on a conceptual model of firm innovativeness
4. The interviewed companies are selected based on a number of criteria, including size (mostly SMEs), age, geographical distribution, and likelihood of being involved in innovation.
5. Firms are classified postinterview into a number of categories: "champions," "sleeping beauties," "steady state," and "declining" (see definitions in Box 18).

Key statistics:

1. More than 500 interviews were completed in four regions by 11 World Bank experts.
2. An additional 138 interviews were conducted by 20 regional consultants trained by the Bank.
3. More than 40 regional consultants were trained to conduct interviews at a later stage.

A full description of the activities undertaken, as well as a detailed description of the methodology, can be found in Annex 1 and Annex 2 on the project's website.

Source: The World Bank.

Table 2. Interview objectives

Main objectives	Secondary objectives
Identify real innovation and growth constraints, as well as key drivers of innovation for Polish SMEs	Assess firm perceptions of the quality of public innovation support systems and identify the key reform areas
Identify key attributes of companies that could benefit the most from public intervention	Test a new way to conduct the innovation dialogue between the public and private sectors based on direct face-to-face interviews
Identify key business and technological trends perceived by the companies	Build capacity at the national and regional levels to conduct firm-level surveys on a continuous basis
Identify the leading companies in selected business areas/economic activities to participate in Smart Labs	Identify public and private services that companies need most
Provide a new method for the public administration to proactively reach out to business	Provide strategic innovation and managerial advice to the participating companies
Assess the companies' awareness of the smart specialization process	

Source: The World Bank.

Companies participating in interviews were selected from among 10 out of 20 national smart specializations. The 10 smart specializations, selected by the MoED, are listed in Table 3. Sources of data for firm selections included Marshal Offices, BSIs, peer recommendations, results of firm innovation competitions, and a proprietary national-level firm dataset.

Table 3. List of 10 smart specializations selected for firm interviews

	Specialization	Meta-specialization
1.	Medical engineering technologies, including medical biotechnologies	Healthy society
2.	Diagnostics and therapy of lifestyle diseases (diseases of modern civilization) and personalized medicine	
3.	Healthy food	Bioeconomy
4.	Biotech processes and products of chemicals and environmental engineering	
5.	High-efficiency, low-emission, and integrated systems of production, storage, transfer, and distribution of energy	Energy efficiency
6.	Intelligent and energy-saving construction	
7.	Modern technologies of acquiring, processing, and usage of natural resources + producing their substitutes	Natural resources and recycling
8.	Minimizing waste, including those not for recycling + material usage of waste (recycling and other methods)	
9.	Multifunctional materials and composites with advanced attributes, including nanoprocesses and nanoproducts	Innovation technologies
10.	Automation and robotics of technological processes	

Source: Ministry of Economic Development, National Smart Specialization (KIS).

Smart Labs

A Smart Lab (SL) is a key element of the EDP that identifies and assesses the innovation potential of an economic activity. SLs offer a fast and effective way to validate, deepen, modify, or identify a smart specialization. They also have a number of other objectives (Table 4). There are about 20 participants in each SL, including representatives of the best companies ("champions") identified during interviews, representatives of the scientific community, BSIs and administration, and an experienced moderator (Box 17). SLs provide space for informal discussion and exchange of opinions. The results of each SL are summarized in a short summary. The Smart Lab process applies a stage gate approach, where each next SL depends on the success of the previous one.

Table 4. The goals of Smart Labs

Main objectives	Secondary objectives
A bottom-up approach to validate, deepen, or modify existing smart specializations, as well as to identify new business areas with potential Analyze the growth potential of the given economic area based on R&D&I Generate a development vision for an economic area financed by private and public funds	Identify business and technological trends Generate new knowledge among the participants and the public by publishing the results online Initiate cooperation between business and science to create joint R&D&I projects

Source: The World Bank.

BOX 17

SMART LAB METHODOLOGY

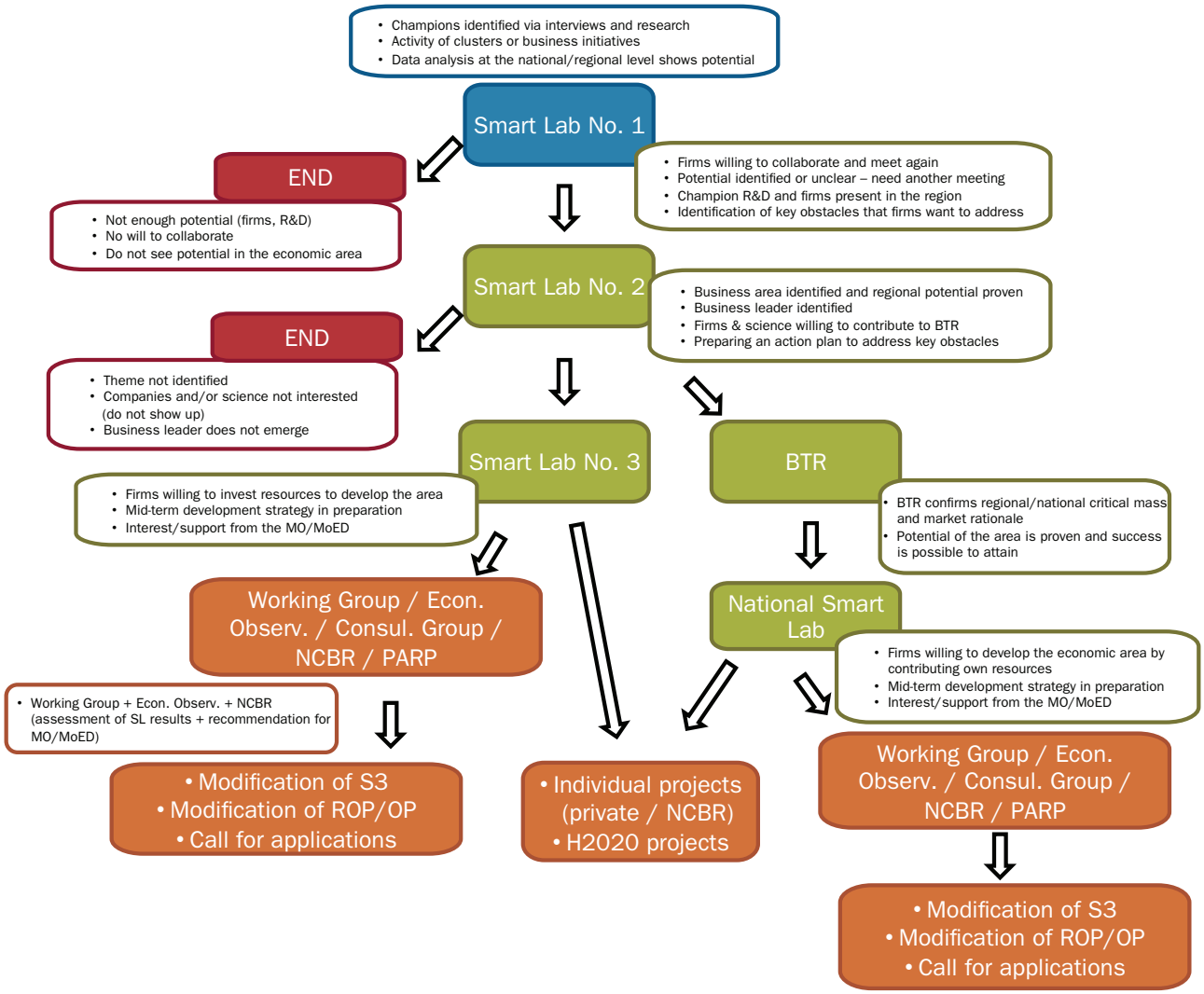
- Smart Labs (SLs) are a series of meetings that take place every month to month and a half; each following meeting can happen only if the participants are willing to participate.
- They include 15 to 20 participants: 8 to 10 entrepreneurs, 3 scientists, 3 BSIs, the MO, and the NCBR/PARP/MoED/ARP; entrepreneurs are chosen from a pool of "champion" companies identified in the interview process—participation via invitation only; scientists are selected among those with sufficient experience in working with business.
- SLs aim to define the economic activity, prepare a SWOT analysis, identify the key success factors (KSFs), analyze the value chains, and assess the scientific potential of the economic activity.
- They last up to four hours and are moderated by a a regional consultant (and/or a business angel)
- Each SLs is followed by a summary with proposals for next steps, surveys among the participants with ideas for cooperation in R&D, and the participants' evaluation of the meeting. The meeting summaries are to be published online to share knowledge outside the SL's participants.
- Successful SLs help produce a Business and Technology Roadmap (BTR) to validate the potential of the economic activity and propose a roadmap for an innovation-based growth.

Source: The World Bank.

The Smart Lab process is designed to quickly test the potential of a business area. It is achieved in the following steps (Figure 19):

- **The first SL** aims to help the SL members to get to know one another, define the SL's business area, prepare a SWOT and/or a value-chain analysis (VCA), and identify key success factors. After the first SL, participating companies are asked to indicate their R&D needs and perceived market trends. The answers inform the content of the second SL.
- **The second SL** showcases the scientific potential of regional RDIs/universities within a given business area in the context of R&D needs and market trends identified by companies participating in the initial SL. The second SL can also be used to further define the scope of the SL (if this was not achieved during the first meeting). The SL should conclude with a joint vision of development of the business area.
- **Depending on the results of the second SL, a business-technology roadmap (BTR) is subsequently prepared** by an external expert(s) in collaboration with a SL business leader. The BTR analyzes market and technology trends for the business area and proposes a roadmap for development based on R&D and innovation.
- **The third Smart Lab** is organized by the national smart specialization working group to verify the BTR's proposed development vision for the business area. Additional national Smart Labs are organized, if needed.
- **The WG incorporates the bottom-up results of the SL process into the development vision of the selected national S3.** The WG's development vision is then reviewed by the national Economic Observatory and the Consultative Group and submitted to the Steering Committee to modify/deepen national smart specializations and adjust public innovation policy.

Figure 19. The Smart Lab process



Source: The World Bank.

Each Smart Lab can evolve in a number of ways. SLs can help verify existing S3s, identify potential new smart specializations, and initiate R&D&I projects, as tested during the project's 20 Smart Labs (Table 5). The possible SL scenarios are the following:

i. **Potential regional smart specialization**—A Smart Lab can help test whether a selected business area in the region has a strong business and scientific potential. SLs can also test whether there is a critical mass of stakeholders that are willing to collaborate and pursue a joint vision of development for their business area. Finally, SLs can also inform regional policy makers about the potential of a selected business area for the regional economy. The SL process in the end can help select a new smart specialization.

ii. **Potential national smart specialization—**A regional SL identifies an international market niche in a given business area that requires top-notch scientific research and business expertise. To fully tap the potential, regional resources need to be supplemented with business and scientific skills present elsewhere (for instance, "CNC machines"). When the BTR confirms these findings and provides a market and technology analysis, a national Smart Lab is organized to further assess the potential of the niche and the country's capacity to address it. The results of the national SL can then be incorporated into the national S3.

iii. **R&D&I projects—**Smart Labs help start and deepen collaboration between participants that can result in preparing individual R&D&I projects. Smart Labs can be a suitable venue for networking and starting new joint undertakings among companies, universities, and R&D institutes.

iv. **Too little potential**—The SL can conclude that a business area is not yet ready to become a smart specialization. This can be caused by various factors, such as a lack of potential in terms of "champion" companies, lack of scientific capacity, stakeholders' unwillingness to collaborate, or inability to find a common definition of the business area to concentrate resources.

Table 5. List of the project's Smart Labs

Region	Theme	Number of SLs
Dolnoslaskie	• Smart home (smart and energy-efficient construction) • CNC/advanced processing of materials	2 2
Zachodniopomorskie	• Packaging • Recycling of resources	2 2
Slaskie	• Automotive • Nanotechnologies • Medical technologies and devices	2 2 2
Swietokrzyskie	• Metallurgy and casting • Food processing (fruits and vegetables)	2 2
National level	• 2nd generation of CNC machines for advanced material processing	2

Source: The World Bank.

Smart Labs support synergies between the national and regional levels. Smart Labs are designed to be an open platform for dialogue and cooperation between regional and national actors. This is particularly important to strengthen vertical synergies between the national and regional levels, and horizontal synergies among the regions. The cooperation can be enhanced by (i) presenting the results of regional SLs to the national working groups; (ii) inviting the regional consultants (who organize Smart Labs financed by the MoED) to join activities carried out within regional EDPs, for instance, region-initiated SLs/focus groups/consortia/partnerships; (iii) merging similar regional SLs into national SLs; and (iv) inviting national innovation support bodies (MoED, NCBR, PARP, etc.) to participate in regional SLs. (see Box 18 for a case study of CNC);

BOX 18

FROM A SINGLE SME TO A NATIONAL SMART LAB—THE CASE OF A SMART LAB PROCESS ON CNC MACHINES

The Smart Lab process in the Dolnoslaskie region revealed a new business area that had the potential to become a part of the national smart specialization on "automation and robotics of technology processes."

An initial SL (SL1) was organized under the theme of advanced metal processing (AMP). This topic emerged from firm interviews in Dolnoslaskie, which helped discover a number of "champion" companies operating in the business area of second-generation of CNC machines. Researchers operating in this field were identified and included in the process. The first SL meeting included seven entrepreneurs, two scientists, two representatives of BSIs, representatives of the Marshal Office, representatives from the national level (MoED, NCBR, MID), the WB moderator, and the WB team. The goal was to verify the proposed theme, elaborate a SWOT analysis, and identify key success factors. The SL also aimed to encourage participants to get to know one another and build trust. The initial SL was region-centric and concentrated on defining its focus. The participants considered broadening the focus of the SL to advanced materials processing, which was to be further discussed during the second SL.

(*continued*)

BOX 18

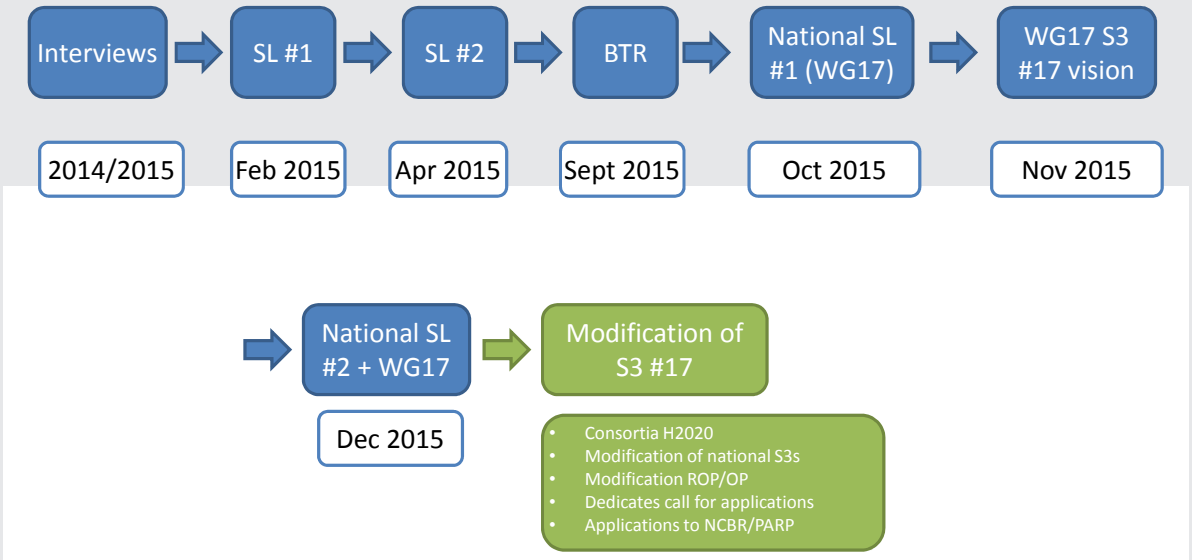
The second SL (SL2) took place two weeks later. Before it was held, participating companies completed "homework" assignments on their R&D plans and perceived technological trends. Almost all of the participants from SL1 came to the second meeting, ensuring continuity and confirming the added value of the process. During the second SL, the R&D sector presented its offer tailored to the SL theme. This was followed by a discussion on what the firms expected would be the "next big thing" in the market. The moderated discussion concluded that three main technologies were important for the area of advanced metal processing: CNC, laser microprocessing, and 3D printing. Following further discussions, it emerged that the second generation of CNC machines had the largest potential for growth. A business leader and a co-leader from the science world emerged to take the lead on the process.

Between SL1 and SL2, new interviews were organized in other regions to confirm the potential of the CNC area. It has been decided to prepare a BTR to analyze the potential of the CNC industry in more depth and propose a roadmap for innovation-based development.

A business and technology roadmap (BTR) was then prepared by an external consultant in collaboration with the SL business leader. The BTR analyzed the market potential and technology and business trends, and it identified key players in the Polish and global market. It also proposed a midterm development roadmap of the area.

The national Smart Lab: On the basis of the previous work, a national SL was co-organized with the national working group (WG). It featured the best Polish CNC companies and top scientists, who confirmed the relevance of the BTR analysis and expressed interest in continuing work on the topic under the auspices of the national WG. At the end of the process, the results of the national SL translated into the development vision for the national smart specialization No. 17 on "automation and robotics of technology processes" (see Figure 20 for the timeline of the process).

Figure 20. Timeline of the SL process for "CNC machines"



Source: The World Bank.

Crowdsourcing

Crowdsourcing is a new platform to directly engage SMEs in innovation policy making. The main objective of crowdsourcing is to reach out to a large number of SMEs that cannot be directly engaged through the limited number

of interviews and Smart Labs. It is modeled on international benchmarks, such as the U.S. Open Government initiative, but adjusted to the specific conditions in Poland.[26] The crowdsourcing is meant to be a cost-effective, flexible, and fast way to establish a systematic dialogue between the private and the public sectors to seek feedback on, for instance, priority areas for policy intervention, barriers to innovation-based growth, emerging business and technological trends, or the efficiency of public support policy on an ongoing basis. In addition, crowdsourcing can also be used to help identify firms that could be interviewed later within the EDP process and invited to Smart Labs (Box 19).

BOX 19

CROWDSOURCING METHODOLOGY

- An introductory email is sent to companies with a description of the goals of the survey and a link to an online questionnaire (there are a number of online platforms that can be used for free).
- The pool of addresses is not restricted to smart specialization areas.
- Information about which companies to include comes from the same sources as for the interviews.
- The project's questionnaire includes 22 qualitative and quantitative questions.
- It takes up to 10 minutes to fill out the questionnaire.

Objectives:

- Identify differences between companies from various smart specializations
- Identify sources of information and barriers to innovation between companies
- Collect opinions on public innovation support
- Identify new ideas for public innovation support
- Reach companies that are not easy to interview or have not been reached before

For more information on crowdsourcing see Annex 2 available on the project's website.

Source: The World Bank.

Innovation maps

The idea of an innovation map is to collect and analyze data from grant applications to inform innovation policy. All types of grant applications submitted to national and regional innovation support institutions constitute an excellent source of crucial and otherwise inaccessible information about companies' perception of ongoing and emerging business and technology trends. Given that each approved grant requires the applying companies to share the cost of the R&D investment, information included in the applications is likely to be more credible than formal declarations in official forums, working groups, and surveys (companies are "putting their money where their mouth is").[27]

The objective of the data analysis is to create innovation maps built along a business/technology matrix. Innovation maps combine the business area of the grant application based on the OECD classification with the technological classification based on the NABS 2007[28] classification to identify business and technology trends and new areas of competitive strengths based on revealed preferences of the private sector (see Box 20 for the methodology).

[26] See, for instance, http://www.whitehouse.gov/open; and Sharma (2010).

[27] Most grant programs financed by the EU required firms to co-finance R&D projects on a 50-50 basis (in some specific cases, 20-80).

[28] Description of the chapters of NABS 2007: 1. Exploration and exploitation of the earth; 2. Environment; 3. Exploration and exploitation of space; 4. Transport, telecommunication and other infrastructures; 5. Energy; 6. Industrial production and technology; 7. Health; 8. Agriculture; 9. Education; 10. Culture, recreation, religion and mass media; 11. Political and social systems, structures and processes; 12. General advancement of knowledge: R&D financed from General University Funds (GUF); 13. General advancement of knowledge: R&D financed from other sources than GUF; 14. Defense.

INNOVATION MAP METHODOLOGY BOX 20

- Grant applications for R&D and innovation support submitted by firms to public support institutions are classified based on the OECD and Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets (NABS) (2007) business and technology classifications.
- OECD and NABS classifications are based on the nature of the submitted projects, not on the general business activity of the applying firm.
- Applications can be divided into various categories: (i) private sector versus academia, (ii) approved applications versus declined, and (iii) by geographical distribution around the country.
- The results of the analysis are graphically shown on heatmaps and charts.

Source: The World Bank.

There has been little effort so far to analyze data from private-sector R&D and innovation-oriented grant applications. Since EU accession in 2004, dozens of institutions around the country, including the flagship institutions such as NCBR and PARP, have accumulated large data sets of thousands of grant applications from the private sector and academia for different types of public support instruments. Since it was established in 2007, the NCBR alone has received more than 13,000 grant applications across all of its support programs included in the national "Smart Economy Operational Program." Yet, in addition, none of the other support institutions have analyzed the grant applications.

3.4 Cooperation model for the EDP in Poland

The EDP requires a cooperation mechanism focused on the quality of the process, not its uniformity. Currently there are 17 different EDP schemes (1 national and 16 regional), 81 regional smart specializations, and 20 national smart specializations. These specializations and individual EDPs partly overlap, and there is scope for joint action that would benefit engaged parties. Moreover, the EC's RIS3 Guide and ex ante conditionalities indicate that authorities have to select a limited set of investment priorities (smart specializations), which, thanks to concentrated financing, will be able to bring real economic effects and allow companies to compete on the international markets. In the Polish context there is scope for EDP collaboration in three dimensions:

- Thematic cooperation
- Process cooperation
- Institutional cooperation

Cooperation will be key to a higher quality of EDP results and improved planning and implementation of the innovation policy. Collaboration facilitates information exchange, mutual learning, and joint actions between stakeholders, and helps divide roles and lines of responsibility. This increases the efficiency and robustness of the process, allowing for better-informed decisions.

The proposed model for EDP cooperation focuses on the national level, but it can also support the regional EDPs. One of the main assumptions of the collaboration mechanism is that national and regional stakeholders are committed to cooperating with one another, willing to learn from each other and share information stemming from their individual EDPs. Such information and knowledge exchange can benefit both levels: it can provide new and critical data for carrying out an effective innovation policy, help avoid duplication of efforts, and save costs. Table 6 summarizes the key benefits of EDP coordination; Box 21 proposes the basic principles of the cooperation model and makes recommendations for the future design of the cooperation mechanism for the EDP.

Table 6. Benefits of EDP coordination

Benefits of EDP collaboration	
For the national level	**For the regional level**
• Opportunity to review and update national S3s based on the results of regional EDPs • Access to analyses conducted at the regional level ("local knowledge"), information on the regional smart specializations (S3s), and results from regional Smart Labs/working groups • Identification of interregional synergies • Facilitated flow of information between national and regional working groups • Improved quality of national level innovation policy based on inputs from the regions	• Utilization of analyses and research performed at the national level and results of the monitoring and evaluation of smart specializations ("opening report," other analytical reports) • Access to results of company interviews, Smart Labs, and BTRs to implement and/or modify regional specializations • Cooperation with regional consultants (RCs) to leverage their bottom-up knowledge to adjust regional public support instruments, including BSIs • Engagement in interregional projects generated during the EDP

Source: The World Bank.

BOX 21

KEY FEATURES OF THE PROPOSED COOPERATION MECHANISM BETWEEN NATIONAL AND REGIONAL LEVELS

1. **Voluntary:** The proposed EDP model is not mandatory and does not impose solutions on regional governments.
2. **Single coordinator:** The central point of the collaboration mechanism is the KIS Coordinator located at the MoED, responsible for management of the national EDP.
3. **Regional consultants:** The proposed model of EDP "made in Poland" is based on regional consultants (RCs) financed from the funds that are at the disposal of the MoED. The RCs conduct interviews, lead crowdsourcing, organize SLs, and publish information about the results of their work on a dedicated website (www.smart.gov.pl). RCs can also participate in the work of the regional and national working groups and support the preparation of BTRs.
4. **Cooperation with Marshal Offices (MOs):** The areas to conduct interviews with entrepreneurs are identified in consultation with MOs; topics for SLs are identified by RCs and PARP in consultation with the MoED and MOs.
5. **PARP:** PARP coordinates the work of RCs and also helps them improve the quality and efficiency of their work. It also analyzes the data and information collected during interviews and Smart Labs. The results of the analysis inform the S3 monitoring system coordinated by the MoED.
6. **Self-coordination:** The RCs collaborate with one another in organizing joint projects and exchanging information. This can be done, for example, by (i) maintaining a common online calendar of interviews with entrepreneurs and a database of interviews, (ii) collaboration in organizing Smart Labs (for instance, help in SL topic identification), and (iii) organizing crowdsourcing. The MoED, PARP, and MOs have access to the calendar of interviews and information about planned events.
7. **Competences:** The MoED, in cooperation with PARP, supports RCs in developing their professional competences, especially in the area of enterprise innovation, by organizing regular national and regional trainings. The interactive trainings will also be a useful platform for exchange of experiences and information among the RCs.
8. **Funding:** In the national resources intended for the EDP, it is recommended that a financial envelope be reserved for which the RCs may apply with various bottom-up initiatives, for instance, to invite external experts/speakers to SLs and Champions Clubs, organize training trips for SL participants, or access various other sources of information. Such initiatives, subject to a short competitive process, could be financed through, for instance, a 50-50 matching grant.

(*continued*)

BOX 21

9. **Public good:** the results of each SL, Champions Club, BTR, and others should be published online in a standardized form (for instance, each event should be summarized in a two-pager). This information constitutes a public good and builds knowledge in a specific business area.
10. **Cross-fertilization:** RCs may also be involved in regional EDPs by participating in regional working groups, subject to the agreement of the Marshal Office.
11. **Communication:** At the national level, the website www.smart.gov.pl will collect information regarding the national EDP. The website will describe cooperation between the national and regional EDPs. It will also feature links to the regional EDPs/RIS3s and will contain results of the SLs, BTRs, and other items related to the EDP.

Source: The World Bank.

Thematic cooperation (smart specializations)

Thematic cooperation of the EDP should help verify and/or modify national and regional smart specializations (S3s). It should aim to identify (i) potential interregional smart specialization areas, (ii) synergies between the national and regional levels, and (iii) areas with comparative advantages that distinguish Poland in the European/international context.

There is potential for streamlining the number of national smart specializations. There are currently 20 smart specializations at the national level, which are divided into five broader thematic "groups." For instance, the "healthy society" group consists of three S3s. The individual S3s in each group seem to partially overlap with each other. It would be useful to consider limiting the number of national S3s by combining some of them under existing groups to enhance clarity.

Data from firm interviews can help modify existing national S3s. Interviews conducted during the project indicate that entrepreneurs cannot easily differentiate between national S3s and cannot ascribe themselves to a single specialization at the national level. Entrepreneurs often indicate that they belong to several adjacent specializations within a given group. Analysis of the interview data shows that a majority of observed differences at the level of individual national specializations is not statistically significant and becomes significant only at the group level. In cases where statistical differences are not significant, it might be reasonable to merge individual specializations.

A number of national specializations are strongly embedded in regional specializations. For illustrative purposes, Table 7 shows a potential matching of national S3s with corresponding regional S3s. It suggests that a majority of national S3s connect to more than one regional specialization. Such strong national–regional matches represent a natural direction for thematic EDP collaboration. They could be the basis for the selection of areas that should be deepened, expounded, and clarified in the process of entrepreneurial discovery. They can also point toward areas with interregional significance that require national-level intervention.

Some national specializations are not matched by regional specializations. This suggests that companies in these fields are geographically dispersed and are too small in each of the regions to have been selected as a smart specialization. Such S3s could be subject to further analyses and interviews to verify their national potential. For the regional level, information from these analyses can provide added value by suggesting potential new regional specializations or areas for interregional collaboration.

Table 7. An illustrative example of possible matching of the national and regional smart specializations

No.	National specialization	Regional specialization	Region
Healthy society			
1.	Medical engineering technologies, including medical biotechnologies	Modern medical technologies	Wielkopolskie
2.	Diagnosis and treatment of civilization diseases and personalized medicine	Medical technology in terms of lifestyle diseases and aging period	Pomorskie
		Quality of life (health)	Podkarpackie
		High quality of life	Mazowieckie
		Medicine and health	Lubelskie
		Health and quality of life	Lubuskie
		Medicine, medical services, and medical tourism	Kujawsko-pomorskie
		Medicine	Slaskie
		Medical sector and life sciences as well as value-chain-related sectors	Podlaskie
		Medical industry (pharmaceutics and cosmetics)	Lodzkie
		Tourism and wellness tourism	Swietokrzyskie
3.	Production of medicinal products	Chemical and pharmaceutical industry	Dolnoslaskie
		(Medical sector) pharmaceuticals and cosmetics	Lodzkie
Agri-food, forestry-timber, and environmental bio-economy			
4.	Innovative technologies, processes, and products of the agri-food and forestry-timber industries	Bio-economy (based on natural resources available in the region, and also on its economic, scientific, and research potential)	Zachodniopomorskie
		Agri-food sector and related sectors of the value chain	Podlaskie
		Bio-based raw materials (and food for conscious consumers)	Wielkopolskie
		Bio-economy	Lubelskie
		Modern agriculture and food processing	Swietokrzyskie
		Agri-food specialization	Opolskie
		Innovative agriculture and food processing	Lodzkie
		Interiors of the future	Wielkopolskie
		Furniture	Warminsko-mazurskie
		Wood and paper specialization, including the furniture industry	Opolskie

(*continued*)

Table 7. Continued

No.	National specialization	Regional specialization	Region
5.	High quality food	Quality of life (production and food processing)	Podkarpackie
		Safe food	Mazowieckie
		(Bio-based raw materials) and food for conscious consumers	Wielkopolskie
		High-quality food	Warminsko-mazurskie
		Best healthy food	Kujawsko-pomorskie
		High-quality food	Dolnoslaskie
6.	Biotechnological processes and products of household chemistry and environmental engineering	Chemistry	Malopolskie
		Chemical specialization	Opolskie
Sustainable energy			
7.	High-efficiency, low-emission and integrated energy production, storage, transmission, and distribution systems	Eco-efficient technologies in production, industry, distribution, and consumption of energy and fuels	Pomorskie
		Low-emission energy production	Lubelskie
		Energy production	Slaskie
		Sustainable energy development	Swietokrzyskie
		Sustainable energy production	Malopolskie
		Fuel and energy specialization	Opolskie
		Energy production	Lodzkie
8.	Smart and energy-efficient construction	Quality of life (eco-technologies—energy-saving construction)	Podkarpackie
		Resource-efficient construction	Swietokrzyskie
		Construction specialization with mineral industry and construction services	Opolskie
		Advanced construction materials	Lodzkie
9.	Environmentally friendly transport solutions	Specialized logistics processes	Wielkopolskie
		Automotive, transport equipment (and industrial automation)	Kujawsko-pomorskie
		Transportation, logistics, trade (waterways and land)	Kujawsko-pomorskie
		Spatial mobility	Dolnoslaskie

(*continued*)

No.	National specialization	Regional specialization	Region
Natural resources and waste management			
10.	Modern technologies for sourcing, processing, and use of natural resources and production of substitutes thereof	Natural and secondary resources	Dolnoslaskie
		Metalworking industry	Swietokrzyskie
		Manufacture of basic metals and metal products and manufacture of nonmetallic mineral products	Malopolskie
		Metal and metallurgical specialization	Opolskie
11.	Minimizing waste, including waste unfit for processing and use of waste for material and energy purposes (recycling and other recovery methods)	Eco-innovation, environmental science, and value-chain-related sectors (including renewables)	Podlaskie
		Green economy	Lubuskie
		Bio-intelligent specialization (natural potential, environment, energy)	Kujawsko-pomorskie
12.	Innovative technologies for processing and recovery of water and reducing its consumption	Economics of water	Warminsko-mazurskie
Innovative technologies and industrial processes (in horizontal approach)			
13.	Multifunctional materials and composites with advanced properties, including nanoprocesses and nanoproducts	—	
14.	Sensors (including biosensors) and smart sensor networks	—	
15.	Smart grids and geo-information technologies	—	
16.	Electronics based on conducting polymers	—	
17.	Automation and robotics of technological processes	Machinery and metal industry	Zachodniopomorskie
		Mechanical engineering and value-chain-related sectors	Podlaskie
		Industry of the future	Wielkopolskie
		Informatics and automatics	Lubelskie
		Innovative industry	Lubuskie
		Automotive, transport equipment, and industrial automation	Kujawsko-pomorskie
		Manufacture of machinery, equipment, materials processing	Dolnoslaskie
		Electrical and mechanical engineering	Malopolskie
		Machinery and electrical engineering specialization	Opolskie

(*continued*)

Table 7. Continued

No.	National specialization	Regional specialization	Region
18.	Optoelectronic systems and materials	—	
19.	Intelligent creative technologies	Interactive technologies in an environment saturated with information	Pomorskie
		Services of the future (ICT, IT, KPO, creative industries)	Zachodniopomorskie
		Informatics and telecommunication	Podkarpackie
		Development based on ICT	Wielkopolskie
		Informatics (and automatics)	Lubelskie
		Information processing, programming, ICT services	Kujawsko-pomorskie
		Cultural heritage, art, creative industries	Kujawsko-pomorskie
		Creative and free-time industries	Malopolskie
		Information and communication technologies	Slaskie
		Information and communication technologies	Dolnoslaskie
		Information and communication technologies	Swietokrzyskie
		Information and communication technologies	Malopolskie
		Informatics and communication	Lodzkie
Others			
20.	Innovative technologies in the field of specialized marine vessels, marine and coastal structures, and logistics based on maritime transport and inland waterways	Offshore, port, and logistic technologies	Pomorskie
		Maritime activities and logistics (including marine technology)	Zachodniopomorskie
	Regional specializations not linked with the national smart specializations	Tourism and health (use of natural resources and cultural heritage)	Zachodniopomorskie
		Cultural heritage, art (creative industries)	Kujawsko-pomorskie
		Trade fair and congress industry	Swietokrzyskie
		Quality of life (sustainable and responsible tourism, eco-technologies—renewable energy)	Podkarpackie
		High quality of life	Mazowieckie
		Life sciences	Malopolskie
		Aeronautics and cosmonautics	Podkarpackie
		Tools, injection molds, plastic products	Kujawsko-pomorskie
		Intelligent management systems	Mazowieckie
		Modern services for business	Mazowieckie
		Modern textile and fashion industry	Lodzkie

Source: The World Bank.

Process cooperation

Poland features a variety of diverse approaches to EDP at the national and regional level. The authorities at the national and regional level designed 17 distinct EDPs that have diverse organizational structures (involvement of the various actors) and process arrangements (EDP composed of various elements and not all are present in each EDP). Such diversity could be helpful to test different EDP models, experiment with different solutions, and leverage good practices. Nonetheless, despite significant differences, each EDP includes three universal parts (stages): (i) analysis of existing data, (ii) dialogue with entrepreneurs, and (iii) translation of the EDP into the innovation policy (Figure 21).

Figure 21. Universal elements of the EDP

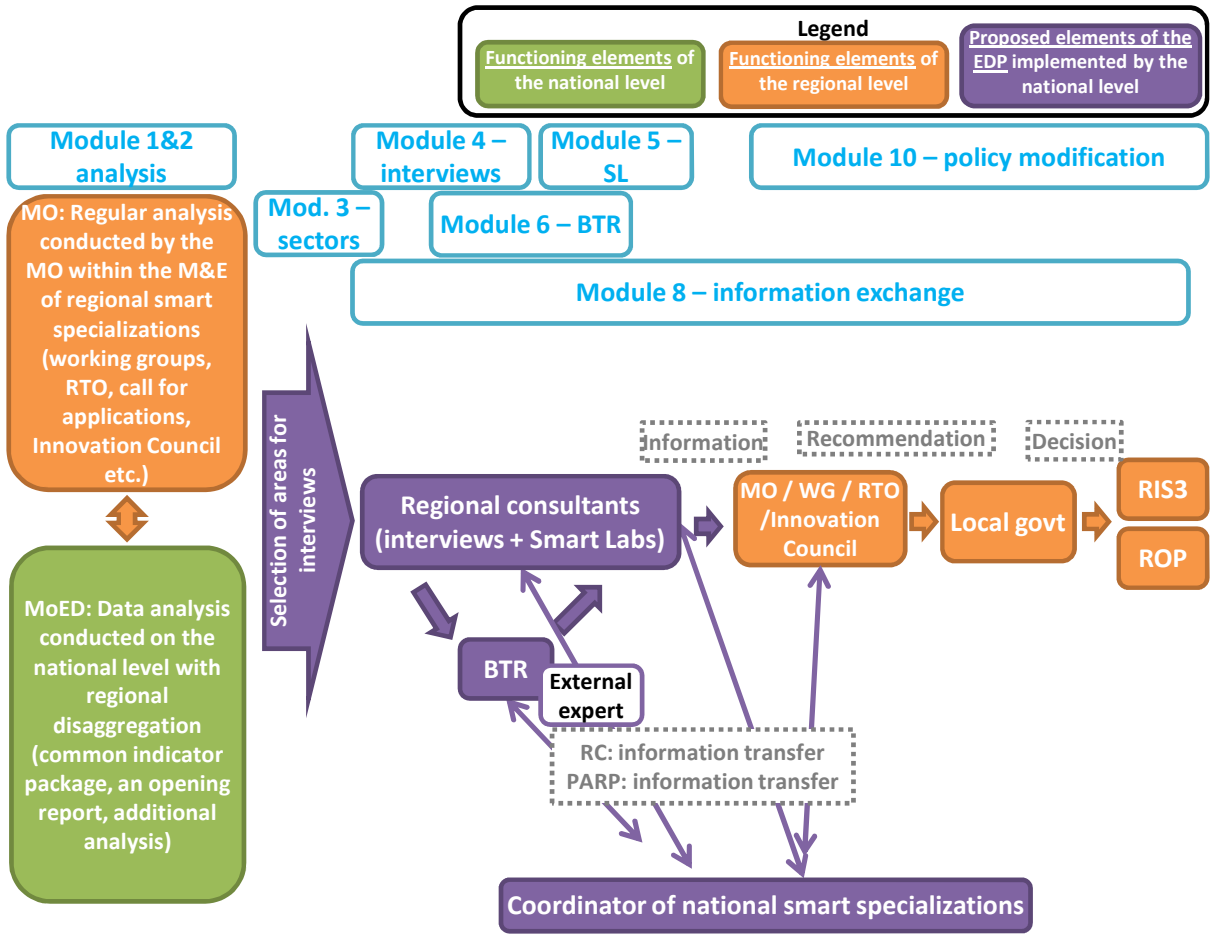
Source: The World Bank.

The proposed model for EDP cooperation is schematic and modular. This implies that the presented model does not precisely reflect the organizational structures that are operating in individual regions, but schematically shows the links between existing and proposed modules (e.g., data analysis, interviews, Smart Labs, BTR, and so on). The modules can already function within various EDPs under different names or may be absent. Figure 22, Figure 23, and Table 8 show the national EDP scheme and a proposed collaboration mechanism and interdependence between the national and regional dimensions. The model is not a "take-it-or-leave-it" solution and can be customized to local circumstances.

Modular structure of the cooperation framework facilitates linkages across various EDPs and promotes flexibility. The modular division was introduced to simplify and generalize the description of the process and facilitate comparisons and linkages between modules already present in the 17 EDPs. The modules focus on processes rather than on institutions, because the latter will vary across the regional and national EDP operational structures. The modular approach to cooperation also facilitates comparison of experiences and exchange of knowledge related to individual EDPs and can help avoid duplicating solutions. Some modules are present only at the regional or national level (interviews only in regions, national Smart Labs at the national level); some exist at both (data analysis, information sharing). Some modules take place almost continuously (information exchange, interviews), some have a limited time span (SLs, BTRs), and some are linked to one another (SLs can be organized only after "champion" companies are identified during the interviews).

The collaboration mechanism matches the iterative and continuous character of the EDP. The EDP does not end after the completion of one cycle, starting from data analysis, through interviews and SLs, to influencing the innovation policy instruments and priorities. The EDP should be regularly repeated, and the continuity of the dialogue constitutes one of its key advantages.

Figure 22. Illustrative contribution of the national EDP to the regional EDPs



Source: The World Bank.

The collaboration model allows for an area of analysis to be narrowed gradually. As in a funnel approach, the EDP starts with a broad, sweeping input (extensive quantitative analysis of available data), then gradually limits the scope of the search by focusing on the most promising areas, where companies are ready, willing, and able to absorb public financing (interviews, SL, etc.), and finally results in a narrow output (identification of well-defined areas within the BTR and national SL). The results then contribute to the decision making of the national working groups, Economic Observatory for KIS, the Consultative Group for KIS, and the Steering Committee for KIS and have an impact on verification and/or modification of the national S3s.

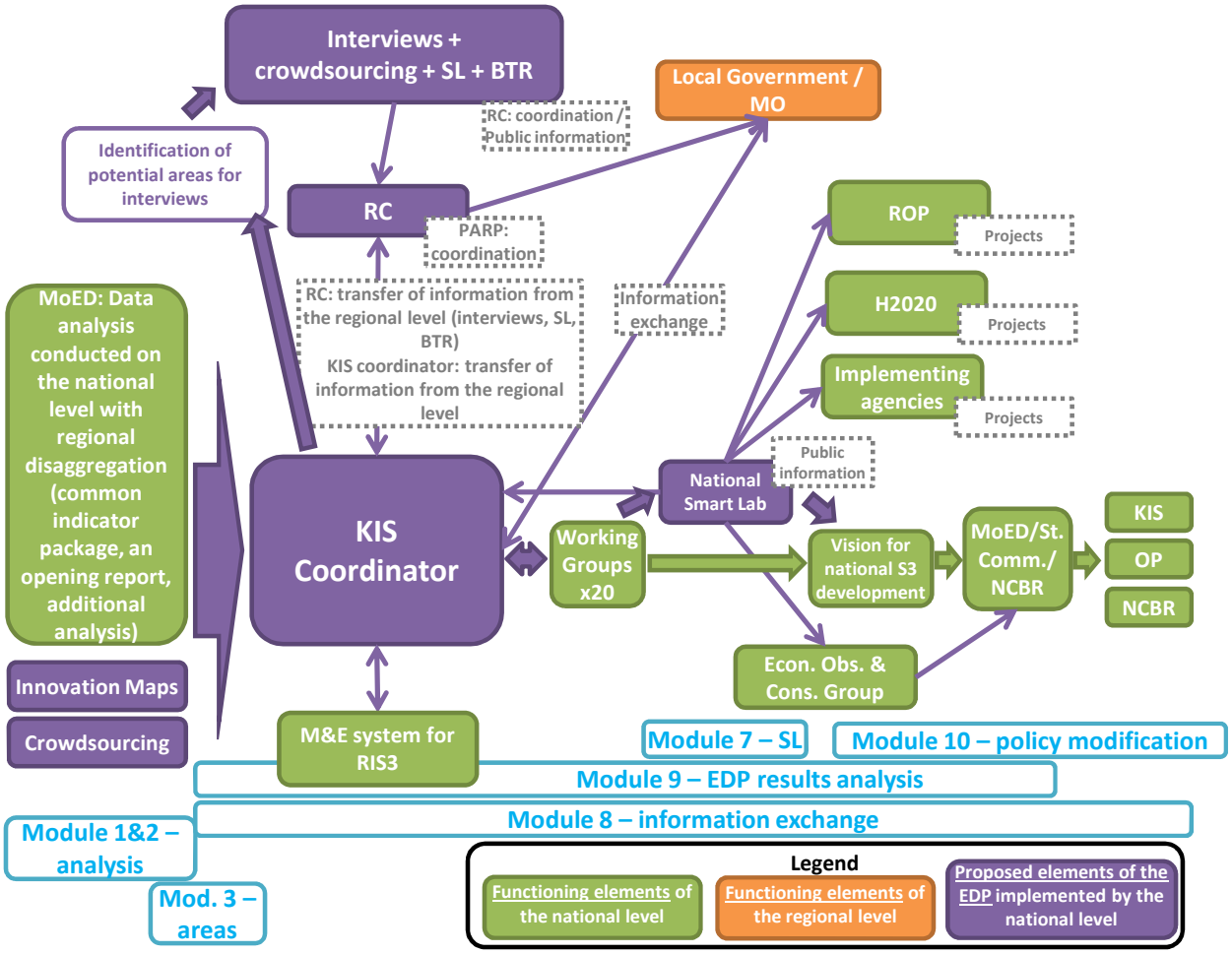
Institutional cooperation

Polish innovation policy could benefit from enhanced institutional collaboration within the EDPs. Current institutional diversity at the national and regional levels creates a complex network of stakeholders, which may not be fully clear for external "users" such as entrepreneurs, who should be the core beneficiaries of the EDPs. The smooth functioning of the EDPs requires a clear division of responsibilities among stakeholders, clear lines of accountability, efficient information flow, and simplicity of use from the viewpoint of companies.

Institutional cooperation does not impose a single institutional structure on existing EDPs. Such an attempt would be particularly futile at the regional level, where EDPs reflect an institutional framework particular for each

region. On the contrary, the model builds upon the existing institutional structure and takes into account already-created entities. Because every model is a simplification of the reality, the model more strongly reflects the national institutional context, whereas the regional dimension, due to its diversity, is treated more schematically. The function of each stakeholder, for example, Marshal Offices, working groups, PARP, regional consultants, and the Economic Observatory, are presented in Figure 22, Figure 23, and Table 8.

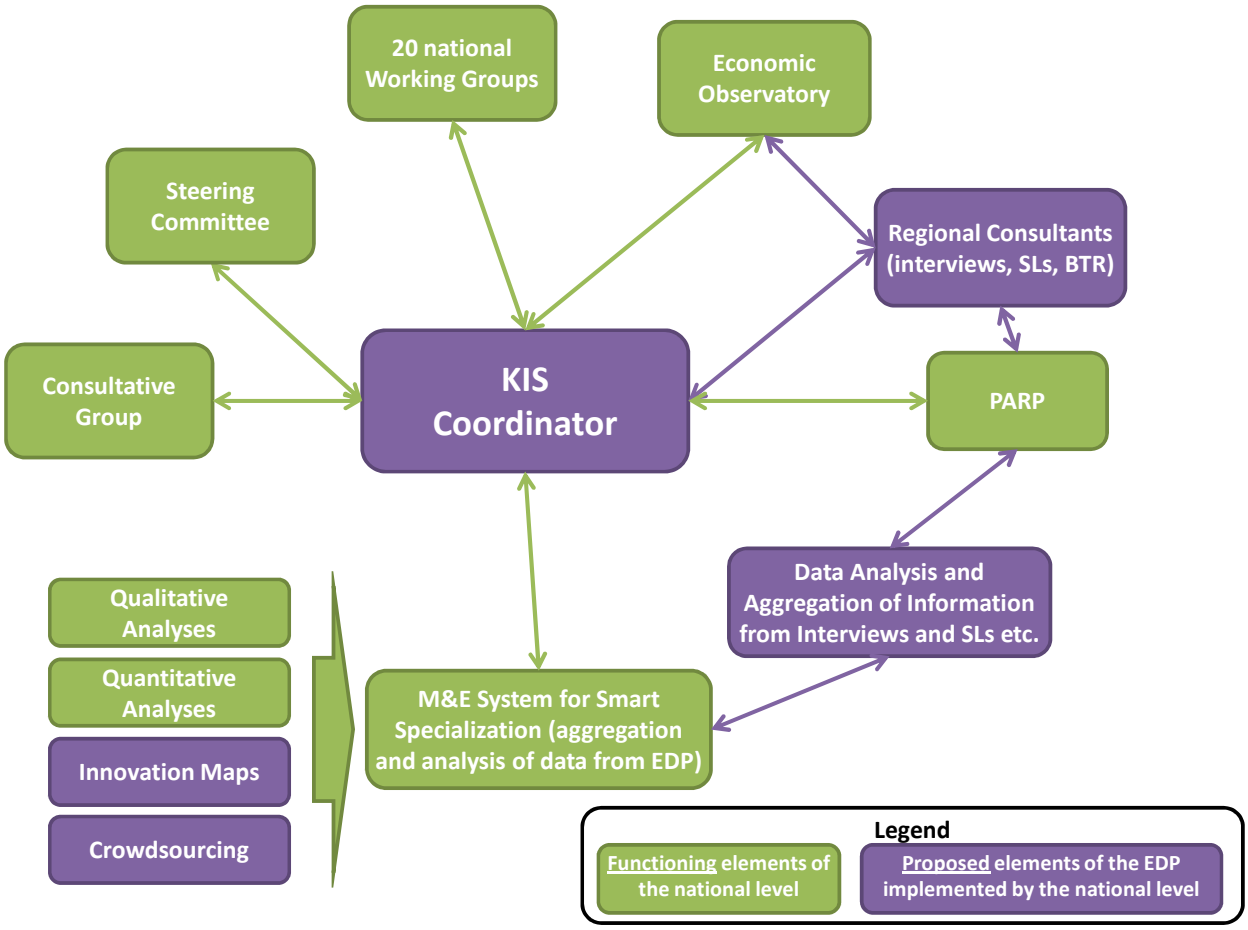
Figure 23. Process cooperation within the national EDP "made in Poland"



Source: The World Bank.

The KIS Coordinator in the Ministry of Economic Development is the focal point of the EDP cooperation mechanism. The KIS Coordinator is a unit responsible for management of the smart specialization agenda at the national level. It supervises the national EDP process, initiates changes to the S3 areas, manages other stakeholders at the national level (PARP, national working groups, the Economic Observatory, the Consultative Group, etc.), and collaborates with the actors from the regional level. The KIS Coordinator delegates tasks, gathers data and analyses related to the national S3s, and finances and monitors the activities within the EDP. This implies close collaboration with the implementing units responsible for managing European structural funds and other entities (Figure 24). Besides the central role of the KIS Coordinator, other stakeholders must also be closely connected, exchange information, and collaborate with one another.

Figure 24. Proposed institutional system of the national EDP



Source: Ministry of Economic Development and the World Bank.

The KIS Coordinator should have sufficient resources to manage the smart specialization agenda. Cooperation of national and regional EDPs seems crucial for the success of Poland's innovation policy, which during the 2014–2020 period is receiving 10 billion euro in financing support. The creation and maintenance of cooperation is an important and time-consuming task. Adequate resources should be allocated for this purpose.

PARP would be well positioned to coordinate the regional consultants (RCs). PARP, in collaboration with the KIS Coordinator and in consultation with the MOs, could be responsible for selecting the regional consultants as well as for coordinating and ensuring high quality of their work. PARP might also help develop the RCs' professional skills related to their EDP functions by organizing regular skill-development trainings on hard and soft skills. The trainings would not only develop the capacity of regional consultants, but also make it easier for them to exchange knowledge and build networks.

Regional consultants play a pivotal role in the coordinated EDP system. Their tasks would include (i) carrying out interviews with companies in selected areas, (ii) leading and documenting Smart Labs (two-pagers after each SL), (iii) recommending areas for BTR preparation, (iv) transferring gathered information to the national level, and (v) collaborating with Marshal Offices and business support institutions. Regional consultants could also work with mentors, experienced businesspeople who could assist RCs in carrying out interviews and moderating SLs. The RCs can also perform other tasks and come up with new ideas to support the EDP process and the participating companies. The RCs should be able to apply for additional funding to the MoED/PARP to finance these additional efforts.

National working groups may propose modifications to the national S3s on the basis of EDP results. Each national S3 has a respective working group (WG) responsible for preparing a development vision for the specialization and for recommending modifications to the scope of the S3. The national WGs are well placed to receive, discuss, and analyze information flowing from firm interviews and Smart Labs to verify their respective smart specializations. For each new BTR prepared for a given business area, the WGs could organize national Smart Labs during which the BTR could be discussed to inform the S3 policy. National WGs may then recommend a given business area to be considered by the KIS Steering Committee as a new potential S3. The Economic Observatory and the Consultative Group should also be included in such a decision.

The national Economic Observatory works as a "wisdom council" and provides checks and balances for the WGs. Due to its expert character, the Economic Observatory (EO) can check actions and recommendations issued by the national WG regarding individual specializations. The EO should play an important role in assessing the quality of BTRs and the results of the national Smart Labs, which constitute the basis for recommendations to the Steering Committee regarding modification of S3s.

Institutional collaboration should be based on regular formal and informal interactions. Although a clear formal line of responsibility needs to be clarified among all the EDP stakeholders, informal forms of communication will be important to keep the system running. A good example of such informal cooperation is the regular meetings of representatives of national and regional authorities in the smart specializations' M&E framework. A similar informal formula for EDP-related topics could be considered to facilitate an exchange of information and experiences and promote mutual learning among regions and between regions and the national level. This could also serve as a platform for initiating joint activities.

Table 8. Modules of the proposed EDP "made in Poland" (process and institutional cooperation)

Module	Activity/goal	Comment/explanation	Who	Financing
Module 1	**Analyses:** Identification/ verification of potential areas of specialization based on the results of quantitative research and S3 monitoring and evaluation: • A list of common indicators used for M&E of S3s • Specific analyses (as a part of M&E of S3s) • Data from the innovation maps, crowdsourcing, previous interviews, BTR, and so forth	Broad economic and scientific analyses of existing data help single out the most promising areas that can be identified with this method.	MoED: own analyses and outsourced ones MoED: the opening report NCBR/ implementing institutions—innovation maps	MoED: the main funding MoED: the opening report
Module 2	**Analyses** of results of regional EDPs and their specializations: • Potential analysis: development potential of the national S3s in the regions • Application of information produced by regions	Linkages between national and regional specializations presented in Table 7 and interregional linkages require more in-depth analysis; hence there is a need to take into account materials produced by the regions and additional studies.	Marshal Office: units responsible for RIS3	Marshal Office MoED

(*continued*)

Table 8. Continued

Module	Activity/goal	Comment/explanation	Who	Financing
Module 3	**Selection of areas for interviews:** • Selection criteria: areas with the greatest potential for development at the national and interregional levels (including those already selected as national S3s, where interregional synergies can be expected, and promising areas emerging from data)	The current national group for M&E of RIS3 (informal body) could be an advisory body in terms of selection of priority areas for interviews. Interviews will be financed from the national level in the framework on the national EDP, but their results will be available to regions, which will allow the latter to use them in their own EDPs.	MoED + consultation with Marshal Offices	
Module 4	**Interviews:** identification of innovation needs of enterprises: • Interviews carried out by trained regional consultants matched with mentors • Interviews are the basis for the identification of Smart Lab themes • Data gathered during interviews are analyzed from different perspectives: for the entire firm population and by individual S3s, type of enterprises, region, and so forth	During the interviews, the role of regional consultants is particularly important. They are expected to select companies, conduct interviews, propose topics for potential SLs, organize SLs, and cooperate at the regional and national levels. Consultants should be adequately trained and be involved in an ongoing process to improve their skills and cooperate with mentors with business experience. Cooperation between consultants and the business support institutions is vital, because the latter can translate needs identified during the interviews into services that could be offered to firms.	Regional consultants and mentors, for example: business angels, experienced managers, venture capital (VC) investors, etc. (PARP coordination, cooperation with the BSIs in the region)	MoED
Module 5	**Smart Labs** in the most promising areas: • Identification of business areas that can develop based on innovation and R&D • Definition of the business area and an analysis of its economic and scientific potential • An analysis of the business area based on a value chains • A vision for development of the business area • Identification of potential individual R&D&I projects • Recommendations for the innovation policy	SL allows moving beyond the micro perspective (single company) and looking at the business area from a collective point of view (entrepreneurs, scientists, authorities, BSIs)—a middle-level perspective. SLs can also motivate participants to initiate individual projects. Selection of high-quality participants is essential. Smart Lab results are part of the national EDP, but could also be utilized at the regional level. Within the national EDP, it is foreseen that interregional Smart Labs connecting stakeholders from several regions will be organized.	Regional consultants and mentors, for example: business angels, experienced managers, VC investors, and so forth + PARP (PARP coordination, cooperation with BSIs in the region)	MoED

Module	Activity/goal	Comment/explanation	Who	Financing
Module 6	**BTR** (business and technology roadmap): • Business and technology verification of ideas that were identified during SLs • Assessment of entry barriers, market potential, and opportunities for the area's development	First, the BTR verifies the results of SL work through an expert assessment of the market and technological potential of the analyzed business area. Second, it helps create a medium-term plan (about five years) for development of the specific area. The BTR should indicate whether the results of previous SL work have a business justification, fit into the technological trends, and have a chance to enter into international value chains or niches in international markets. BTRs should be prepared in a short time (approximately three months) by experienced experts in cooperation with companies and scientists from industry (including a business leader chosen during SLs) and regional consultants. BTRs are financed by the national level and may be consulted with national working groups.	Leading external expert + peer reviewers in cooperation with entrepreneurs and scientists	MoED (+ firms)
Module 7	**The National Smart Lab:** an analysis of the economic and scientific potential of a business area at the national level: • Preparation of a vision and an action plan (roadmap) for the development of a business area, based on R&D and with private and public funding • Identification of interregional dimensions for the area • Initiation of individual applications to national, international (H2020), and regional programs	The National Smart Lab is an "extension" of (inter)regional meetings that concern topics extending beyond a single region and with potential identified in the BTR. The national SL is organized by a national working group. However, continuity of the work performed at the regional level should be maintained. Therefore, some overlap between participants of regional and national SLs should be maintained. Also coordinators of regional SLs should be engaged at the national level; for instance, regional consultants, BTR experts, and business mentors who moderated regional SLs should participate in the meetings at the national level.	National working group + regional consultant + BTR expert + mentor	MoED

(*continued*)

Table 8. Continued

Module	Activity/goal	Comment/explanation	Who	Financing
Module 8	**Information exchange:** exchanging results of interviews, Smart Labs, BTRs, innovation maps, crowdsourcing, and so forth: • Ensuring the flow of information between the various levels of EDP	Information exchange is an indispensable part of the EDP collaboration, and it should take place on a continuous basis. All involved stakeholders should have permanent access to the results achieved and to an overview of planned activities. On the institutional side, information should flow between the KIS Coordination, Marshal Offices, regional territorial observatories, regional consultants, national and regional working groups, the Economic Observatory, the Consultative Group, the Steering Committee, and so forth. Information exchange facilitates EDP management by setting the priority areas for interviews, coordinating the work of the RCs, encouraging collaboration with the WGs, and so forth. The exchange of information should also encompass sharing experience about, for instance, the efficiency of applied public interventions, new ways of engaging stakeholders in the EDP, and how to modify management processes. Information from SLs and working groups should be published online and create new public goods. At the national level, a website, www.smart.gov.pl, already operates. This seems to be a suitable location for sharing all information related to the EDP.	MoED + Marshal Office	
Module 9	**Analysis of the EDP results:** • Verification of existing national S3s and proposals for S3 modification • Identification of synergies between regional S3s—potential for new national S3s • Identification of synergies between regional and national specializations	The data collected during the EDP are analyzed at the national level to (i) monitor the process and check the efficiency of its individual modules, (ii) verify selected specializations, and (iii) identify new potential S3s. This module will also indicate whether new analyses and research are needed to complement already existing data and to better understand and manage the S3 agenda.	MoED	MoED

Module	Activity/goal	Comment/explanation	Who	Financing
Module 10	**Influence on the innovation policy:** • Updating innovation strategy and policy on the basis of EDP results • Analyzing influence of the EDP results on operational programs	Information collected during the EDP is the basis for updating and fine-tuning the innovation policy by, for instance, modifying the S3s list (redefinition of S3s, addition/removal of S3s, verification of S3, etc.) and adjusting the instruments available under the operational programs. At the regional level, the use of the EDP results is optional. Transparency about and clear articulation of how the EDP translates into modification of the innovation policy and its instruments is essential to sustain entrepreneurs' engagement, which is at the core of the EDP. Without such clear feedback, entrepreneurs will not be able to understand the effects of their involvement and may not be willing to participate in future iterations of the EDP.	MoED (optional—Marshal Office)	

Source: The World Bank.

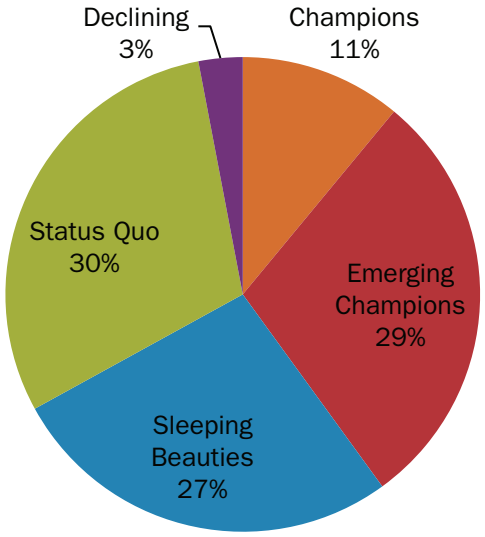
4 "WHAT"—Main Findings from the Project

This chapter analyzes findings from the firm interviews, Smart Labs, innovation maps, and crowdsourcing. The main conclusion is that the proposed EDP helped identify high-growth-potential firms, differentiate smart specializations in terms of their economic and innovation-based potential, and provide recommendations on how to adjust the public support system, in line with the objectives of the project.

4.1 Firm interviews

Mature SMEs represent the majority of interviewed companies. In line with the objectives of the EDP project and the smart specialization policy, SMEs represent about 93 percent of the sample. Large companies represent the remaining 7 percent of the sample and are treated as a de facto control group (Figure 25). Start-ups, defined as companies less than five years old, represent about one-fourth of the sample.

Figure 25. Distribution of the interview sample by company size



Source: The World Bank.

NOTE: "Large" is defined as companies with more than 250 employees, "medium" as 50 to 249 employees, "small" as 10 to 49 employees, and "micro" as those with fewer than 10 employees.

Each interviewed firm is assigned to a specific typology. The typology includes "champions," "emerging champions," "sleeping beauties," "steady state," and "declining" (see Box 22 for definitions). The classification of each company is based on the firm's quantitative and qualitative characteristics and experts' judgment. Each interviewed company can belong to only one category.

BOX 22

TYPOLOGY OF COMPANIES APPLIED IN THE ANALYSIS

Champion—a top-class company that has strong leadership, an innovation-focused mind-set, and a clear vision of its development. It actively monitors business, market, and technology trends; systematically seeks knowledge domestically and internationally; constantly looks for new market opportunities (adopts a preemptive or proactive market behaviors); follows good management practices; and is strongly connected with a network, including within its value chain (customers, suppliers).

Emerging champion—a very good company that demonstrates many features of a "champion," but it has not yet demonstrated that it can scale up its growth path and expand on its innovation track record.

BOX 22

Sleeping beauty—a company that exhibits several behaviors of "champions"; it is doing well and has potential to develop quickly, but it lacks exposure or has not yet capitalized on opportunities that could make it grow faster. Such firms usually do not realize what they need to accelerate their growth or do not have access to the necessary services or skills. They typically underappreciate opportunities inherent in foreign expansion, they tend to be understaffed in the marketing and R&D areas, and they display fewer networking behaviors.

Steady state—a company that is reasonably successful, but is conservatively managed, with a low level of ambition, distrustful of outsourcing, lower networking scores, small overseas presence, and not much visionary ability. Management is risk averse, is comfortable with the status quo, and passively reacts to market trends. It has limited track record of innovation.

Declining—a company that typically scores low on dimensions of clarity of vision, growth, and ambition; it is usually locked in stagnant and/or declining markets, is incapable of foreign expansion/presence, has poor networking behavior, has weak access to knowledge, and has no track record of innovation.

Source: The World Bank.

The objective of the typology is to help identify priority target groups for public intervention. Public support is likely to be most efficient when it reaches companies that are ready, willing, and able to spearhead their development through innovation and R&D. Given the complex nature of innovation, selecting companies based only on quantitative, hard data is not likely to be sufficient. For instance, fast-growing companies ("gazelles") do not necessarily need to be innovative, and vice versa—innovative companies do not necessarily need to grow fast.[29] Hence, the choice of companies worthy of public support needs to be based not only on quantitative characteristics, but also on qualitative, soft characteristics, including such key attributes of innovative firms as the company's vision, management's mind-set, quality of management practices or strength of networking skills. Data analysis suggests that, in principle, it is possible to identify "champions" and other companies based on a number of key qualitative and quantitative attributes (Box 23).

BOX 23

HOW TO IDENTIFY A "CHAMPION"? A PREDICTION MODEL

Using the data from the firm interviews, it is possible to construct an econometric model that attempts to identify different types of companies—"champions," "emerging champions," "sleeping beauties," and others—based on statistically significant attributes. There are two models that can be used to predict if a firm is a "champion" or not, briefly described here.

i. "Champion"/"non-champion" model based on soft data

The preliminary analysis suggests that "champions" can be identified by the following attributes:

Variables/reference category	Significance
Expert's assessment: Willingness to grow	+++
Expert's assessment: Visionary ability	+++
Expert's assessment: Potential to internationalize	+++

+++ = the strength, significance level < 0.01; ++ = significance level < 0.05

These attributes allow for a "champion" to be identified with a high probability (87 percent for the project's sample of firms). The analysis also suggests that identifying a "champion" and/or a "sleeping beauty" is largely based on qualitative attributes. This suggests that the public support systems might need to be adjusted to allow for

(*continued*)

[29] Coad et al. (2014); OECD (2015b).

BOX 23

more qualitative assessment of companies for support. Professional investment committees and a face-to-face contact with an entrepreneur are likely to be critical for effective public support of innovation.

ii. "Champion"/"non-champion" model using hard data

It is also possible to predict the type of company based on more quantitative data. The key preliminary attributes are the following:

Variables/Reference category	Significance
Number of process innovations introduced in the last three years	+++
R&D expenditures in the last three years	+++
Average revenue growth in the last three years	+++
Percent of employees with higher technical education (STEM)	++
Export share as percent of the turnover	++

+++ = the strength, significance level < 0.01; ++ = significance level < 0.05

Such analyses could help create a specific scoring model to filter companies based on data collected during face-to-face interviews and online crowdsourcing. This could be one of the elements of the process of identifying high-growth-potential firms to be supported by the public sector.

Source: The World Bank.

"Champions" and "emerging champions" represent the likely preferred target group.[30] There is a growing body of literature on the special characteristics of "high-growth-potential firms," which seem to be responsible for the bulk of reported growth in productivity, employment, and social welfare and are increasingly the subject of focused governmental support around the world (Box 24). In our data set, "champions" are companies that rise above their regional and national peers. They have strong management teams that can articulate a clear vision of the company's growth and that perceive innovation as one of the key sources of competitiveness. They also have a good assessment of their companies' strengths and weaknesses. They implement innovation most frequently among the interviewed companies (Figure 26). Public support could help them leverage existing competitive advantages to become larger players in the national, European, and global markets and provide above-average rates of return on public investment.[31]

"Sleeping beauties" could provide substantial economic impact by becoming "champions." "Sleeping beauties" are companies with a significant, but not fully tapped potential, which could become "champions" with the right dose of incentives to innovate, "sticks and carrots." In many ways, as also argued by the EBRD (2014) Transition Report and the UK 2014 Innovation Survey,[32] given the low starting base in terms of innovation intensity, payoffs from waking up "sleeping beauties" to become innovative "champions" could be substantial.

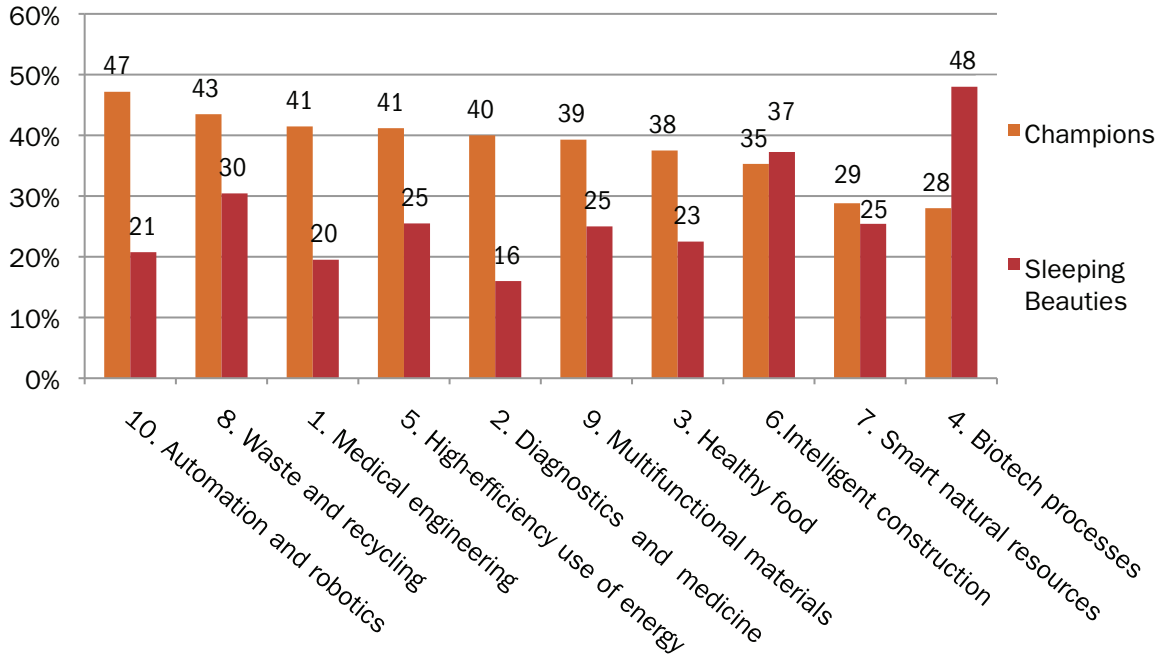
The remaining types of companies—"steady state" and "declining"—may not be the priority for public innovation policy. This is because they tend not to have the inherent innovation abilities to productively use public support. That said, they should still be supported, primarily through horizontal policies focused on improving the business

[30] In the following discussion, most analysis and recommendations for "champions" also apply to "emerging champions," unless noted otherwise.
[31] The specific impact should be evidenced by rigorous follow-up evaluation studies, based on randomization techniques.
[32] EBRD (2014); Coad et al. (2014).

climate, enhancing access to financing, and improving human capital. They should also have access to public support, especially aimed at increasing the companies' seemingly low level of ambition through, for instance, programs helping to expand access to knowledge about technologies and market opportunities.

"Champions" represent a substantial proportion of the interviewed companies. They make up 40 percent of all interviewed firms within the sample, which is more than in other studies, such as the UK 2014 Innovation Survey, which is based on the results of Eurostat's Community Innovation Survey 2006–2012 (Eurostat, 2012). The UK Innovation Survey shows that the distribution of "champions" (defined as "highly innovative firms," or HIFs) is highly skewed—only 20 percent of companies were HIFs. The higher proportion of "champions" in the project sample can be explained by the specific focus of the project on innovative companies rather than on a random sample of all companies.

Figure 26. Distribution of the top 25 percent of the most frequently innovating firms



Source: The World Bank.

BOX 24

THE CASE FOR SUPPORTING HIGH-GROWTH-POTENTIAL COMPANIES

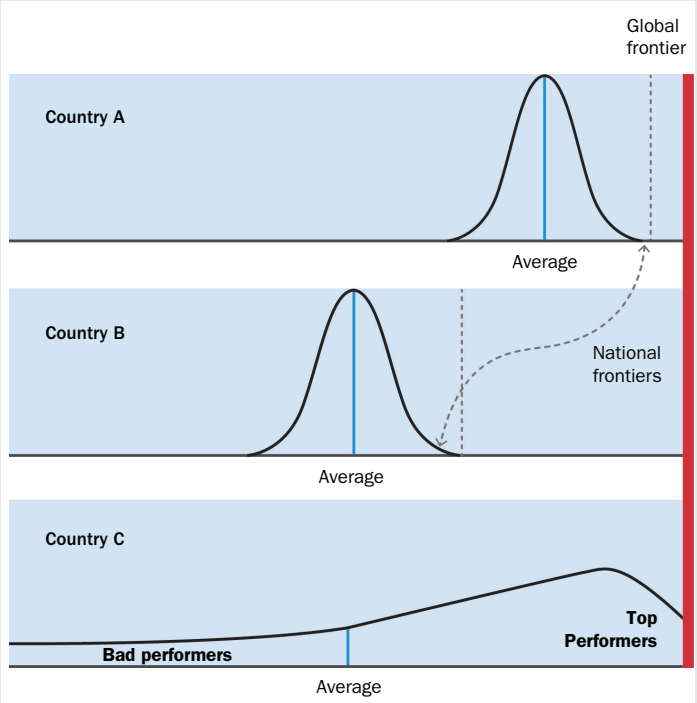
There is a growing body of literature that documents a substantial heterogeneity in productivity levels among firms. For instance, in the United States, the top 10 percent of the most productive firms in each industry are twice as productive as the bottom 10 percent of firms; in China the ratio amounts to 3:1; and in India, even 5:1. High-productivity firms are persistent: they tend to sustain high productivity levels over time. The top 10 percent of firms seem to be responsible for the bulk of increase in productivity, employment, and social welfare.

There is large heterogeneity among countries in the distribution of high-growth-potential firms and their level of productivity. The stylized picture of the heterogeneity is reflected in Figure 27: The United States is likely to be considered "country A," with a normal distribution of firms around a high average productivity; Poland could be "country B," with the same distribution, but with a lower average of productivity; India could represent "country C," with a wide distribution of outcomes, where many poorly performing firms survive because of weak competitive pressures, pulling down overall productivity and constraining resources available for the most productive firms.

(*continued*)

BOX 24

Figure 27. Distribution of innovative companies

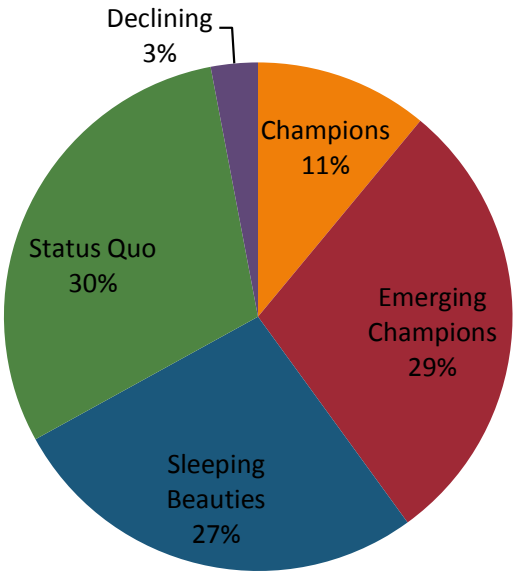


Source: OECD (2015b).

For policy makers, the objective should be to narrow down the distribution of outcomes and shift it toward the global productivity frontier by, among other things, enhancing competition to weed out poorly performing firms, help the best performers reach global levels of productivity, and increase the number of best companies ("champions") by supporting innovative start-ups and transforming "sleeping beauties" into "champions."

Source: The World Bank based on OECD (2015b); Syverson (2011); and Acemoglu, Akcigit, Bloom, and Kerr (2013).

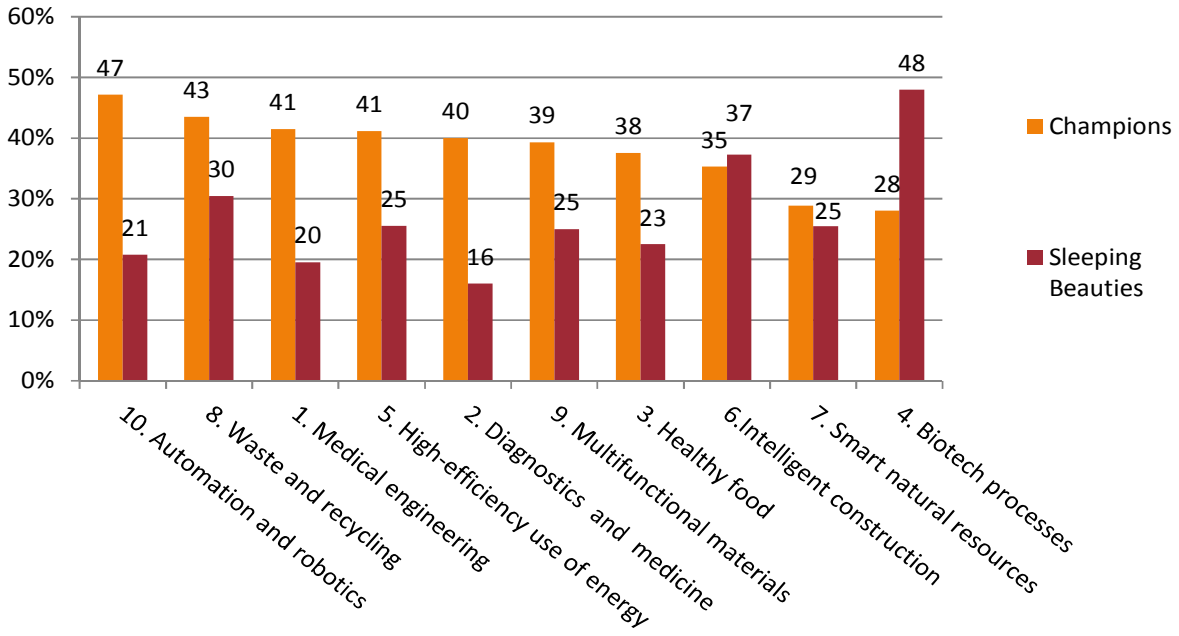
Figure 28. Ratio of firm types in the sample



Source: The World Bank.

"Champions" and "sleeping beauties" tend to be unevenly distributed among smart specializations. Although there is innovative potential in each of the smart specializations, there are relatively large differences among the proportion of "champions" and "sleeping beauties" in each of the national smart specializations (Figure 29): among companies belonging to "automation and robotics," almost half were classified as "champions"; in turn, biotech had only 28 percent of such companies. Similarly, large differences were found among "sleeping beauties." Although one cannot draw statistically viable conclusions from the interviews, they nonetheless provide a useful snapshot of the likely innovation-based growth potential within each smart specialization.

Figure 29. "Champions" and "sleeping beauties" across smart specializations



Source: The World Bank.

Drivers of innovation

There are many drivers of company innovation. A large body of economic literature[33] suggests a whole list of macro-level, middle-level, and firm-level innovation drivers. On the macro level, these usually include access to financing, rule of law, openness to trade, availability of skills, exports, and technological changes. On the firm level, innovation is largely driven by age, size, export intensity, and ownership status. The EBRD 2014 Transition Report found, for instance, that on the macro level, innovation among firms in the Europe and Central Asia (ECA) region was driven by openness to international trade, trade regulations, and availability of a skilled workforce. Access to financing and ICT infrastructure were also important. As to the firm level, larger, older, export-oriented, and foreign-owned firms were more likely to be innovative than the average.

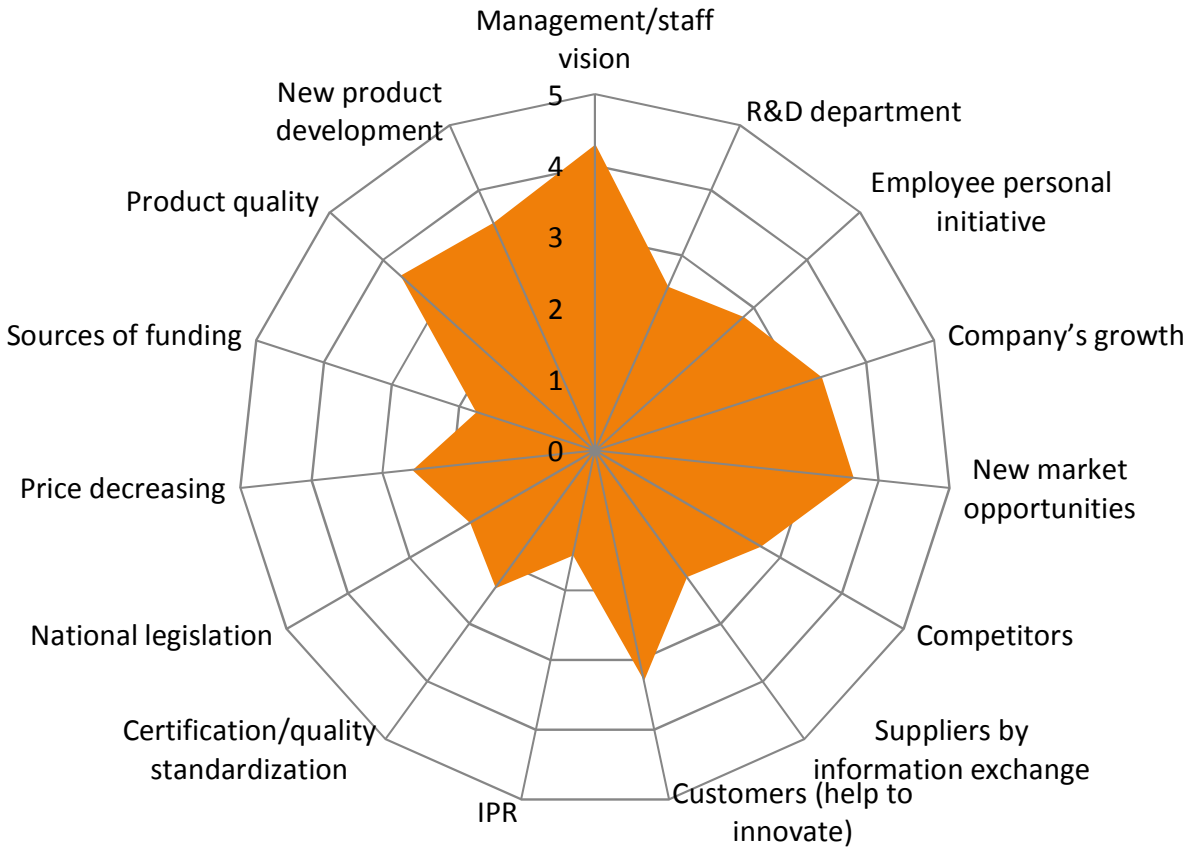
The project's interviews focused mostly on firm-level innovation drivers. This focus was dictated by (i) the objectives of the EDP, which emphasize that firms are key to robust entrepreneurial discovery; (ii) the need to understand the "soft" drivers of innovation, such as management's ability to provide a vision of growth based on innovation; and (iii) the need to provide added value going beyond the existing studies.

The management's mind-set, new market opportunities, and the need to improve product quality are the key innovation drivers for the interviewed companies. In the sample, these drivers averaged almost 4 points on a 0-to-5 scale. The role of management as the driver of innovation was particularly important, suggesting that efforts to increase the understanding of the importance of innovation among top management could provide substantial benefits. This could be achieved through, for instance, innovation outreach and business networks and trainings

[33] See OECD (2015b), EBRD (2014), and Christensen (2011) for a useful review of the existing literature of innovation drivers.

(see Box 26 later in this section on the importance of management practices for innovation and productivity). New market opportunities were another important driver of innovation, suggesting that enterprise innovation could be spurred by further opening of product markets to more competition, in Poland and abroad. Finally, the need to enhance the quality of products was another source of innovation, implying that innovation is rightly seen as critical to upgrading production toward more value-added products. The three main drivers were followed by market developments, technological changes, and the need to listen to customers (Figure 30).

Figure 30. Firm-level innovation drivers



Source: The World Bank.

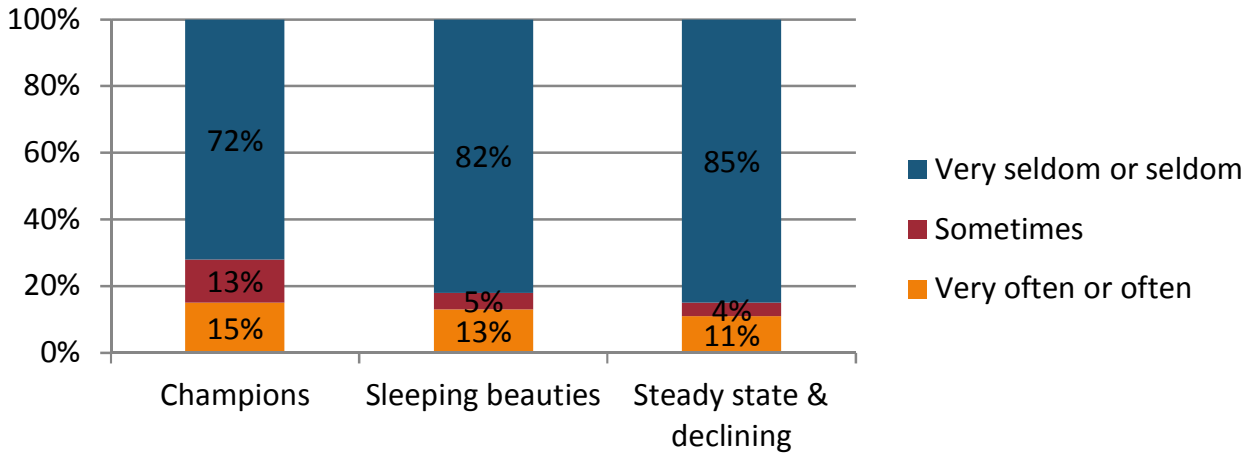
Open-ended, qualitative questions showed that external factors had a big impact on innovation. Interviewed firms identified customer demand, new product trends, and management vision as the top three drivers of innovation.[34] "Champions" tend to enumerate a broader range of drivers than other types of companies; however, for every type of firm, the company's customers are the most important driver of innovation. This suggests that enterprise innovation is sensitive to clients' overall level of innovativeness and risk appetite. Unfortunately, many customers do not seem to have a high risk appetite, which is in line with the overall image that there is little appreciation of innovation as a key source of competitiveness. However, foreign-owned customers (and suppliers) were a more significant driver of innovation than Polish-owned customers. This suggests an important role of FDI and global value chains for technology absorption and innovation among Polish SMEs.

Intellectual property rights (IPR), suppliers and providers of funding seemed to be the least important drivers of firm innovation. Less than 15 percent of companies across the sample considered IPR as an important driver of innovation (Figure 31). This finding confirms the anecdotal evidence that Polish companies do not fully appreciate the value of protecting IPR. This seems to be the result of a low level of awareness about IPR rights and distrust of a

[34] For a detailed methodology of the qualitative questions asked during the interview and the postinterview qualitative summary, please refer to the Questionnaire Manual in Annex 1 available on the project's website at www.worldbank.org/poland/innovation/edp.

patent's ability to provide effective IPR protection. Even firms that do appreciate IPR often do not try to protect their intellectual rights because they are concerned about the low quality of IPR court enforcement, the high costs of potential litigation, and the often insufficient quality of patent attorneys. Debt financiers such as banks (not to be confused with access to financing, discussed in other studies) do not seem to put much pressure on firms to innovate. That said, the few SMEs in the sample that were co-owned by business angels and/or VC funds reported much higher pressure from shareholders to innovate. This suggests that it would be useful for the public sector to further promote VC funds/ business angels, through co-investment, conducive horizontal polices, and activities to raise awareness.KFK (National Capital Fund) and NCBR financed VCs and seed funds and PARP financed business angel networks are a step in the right direction, but such policies could be developed further.

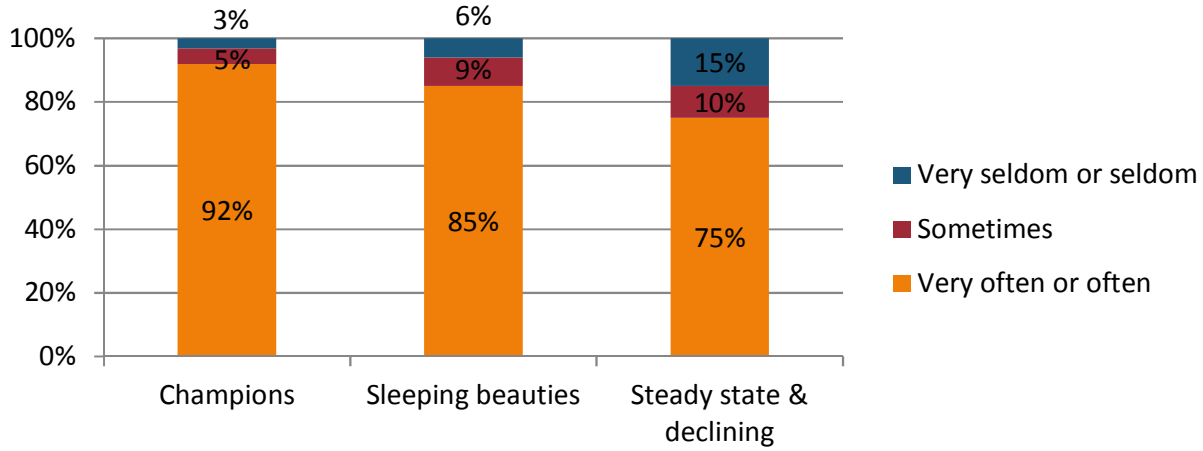
Figure 31. IPR as a driver for innovation



Source: The World Bank.

Among innovation drivers, the management's mind-set is a key attribute of "champion" companies. Top managers in "champion" companies consider innovation as a vital element of their competitive advantage and growth, as opposed to, for instance, low labor costs. The management's innovation mind-sets in "steady state" and "declining" companies are significantly less pronounced (Figure 32). Although it is not fully clear what drives the emergence of such innovation mind-sets (see Box 25 for characteristics of founders of high-growth companies), innate abilities and education are likely to play a role. This is an important area for further research.

Figure 32. Management's mind-set as a driver of innovation



Source: The World Bank.

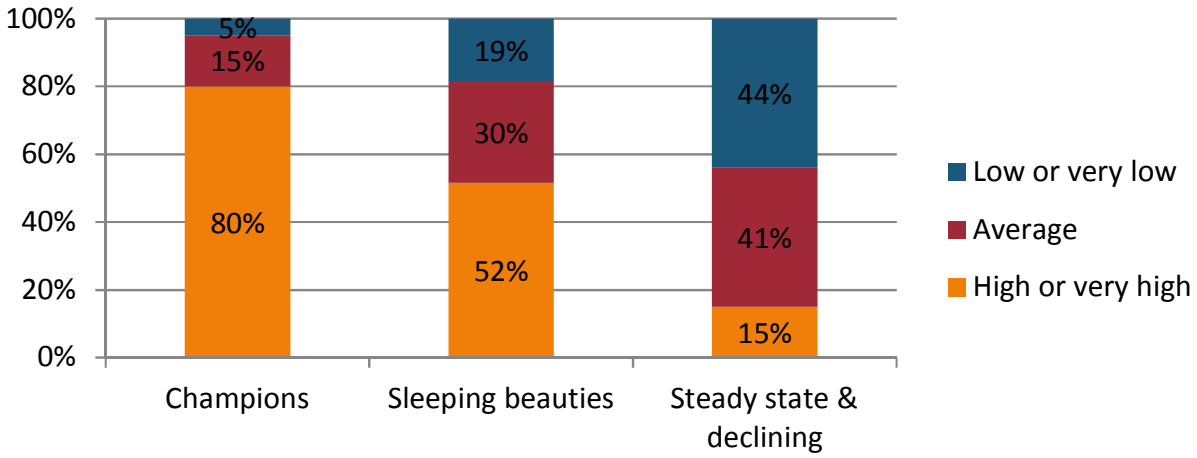
WHO ARE THE FOUNDERS OF BUSINESSES IN HIGH-GROWTH INDUSTRIES WORLDWIDE? **BOX 25**

A recent international study surveyed 549 company founders in a group of high-growth industries, including aerospace and defense, computer and electronics, health care and services (computer services, engineering consultants, software and programming). Founders were asked detailed questions about their backgrounds, motivations and experiences in launching companies. The findings show that entrepreneurs typically come from a middle-class or upper-lower-class background, are well-educated, middle-aged, married and have at least one child (60 percent of the sample). They pointed to "prior work experience, learning from previous successes and failures, a strong management team, and good fortune" as the key success factors in entrepreneuship. The respondents identified risk aversion as the key barrier to entrepreneurial success.

Source: Vivek, Aggarwal, Holly, Salkever (2009s, 2009b).

Management of "champion" companies also score highly on visionary ability. Although assessing the ability of members of top management to formulate visions of their companies' development is by definition difficult and subject to perception bias, "champion" companies seem to stand out among other types of companies by the ability of members of top management to delineate where they want their companies to go. They understand that, to paraphrase Alice in Wonderland, "if you do not know where you are going, any road will take you there." The road followed by most "steady-state" and "declining" companies focuses mostly on day-to-day survival rather than further development (Figure 33).

Figure 33. Visionary ability



Source: The World Bank.

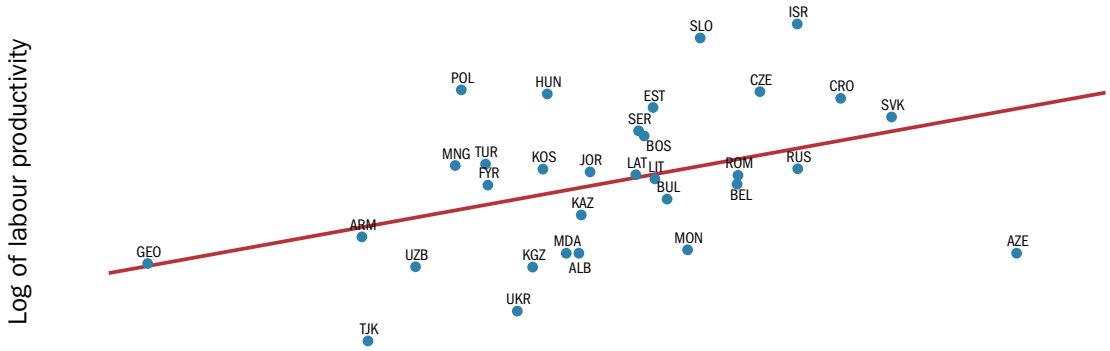
The quality of management practices is also important for innovation. Data collected during interviews suggest that there is a strong correlation between the quality of company's management practices, as reflected in performance measurement, management structures, and human resource practices, and the innovation intensity of a company. This is in line with the research by Bloom, Sadun, and van Reenen,[35] which shows—based on a large sample of enterprises in more than 10 countries—that management practices explain much of the divergence in productivity among firms and are also correlated with innovation. Similarly, the EBRD 2014 Transition Report argues that higher quality of management practices enhances labor productivity. Somewhat in contrast to the results of the Bloom et al., which show that Poland's quality of management practices is in line with its level of development, the EBRD finds that the management practices in Poland are below the average in the Europe and Central Asia region (Figure 34).[36] This

[35] Bloom, Sadun and Van Rennen (2012).

[36] The difference may be driven by a different sample of interviewed companies; the EBRD focused on smaller enterprises with 20+ employees, whereas Bloom, Sadun and Van Rennen (2012) included firms with 100 to 5,000 employees, with a median size of 270 employees. A low score in the EBRD survey suggests a large scope for improvement in the quality of management practices among Polish SMEs.

suggests an important area for public policy intervention, especially because many managers do not seem to be able to correctly self-assess the quality of their own management practices (Box 26).

Figure 34. Positive correlation between the quality of management practices and labor productivity



Source: EBRD (2014), p. 40.

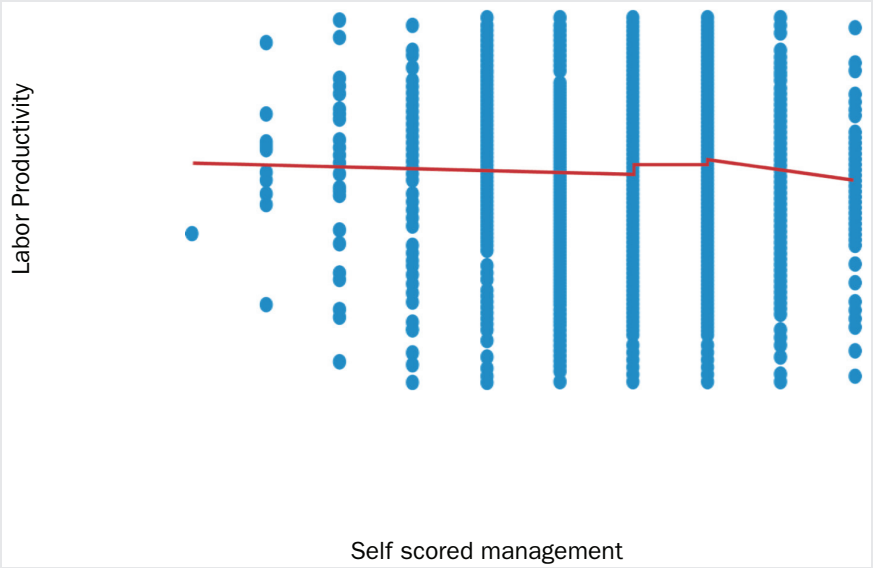
BOX 26

MANAGEMENT PRACTICES: FIRMS DON'T KNOW WHAT THEY DON'T KNOW

The quality of management practices is critical to productivity and innovation. Although the quality of management in Polish companies seems to be largely in line with the country's level of development, there is much heterogeneity in the quality of management practices among the surveyed enterprises (Bloom, Sadun and Van Rennen, 2012).

Interestingly, it seems that many firms are not aware of the quality of their management practices: their self-assessments suggest that many CEOs do not know that management practices in their firms may be below par; Figure 35 shows that CEOs even in the least productive firms consider their management practices to be better than the assessment of these skills by external experts.

Figure 35. Self-assessed management and labor productivity



Source: Bloom, Lemos, Sadun, Scur, and Van Reenen (2014).

(continued)

BOX 26

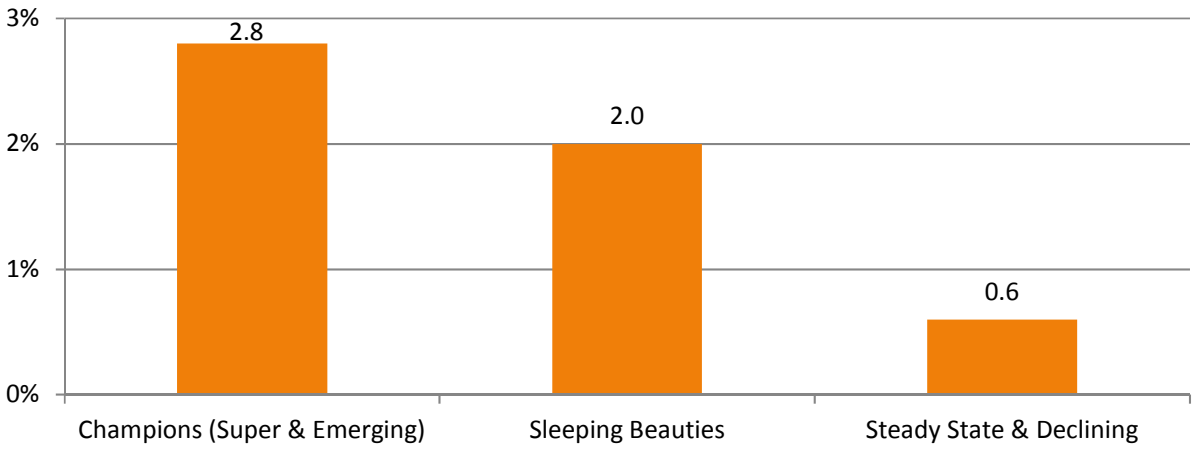
Such findings are broadly in line with the conclusions from the firm interviews conducted within the project. The companies' managements often did not acknowledge that the quality of management itself might be the main constraint to innovation. For instance, managements in "champions" gave themselves an average score of only 1.8 on a 0-5 scale of "constraints to innovation". "Declining" companies had a score of 2.3, suggesting that they did not perceive their managements' skills as a constraint to innovation.

The findings of both projects suggest that there is a need to inspire companies to benchmark their management skills and improve them when necessary. Given that better management practices could explain almost half of the difference between productivity levels among firms (Bloom, Sadun and Van Reenen 2013), such public outreach programs could have a substantial impact on growth, productivity and innovation, especially among SMEs.

Source: The World Bank.

R&D is another vital driver of innovation. Although R&D is not always necessary to develop innovation, it is nonetheless one of its key drivers, especially in regard to technological innovation. Our sample confirms this finding: "champion" companies are most R&D intensive among all interviewed companies (Figure 36). What is more, R&D expenditures are one of the key predictors of being a "champion" (see Box 23). "Sleeping beauties" spent less on R&D, suggesting that this might be one of the barriers to them becoming "champions." The other two types of firms spent little on R&D.

Figure 36. R&D intensity by type of firm, R&D spending as % of revenue



Source: The World Bank.

R&D spending is positively correlated with company growth. Data from our sample show a positive correlation between R&D intensity and three-year average revenue growth. Although correlation is not causality, and further research is needed, it seems likely that R&D is among key growth drivers. This is in line with results from other research on companies in Poland, including the EBRD (2014) and the most recent NBP analysis, which found a positive correlation between R&D spending and productivity in Poland (see Box 27).

BOX 27

R&D AND PRODUCTIVITY: FIRM-LEVEL ANALYSIS FOR POLAND

R&D spending is positively correlated with firm productivity. A new study by Jan Hagemejer from the National Bank of Poland, based on a financial data set from more than 40,000 firms employing 10 or more employees, found that during 2006–2013, companies with non-zero R&D spending (defined as "cost of completed R&D projects") had 23.7 percent higher productivity and 43.9 percent higher total factor productivity (TFP) than firms with no reported R&D expenditure. Companies that spent on R&D also had much higher capital intensity (89.5 percent) and employment (107.2 percent).

BOX 27

VARIABLES	(1) LP	(2) TFP	(3) K/L	(4) employment
R&D dummy	0.237***	0.439***	0.895***	1.072***
	(0.0144)	(0.0167)	(0.0223)	(0.0245)
Constant	3.541***	3.657***	3.858***	4.178***
	(0.00730)	(0.00733)	(0.0111)	(0.00905)
Observations	360,932	355,479	366,556	383,525
R-squared	0.146	0.331	0.216	0.119
Robust standard errors in parentheses; LP-labor productivity; TFP-total factor productivity; K/L-capital per worker.				

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

R&D spending does not seem to affect productivity among Polish exporters, but it is correlated with higher productivity in the group of nonexporting domestic firms. The impact is substantial: a decision to initiate R&D activity can bring at least half of the productivity premium usually attributed to foreign ownership and exporting.

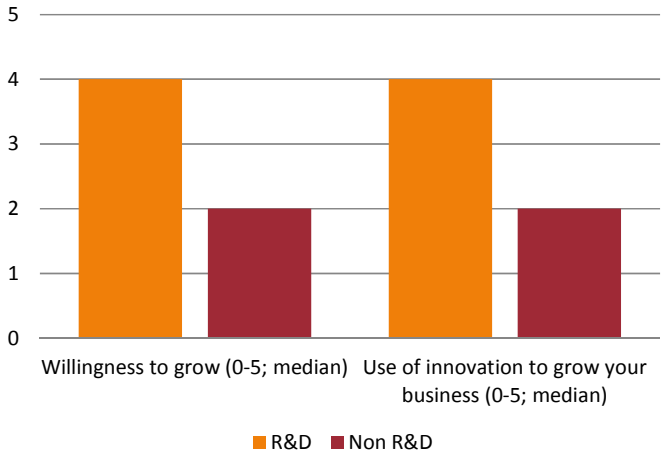
VARIABLES	(1) LP	(2) TFP	(5) LP	(6) TFP
R&D dummy	0.207***	0.416***	0.229***	0.361***
	(0.0143)	(0.0165)	(0.0315)	(0.0373)
Foreign	0.363***	0.412***		
	(0.00844)	(0.00887)		
Foreign & R&D	–0.301***	–0.229***		
	(0.0512)	(0.0699)		
Exporter			0.339***	0.465***
			(0.00327)	(0.00343)
Exporter & R&D			–0.131***	–0.0520
			(0.0348)	(0.0410)
Observations	363,918	358,285	363,918	358,285
R-squared	0.147	0.315	0.168	0.346
Robust standard errors in parentheses. LP-labor productivity; TFP-total factor productivity; K/L-capital per worker.				

*** p < 0.01, ** p < 0.05, * p < 0.1

Source: Based on the National Bank of Poland (2016).

R&D investment is a strong predictor of willingness to grow and innovate. Firms that invest in R&D seem to have significantly higher willingness to grow and are more likely to implement new, innovative solutions (Figure 37). Although the direction of causality is likely to go both ways, the importance of R&D in driving firm growth and innovation underlines the importance of public support for enterprise R&D.

Figure 37. R&D investment versus use of innovation and the firms' willingness to grow



Source: The World Bank.

However, for most firms, R&D investment is not a priority. Qualitative questions revealed that when firms were asked during the interview to hypothesize how they would invest a windfall of 1 million dollars, 42 percent said they wanted to invest in development of new products and services. One-third of companies said they wanted to invest in enlarging their production capacity; 8 percent considered strengthening marketing. Only 5 percent of the interviewed companies wanted to invest in R&D. "Champions" were much more likely to want to invest in R&D (more than 20 percent of the total), "sleeping beauties" less so (15 percent of the total), and the remaining companies were largely not interested in investing in R&D. See Box 28 for the main conclusions of the qualitative analyses.

BOX 28

QUALITATIVE ANALYSES: KEY CONCLUSIONS

Including qualitative research questions into the firm interviews allowed for a more nuanced understanding of enterprise innovation. Key conclusions from the qualitative analysis based on more than 200 firm interviews were the following:

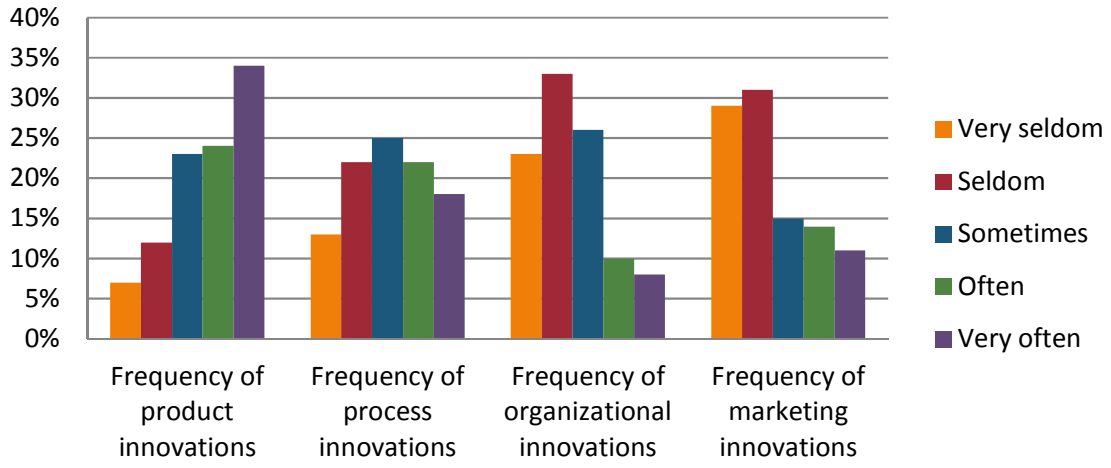
- According to about 40 percent of the respondents, quality of the product, ability to adapt to market needs and customer expectations, and the ability to implement innovations determine a company's success.
- "Champions" introduce more innovations and higher-quality innovations than other firms. "Champions" implement the most world-class innovations, "sleeping beauties" implement innovations new to the country, and "steady-state" and "declining" firms implement innovations that are mostly new to the firm. The most frequent improvements are changes to products—"champions" do this most often; "steady-state" and "declining" companies do this least often. Only "champions" and "sleeping beauties" invest in new technologies.
- "Champions" and "sleeping beauties" use different practices for managing employees than other firms. "Steady-state" and "declining" companies do not use specific practices to manage the performance of their employees, whereas "champions" and "sleeping beauties" use quantitative and qualitative indicators to monitor their workers' efficiency. These indicators include financial targets, product quality, and project outcomes, but only 5 percent of firms have performance indicators based on the quality of output.
- Firms seem to overestimate the importance of external innovation constraints and underestimate internal constraints in their companies, such as the quality of management skills. Firms find it difficult to self-evaluate, which underlines the importance of using experienced consultants as the interviewers.
- Qualitative and quantitative analyses are compatible. The results of the qualitative research complement the quantitative results and help better identify innovation drivers, innovation constraints, and companies' needs. Qualitative analysis of firm innovation performance should be a standard feature of the EDP process.

Source: The World Bank.

Innovation strategies

Product innovation happens most frequently. Two-fifths of companies in the sample indicated that they introduce product innovation often or very often (see Box 29 for definitions). Process innovation is introduced only half as frequently. Marketing and organizational innovations are the least frequent (Figure 38). This may suggest that companies seem not to appreciate the full productivity potential of improving business processes, upgrading marketing skills, and enhancing organizational practices. Another possibility is that firms may implicitly underreport process innovation because it is less tangible than product innovation.

Figure 38. Popularity of different types of innovation strategies



Source: The World Bank.

BOX 29

DEFINITIONS OF PRODUCT, PROCESS, MARKETING, AND ORGANIZATIONAL INNOVATION

Product innovation: technologically new or improved products. A technologically new product is a product whose technological characteristics or intended uses differ significantly from those of previously produced products. Such innovations can involve radically new technologies, can be based on combining existing technologies in new uses, or can be derived from the use of new knowledge. A technologically improved product is an existing product whose performance has been significantly enhanced or upgraded. A simple product may be improved (in terms of better performance or lower cost) through use of higher-performance components or materials. A complex product that consists of a number of integrated technical sub-systems may be improved by partial changes to one of the subsystems.

Process innovation: adoption of technologically new or significantly improved production methods, including methods of product delivery. These methods may involve changes in equipment and/or production organization and may be derived from the use of new knowledge. They can be intended to create technologically new or improved products that conventional methods cannot produce. They can also be used to increase the production or delivery efficiency of existing products.

Marketing innovation: implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion, or pricing. Marketing innovations are aimed at better addressing customer needs, opening up new markets, or newly positioning a firm's product in the market, with the objective of increasing the firm's sales. The distinguishing feature of a marketing innovation compared with other changes in a firm's marketing instruments is the implementation of a marketing method not previously used by the firm. It must be part of a new marketing concept or strategy that represents a significant departure from the firm's existing marketing methods. The new marketing method can either be developed by the innovating firm or adopted from other firms or organizations. New marketing methods can be implemented for both new and existing products.

(*continued*)

BOX 29

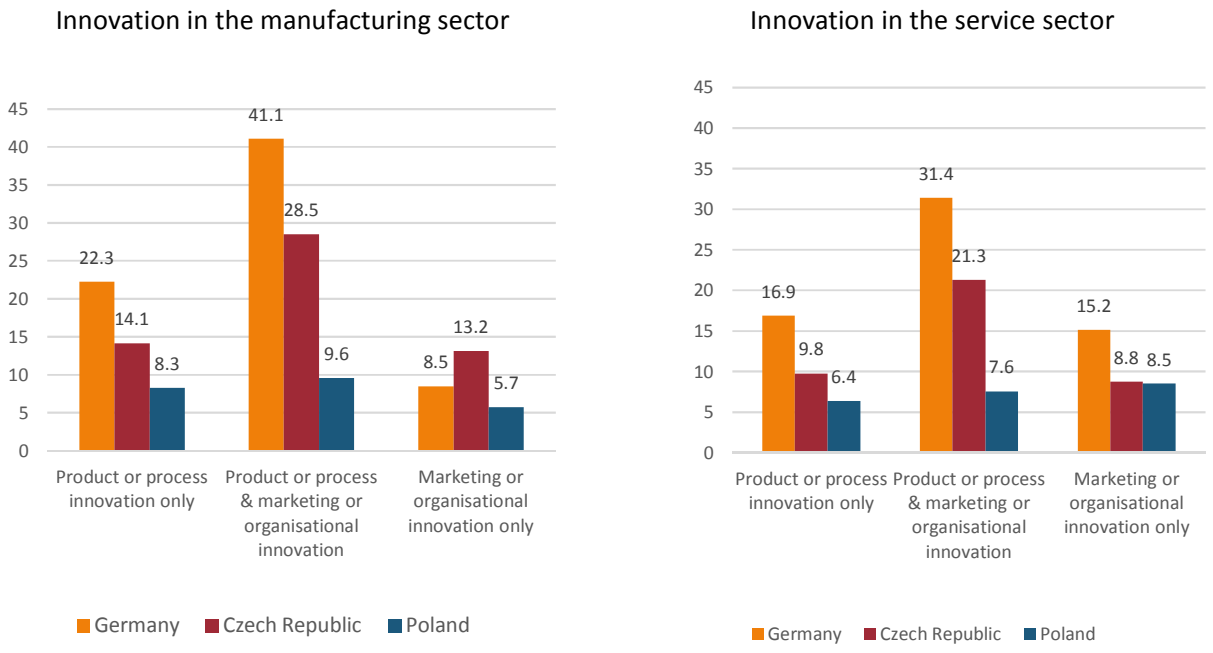
Organizational innovation: implementation of a new organizational method in the firm's business practices, workplace organization, or external relations. Innovations in workplace organization involve the implementation of new methods for divvying up responsibilities among employees and between firm activities (and organizational units). They also include new concepts for structuring activities, such as the integration of different business activities. An example of innovation in workplace organization is the initial implementation of a model that gives the firm's employees greater autonomy in decision making and encourages them to contribute their ideas.

Source: OECD (2005)..

The project's findings on the types of enterprise innovation are broadly in line with other data. GUS, the National Statistics Office, provides data on all types of innovation among Polish companies during 2011–2013. The data show that 28 percent and 32 percent of companies are involved in product and process innovation, respectively, whereas only 19 percent and 21 percent are involved in marketing and organizational innovation, respectively.[37] This pattern of innovation is similar for less developed EU member states. In EU-15 countries and Israel, product innovations are much more frequent than process and organizational innovation, likely because business processes and management practices are already well developed.[38]

Polish SMEs seem to be much less innovative than regional peers. According to the OECD, Poland achieves poor results in innovation across both the manufacturing and service sectors, relative to peer countries such as Germany and the Czech Republic (Figure 39). In particular, only 8 percent of manufacturing firms introduced product or process innovations, versus 14 percent and 22 percent in the Czech Republic and Germany, respectively. Likewise, organizational innovation and marketing innovation also lag behind. Given the concerns about the quality of data obtained through national innovation surveys, it is not clear to what extent these results fully reflect the level of innovativeness of Polish SMEs.

Figure 39. Share of innovative enterprises in manufacturing and service sectors in Poland and peer countries, 2010–2012

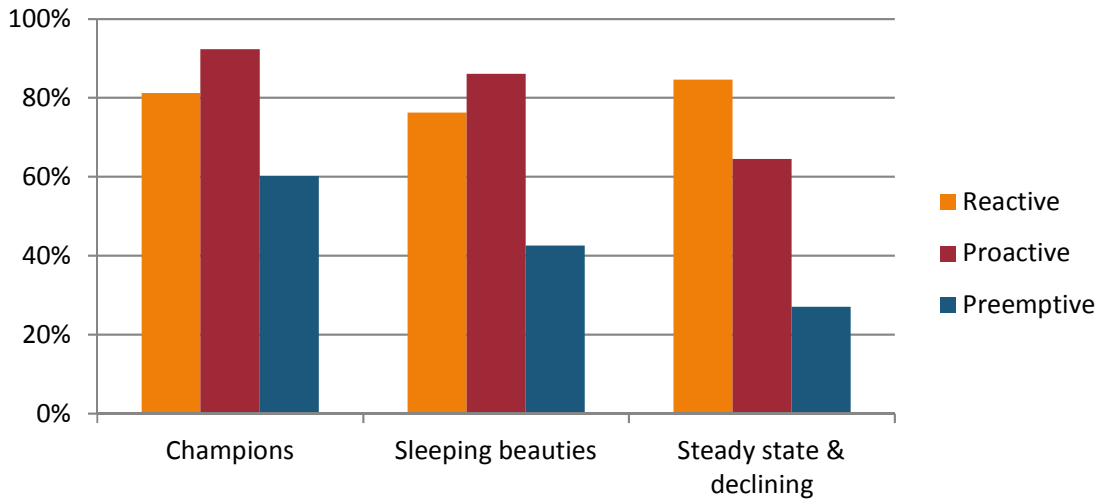


Source: The World Bank based on OECD (2015a).

[37] GUS (2015).
[38] EBRD (2014); OECD (2014).

Companies have different attitudes toward markets and innovation. Companies can be preemptive, proactive, and reactive. Preemptive companies try to create new markets (e.g., Apple's iPhone), and by doing so they can capture a large share of potential clients. Proactive companies anticipate the needs of clients and adjust their growth strategies accordingly (e.g., Samsung's smartphones); they follow closely behind preemptive firms but also adjust already existing products and services. Reactive companies simply react to what is happening in the markets and to what customers tell them; they are forced to change by the market—otherwise they would be likely to lose clients. Preemptive and proactive attitudes are key drivers of innovation. "Champions" tend to be much more preemptive than "sleeping beauties" and "steady-state" companies. "Steady-state" firms are predominantly reactive to market trends and are less likely to innovate.

Figure 40. Preemptive, proactive, and reactive approaches to innovation by company type



Source: The World Bank.

Interviewed companies identified a number of new business trends. The most apparent new business trend is a new approach to business models, such as moving to business-to-business (B2B) business models more often than business-to-consumer (B2C). "Green development," focused on reducing emissions, is another emerging trend. Companies also emphasize the shift from desktop computers to mobile phones in enterprise operations, from standard applications to mobile applications, and from a PC-based to a mobile-based customer market.

There are also a number of emerging technological trends. The interviewed companies most often mentioned the increasing influence of ICT, falling costs of hardware and appliances, convergence of e-commerce and social media, and increased use of applications with mobile access. There are also new product trends in a number of business areas: new polyamide coating, microelectronics and sensors, ICT hardware, meat substitutes for vegetarians, 3D printers and modified printing materials. The top technological trends linked to broad smart specialization areas (meta-specializations) are presented in Table 9.

Sources of information about innovation and markets

"Champions" use many sources of information about market and technology trends. They actively reach out to clients and suppliers, participate in exhibitions and seminars, and follow industry literature (Figure 41). They tend to understand that accessing knowledge from a wide range of sources is important to stay up-to-date with technology and to maintain and develop a network of potential business partners. In contrast, "steady-state" companies are much less active in searching for new information: they lag behind the "champions" in all dimensions (Figure 42). Overall, there is scope to support all types of companies in further developing their interest in and access to knowledge about markets and technology trends. This could be achieved by upgrading the public sector's offer on sharing industry-specific knowledge, through, for instance, industry newsletters distributed by selected BSIs and open lectures for the private sector at public universities.

Table 9. Top technological trends by meta-smart specializations

Meta-smart specialization	Top three technological trends		
Healthy society	Microelectronics and sensors (24 percent)	Remote metering (20 percent)	Product development for skin problems/cosmetics (11 percent)
Bioeconomy	R&D center for creation of new products (apples in chocolate, wines, ciders, energy drinks) (15 percent)	Meat substitutes / Meat supplements (11 percent)	Healthy food products for children (8 percent)
Energy production	New polyamide coating (19 percent)	Wind turbines and production lines for photovoltaic panels (15 percent)	Energy-efficient buildings (8 percent)
Natural resources	Material processing (36 percent)	Co-generational boilers (7 percent)	New insulation materials (5 percent)
Innovative technologies	Increasing influence of ICT (75 percent)	Convergence of e-commerce and social media (23 percent)	Increased use of applications with mobile access (20 percent)

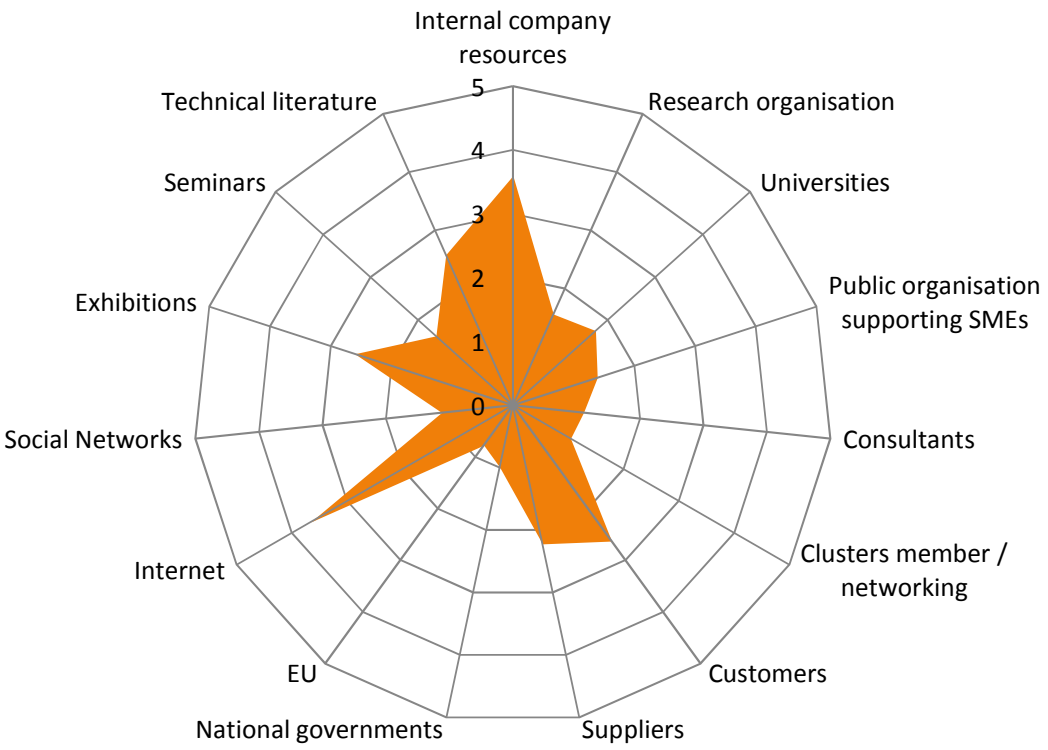
Source: The World Bank.

NOTE: percentage values indicate the fraction of all companies' answers; total does not add up to 100 percent

Figure 41. "Champions"—sources of information about markets and innovation

Source: The World Bank.

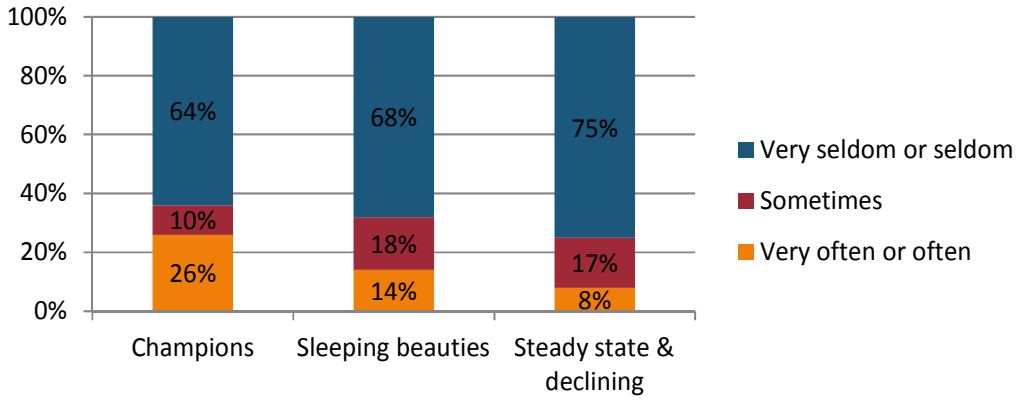
Figure 42. "Steady state"—source of information about markets and innovation



Source: The World Bank.

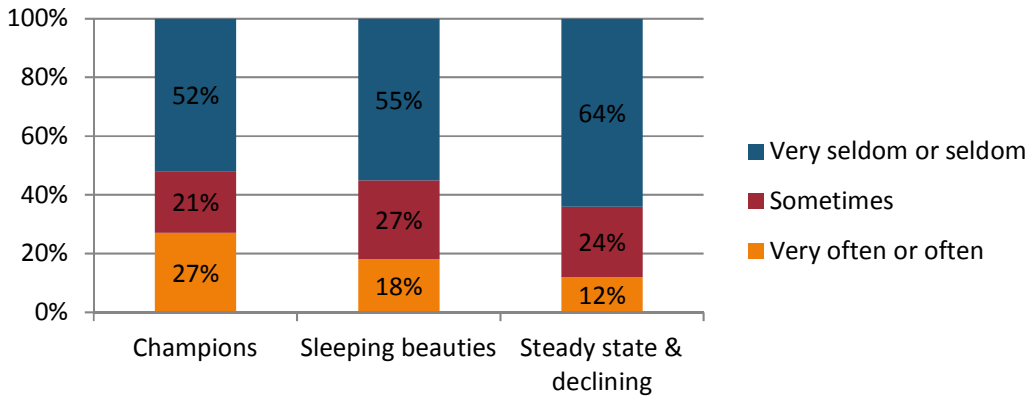
RDIs and universities are not a frequently used source of information. Less than one-sixth of all firms contact RDIs frequently (Figure 43). Universities are used slightly more often, but still only by a minority of firms (Figure 44). The vast majority of SMEs count on internal resources to develop new ideas. More than 25 percent of "champions" frequently reach out to RDIs and universities to access knowledge. Although the Smart Labs showed that even the best companies do not know the scientific potential of their region well, "sleeping beauties" and "steady-state" companies consult RDIs and science organizations much more sporadically. This likely reflects low awareness and low appreciation for the added value that the science sector could provide, as well as public institutions' mistrust and lack of interest for business cooperation. These findings are in line with most studies, including those of PARP (2013) and Eurostat's CIS (2012), which found that only 9 percent of innovative Polish companies cooperate with RDIs.

Figure 43. How often are RDIs a source of information about innovation?



Source: The World Bank.

Figure 44. How often are universities a source of information about innovation?



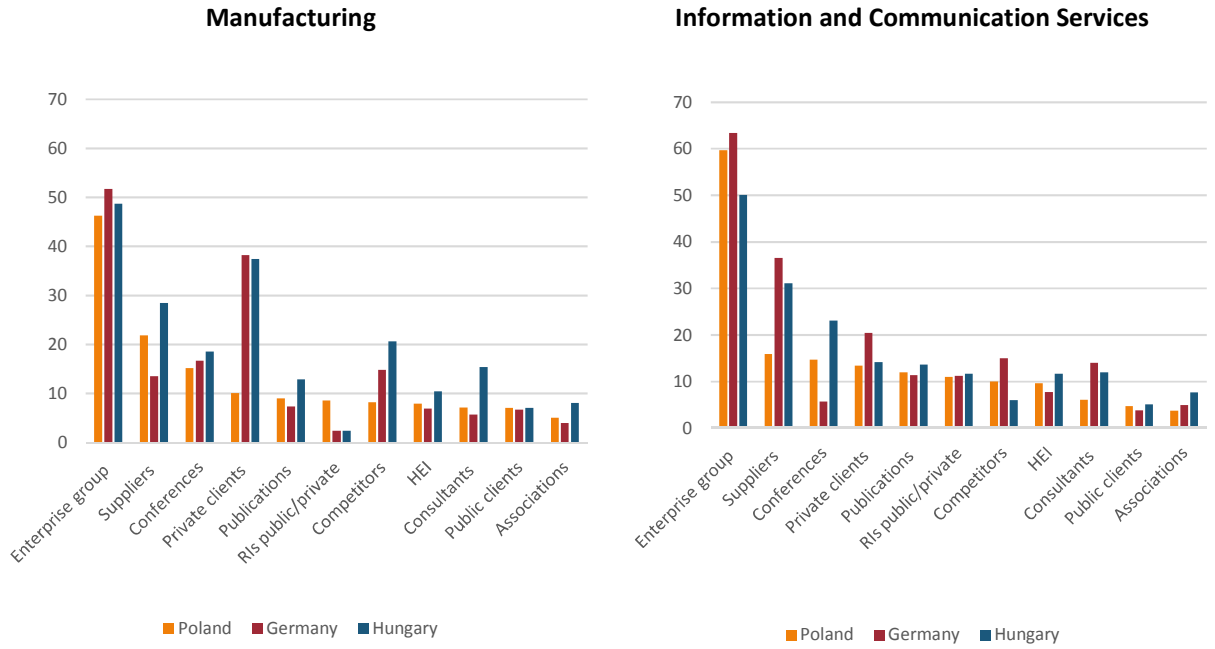
Source: The World Bank.

Only a small proportion of firms consider suppliers as a source of innovative ideas. This stands in contrast with more developed economies, where companies in the supply chain are a frequent source of information on new technologies. Suppliers are not mobilized to detect promising new technologies or processes. Staff in charge of procurement rarely consider it a part of their duties to deal with "intelligent supply"; they mostly focus on ensuring the lowest possible price.

Relatively few companies perceive customers as a useful source of information about innovation. Market intelligence based on existing and future customer needs is not high on the agenda. This is not in line with global trends, where consumers' feedback is increasingly shaping products and services. Customers might be a valuable source of information about possible future development of the market, especially because most firms are unable to provide concrete examples of ongoing market trends, which could help them develop new markets.

Polish firms use various sources of information with less intensity than foreign peers. Customers, for instance, are rarely used as a source of information: in manufacturing only 10 percent of Polish enterprises attached high importance to this source of information, compared with nearly 40 percent in Germany or Hungary (Figure 45). The ICT service sector is even less networked with customers, although this seems to be more universal across countries. These findings corroborate the results of firm-level interviews and suggest a large scope for public intervention in enhancing Polish SMEs' access to information.

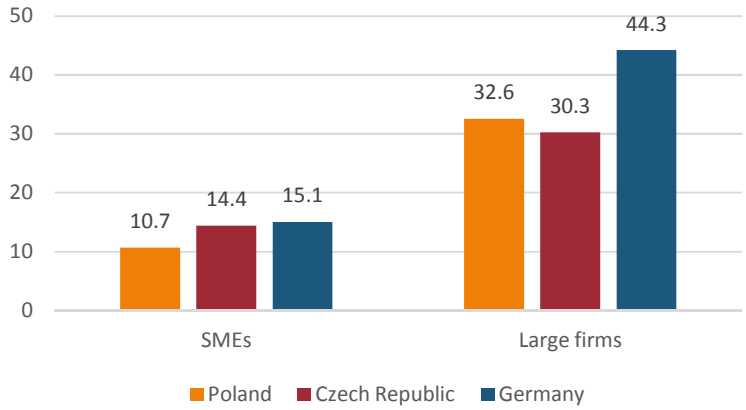
Figure 45. Important sources of information, by percentage of innovators in Poland, Germany, and Hungary



Source: The World Bank based on Eurostat (2012).

Polish firms are also less likely to collaborate with science. Polish SMEs are less likely to reach out to science than their peers in the Czech Republic and Germany (Figure 46). Large firms cooperate much more frequently. The public sector should attempt to reduce this gap and help SMEs access knowledge developed at universities and research institutions in Poland and abroad, including by upgrading the existing matching grant programs for business–science collaboration and reforming incentives for higher educational institutions to reach out to business.

Figure 46. Cooperation with higher education or research institutions, by firm size, in Poland, the Czech Republic, and Germany, 2010–2012, in % of firms

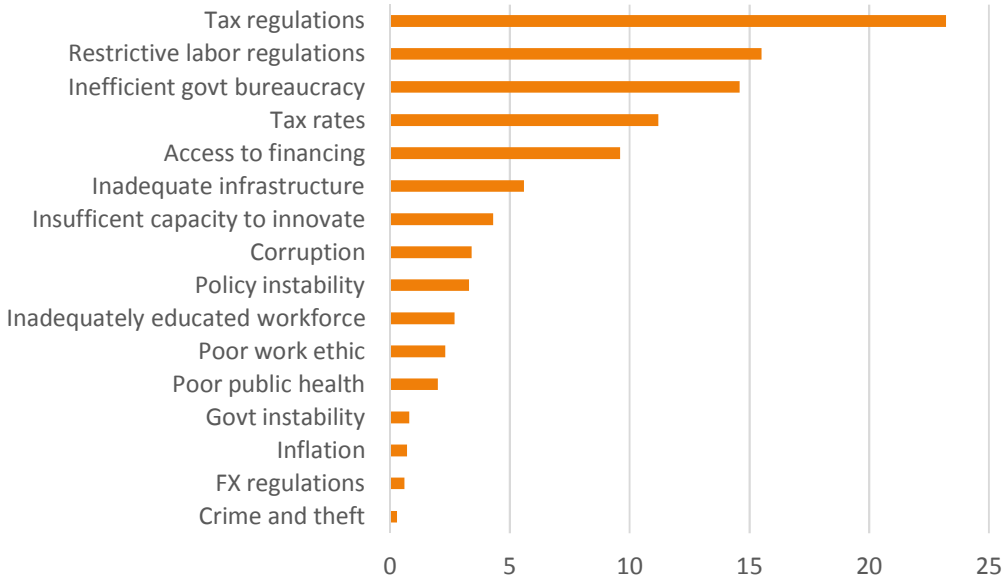


Source: The World Bank based on the OECD Science, Technology and Industry Scoreboard 2015.

Growth constraints

Growth among firms seems to be constrained by multiple factors. The EBRD (2014) reports that quality of tax administration, access to financing, and availability of skills are the main constraints for innovative and noninnovative firms in Central and Eastern Europe. In Poland specifically, the main obstacles were tax administration, access to financing, and labor regulations.[39] In turn, managers surveyed for the World Economic Forum's Global Competitiveness Report 2013–2014 considered tax regulations as the top constraint for doing business, followed by labor regulations and weak administration (Figure 47). The World Bank Doing Business 2016 emphasizes paying taxes and dealing with construction permits as one of the weakest elements of the business climate in Poland.

Figure 47. The main constraints to doing business in Poland, 2013



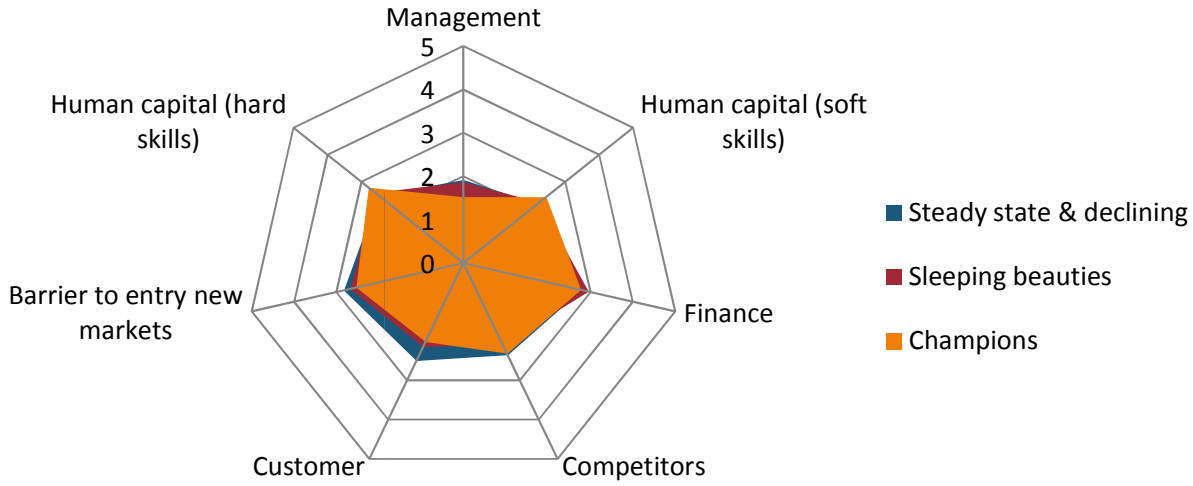
Source: World Economic Forum (2014).

[39] See http://ebrd-beeps.com/countries/poland/.

Interview data suggest that access to financing is the top constraint for SME innovation. The interviewed firms graded access to financing as a significant constraint, at 3.2 on a scale of 0 to 5. Given that the Polish banking sector is well capitalized, profitable, and liquid, and competition in the sector is quite robust, it is not clear what exactly constrains access to financing, although the likely culprits might include the availability of suitable collateral, as well as banks' lower interest and weaker skills in financing SMEs. Further research would be needed. Aside from access to financing, barriers to entry to new markets and availability of hard skills were the other top two constraints (Figure 48). These conclusions are in line with other studies, such as that by PARP (2013).

Different company types have broadly similar growth constraints. The "champion" companies consider access to financing and availability of hard skills as the key constraints to growth. For "sleeping beauties," access to financing is the key constraint. On the whole, though, the growth constraints among the priority group of companies, "champions" and "sleeping beauties," do not seem overwhelming (average constraints range between 2 and 3 on the 0-to-5 scale). This may reflect the improving business climate—in the World Bank Doing Business ranking, Poland improved from 78th place in 2008 to 25th in 2015—and/or that the priority firms are less growth-constrained than average companies. Both interpretations would bode well for the prospects of enhancing innovation in Poland. Perceptions of growth constraints across various types of firms suggest that firms diagnose constraints in a similar way, but differ in their ability to mitigate these constraints and thus develop at a different pace.

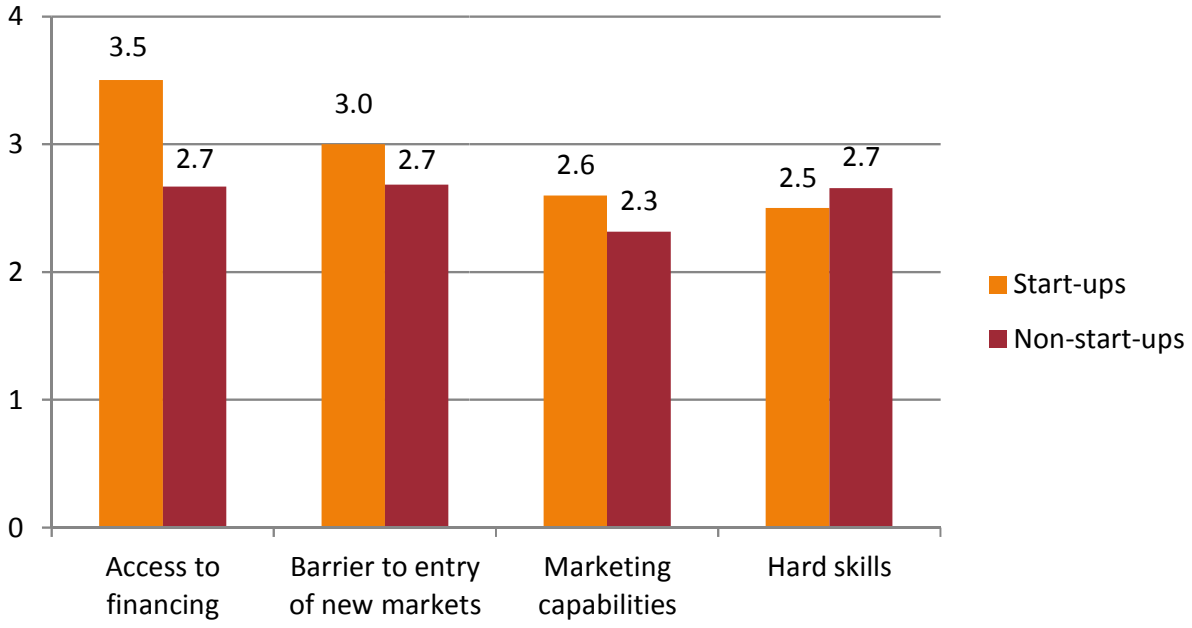
Figure 48. Growth constraints per selected types of companies



Source: The World Bank.

However, start-ups face more constraints to growth than older and larger companies. Entering new markets seems to be the biggest growth constraint for start-ups, and financing is the second most important one. This may suggest that young companies lack information about markets and skills to expand their business. Public support that would help start-ups access information about markets (for instance, by preparing business and technology roadmaps [BTRs], see Annex 3 for details) could be useful. Given that a large proportion of young high-growth companies are in manufacturing (Box 30) and the government's intention to "re-industrialize" the country, the public support programs could specifically focus on promoting growth in manufacturing startups.

Figure 49. Selected growth constraints for start-ups and other firms



Source: The World Bank.

BOX 30

POLISH "GAZELLES"

In 2015, a group of Polish academics prepared the first ranking of Polish business "gazelles." It comprised about 3,600 of the most dynamic enterprises, mostly SMEs. In 2014, total sales of this group amounted to almost 200 billion PLN, and employment exceeded 340,000 people.

How dynamic are the "gazelles"?

In the group, there is a roughly even distribution of firms that are growing fast (on average above 20 percent per year), growing (between 10 and 20 percent), and growing moderately (up to 10 percent). Between 2011 and 2013, the share of fast-growing companies in the whole "gazelle" population fell from 45 percent to 32 percent.

What is the industrial structure?

More than 35 percent of Polish "gazelles" are in manufacturing. This is unusual globally and augurs well for the domestic economy, given that manufacturing seems to provide a larger scope for productivity improvements than other sectors (Rodrik, 2013). These manufacturing firms operate primarily in traditional sectors; about one-fourth of them are from the high- and medium-high technology industries. This is in line with global trends: 65 percent of American and 75 percent of European high-growth companies operate in traditional industries ("Inc. 5000" ranking), showing that innovation is equally possible in traditional areas.

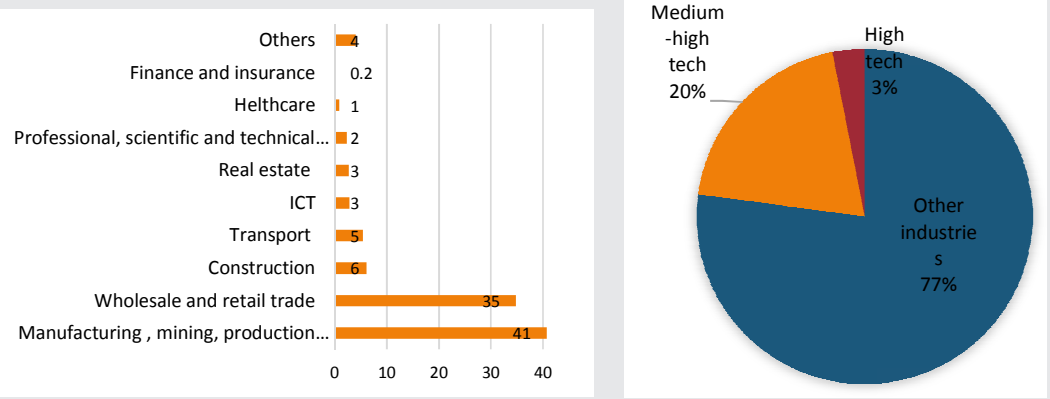
What makes gazelles different?

In Poland and the United States, what differentiates "gazelles" from other companies is a particularly strong role of the company's CEO in the company's management, high-quality management skills, and an openness to searching for new solutions. In high-growth companies, the quality and skills of management are at least as important as the quality of products or services (Wisniewska, 2015).

(*continued*)

BOX 30

Figure 50. "Gazelles" across industries, 2014, in percent

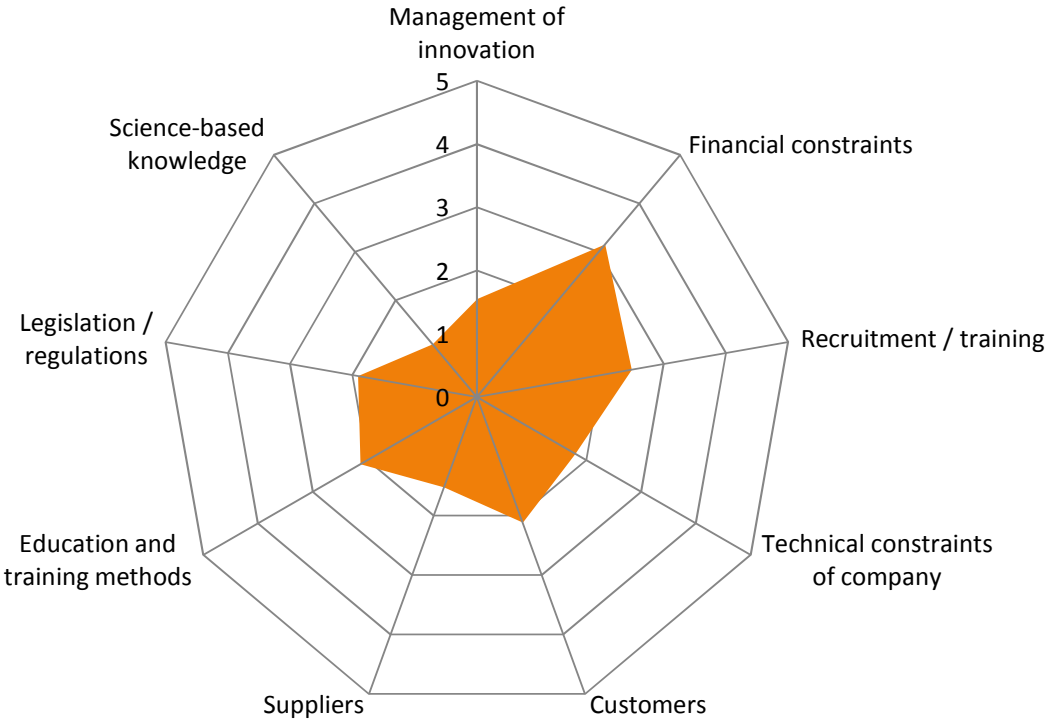


Source: Based on Cieślik and Grycuk (2015).

Innovation constraints

Access to financing is a key innovation constraint. Similar to growth constraints, access to financing is the most important barrier to innovating (3.2 on the 0-to-5 scale). Firms complain about poor access to financing from banks as well as complex and difficult access to public innovation funding. Difficulty with recruitment of staff with specific skills and education is another major constraint, suggesting that access to qualified labor could be a key area of public support (Figure 51). Qualitative data also corroborate these results. When asked which innovation constraints (up to three) hamper the innovation processes the most, lack of capital and lack of good employees were the two outliers that represented more than half the answers. These findings are in line with the constraints to R&D development documented in a 2013 report by PARP (Box 31).

Figure 51. Firm-level innovation constraints



Source: The World Bank.

Low customer interest in innovative products is also a constraint. Firms assert that customers are a constraint to innovation because they are often risk averse and wary of trying new and innovative products and services. This shows that innovation needs to be driven by both supply and demand: innovative firms need innovative customers. The solution could be to help innovative companies by making public procurement more open to new ideas and technologies (e.g., pre-commercial procurement). In addition, if innovative firms cannot find innovative customers in Poland, the public sector could help them internationalize and find access to customers abroad with a bigger appetite for new products and services.

BOX 31

ASSESSMENT OF THE NEEDS OF POLISH ENTERPRISES TO SUPPORT THEIR R&D

According to a 2013 report by PARP, the main barriers to the development of internal R&D activities were the following:

- Poor access to financing, particularly for SMEs; a weak capacity of financial institutions to finance R&D
- Difficult access to public support
- Weak human resources and organizational know-how
- Limited access to external consulting services
- Lack of own R&D infrastructure
- Complicated accounting for R&D expenses
- Difficult cooperation with RDIs: low interest in commercial research, excessive academic focus, failure to meet deadlines, complicated relationship with the scientific staff and administration in RDIs
- Uncertain demand for new products resulting from R&D
- Deficiencies in innovative entrepreneurship education and imperfect information flows
- Insufficiently developed telecommunications infrastructure

Source: Own elaboration based on Bakowski and Mazewska (2015) and PARP (2013).

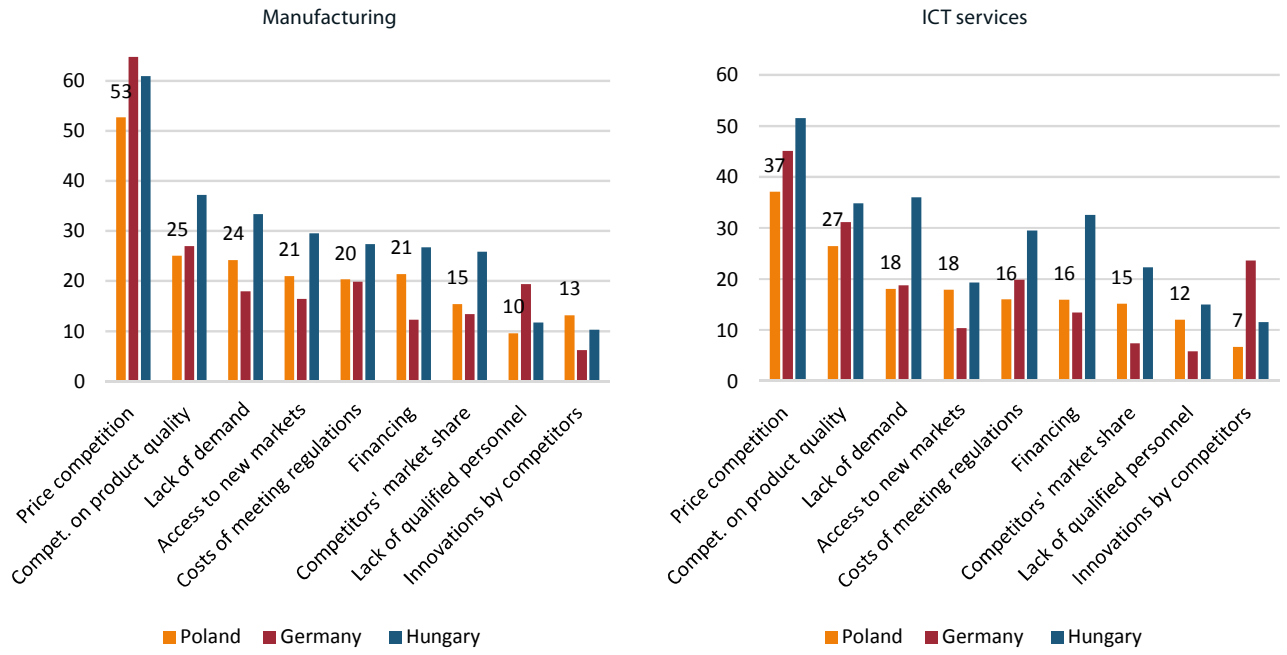
Access to scientific knowledge and technical constraints seem not to hamper innovation. However, this finding, based on the data from the firm interviews, is not fully in line with the fact that the interviewed firms in the eyes of the experts often do not seem to follow technological trends and do not cooperate with scientific institutions, as discussed later in this chapter. This dichotomy suggests that firms may "not know what they do not know." One possible solution would be to raise firms' awareness of technology trends through free dissemination of specialized knowledge. This could be done through business support institutions, social media, online innovation platforms, networking with RDIs, and access to reports funded by business associations.[40]

International surveys show a slightly different picture of the main constraints to innovation. According to Eurostat innovation surveys, which are based on a different methodology than the one employed in this report, key innovation constraints among Polish innovators are price competition, competition on product quality, lack of demand, and access to new markets (Figure 52). Similar trends are observed in Hungary, in which these obstacles are cited even more frequently. Somewhat surprisingly, lack of financing and of qualified personnel are challenges faced only by a minority of innovators in both manufacturing and ICT services.

Firms perceive growth constraints as more important than innovation constraints. The average intensity of innovation constraints is about 1.9 on a 0-to-5 scale, and that of growth constraints amounts to 2.4. Given the overall low innovation intensity of Polish companies, this finding seems counterintuitive: one would expect innovation constraints to be more stifling than growth constraints. One possible explanation is that firms' growth is perceived as more important than innovation, so the growth constraints are deemed to be more of a challenge. The other possible explanation is that many firms in the sample may simply not innovate beyond technology absorption and imitation and therefore have no practical experience of challenges related to innovation.

[40] As an example of good practice, the Technology Transfer Office at the Zachodniopomorskie University of Technology sends out regular newsletters to subscribing companies with short summaries of interesting technological research.

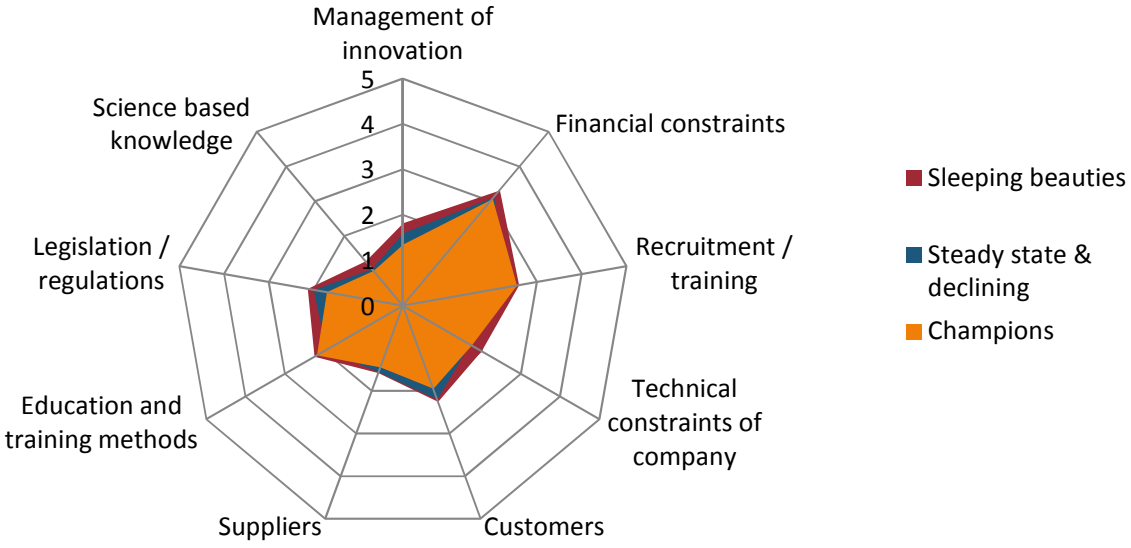
Figure 52. Innovation constraints across selected sectors in Poland, Germany, and Hungary



Source: Eurostat (2012).

"Champions" seem to face lower innovation barriers than "sleeping beauties." The latter perceive higher constraints in practically all areas, except for technical constraints. Financial and other barriers to innovation do not seem to prevent the "champions," which are committed discoverers and innovators, from pursuing their goals and implementing R&D projects. This finding stands in contrast to the results of the EBRD (2014) enterprise survey, which argued that companies with a higher intensity of product innovations, likely to be "champions," were more sensitive to the external environment than firms that did not introduce product innovations.

Figure 53. Innovation constraints per selected types of companies

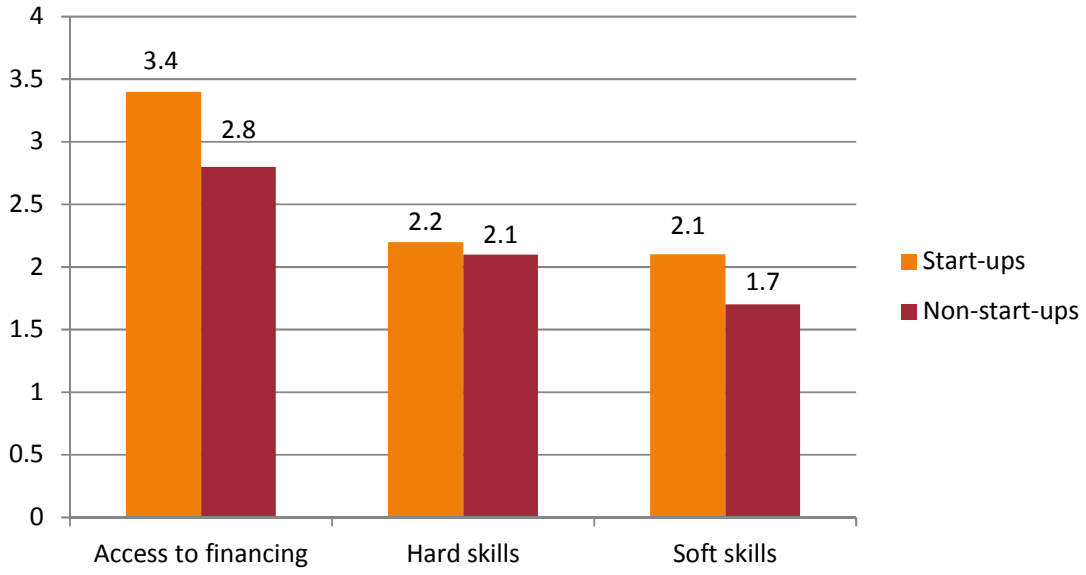


Source: The World Bank.

Start-ups face more barriers to innovation than older companies. As expected, the firm interviews suggest that Polish start-ups are more constrained by access to financing and availability of hard and soft skills than older companies. The continued focus of the public support system on financing start-ups is thus warranted and could be

additionally expanded, especially including "smart money" that combines funding with sophisticated support, mostly from VCs and business angels.

Figure 54. Selected innovation constraints for start-ups and mature companies

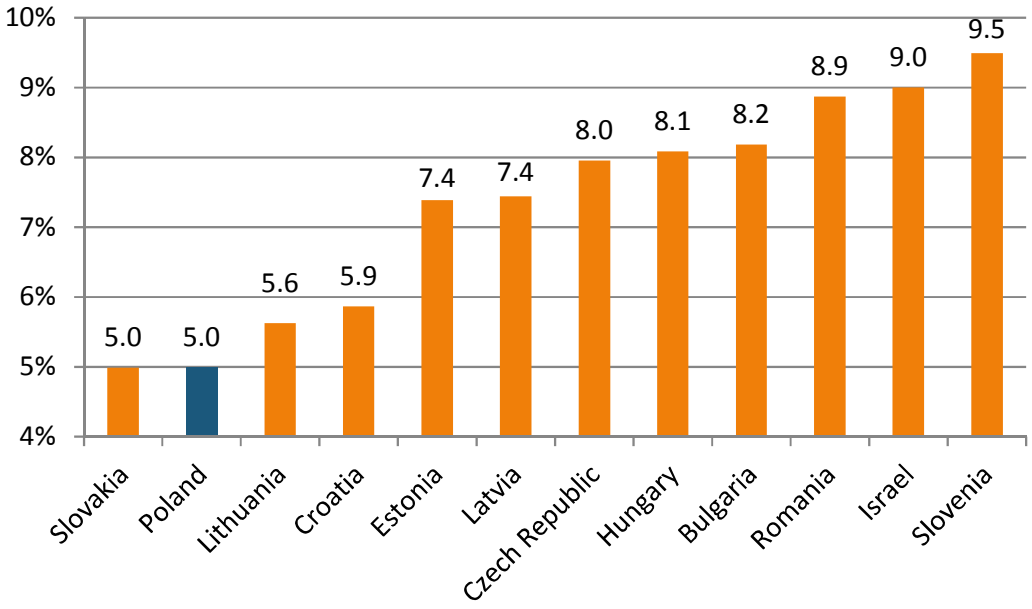


Source: The World Bank.

NOTE: Start-ups are defined as companies with less than five years of operation.

Firms indicated that barriers to innovation are low, but this contrasts with weak innovation outcomes. The EBRD/World Bank 2013 BEEPS enterprise survey (EBRD/World Bank, 2014) of companies in Europe and Central Asia found that only 5 percent of surveyed Polish companies introduced product innovation. This result placed Poland close to the bottom among peer countries (Figure 55). There were more companies that introduced process innovation—7 percent of surveyed companies—but still low relative to most peers. The fact that noninnovating companies do not perceive barriers to innovation might result from their lack of practical experience with innovation.

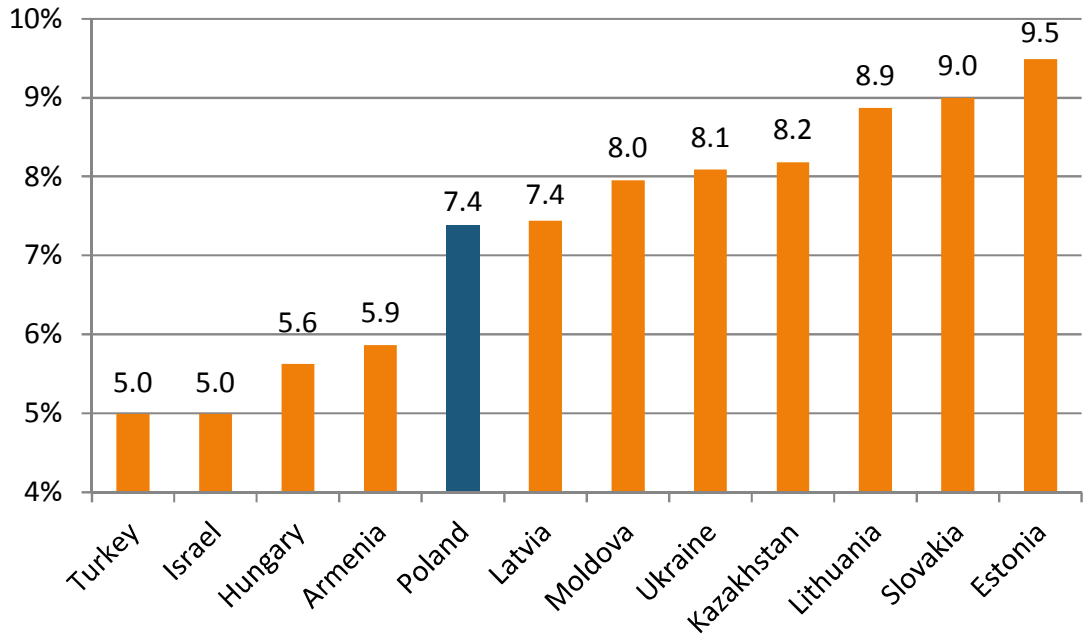
Figure 55. Percentage of firms that introduced product innovation, 2013



Source: Author calculations based on EBRD/World Bank BEEPS (2014).

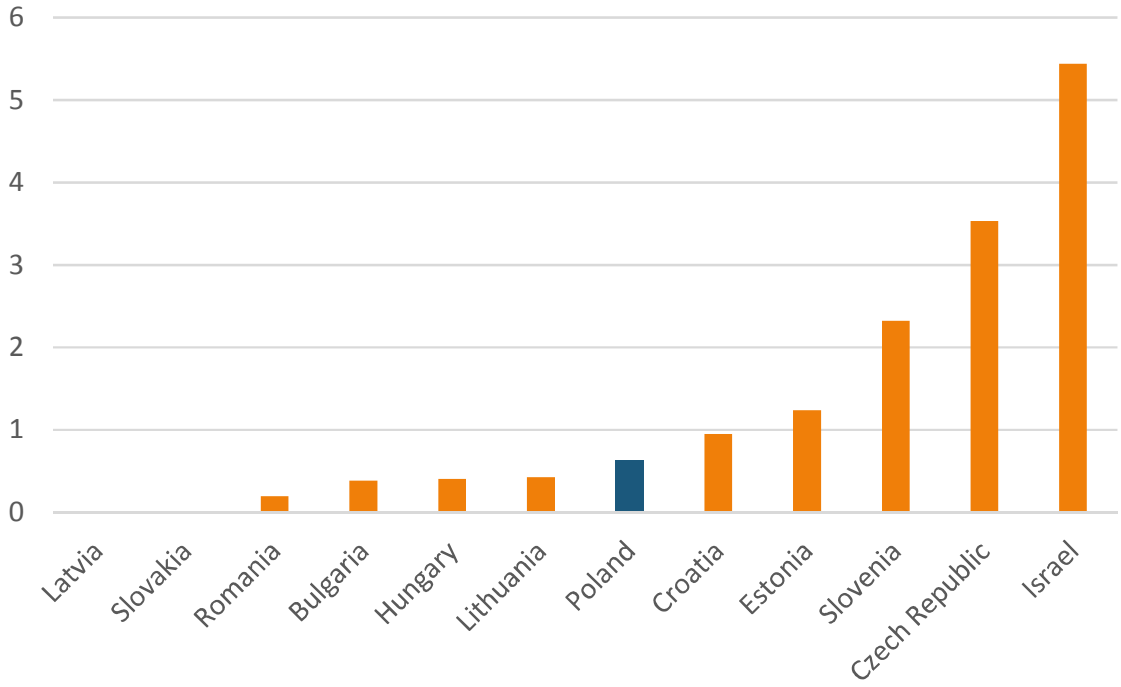
Polish companies absorb technology developed abroad rather than develop new products for the world. The EBRD/World Bank (2014) enterprise survey shows that 9 percent of companies in Poland introduced products and services new to the firm or the country, less than in most peer countries (Figure 56). However, fewer than 1 percent of Polish firms introduced products and services new to the world, as opposed to more than 5 percent of firms in the technologically leading Israel (Figure 57). These findings are in line with the results of the firm interviews and imply the need for even stronger efforts to support enterprise innovation to close the gap with regional peers and some part of the gap with the global leaders.

Figure 56. Percentage of firms with product innovation new to the firm and the country



Source: Author calculations based on EBRD/World Bank BEEPS (2014).

Figure 57. Percentage of firms with product innovation new to the international market

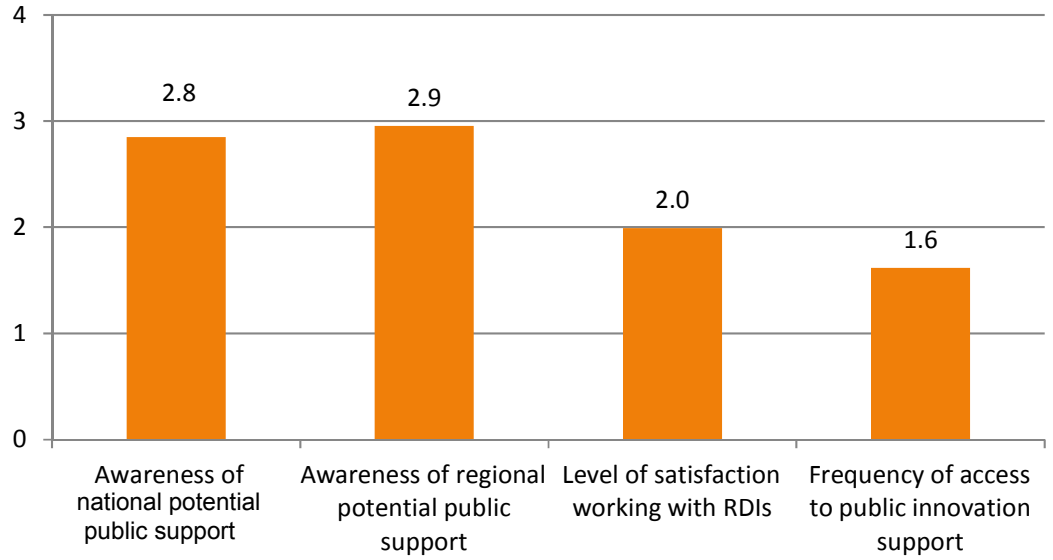


Source: Author calculations based on EBRD/World Bank BEEPS (2014).

Assessment of public support

Most firms report a relatively low level of knowledge and satisfaction with the existing public support system. On a scale of 0 to 5, companies gave an average score of 2.9 when asked about their knowledge of public support mechanisms at the national and regional levels. However, almost half of all companies had hardly any awareness of public support at all (1 to 2 on the 0-to-5 scale). Even among the more aware companies, the level of knowledge tended to be rather general; most of firms were not able to pinpoint any specific public support instruments on the regional or national level. This suggests an important area for policy action and need for a more proactive company outreach. As to the satisfaction with the quality of public institutions, companies tended to be dissatisfied with RDIs (2.0 on the 0-to-5 scale).

Figure 58. Public support and collaboration with RDIs (0–5)

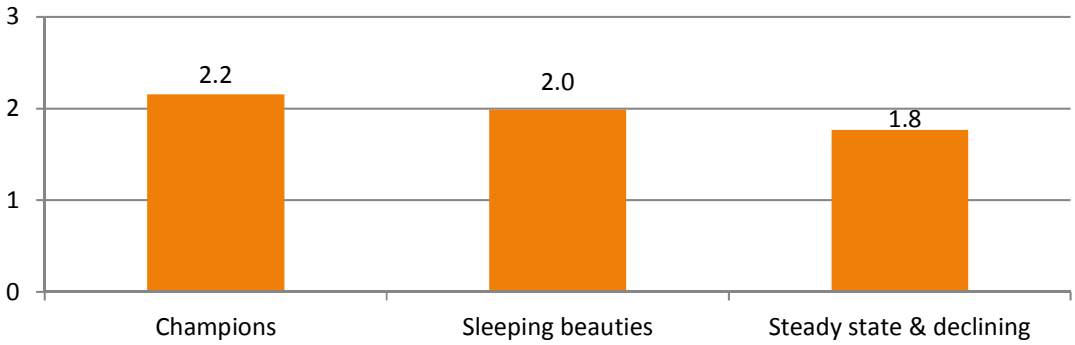


Source: The World Bank.

The overall level of awareness and satisfaction with the quality of BSI support is also low. Firms have little knowledge about the type of support that could be provided by BSIs. Firms that could mention a few BSIs nonetheless ranked them rather low, likely due to the lack of trust in BSIs' capacity to provide high-quality services. Firms assert that potential support is not adequately adjusted to their specific needs. Companies complain that BSIs almost never contact them directly to offer services or to provide support. The general perception is that the vast majority of BSIs are not sufficiently equipped to deliver hands-on, tailor-made services.

"Champions" make use of public innovation support more frequently than others. This reflects their proactive attitude, large appetite for risk, commitment to R&D, and innovation-oriented investment. Other types of companies are less active and less aware of the availability of public support, although the differences are not substantial.

Figure 59. Utilization of innovation support by company types

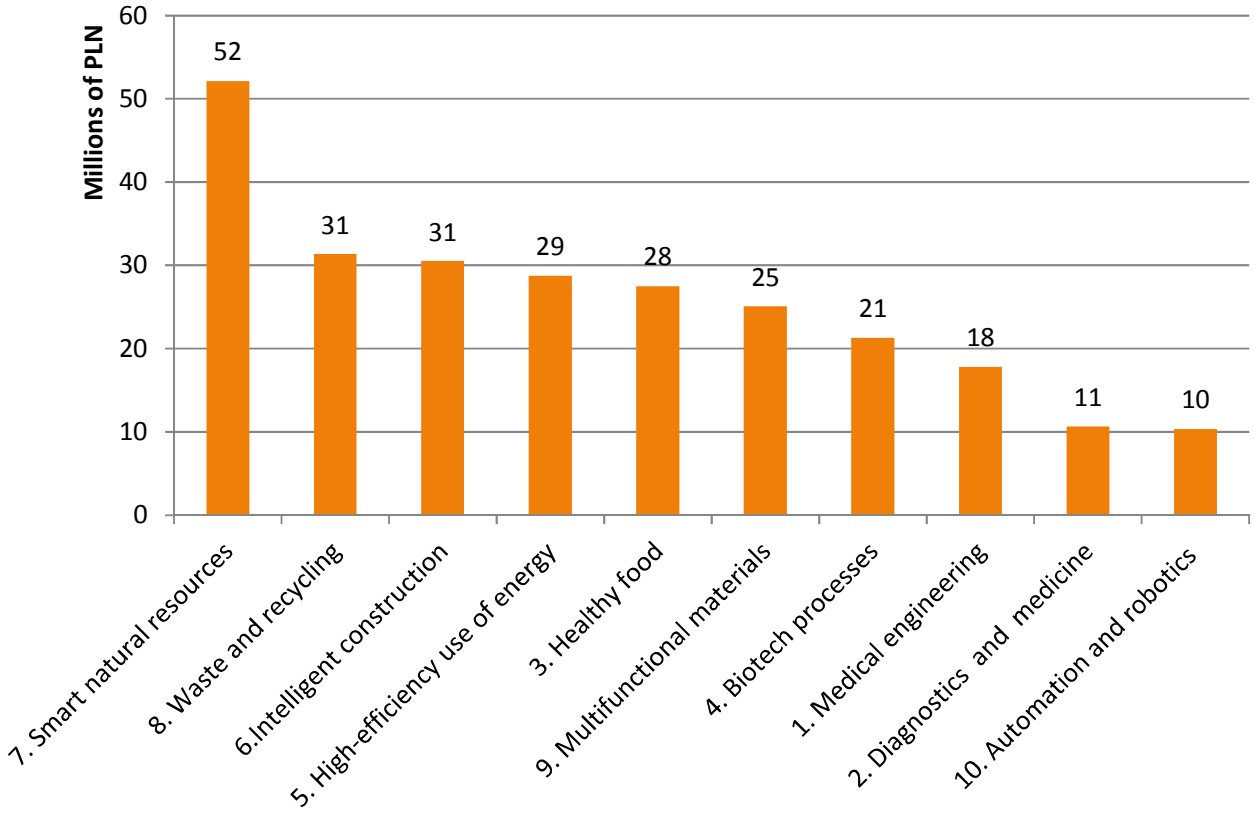


Source: The World Bank.

Analysis of smart specializations

Firms across all smart specializations tend to differ in size. Specialization "smart natural resources" clearly stands out, with companies reporting more than 50 million PLN in annual revenue (Figure 60). Companies in most other specializations are clustered within the range of 20 to 30 million PLN in annual revenue, firmly placing them in the SME category. The smallest SMEs were most frequently found in "diagnostics and medicine" and "automation and robotics," which could suggest that these specializations tend to be relatively young and small and/or that markets are more fragmented.

Figure 60. Average annual revenue of firms in each smart specialization (mln PLN)

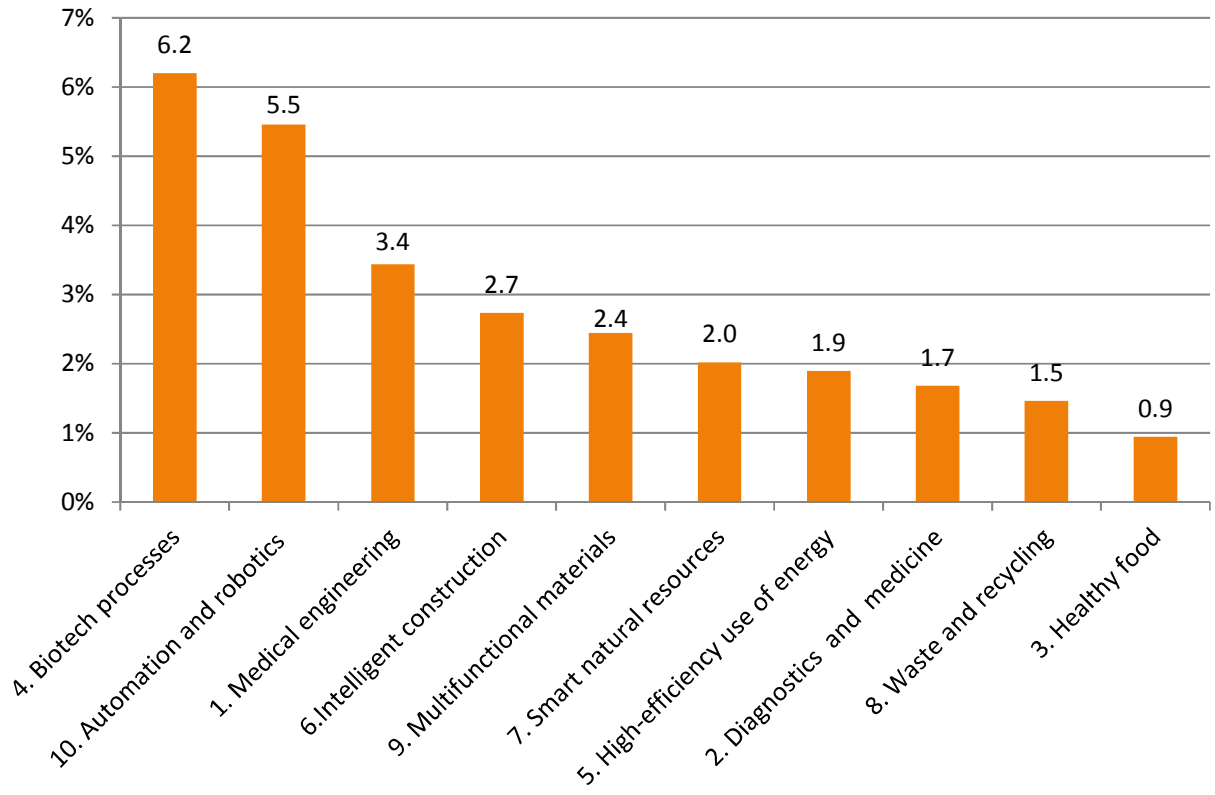


Source: The World Bank.

Smart specializations have different R&D intensity. Firms in biotech are much more R&D intensive than other smart specializations, spending on average 6.2 percent of their revenue on R&D, a high proportion. "Healthy food" is the least R&D intensive (Figure 61). Although more information is needed on the R&D intensity of each smart specialization, the results suggest potential directions of public support for enterprise R&D investment going forward.

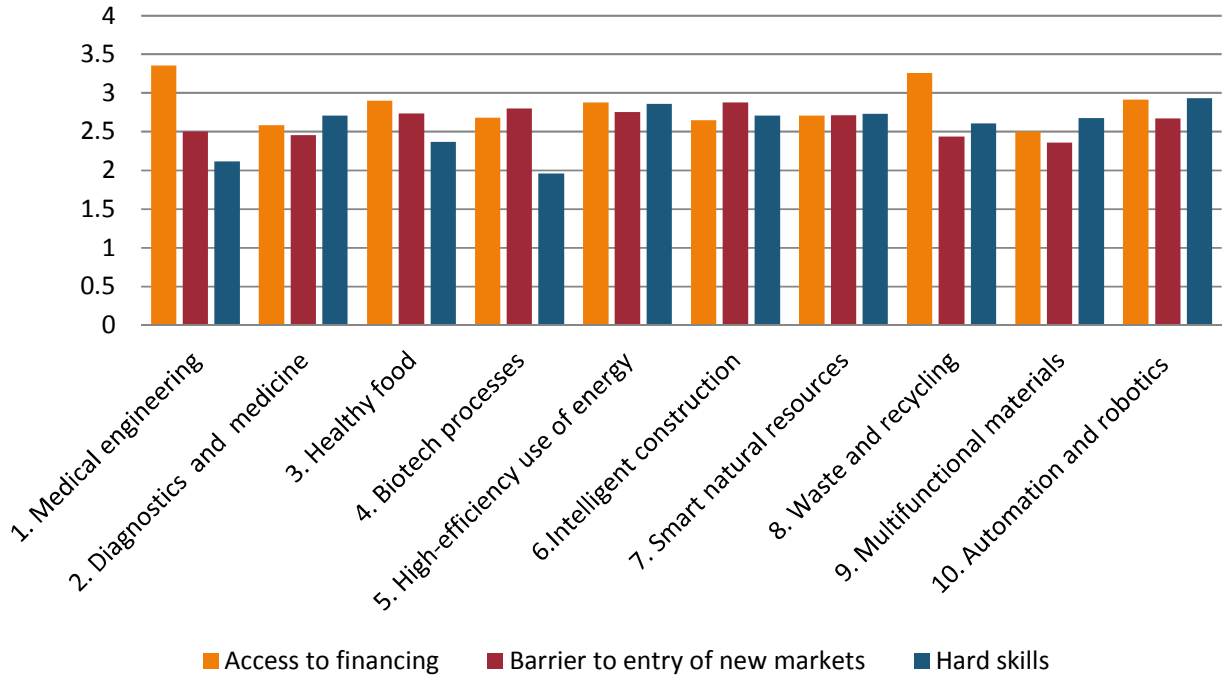
Firms across all smart specializations tend to perceive similar constraints to growth and innovation. Growth is constrained by access to financing, barriers to entry, and availability of hard skills, whereas innovation is restrained by financing, availability of soft skills, and a low level of customer interest in innovative products and services (Figure 62, Figure 63). This suggests that all smart specializations could be supported by a similar set of policies directed at mitigating the biggest constraints. Smart Labs could provide additional information needed so that policies could be tailor-made to specific industry constraints.

Figure 61. Average R&D expenditures as percent of turnover



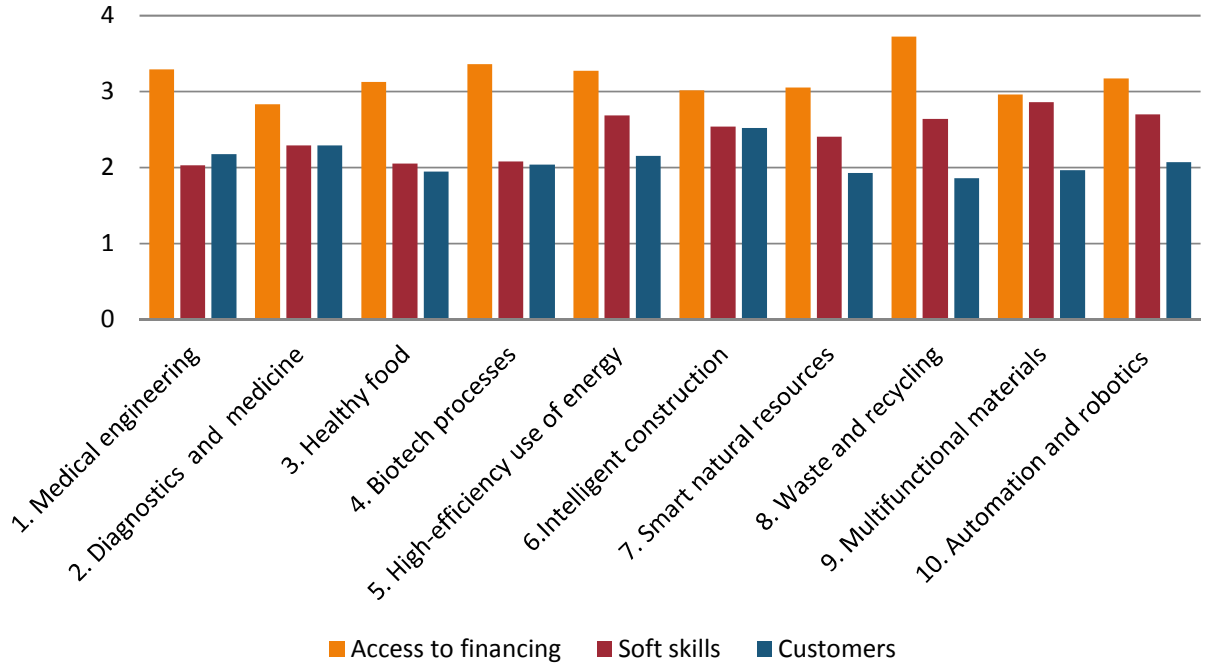
Source: The World Bank.

Figure 62. Top three growth constraints across 10 smart specializations



Source: The World Bank.

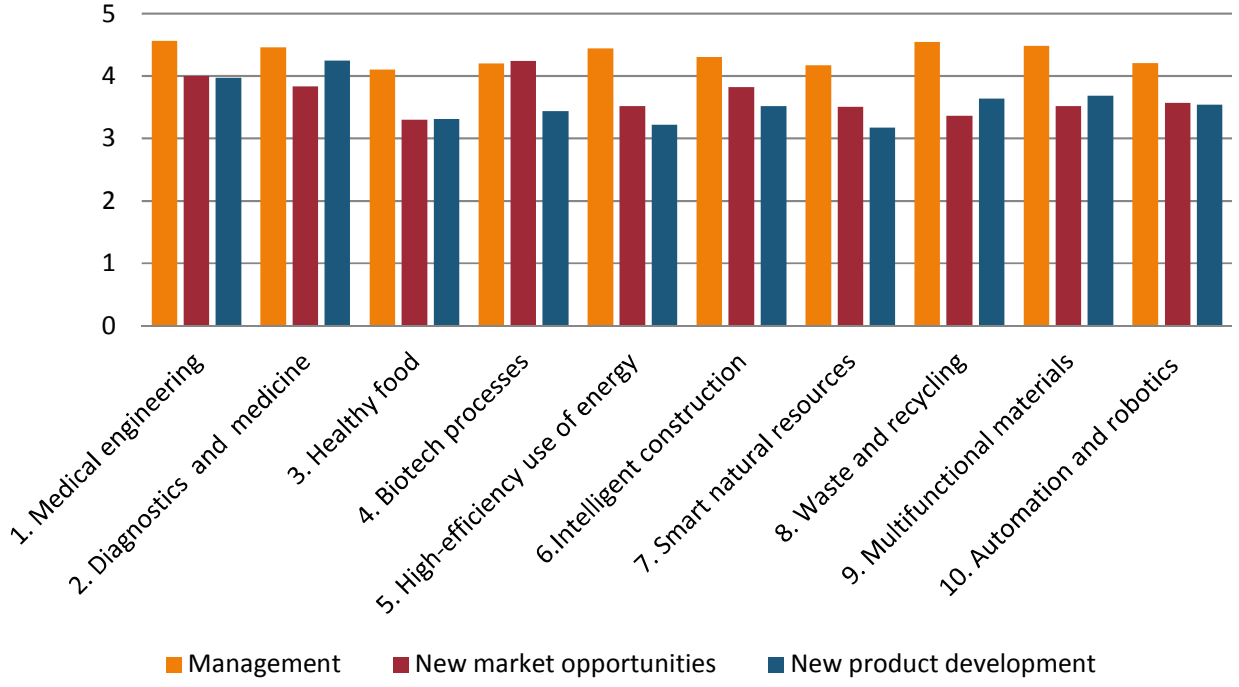
Figure 63. Top three innovation constraints across 10 smart specializations



Source: The World Bank.

Drivers of innovation are also similar across all smart specializations. Management's innovation mind-set and the quality of management practices are the key sources of innovation. Innovation efforts are also driven by new market opportunities. Finally, the need to develop new products and services also helps companies start to innovate (Figure 64).

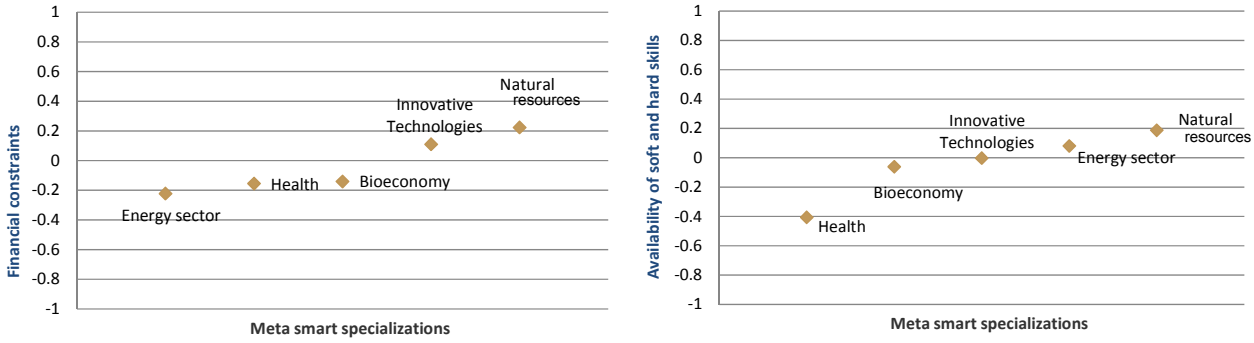
Figure 64. Top three innovation drivers across 10 smart specializations



Source: The World Bank.

Meta-smart specializations differ in terms of innovation constraints. The results of factor analysis (see Box 32 for a definition) show that innovation in firms operating in the "energy industries" meta-specialization face more substantial financial constraints than those in other meta-specializations (Figure 65). However, firms in "natural resources" and "healthy society" face challenges in sourcing sufficient hard and soft skills from the market. These findings suggest an important area for public intervention.

Figure 65. Innovation constraints



Source: The World Bank.

NOTE: Based on factor analysis. Outcomes range from –1 to 1.

Table 10. Definitions of meta-smart specializations used in the report

Meta S3	Number and name of first smart specialization	Number and name of second smart specialization
Healthy society	1. Medical engineering	2. Diagnostics and medicine
Bioeconomy	5. Healthy food	6. Biotech processes
Energy sector	7. High-efficiency use of energy	8. Intelligent construction
Natural resources	10. Smart natural resources	11. Waste and recycling
Innovative technologies	13. Multifunctional materials	17. Automation and robotics

Source: The World Bank.

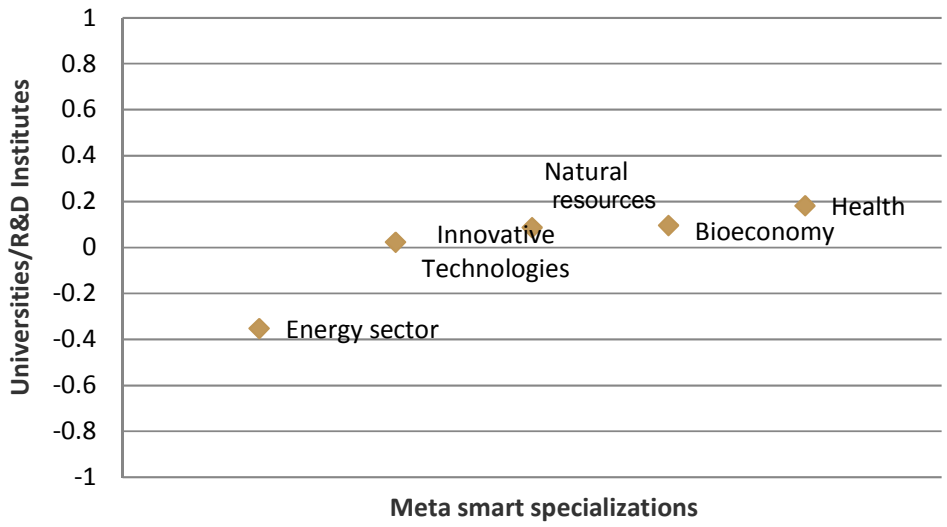
BOX 32

WHAT IS FACTOR ANALYSIS?

"Factor analysis is a way to take a mass of data and shrinking it to a smaller data set that is more manageable and more understandable. It's a way to find hidden patterns, show how those patterns overlap and show what characteristics are seen in multiple patterns. It is also used to create a set of variables for similar items in the set (these sets of variables are called dimensions). It can be a very useful tool for complex sets of data involving psychological studies, socioeconomic status and other involved concepts. A 'factor' is a set of observed variables that have similar response patterns because they are associated with a variable that isn't directly measured. Factors are listed according to factor loadings, or how much variation in the data they can explain."

Source: http://www.statisticshowto.com/factor-analysis/. See also Garson (2013).

Figure 66. Sources of information

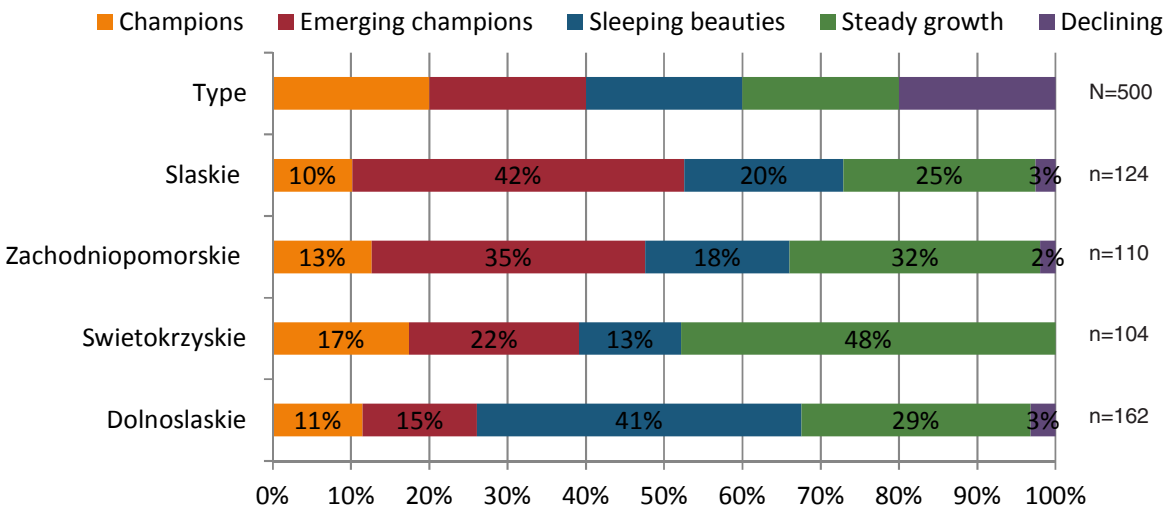


Source: The World Bank.

Regional analysis

Firms differ among regions in their growth potential. There are differences in the typology of interviewed firms in each region (Figure 67). Slaskie has the largest proportion of "champions" and the lowest proportion of "steady-state" companies, an important finding confirming the large growth potential of the region. Dolnoslaskie has the lowest proportion of "champions," but the largest proportion of "sleeping beauties," which could become "champions" with sufficient public support. Swietokrzyskie reported the largest number of "steady-state" firms, which do not seem to have a large growth potential.

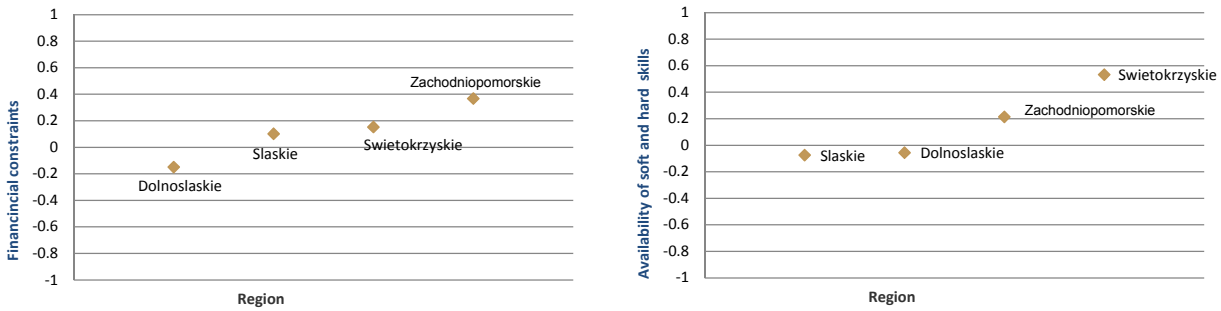
Figure 67. Distribution of company types among regions



Source: The World Bank.

Regions differ in innovation constraints faced by firms. Factor analysis shows that firms in Swietokrzyskie perceive access to financing as a much bigger barrier to innovation than in other regions. In turn, availability of hard and soft skills is a major challenge for companies in Dolnoslaskie (Figure 68). This suggests a possible scope of focus for policy action (access to financing in Swietokrzyskie, availability of skills in Dolnoslaskie).

Figure 68. Innovation constraints

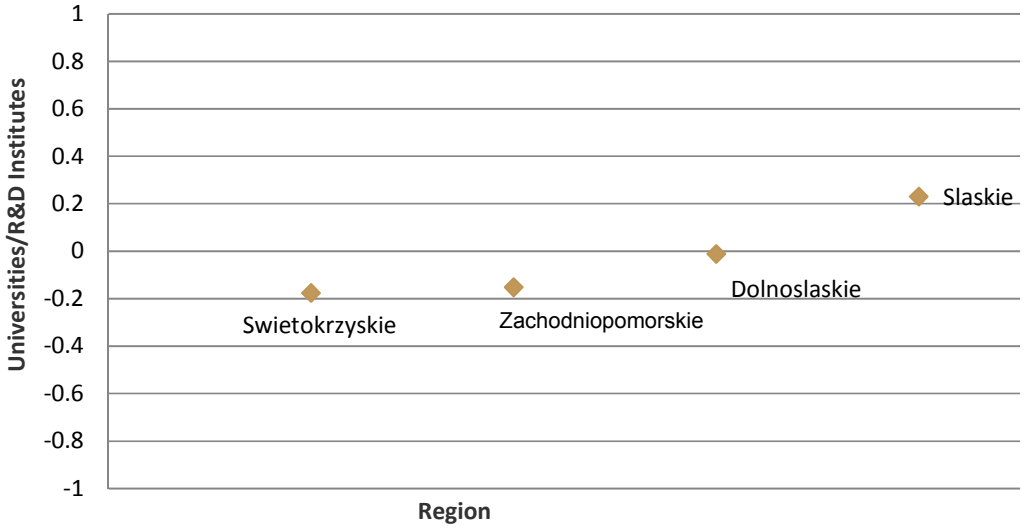


Source: The World Bank.

NOTE: Based on factor analysis. Outcomes range from –1 to 1.

There is also regional differentiation in terms of sources of information about innovation. Firms in Zachodniopomorskie were the least likely to resort to universities and R&D institutions for information, guidance, and advice on innovation among the four analyzed regions (Figure 69). This suggests another area for possible policy intervention, focused on strengthening links and sharing knowledge between business and science.

Figure 69. Sources of information on innovation



Source: The World Bank.

Additional analyses on the regional level could provide valuable information. Given the rich data set gathered during the interviews, it would be possible to position all regions across all the drivers and constraints of innovation analyzed in the questionnaire. The same applies to all other elements in the data set, including growth constraints, strength of networking, and the ability to follow business and technological trends. The data set could thus provide an important source of bottom-up information about firms in the regions and help adjust public support instruments accordingly. The data from future firm interviews should be made public (in an anonymized form) to allow stakeholders to produce their own analyses.[41]

Many interviewed companies were not aware of the smart specialization policy. Less than one-third of the interviewed firms had heard about national or regional smart specializations. They were also rarely aware of the details of the new smart specialization policy and the impact it is supposed to have on the national and regional innovation support system and support instruments. This relatively low level of awareness suggests that further efforts to make firms familiar with the goals of smart specialization policy would be useful.

[41] To provide a blueprint, anonymized data from the firm-level interviews conducted by the World Bank are available on the project's website.

Business needs analysis—summary

Public interventions in the new EU budgetary perspective should be developed based on the real needs of enterprises. These can be identified as a result of in-depth outreach to enterprises rather than, for instance, standard paper-based and impersonal surveys. Face-to-face interviews should be a critical part of the EDP and become a key input for smart specialization policies and the RIS3. Business needs analysis should focus on real barriers to innovation-based growth rather than on standard calls for easier access to capital, streamlined procedures, curtailed bureaucracy, or reduced taxes.

Business needs analysis is a key element of the EDP. By assessing enterprises' needs, public sector innovation support services can be targeted more precisely. Business needs analysis can also help the public sector focus on those areas in which development can increase innovation and improve the Polish economy's competitiveness. This is fully in line with the smart specialization policy and the RIS3, which aim to provide an integrated, place-based economic transformation agenda that focuses policy support and investments on key national/regional priorities, challenges, and needs for knowledge-based development. The RIS3 should set priorities to build competitive advantages by developing and matching research and innovation with business needs.[42]

Needs correlated to growth

Overall, the interviewed companies expressed needs relevant for almost all areas of business development. The most prevailing elements include access to financing, human capital, management skills, and market intelligence. These findings apply across most specializations and most innovation and growth drivers. In addition, however, many firms noted the importance of stronger networking, internationalization, and easy-to-understand regulations.

As for access to financing, the awareness of different types of public funding is relatively high. However, this is balanced by a rather weak understanding of how to access public funding instruments, concerns about the need to deal with substantial red tape in the application process, and confusion as to the objectives of many EU-funded programs, at both the national and regional level. Firms tend to rely on private consulting firms that specialize in preparing grant applications to help them navigate complex bureaucratic systems. Firms do this because the grant selections systems are largely paper-based, where there is no need for entrepreneurs to present their ideas in person. As a result, such selection processes transform grant competitions into "beauty contests," where style overshadows substance. This undermines the ability of the public sector to choose projects and firms with the highest potential return.

Firms also have trouble accessing private funding. Firms have difficulty in understanding how to mobilize external financing from banks, business angels (BAs), and venture capital (VC) firms. Within the start-up community, a specific need is to access "smart financing," which bundles financing and counseling, including mentoring, coaching, and strategic advising. Although the level of awareness and knowledge about BAs and VCs is relatively low, entrepreneurs generally tend to distrust such investors and do not see them as potential opportunities. BSIs are often not sufficiently skilled to assist SMEs in dealing with external equity investors.

In terms of human capital, firms find it difficult to upgrade the quality of their workforce. This is partly due to the low awareness of the support instruments that would help train staff to deal with new machines/processes/knowledge as well as improve soft skills, including project management and teamwork. In addition, firms find it difficult to attract well-trained staff (both from universities and from the labor market). This lack of match between needs and supply could be addressed by public policy reforms and tailored trainings that deliver quality knowledge and create added value for firms.

Firms often struggle to properly incentivize their staff. Most firms do not seem to appreciate the need to introduce clear, strong incentive systems for staff, including incentives focused on innovation efforts. They also seem not to follow basic management practices on staff performance assessment, including clear objectives and proper monitoring mechanisms. This suggests that there is a need for public support to help expose firms' management to best management practices, including on human resources.

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[42] European Commission (2012a).

Market intelligence tends to be weak. Managers often struggle to take actions that would allow them to collect and analyze information related to new market opportunities, market trends, and competitors. This includes the ability to make decisions related to new product development, product quality, or better understanding of suppliers. Weak market intelligence leads to serious constraints—firms state that entry barriers to new markets is a major challenge. They do not know how to access the relevant information and have difficulties determining which actions would help them find proper instruments to overcome these barriers. Firms admit that market intelligence is crucial for them, but the majority of firms are not aware that BSIs could provide such knowledge. The few firms that know about this possibility do not trust the BSIs' capacity to deliver high-quality services.

Needs correlated to innovation

The majority of firms do not seem to recognize the need for innovation to improve growth and competitiveness. This often reflects low awareness of global challenges and an absence of exposure to international practices. It also likely reflects the fact that most companies do not need to innovate to survive: they prefer to stick to what they know, that is, the traditional sources of competitiveness based on low labor costs, high-quality human capital, flexibility, and responsiveness.

Access to financing and human resources are high on the firm growth agenda. This is in line with general findings across Europe. However, it seems that financial support is either not optimally calibrated or not used well. In many cases the amount of funding is inadequate, partly because many public support programs are spread too thinly among many beneficiaries. There are also the usual complaints about red tape and excessive reporting requirements.

Firms face constraints in following technology trends. They find it difficult to determine what type of innovations they could undertake to boost their competitiveness and/or enter new markets. Only one-fifth of firms mobilize resources to understand in which areas future innovations will happen and how to use this information. This highlights a need for strengthened access to information on domestic, European, and global technology trends. Public policy should develop a system that would help companies stay on top of technological trends and new business opportunities. This should be done in cooperation with BSIs and RDIs.

Firms are also not used to collaborating to develop innovation. Firms tend not to collaborate with competitors, suppliers, or providers of capital to develop R&D&I. When they innovate, they take the whole risk of innovation on themselves. Sharing the risk with other stakeholders, such as within a research consortium or a cluster, would increase firms' risk appetite and lower the costs of potential failures.

The legislative environment is a constraint to innovate. A large majority of firms in the sample believe that national regulations thwart their ability to develop and implement innovations (across all drivers). Firms that are well acquainted with international markets think that EU regulations are more favorable than domestic regulations.

Firms report that customers rarely seek innovative solutions. In general, companies believe that customers are not willing to pay more for an improved product or service, which undermines the motivation of would-be innovators. This finding tends to be in line with the overall relatively low innovativeness of the Polish economy. Customers are not different than the average. However, "champions" working on the technological frontier have no doubt that innovating is a must and higher costs are acceptable if they bring productivity enhancement or higher quality.

Needs are well correlated with the company typology. "Champions" have more sophisticated needs than other types of firms. They require more help in managing IPR and innovation, human resources, and R&D than other types of companies in the sample. "Sleeping beauties" in turn need more basic support, especially on how to access knowledge domestically and abroad, how to network better, and how to build basic skills for conducting R&D and innovation. They also need basic business development advice on how to scale up their business and market their products and services.

Identifying the needs of specific firm types should help in adjusting public policy. The variety of needs and the variation of the intensity among interviewed companies should enable policy makers and support agencies to deliver well-defined "smart support" directly adapted to their target groups. The tailor-made approach is likely to be much more efficient in terms of take-up and impact compared to generic support programs that deliver grants on a horizontal basis. Table 11. Examples of support programs for firms with high growth potential: New Zealand and Denmark presents examples of support programs for firms with high growth potential in Denmark and New Zealand.

Table 11. Examples of support programs for firms with high growth potential: New Zealand and Denmark

Country/Support measures	Revenue criteria	Other criteria
DENMARK ***"GazelleGrowth"*** (1) Extensive and individualised market research to understand the opportunities and competitive landscape in the selected U.S. target market (2) Face time with real U.S. customers, partners and influences at the decision-making level and (3) Hands-on coaching by leading international experts from the firm's industry	More than DKK 2 million (about EUR 0.27 million) in turnover in the last two years (revenue potential of DKK 100 million (about EUR 13.3 million): please see other criteria.)	• Fully developed product or service with clear competitive edge through differentiation in business model or product design. • Scalable business model allowing fast ramp-up in volume with the revenue potential of DKK 100 million (about EUR 13.3) • U.S. market readiness and product readiness
DENMARK ***"Regional Centres of Growth (Regionale vaekstuse)"*** Impartial and free problem clarification and reference to relevant private counsellors and public initiatives		• The screening process is decentralised and handled by the consultants in the centres. The guidelines are that the firms should have potential and ambitions for export or substantial growth in turn-over or number of employees • The Regional Centres are supervised by DECA based on yearly contracts. The 2008 contracts set out 11 targets including the growth in the counselled firms. In order to measure this, DECA has established a CRM system and the registered firms are followed and their own growth is measured. The Centres are awarded a bonus if they fulfill the 11 targets in the contract. This creates an incentive for the centres to counsel the correct customers.
NEW ZEALAND ***"Growth Services Range"*** (1) Client Manager Assignment for the needs assessment (identifying business growth opportunities, firms strength and weaknesses and determining an exit strategy to graduate from the scheme), (2) Grants for (i) feasibility studies, (ii) preparation of documentation to obtain finance for business development, (iii) development of prototype design and testing, (iv) international business exchanges, (v) development of business, strategic or marketing plans, (vi) advice and assistance for human resources development, (vii) development of intellectual property protection and commercialization, etc. and (3) Market Development Services such as specialist information advice and facilitation	The potential to generate either average 20% per annum revenue growth sustainable over 5 years, or revenue growth of NZD 5 million within 5 years	• A differentiated internationally compelling value position • Innovative technology • Technology transfer • National branding potential • Strong international aspirations • Exemplar or leadership role • Strategic fit with NZTE (New Zealand Trade and Enterprise) (Decision is based on the subjective assessment and judgement of Sector Managers and the Growth Service Fund Assessment Panel)

Source: based on OECD (2010a, p. 71).

Innovation strategies, sources of information, and growth constraints

Firms need to be exposed to the entire spectrum of possible innovations. Experience from other countries indicates that firms that are most successful tend to embrace innovation in all dimensions, including products, services, processes, marketing, and organization. There are often synergies and positive feedback loops among these different types of innovation. In the project's sample, "champions" tended to have the most comprehensive approach to innovation strategies.

Access to RDIs is sporadic and is based on personal networks. The existing science base (mainly local) and the access to information provided by RDIs is not considered a major constraint, partly because only a few companies have experience working with them. Systemic information about the quality and availability of research is not available, and companies often do not know how to approach researchers. They often perceive procedures at public universities as burdensome and unfriendly to business. There is also a tradeoff between business secrecy and scientists' interest in publishing articles.

Managers do not feel that they face major constraints on access to information. This is the case for all firms except those that are trying to enter foreign markets. However, many managers have a limited knowledge of domestic and global trends. This highlights both a limited appetite for accessing this knowledge and an insufficiently robust system of business information provided by trade associations and public organizations. Future reforms in this area could be based on best practices found in the United Kingdom, Scandinavia, Germany, or France.

Firms are interested in mentoring and coaching. Most firms would welcome critical and impartial reviews of their competitive advantages, including a market audit of their products and services, organization, and marketing. Companies are interested in reaching out to external professional experts who could provide an outsider's view of the company and indicate areas for improvement. Executive coaching is very much in demand.

Innovation constraints and drivers

Polish companies do not seem to perceive significant constraints to innovation. This is counterintuitive, given the low level of innovation in the country. The likely explanation is that most firms do not innovate much in practice and thus do not experience the real constraints. Discussion about barriers to innovation for the vast majority of companies is still largely academic and theoretical. The interviewed firms are rarely exposed to competition and best practices, are weak in technology-market intelligence, and tend to think locally rather than globally.

Weak networking is also a constraint. Firms that are most successful in developing new products and services tend to be well connected to their local and external environment through a web of private and public systems (clusters, strong associations, international connections, proactive public RDIs and BSIs). This is not the case for most of the interviewed companies. The Smart Labs' findings confirmed this—most participants did not know one another, despite working in the same market niche, technology area, and region.

Many firms were surprised by the range of potential innovation drivers discussed during the interview. Firms would be better off if they could prepare innovation and growth strategies that mobilize more internal and external drivers. The lack of focus on leveraging suppliers, customers, or RDIs as sources of innovation reflects both a lack of awareness and a lack of trust.

Connecting business needs with public intervention

Identifying firms' deeper needs can help adjust public support systems. The analysis of the companies' needs shows that there is a need for both horizontal and vertical innovation policy instruments. Both types of instruments could be discussed in more detail with the participating companies during Smart Labs or within working groups at the national or regional level.

Specific support instruments should respond to different needs of each smart specialization. The support instruments should include not only help in R&D investment and hard technical innovation infrastructure (such as laboratories), but also answer the strategic problems facing a given specialization. They can include some specialized,

sectoral services, but also other challenges identified during Smart Labs and strategic analyses. Companies in a number of specializations, especially in emerging sectors, find it difficult to deal with regulatory issues (such as in the case of the nanotechnology industry in Slaskie). Others need to improve their position in the value chain (for instance, subcontractors for the automotive sector), and yet others (such as those in the CNC machines sector) should invest in new products and technologies. For example, while introducing new products, young nanotechnology companies have to freeze their R&D money for a few years because the registration procedures are unclear. This discourages them from innovative activities and can make other innovation policy instruments inefficient.

Although the general company needs can be identified on the basis of various analyses, specific needs can only be identified through the EDP. The proposed EDP helps identify firm needs that are otherwise difficult to detect through the more traditional channels of public- and private-sector interaction. It is therefore important to keep the process ongoing and the stakeholders involved. This can be achieved by keeping the promises, implementing the instruments, and conducting the activities that were agreed to be of crucial importance. It is also necessary that all stakeholders communicate regularly about the achieved results, promote success stories, and share the lessons learned.

Differences among national smart specializations are statistically significant only when grouped as five meta-specializations. A factor analysis of each of the 10 selected smart specializations did not show sufficient differentiation. Tangible differences are only visible among meta-specializations, which combine a number of underlying individual smart specializations. In addition, the interviewed companies had significant difficulty in associating themselves with only one of the 10 national specializations that were selected for the project. It could be useful to consider reducing the number of specializations, by, for instance, merging some of them together. This would simplify the EDP process, reduce the number of working groups, improve information flow, and lighten the administrative load. The differences in needs of companies in more closely defined smart specializations would help design and implement more specialization-specific actions (as described in Table 12).

Interviews offer a good opportunity to identify the target group for various policy instruments. Absorption is still a dominant feature of the innovative performance of Polish companies. It could therefore be useful to support companies first in the development and implementation of successful, innovative adaptation of the absorbed products and technologies, and only later in more frontier innovations. At the same time, the few highly innovative companies should be able to use more specialized support to scale up and internationalize; their growth could inspire more companies to change their more traditional business models. This means that the support should be tailored to the type of company.

"Champions" and "sleeping beauties" require different support instruments. "Champions" in particular need to be cherished. These are companies that, unlike the vast majority of Polish SMEs, already have the right mind-set, focusing on innovation as the key source of competitiveness. These companies need to be identified through an ongoing EDP and given a priority, especially because "champion" companies are still rather rare (according to GUS, there are not more than 1,000 companies in Poland that record any R&D spending, equivalent to about 60 companies on average per region). The "champion" companies require sophisticated, just-in-time, professional support, which today is largely unavailable because it goes far beyond the capacity of existing BSIs and RDIs. One of the possible solutions would be for the public sector to hire experienced consultants, such as retired successful businesspeople, to provide one-on-one information and coaching services to the "champion" companies. These services could be subsidized for a specific period and then become self-financed by the participating companies (thus providing a useful feedback loop on the quality of experts).

"Sleeping beauties" need carrots and sticks. "Sleeping beauties," as the name suggests, need an incentive to "wake up." These are companies with substantial hidden potential that has not been leveraged yet due to weak access to external knowledge, insufficient ability to identify changing market and technology trends, poor networking, and not-always-optimal management practices. These companies are also often missing R&D as a key factor that could help them improve. As for "carrots," the public sector would be well advised to provide a variety of substantial financial and nonfinancial incentives, including matching R&D grants, pre-commercial procurement, and executive and innovation coaching of enterprise management and staff. When it comes to "sticks," public authorities could use a high-quality

selection processes with involvement of investment committees to encourage "sleeping beauties" to increase their level of ambition, access new knowledge, and follow new markets; or they could help "sleeping beauties" by making it mandatory for firms to use online public services or adjusting public procurement services to promote innovativeness.

"Sleeping beauties" would benefit from improving their innovative and management skills. For a company to be successful, its management has to recognize the need to improve its practices and be able to implement the required changes. Highly professional trainings and courses should be provided, including on strategic management of innovation, access to information sources, and expansion in international markets. The training could also include design thinking, in which the participants have to experiment with a shortened innovation process. Such a training, especially if organized for companies from similar specializations, could be used to generate ideas for new innovative projects. It could be led by business angels or VCs to increase added value, ensure high quality, and initiate potential collaboration between entrepreneurs and sources of "smart money."

Matching the different company type needs with proper support instruments is key for effective support. Table 12 offers an example of how the different needs identified through the firm-level interviews could be linked to the type of company, possible instruments of support, and recommended providers of support. The targeting of the instruments to the type of company could be achieved by adjusting the selection criteria in the general call for proposals. Most of the proposed instruments were already used in the Polish innovation policy, but their impact, due to insufficient targeting or quality and imprecise design, has not always been satisfactory.[43] Some services, such as mentoring, access to financing, and innovation management, will cut across all types of companies, although their intensity will differ. BSIs should be able to provide services at a higher level of sophistication to be useful to enterprise. Whereas more generic services could be financed to a larger extent by the public sector, high-quality services that require expert knowledge could be more substantially financed by the receiving companies.

To address the needs, the public-sector approach will need to be modernized. It will be critical for the public sector to be able to (i) address more sophisticated needs, such as mentoring or dealing with investors; (ii) become more entrepreneurial, open, and proactive; (iii) focus public support on priority groups; (iv) closely monitor performance and evaluate impact; and (v) improve institutional capacity and staff skills.

Specialized pro-innovative services need to be a part of the efficient national innovation system. One of the barriers to the development of an efficient national innovation system can be the way pro-innovative services are financed; in many European countries or regions, BSIs are contracted or even fully financed to perform a certain type of service that the public sector deems necessary. In such a financing system, BSIs' effectiveness can be strictly assessed and continuously improved. In Poland, BSIs compete for public financing, often freely interpreting the conditions of different calls for proposals. Sometimes there is not a clear link between a company's real needs and the services offered by BSIs. Also, the assessment of the quality of services is mostly based on project indicators and not thorough evaluations leading to noticeable improvements. It is therefore recommended to design and implement a new model in which BSIs would be paid for specified and well-justified services to enterprise, identified through a close public–private dialogue. Public financing should also be available to private consulting companies.

The low level of awareness of public support and smart specializations needs to be addressed. Polish SMEs often do not understand the intricacies of different support policies and find them difficult to access. Even though in all regions, and also at the national level, there are information points and portals concerning European funds, they seem to operate on the principle of "come if you find me" and do not actively look for customers. Even if they try to find clients, it happens by rather traditional means of communication, such as conferences, seminars, or webpages, which provide general information that can be difficult to understand. More personalized information, adjusted to the needs of different target groups, could be much more efficient—distinguishing between company types or specializations and focusing on issues most important for the customer, not the provider. The effectiveness of communication should be evaluated on an on-going basis.

[43] Kapil, Piatkowski, Radwan, Gutierrez (2013).

Table 12. Matrix of selected firm needs and matching public support

Type of company	Identified need	Possible instruments of support	Providers of services
"Champions" and "emerging champions"	Building competitive advantage at international level	• Specialized coaching/mentoring • Specialized information on R&D/ internationalization • Trade missions • Internationalization programs • Internationalization readiness audits • International B2B meetings • Financing foreign investment • Networking in value chains	• Specialized consultants • Specialized BSIs • VC capital • Business angels • Banks
	Business upscaling	• Equity • Guarantees • Debt financing • Business development programs • Managerial trainings	• VC capital • Business angels • Banks • BSIs
	IPR protection	• Specialized legal and technological advisory services • Co-financing IPR procedures • International technology benchmarking—open platforms or specialized analyses	• Specialized consultants and patent counsellors • Specialized BSIs • Universities and technology transfer centers
	R&D development	• Grants • Technology loans • Networking opportunities (open days, boot camps, competitions and prizes for R&D ideas)	• Institutions managing national and regional operational programs • Banks and VCs
	Availability of hard skills	• Specialized trainings for employees	• Universities • Vocational schools
"Sleeping beauties"	Upscaling competences for managers	• Workshops • Training • Consulting	• Consultants • BSIs
	R&D stimulation	• R&D vouchers • Information about IPR protection	• Institutions managing national and regional operational programs
	Improving marketing competences	• Vouchers for marketing innovation • Consulting/mentoring	• Institutions managing national and regional operational programs • BSIs
All SMEs	Improving management practices	• Workshops • Training • Benchmarking • Management audits	• Consultants • BSIs
	Building preemptive and proactive attitudes: strategic innovation management	• Strategic business and technology coaching • Specialized trainings for companies in innovation management skills (innovation MBAs)	• Specialized consultants • Specialized BSIs • Universities

Type of company	Identified need	Possible instruments of support	Providers of services
	Financing innovation	• Grants • Technology loans • Matching grants • Soft loans • Equity • Guarantees • Debt financing	• Institutions managing national and regional operational programs • Banks
	Networking	• B2B and business-to-science events • Business and science consortia • Key clusters	• BSIs • Universities • Cluster organizations
	Access to knowledge: technological and market trends, economic intelligence	• Technology audits • Seminars and workshops • Providing specialized analyses • Specialized trainings • National and international benchmarking • Market trends reports • Brokering • Seminars and workshops • Publicly accessible databases/information portals • BTRs	• Specialized consultants • Brokers • Specialized BSIs (especially technology parks and incubators) • Universities
	Implementing product, process, organizational, and marketing innovations	• Innovation and technology audits • Innovation vouchers • R&D vouchers • Grants	• Specialized consultants • Brokers • Specialized BSIs (especially technology parks and incubators) • Universities
	Better use of information sources	• Upscaling competences of staff and management	• Consultants • BSIs
	Access to financing	• Soft loans • Equity • Guarantees • Debt financing • Improving public support procedures	• VC capital • Business angels • Banks
	Access to qualified human capital	• Cooperation with technical and vocational schools • Staff exchanges between universities and companies • Specialized staff trainings	• Vocational and technical schools • Universities • Technology transfer centers

Source: The World Bank.

Summary and recommendations

The firm-level interviews demonstrated the following benefits (Box 33):

- They help identify differences between national smart specializations and provide early evidence for verifying/modifying smart specializations.
- They help identify firms with the largest innovation-based growth potential and the greatest need for public support ("champions" and "sleeping beauties"), detect the determinants of firms' innovativeness, and adjust the public support accordingly.
- They help select priority firms for the Smart Lab portion of the EDP and identify areas of endogenous strengths.
- They identify firms' main barriers to growth and most pressing needs for each smart specialization.
- They help identify emerging business and technology trends.
- They help assess the quality of the public support system.
- They provide a direct way for companies to increase competitiveness, based on the experts' feedback.
- They help the public sector become more proactive, access firms that do not normally interact with the public sector, and reduce the risks of the innovation policy being driven by vested interests.

BOX 33

SMART INTERVIEWS—BENEFITS FOR THE PARTICIPATING COMPANY

The firm interviews may provide a number of benefits to the participating firms:

- The expert feedback delivered at the end of each interview can help increase companies' competitiveness by addressing the perceived shortcomings, emphasizing the strengths of the company and its strategy, and sharing information on the available support instruments.
- A questionnaire-based structured discussion on topics that are strategically relevant for firm's growth can help tackle subjects that sometimes have never been adequately considered by management (for instance, employees' incentives to innovate).
- The interview questionnaire shared with the firm after the interview can be used by a firm for follow-up analyses and self-assessments.
- The data from the interview can help a company benchmark itself against its industry and regional peers (subject to availability of data).
- Participation in an interview can help a company to be included in newsletters and mailing lists provided by public administration with information on public support/financing sources.
- Each interviewed firm receives a certificate confirming the firm's participation in the EDP.

Source: The World Bank.

The main findings from the firm-level interviews are the following:

- National smart specializations are different in terms of the number of firms with high growth potential, R&D intensity, and company needs. Public-sector support should be adjusted accordingly.
- Firms with the largest innovation-based growth potential ("champions") are characterized by high revenue growth rates; spending on R&D; a high proportion of export sales; a high proportion of science, technology, engineering, and mathematics (STEM) employees; and a growth mind-set among the company's management.

- The main barriers for firms' development include access to financing, access to new markets, lack of skilled personnel, insufficient soft skills, mental barriers among customers (afraid to try innovative products), insufficient management skills, a low level of networking, and passive support from the public sector.
- The interviews identified a large number of firms with high growth potential that could benefit the most from public support. "Champions" have different needs than "sleeping beauties" and other types of firms.
- Most firms are not sufficiently networked, especially internationally. Many firms lack up-to-date and comprehensive knowledge about key business and technology trends in their business area.
- Most firms are skeptical about cooperation with the public sector. They generally do not know BSIs and RDIs and do not cooperate with them, and if firms are aware of the existence of support institutions, they appear concerned with the quality of their services. Firms need more proactive outreach from public-sector stakeholders to build networks and trust.
- Firms are aware of the available public innovation support programs, but lack details on which support instruments to access and how.
- Firms generally share similar innovation drivers and constraints across all smart specializations, suggesting a need for horizontal support policies, which can differ in knowledge intensity depending on the type of a company.

Going forward, national and regional authorities can adjust the interview process to their needs. Depending on the specific circumstances and needs of each of the regions, the questionnaire can be modified accordingly. For instance, the interviews could (i) focus only on selected barriers to innovation-based growth, such as the quality of management practices; (ii) be extended to cover specific topics, such as protection of intellectual rights; and (iii) concentrate on providing innovation-oriented feedback and coaching from the interviewing experts.

The quality of the interviewing experts and the postinterview analysis will be key. Interaction with the company's top management and the need to provide feedback requires that the interviewing experts should be credible partners, with substantial professional experience and a comprehensive understanding of innovation management and the public innovation support system. Regional consultants that will be hired by the MoED need to be properly selected, trained, mentored by experienced professionals, and tested on the quality of their work (see Box 34). It will also be critical to ensure that the wealth of information gathered during the interviews is properly analyzed and used in policy making. PARP is likely to be the best partner to analyze the data at the national level. Table 13 summarizes the main recommendations.

Table 13. Main recommendations

Short-term	Medium-term
• Hire top-quality consultants to conduct interviews • Designate an institution responsible for managing the interview process and analyzing the data • Share the methodology of the interview process online, along with anonymized interview results • Introduce innovation and management practices training programs for innovative SMEs	• Adjust public support instruments to the specific needs of enterprises identified through the interview • Introduce a tailored and sophisticated support program for "champions" and a separate program for "sleeping beauties" • Continue to use firm interviews as a key tool for administration to proactively reach out to business

Source: The World Bank.

BOX 34

HIRING CRITERIA FOR REGIONAL CONSULTANTS TO CONDUCT INTERVIEWS

Regional consultants selected to conduct the EDP need to be able to communicate with the interviewed companies' top management. They should be able to assess the business and innovation performance of the companies to ensure that the interview is not only a survey. To ensure that the consultants are of high quality, it would be useful to ensure the following:

- **High professional standards:** consultants should have relevant economic and/or business education, extensive professional experience, and proven knowledge of the innovation system.
- **Intensive training:** consultants should be trained in interview methodology and innovation management, and they should have knowledge of good international practices for supporting innovative companies from the leading countries, such as Finland or Israel.
- **Mentoring:** consultants should be mentored/coached by experienced business experts who can also participate in firm interviews.
- **Monitoring and evaluation:** the performance of each consultant should be assessed through postinterview quality checks and surveys of the companies served.

Source: The World Bank.

4.2 Smart Labs

General conclusions

The results of Smart Labs suggest that the process adds value. Smart Labs go a step beyond the firm-level interviews: they stimulate a discussion of a broader set of actors and concentrate at the level of a business area rather than an individual firm. The SLs' interactive character helps verify and deepen insights from firm interviews, promotes joint creative thinking about how to develop the business area, and builds mutual understanding among the stakeholders.

Smart Labs help overcome a coordination failure. Stakeholders in the innovation system rarely communicate or cooperate, even though their activities can be complementary and collaboration would benefit them all. SLs pave the way for direct communication among entrepreneurs, scientists, BSIs, and public administration. This enhances the understanding of their own strengths and weaknesses and highlights areas for potential joint action that go beyond an individual firm. The SLs help generate farsighted, innovative ideas with strong development potential that could not be realized by an individual entity and most probably would have not been developed outside the SL process.

Smart Labs are well suited to help verify the economic potential of a given business area. Direct communication between innovation stakeholders, moderated by an experienced professional, makes defining the thematic scope of the SL easier. Elaboration of a SWOT analysis and key success factors helps prove the growth potential of the business area. In situations when the first SL offers an ambiguous answer about the potential, the second SL meeting is devoted to probing other possible economic activities/business areas, with a modified list of participants, whenever needed. The first two Smart Labs can be organized within one to two months, and afterward it should be clear whether a business area looks promising enough to invest further resources. The willingness of business participants to engage in further analytical work, including by taking the lead on preparing a BTR, is also a good indicator of the area's business potential and for the commitment of business partners.

Smart Labs also help identify new potential smart specializations. The Smart Lab discussions among the private sector, science, public administration, and civil society can produce information about emerging technologies and areas of economic potential related to the topic of the Smart Lab. For instance, during the SL process on "smart building" in the Dolnoslaskie region, it emerged that "assisted living" for elder people could be a promising new area of growth and a subject of a separate SL process. Such bottom-up-driven findings are at the core of the entrepreneurial discovery process.

Entrepreneurs seem willing to engage in the SL process and play a leading role. A majority of enterprises that were invited to the SL were interested in this collaboration format, accepted the invitation, and joined the initiative. The entrepreneurs expressed interest in taking on individual joint projects, as well as influencing regional and national innovation policy. This suggests that the interviews work well as a tool for reconnaissance and spotting willing entrepreneurs. It also suggests that entrepreneurs are eager to devote their time and effort if they see added value in the SL process.

SLs help identify business leaders. Leading entrepreneurs and scientists can be identified during SL meetings. These are individuals who usually have a vision of development of a given business area and can convince other SL participants to embark on a proposed undertaking. Emergence of a business leader during the SL is an important indicator of whether this business area can develop further and whether it should receive support from the public sector. The leader should participate in BTR preparation by providing insights about the market, technologies, and key players.

Smart Labs promote business networking. Smart Labs provide a useful platform for a dialogue among innovation stakeholders. Smart Labs organized during the project revealed that many participating companies, despite operating in small market niches and in the same regional markets, often did not know one another. They were also not fully aware of the academic potential that existed in the region. The SWOT analyses conducted during SLs suggested that the companies also had low exposure to sources of information and knowledge. The entrepreneurs usually knew their narrow market niche well, but were unable to refer to a broader (domestic and international) context. Smart Labs help connect innovation stakeholders, raise awareness, and build trust.

They can also help analyze industry-level value chains. Smart Labs can be used as a platform to pull together the participants' knowledge to describe their specific industry's value chain and identify the highest-added-value elements of the production chain that they could aspire to join. The value-chain analysis reduces the information gap among many participating firms and provides directions for strategic planning. The value-chain approach was tested in the project and yielded positive results (see Box 35 for an example of an SL based on a value-chain analysis).

BOX 35

A CASE STUDY OF A SMART LAB BASED ON A VALUE CHAIN ANALYSIS: NANOTECHNOLOGY SMART LAB IN SLASKIE

Two Smart Labs took place in the Slaskie region during September and October 2015. They featured more than 20 companies, research institutes and universities, BSIs, and public administration. The main takeaways were the following:

- There is still only a small group of companies and research institutions working on nanotechnology.
- There are significant difficulties with certification, registration, and security confirmation for nanotechnology products, which force young companies to freeze money for product development for long periods of time.
- Most companies participating in the SL represented the initial and middle parts of the value chain, where most value is generated in final products.

The main recommendations going forward were the following:

- There is a need to connect the nanotechnology industry with potential users in other sectors, such as energy, construction, or chemical products, and concentrate on the development of products positioned in the higher-valued-added segment of the production chain.
- Poland should adopt regulations from other countries, such as Germany or France, and learn from their good practices to help support further growth of the industry.
- There is a need to concentrate public support on components and products that are already or can be manufactured in Poland (for some nano-components the market is already dominated by the international players). Such product and components include nano-cables, nano–glass covers, batteries, heating elements, nano-disinfectants, and nano-catalyzers.

(*continued*)

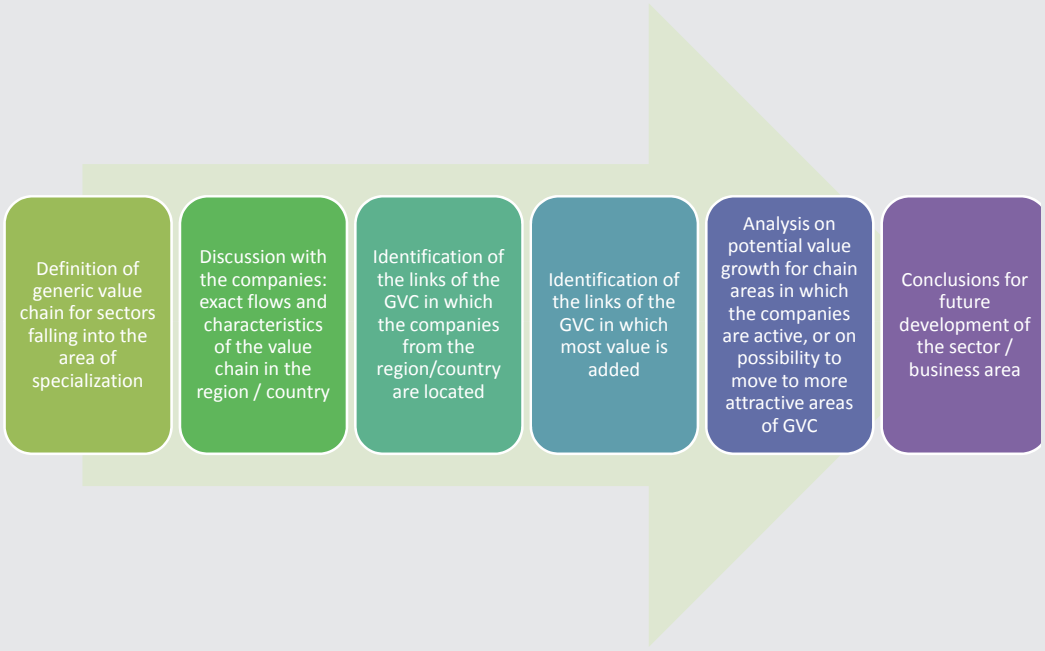
BOX 35

- The Asian and American markets hold the best potential for internationalization because they are not as highly regulated as the European one.
- Because nanotechnology research sometimes produces materials and components that can lead to completely new products in sectors different than originally planned, there should be some pilot support instruments for experimental nanotechnology processes. Such an approach also fits the EU guidelines on smart specialization.
- The local leader, the Nanotechnology Cluster, will implement the main findings from the Smart Lab in its strategy to become a national key cluster in the cooperation with the Nanotechnology Observatory in the Slaskie region.

The identification of relevant global value chains (GVCs) and mapping exercise (Figure 70) with the entrepreneurs should be accompanied by addressing the following questions:

- Do the presented value chains correspond to the specifics of the sector in the region/country?
- Which value chains are present in the region/country? Who are the key players?
- Where in the value chain would it be easiest to increase value through innovation?
- Does the value chain have bottlenecks?
- What are the challenges facing the industry in the near future?

Figure 70. Global value-chain analysis—methodology



Source: The World Bank.

Scientists are willing to collaborate and exchange information with entrepreneurs. University academics and representatives of RDIs welcomed the opportunity to present their research and offer ideas to potential business partners. SLs also provide an opportunity for companies to enhance their knowledge about how they can develop collaboration with science, something that most of them have not dared to try before. The more commercially oriented RDIs are ready to grasp an opportunity offered by the SL to reach out to companies.

The SL process seems to offer benefits for all participants. Entrepreneurs invited to the SLs seemed to appreciate the chance to deepen their knowledge about their business peers, technological trends, market opportunities, and funding sources for their innovation activities (see Box 36). Scientists seemed to benefit from interactions with real business and robust feedback about which technologies could be commercially promising. BSIs were able to build

their knowledge base and offer tailor-made services to the participating companies and to the business area that they represented. Finally, public administration met its objectives of involving all stakeholders in co-creating innovation policy and selecting priorities for funding.

Business and technology roadmaps (BTRs) can help verify the potential of selected business areas. A BTR is a short document that aims to (i) analyze the business and scientific potential of a specific business area to verify/modify existing smart specializations or identify new ones; (ii) assess the main business and technology trends; (iii) describe the main market players; and (iv) provide a roadmap of R&D and innovation investment and the corresponding budgets. The BTRs should be made public to help guide private sector's investment decisions, spur public-private coordination, and enhance access to market intelligence. BTRs should be prepared by external experts and financed by both the public and private sectors.

BOX 36

SMART LABS—BENEFITS FOR THE PARTICIPATING COMPANIES

The Smart Lab process is a swift, flexible, and informal way to engage companies. It is designed to stimulate joint creative thinking about the area of specialization and build participants' mutual understating. The participating firms receive the following benefits:

- **The possibility to impact national and regional innovation policy and spending patterns.** Entrepreneurs often complain about the quality and direction of public policy, and many of them are willing to provide constructive feedback. However, they rarely engage in more formal and resource-intensive forms of dialogue (industry associations, advisory bodies, councils, etc.). Smart Labs give them a legitimate forum to address public policy actors without spending much time and effort.
- **Access to knowledge and market intelligence.** The structured and professionally moderated discussion provides the participants with a diagnosis of the sector through SWOT or GVC analysis. It also allows the firms to learn more about the technology trends and relevant activity of the research institutes (technology supply side). The Smart Lab process is also designed to provide key input to a business and technology roadmap (BTR).
- **The opportunity to network with science and business peers.** It often turns out that regional actors do not know one another, and if they do, they have never held a structured discussion about the sector. Smart Labs are designed to address this coordination failure.
- **The opportunity to create science–business consortia.** Smart Labs stimulate direct communication among entrepreneurs, scientists, and BSIs. At the meetings, companies can enhance their knowledge about how they can develop collaboration with other innovation stakeholders. This provides a good context to discuss joint activities that go beyond an individual firm and generate new R&D&I projects for various innovation programs.

Source: The World Bank.

Methodological conclusions

The quality of participants is the most important key success factor for the SLs. The success of the Smart Labs depends on the quality of participants and their willingness to collaborate. The interviews help identify entrepreneurs who have the potential and willingness to cooperate with other stakeholders. Other participants also have to be selected on the basis of their merit and ability to contribute to the discussion. The interviews can help identify suitable scientists, BSIs, and RDIs; however, additional research is often needed to select them and invite them to the SL.

The SL process needs to be swift, flexible, informal, and based on trust. The themes of SLs that are proposed after the interviews are likely to evolve during the first two SL sessions. Hence, the SL should remain flexible to define the business area in line with participants' suggestions and the identified potential. The composition of the SLs must also be flexible; subsequent meetings can benefit by modifying the list of participants depending on the main theme. The nature of the SL also requires a sufficient level of trust among the participants for the SL process to become productive and possibly also self-sustaining. Business-type informality is essential. A one-size-fits-all approach to the SL process is likely to be ineffective.

BSIs are an important element of the SL process. Involvement of professional BSIs strengthens the SL process. BSIs are often the most knowledgeable actors in terms of available support and services offered to the enterprises.

Proactive BSIs tend to have a good understanding of how the commercialization process works and how an individual enterprise can approach RDIs to gain knowledge about new technologies. BSIs could fulfill the role of a SL moderator and perform some back-office activities within the SL process, as long as they can provide high-quality staff who are dedicated to the process, manage the flow of communication, and keep up the participants' engagement.

The efficiency of each SL depends on the strengths of the moderator, business leader, and facilitator. Each function requires different qualities, skills, and time engagement. Specifically:

- **An impartial moderator steers the discussion and provides independent opinion.** This role should be performed by an experienced and trustworthy (neutral) professional. To gain the trust of the SL participants and identify key aspects of the business area, an experienced moderator is needed, preferably with a track record in running her or his own successful business, advising companies, and/or being an investor in innovative companies. Former business managers, business consultants, business angels, and venture capitalists could be suitable to be the moderator. Importantly, there should be no conflict of interest between the moderator and participants, because this would undermine trust.
- **A business leader ensures market relevance and intelligence.** A business leader is an entrepreneur who is recognized by SL participants as a knowledgeable professional, has a deep understanding of market and technology trends, and has a track record of implementing innovation. The leader is also the external face of the SL who presents it at external meetings. She or he successfully runs her or his own business and is willing to invest time to better understand the business area, including by contributing to the BTR.
- **A facilitator ensures the SL process runs smoothly and stimulates the flow of information.** This role requires good communication and administrative skills and concentrates on back-office activities. An animator is a secretary of the SL, organizes meetings, circulates information, and ensures that every participant is engaged in the process. This role does not have to be performed by a single person, but can be shared among several people. BSIs such as clusters or business associations as well as public authorities are suitable for this role.

Active support from the administration is important for the success of the SL process. Participating companies and researchers are open to dialogue with the authorities because they see decision makers and innovation program managers as important counterparts and sources of financial and nonfinancial support. The role of public administration participating in the SL is to show that the results of the discussions will have a tangible impact on policy making and on adjusting the public support system. It is also useful for public administration to inform the participants of all the various support mechanisms.

Conclusions for the EDP

SLs can complement or substitute national and regional working groups. Owing to their temporary, informal, and fast-paced character, SLs add value to the EDP and can help verify selected smart specializations and engage stakeholders. Usually it takes two SL meetings to assess whether a business area has enough potential to continue the SL process. SLs usually have a narrower scope than working groups (WGs) at the regional and national level and can thus provide additional and more granular knowledge.

SLs can reinforce already-existing business groups (clusters) and lead to new ones. The project's Smart Labs showed that the SL process can deepen cooperation between already functioning groups or networks, as was the case in the project for the automotive sector in Slaskie or the packaging industry in Zachodniopomorskie. SLs can also help identify new promising areas of growth unconnected to the SL meetings' initial themes, which could be a starting point for separate Smart Lab process, the core of the specialization discovery process.

Smart Labs can become a springboard for applications to international programs. Because the Smart Lab participants are often the leading firms and scientists in the specific business and technology area, they could form consortia to, and reach out for resources from, international programs such as Horizon 2020. Tailor-made information and coaching would be useful in this respect. This should be available to a broader group of companies and scientists than only those participating in the SLs.

Smart Labs can facilitate M&E of smart specializations by creating roadmaps with milestones. Monitoring and evaluating S3s is a challenge, due to their sometimes generic definition. The Smart Labs aim to prepare not only a development vision but also a development roadmap for a given business area. The vision and roadmap should also provide milestones that would constitute reference points for future M&E. Results of R&D projects are difficult to foresee, which is why it will be difficult for roadmaps to provide specific outcomes. However, input and action from the private sector can be easily monitored.

The SL process requires a strong coordinating institution. There needs to be an institution that actively coordinates the Smart Labs around the country, analyzes the results, and uses them to inform the policy. Given its experience, regional outreach, and strong capacity, the coordinating role could be productively played by, for instance, PARP. Table 14 summarizes the section's main recommendations.

Recommendations

Table 14. Main recommendations

Short-term	Medium-term
• Ensure a high quality of SL participants through firm interviews and careful selection of representatives of science • Involve high-quality experts from the private sector to moderate SL meetings • Clearly communicate the expected results of the SL process • Keep the process open for new participants • Do not hesitate to stop the SL process when the selected business area does not have sufficient potential • Keep SLs informal and business-friendly; refrain from red tape and bureaucracy • Summarize and share the results of each SL online to generate intellectual capital • Focus on results and added value for firms, not on the quantity of meetings • Provide additional input when needed (hire sector-specific experts to fill in lacking knowledge)	• Build up a pool of consultants able to moderate SL sessions around the country • Build trust by acting upon SL results to modify innovation policy priorities and instruments • Strengthen cooperation with regions to create the most added value • Expand the use of BTRs (or equivalents) and disseminate them online • Coach firms willing to apply to H2020 programs • Build broader information-sharing and collaboration networks among firms participating in SLs

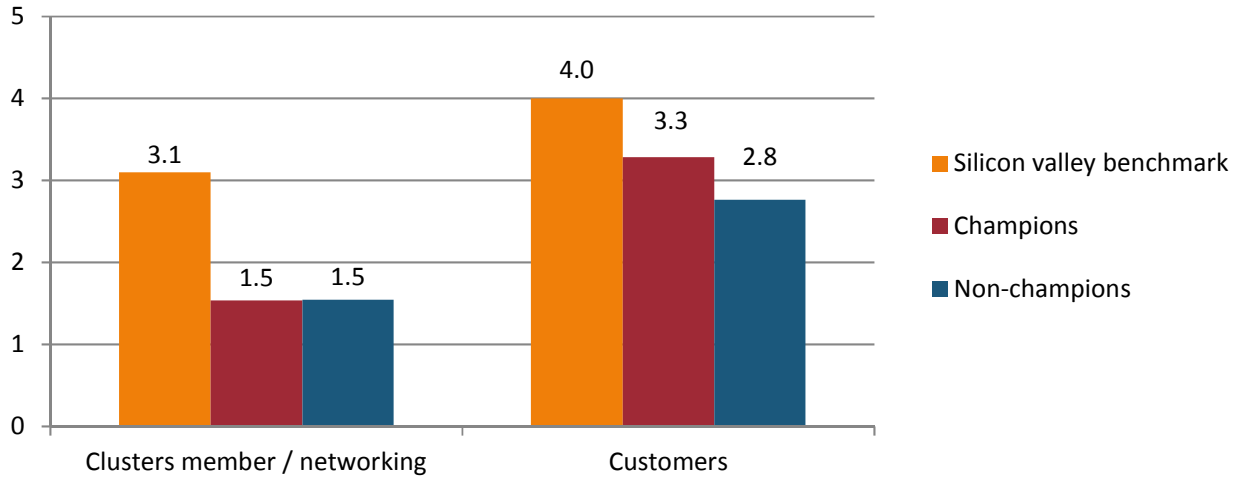
Source: The World Bank.

4.3 Crowdsourcing

Analysis of data received through crowdsourcing is largely in line with the interview analysis. More than 40 companies that responded to the survey believed that the process of applying for public innovation support was too long and complicated, which is consistent with the information obtained in the interviews. Access to financing, legislation, and availability of skills were perceived as the most important constraints for business. Innovation drivers included internal company resources, customers, and the Internet. Polish companies operating in Silicon Valley were using networking with other firms and with customers more extensively than companies in Poland. There is a wealth of other data gathered during the surveys that could be used going forward.[44]

[44] The entire data set is available on the World Bank project's website.

Figure 71. Sources of information about innovation



Source: The World Bank.

Crowdsourcing can also be used to collect panel data. Crowdsourcing can be used to track companies' performance over time through periodic surveys. The results would help inform public policy and adjust public support instruments. Specifically, crowdsourcing could track the awareness of and perceived usefulness of specific public support instruments, such as innovation vouchers, and help align them with the needs of the private sector on a systematic basis.

The survey should be short, simple, and user-friendly. The main idea behind crowdsourcing is for it to be quick, efficient and simple. Hence, the time needed to respond to the survey should not exceed 10 to 15 minutes. The questions should be user-friendly, clear, and intuitive. They also need to be accompanied by clear information about the objectives of the survey and how the results will be used. Crowdsourcing could use the existing survey platforms, many of which are free of charge.

Coordination within the public sector is crucial to increase the response rate. There are already a number of ongoing public-sector initiatives that survey the private sector. It would be useful to coordinate these initiatives and avoid duplication, especially among the key institutions—PARP, NCBR, and BSIs—to not overburden the private sector and to collect the most important data for all the participating institutions. One large survey with a significant response rate would be more productive than a set of specific surveys with limited firm participation. Finally, the source data from all the surveys should be easily accessible online and be provided in an appropriate format for downloading, in line with the "open data" initiative.

Incentives for firms to participate in crowdsourcing are important. So far, the public sector has rarely used surveys to reach out to a wide group of companies; the companies have also rarely been exposed to the public sector's surveys, if at all. As a result, both a low level of trust and a low level of dialogue have been established. To change this and establish an efficient tool to crowdsource private-sector opinions and information into innovation policy making, it will be important for the public sector to start using online surveys on a regular basis and thus create a new cultural norm. To make this work, it will be important to provide incentives for the firms to participate in the surveys. These could include, for instance, information on how the participating company compares with

peers in the region or access to technology/business newsletters from the BSIs. Many firms did not fill out the survey because they did not believe it would have any impact. Showing them the impact will therefore be critical. Making crowdsourcing successful will likely be a slow process, but it needs to start now. Table 15 summarizes the section's main recommendations.

Table 15. Main recommendations

Short-term	Medium-term
• Introduce systematic crowdsourcing of enterprises based on simple, clear, and user-friendly survey • Provide incentives to the participating companies, including robust feedback on the impact • Continue experimenting with various formats	• Nurture a culture of a public–private dialogue • Expand public administration's online presence, including in social media • Collaborate with the private sector, including consulting firms, to reach out to SMEs

Source: The World Bank.

4.4 Innovation maps

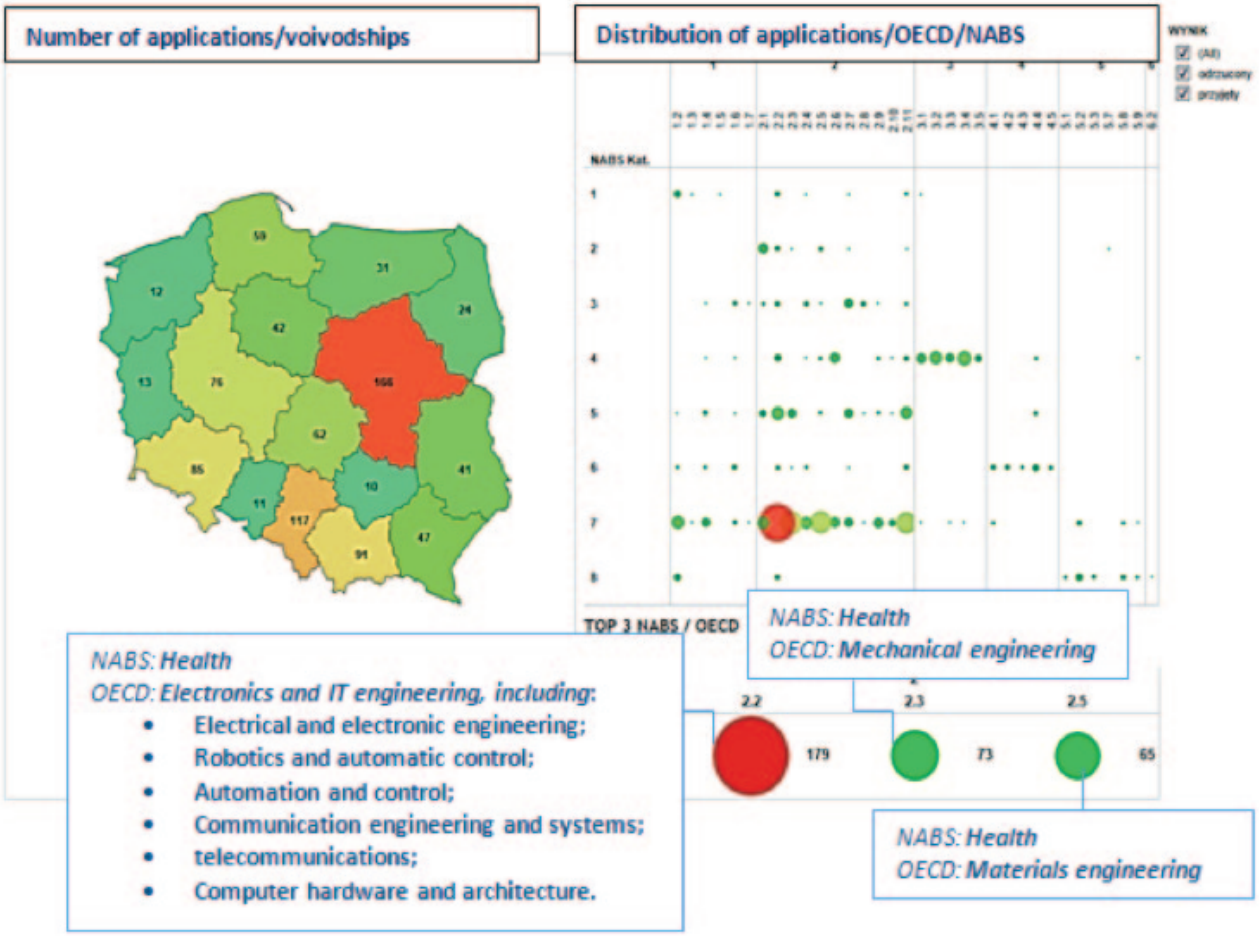
With the support of the Bank, NCBR has produced the first set of innovation maps. These were based on data from almost 1,000 applications received within the new open-ended, "fast track" innovation support program started in April 2015. Each of the submitted applications contained detailed information about a given project, including a business area (OECD) and technology (NABS code). On that basis, emerging areas of business and technological strengths can be determined in a consistent way. The OECD and NABS classification hierarchy is broken up into levels on which every application can be classified.

Innovation maps have the following benefits:

- They can complement the top-down foresight programs, macro and sectoral data, or innovation surveys with a bottom-up approach based on the private sector's real demand for innovation and thus help verify/modify/eliminate smart specializations selected at the national and regional levels.
- They can help monitor business and technology trends in real time, based on an online, standardized, and automated system of submission of grant applications.
- They can provide detailed information on the applying firms' characteristics, which can be further analyzed in connection with other sources of firm-level data, including from the national statistics.

Innovation maps helped identify key priorities for business innovation spending. The analysis of all the grant applications for "fast track" revealed that "health and medicine" is the dominant technology among the applying firms, and "electronics and IT engineering" is the key business area of declared R&D and innovation investment (Figure 72). In addition, electrical and electronic engineering, robotics and automatic control, automation and control systems, communication engineering and systems, telecommunications, and computer hardware and architecture were also important. These business and technology areas make up one-fifth of all applications.

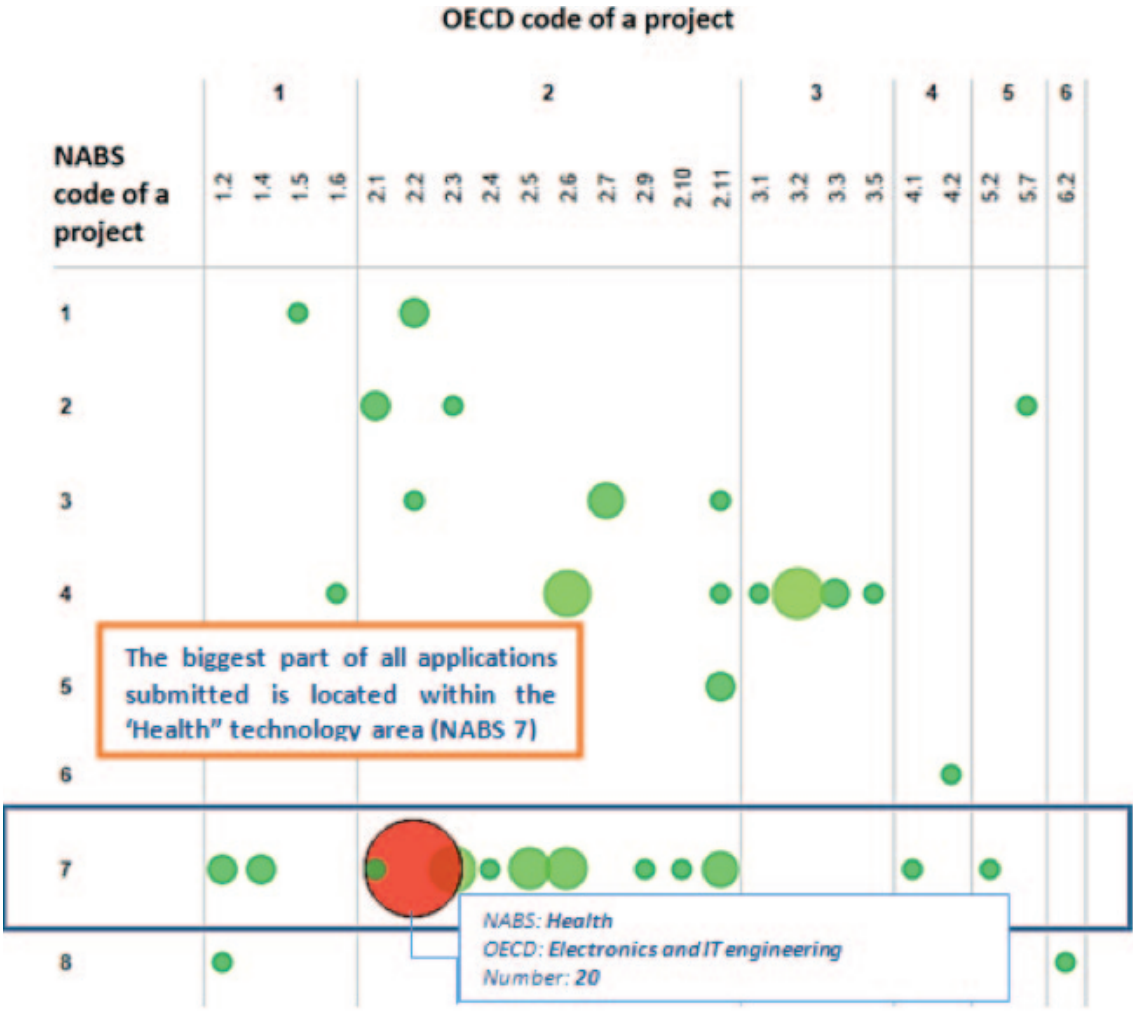
Figure 72. Distribution of applications based on the NABS and OECD classifications within the "fast track" program



Source: The World Bank, based on NCBR data.

Innovation maps can also help identify regional strengths. So far, most applications have been submitted by firms in Mazowieckie (166) and Slaskie (117). Opolskie, Zachodniopomorskie, and Lubuskie had the lowest number of applications. This suggests some scope for adjusting regional innovation policies, including by expanding efforts to help companies in the lagging regions submit applications. Innovation maps also allow for zooming in on each of the regions. In Dolnoslaskie, for instance, firms see the largest technology potential in the "health" sector (20), which accounts for one-fifth of the 85 total applications. Information from the innovation map could be juxtaposed against the results of the ongoing process of selecting smart specializations in Dolnoslaskie (Figure 73).

Figure 73. Innovation map for Dolnoslaskie based on "fast track" applications

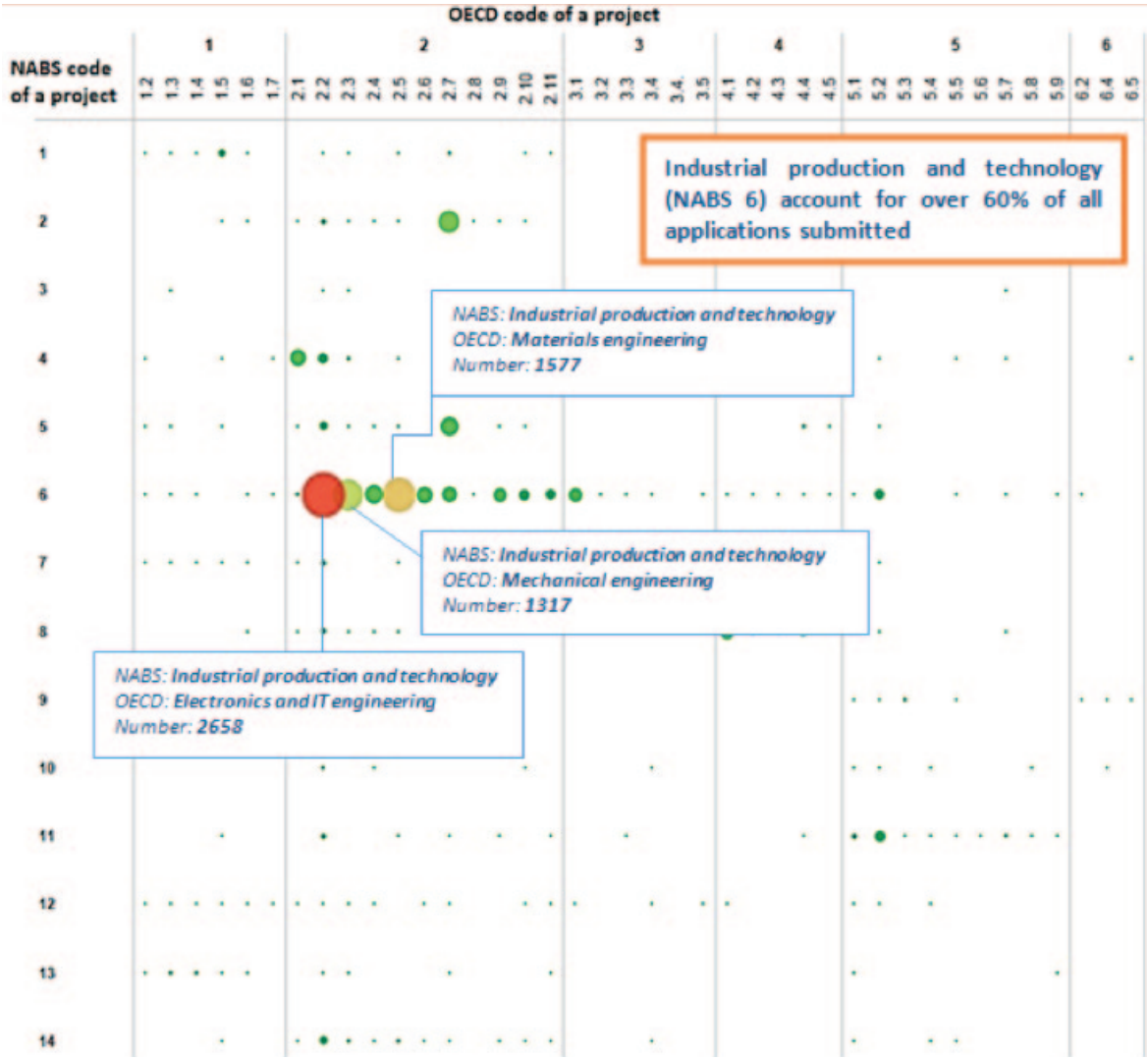


Source: The World Bank, based on NCBR data.

NOTE: The size of each bubble corresponds to the number of submitted applications.

Innovation maps can also use data from past support programs. During 2007–2013, as part of the Smart Economy Operational Program, NCBR collected almost 13,000 grant applications across all of its support programs. The innovation map based on data from these grant applications suggests that applicants declare "industrial technology" as the dominant technology of investment: these were included in 7,855 applications (Figure 74). In terms of the business area, most applications were submitted within "electronics and IT engineering," "mechanical engineering," and "material engineering." These findings could be compared with the results of the national technological foresights, benchmarked against the national smart specializations, and analyzed within national working groups.

Figure 74. Innovation map based on the applications submitted to NCBR during 2007–2013.



Source: The World Bank, based on NCBR data.

NOTE: The size of each bubble corresponds to the number of submitted applications.

Innovation maps could be replicated by other innovation support institutions. Based on the successful example of NCBR, it would be useful for all other public support institutions to generate similar innovation maps. This would require that they adjust the existing grant application systems to collect data from enterprises based on the proposed NABS and OECD classifications. A standardized approach to data would help create a national innovation map based on information from all relevant public support instruments, specifically including flagship matching-grants programs. In the spirit of an "open government" initiative, all data should be posted online for wide public distribution. Table 16 summarizes the section's main recommendations.

Table 16. Main recommendations

Short-term	Medium-term
• Produce innovation maps as a default option for relevant public support programs at the national and regional level (RPO/RIS units in each of the regions) • Continue to collect the data from the "fast track" program and publish the resulting innovation maps online • Make innovation maps more granular by collecting more detailed information on OECD and NABS classifications	• Introduce a new standard requiring that all firm applications for public support should to be submitted online • Develop a synchronized database for all grant applications from all support institutions, including PARP and NCBR

Source: The World Bank.

4.5 Champions Club

During the project, the Bank experimented with a new platform for networking and capacity building among firms. The resulting "Champions Club" (ChC) is an unofficial workshop-style meeting lasting up to four hours that gathers "champion" companies selected through firm interviews. The main objective of the ChC is to facilitate networking, enhance social capital, and provide additional training.

Champions Clubs should be a community-driven activity. Regional consultants could help initiate, coordinate, and moderate ChC meetings. The cost could be initially borne by the public sector. However, any subsequent meetings need to be financed by the private-sector participants to ensure buy-in and align incentives.

Quality is key for the sustainability of Champions Clubs. This implies hiring experienced speakers and consultants to deliver content for which companies would like to pay. Experience from Dolnoslaskie, where the Bank organized an experimental Champions Club followed by a second meeting organized by the local business association, showed that firms need networking opportunities and were interested in participating in such activities.

Firms expect quick wins and direct benefits from the meetings. Long-term benefits and networking seem less appealing to entrepreneurs. That is why high-quality trainings or a knowledge component of the ChC, which provide tangible added value, are crucial. Without these, the networking objective can be difficult to achieve because firms may not be willing to participate. Table 17 summarizes the main recommendations.

Table 17. Main recommendations

Short-term	Medium-term
• Initiate ChCs with public support to ignite interest • Monitor the impact of ChCs to promote success stories • Experiment with various incentives and formats of Champions Clubs	• Develop additional instruments of public support for firm networking

Source: The World Bank

4.6 Business support institutions: diagnosis and recommendations for reform

Business support institutions (BSIs) can play a key role in the EDP process. BSIs support enterprise development, offer services to the private sector on innovation and technology transfer, and provide training programs to private-sector firms (Box 37). Given their proximity to enterprises, experience in working with the private sector, and accumulated skills, BSIs are well positioned to be the key elements of EDPs on the national and regional levels. Several BSIs have been present on the market for many years, which has helped them become familiar with the public support system and reach out to entrepreneurs. They have also trained a number of committed and capable professionals who are respected for their skills in the local markets.

However, BSIs struggle to meet the needs of enterprises. Interviews, Smart Labs, and workshops organized for BSI management in all four regions identified significant gaps between company needs and the type and quality of services provided by BSIs. This section diagnoses challenges facing BSIs and offers recommendations for improvement in their functioning in the context of the EDP and the overall efficiency of the public innovation support system.[45]

BSIs can benefit from conducting the EDP in several ways. Participation in the EDP can help BSIs build staff competences, better position themselves in the regional innovation ecosystem, and access another source of financing. In addition, it should help them broaden their portfolio of potential customers, acquire specific knowledge about firms' needs, and adjust their services accordingly.

BOX 37

A SNAPSHOT OF BUSINESS SUPPORT INSTITUTIONS

BSIs include:

- National-level institutions, such as PARP, NCBR, and NCN
- Local government entities and their auxiliaries, such as employment offices, social support entities, FDI services, and managing authorities for structural funds focused on SME support
- Agencies for regional and local development
- Business organizations, such as the Business Centre Club (BCC) and trade unions
- Chambers of industry, commerce, producers' cooperatives, and so forth.
- Training, consulting, and advisory services and nonpublic labor market institutions
- Entities supporting entrepreneurship, such as incubators, accelerators, industrial parks, technology parks, academic business incubators, and so forth
- Networks supporting entrepreneurship and innovation, such as technology platforms, clusters, National Services System (EEN, and technology transfer offices (TTOs)
- Financial institutions, such as local loan funds, guarantee funds, and investment funds
- Research and development institutes (RDIs)—including public and private universities, the Polish Academy of Sciences, excellence centers, and auxiliary entities supporting science

In 2014, there were almost 780 BSIs in Poland, including over 180 RDIs. Additionally, some 450 universities and institutions of higher education were functioning. In 2014, they employed 120,000 people, out of which 80,000 were employed by universities and higher education institutions. The geographical distribution of BSIs varied significantly. Individual regions hosted the following number of BSIs: Mazowieckie, 84; Slaskie, 81; Wielkopolskie, 69; Malopolskie, 59; Dolnoslaskie, 54; Podkarpackie, 43; Pomorskie, 40; Zachodniopomorskie, 40; Lodzkie, 39; Warminsko-Mazurskie, 33; Kujawsko-Pomorskie, 32; Lubelskie, 31; Swietokrzyskie, 23; Podlaskie, 22; Lubuskie, 20; Opolskie, 11.

Commercial code entities represent almost half of all BSIs. The key feature of these entities is that the financial surplus they generate is devoted to realization of statutory goals. Limited liability is predominant in guarantee funds, seed funds, technology parks, and incubators. Often shareholders of those institutions are public (regional) authorities and universities (for example, regional authorities hold stakes in 80 percent of companies that run technology parks).

[45] Unless noted otherwise, analysis of BSIs also applies to RDIs.

BOX 37

Revenue structure varies among different types of BSIs (Table 18). The two most popular funding sources are EU grants and projects and owner subsidies. Services usually constitute a small part of revenues. For business incubators and technology incubators, revenue from office space rental is the biggest part of the budget.

Table 18. Structure of BSI budgets in 2014

	Technology parks	Incubators	Academic business incubators	Tech. transfer office	Innovation centers	Business incubators	Centers for training and advisory	Loan funds	Guarantee funds
Office space	33%	43%	18%			72%			
Grants/ projects	36%	21%	20%	46%	66%		51%		
Owner subsidies	15%	17%	38%	45%		7%	13%	32%	35%
Services	4%	2%			16%	8%	31%		
Public funds								12%	
Structural funds								18%	39%
Other								30%	

Source: The World Bank, based on SOOIPP (2015).

Diagnosis

BSIs face many challenges.[46] Table 19 presents the assessment of the main constraints to BSI development. The findings are in line with other studies that diagnosed similar deficiencies.[47] One of the main challenges is that most entrepreneurs were not well informed about how they could be supported by BSIs and have never collaborated with BSIs. Firms that worked with BSIs had mixed opinions about the quality of services provided and tended to be skeptical about the level of BSIs' skills and competencies.

Table 19. Diagnosis of systemic and operational constraints on BSIs

Systemic	Operational
• Limited market responsiveness and weak understanding of business needs • Lack of clear goals and targets; weak system of incentives • Limited skills and capacity to conduct market intelligence • Unstable access to financing • Weak coordination and collaboration among BSIs • Duplication of generic services, but gaps in the provision of high-quality, specialized support • Limited trust among innovation stakeholders • Lack of standardized procedures for handling IPR • Weak international outreach	• Management's lack of specific knowledge about innovation management and commercialization • Risk aversion • Weak M&E systems, often inhibited by conflicts of interest • Weak accountability • Temptation to favor short-term financial returns over long-term sustainability and capacity building • High staff turnover and frequent loss of institutional memory when key personnel quit • Limited staff quality and experience in working with business • Low esteem for BSIs among entrepreneurs

Source: The World Bank.

[46] This section is based on the literature review and the results of four dedicated workshops for BSIs organized by the World Bank together with the Polish Business and Innovation Centers Association (SOOIPP). The main objective of these workshops was to discuss how to ensure BSIs' participation in the EDP process and to find solutions to improve the overall performance of BSIs and their focus on firms' needs identified during the EDP.

[47] See, for instance, Bakowski and Mazewska (2015).

BSIs rarely cooperate with one another. Lack of cooperation often results in duplication of efforts in some areas, such as in generic market services, and gaps in other areas, such as sophisticated, high-value services. The fragmentation of BSIs, despite their often limited capacities, seems to fuel competition in the lower end of innovation services. At the same time, this does not incentivize BSIs to work together in providing more sophisticated services, which would require BSIs to specialize in a particular range of services. Although competition among BSIs for public support and private sector "clients" is welcome, it would also be useful for BSIs, given their often limited capacity, to join forces whenever needed to provide a more comprehensive and more attractive package of services.

BSIs have not always been able to make use of newly built infrastructure. In recent years, extensive EU-funded infrastructure to support innovation has been built in Poland. However, owing to unclear goals, weak incentives, and poor monitoring and evaluation systems, the new infrastructure is not used inefficiently. Often, brand new R&D equipment cannot be used commercially because EU state aid rules do not allow it. However, there are RDIs in Poland that made different funding choices and can capitalize on investments in such equipment. Their examples should be followed.

BSIs need to be part of a comprehensive regional innovation ecosystem. The EDP will maximize its effectiveness only when a comprehensive innovation ecosystem is in place, in which BSIs and RDIs collaborate with and support one another and public authorities and other stakeholders are also included. The communication among the stakeholders seems, however, insufficient, because it is mostly conducted in a formal manner at official fora and is often missing at the operational level. The lack of stable, adequate financing for BSIs is an important constraint. Often, financing sources are dispersed between national- and regional-level institutions that are trying to achieve different goals. This can make it difficult for BSIs to achieve synergies and fulfill their missions. Also, significant changes in the innovation policy and in funding schemes available to BSIs from one financial framework (2007–2013) to another (2014–2020), especially the decreased subsidies for operational work, made it more difficult for BSIs to adjust properly. The proposed change in funding mechanisms aims to channel resources to the best BSIs because money will follow "customers" (firms). That said, the transition period can be difficult for many BSIs.

Lack of clear goals and targets undermines the BSI's mission. Although BSIs and RDIs usually possess a general vision and mission, these often do not translate into clear goals and targets that these institutions are expected to achieve. Lack of a strong strategic direction that steers the BSIs and RDIs makes them more vulnerable to influence from funding sources and causes instability in how they function and provide services to companies. Unclear goals discourage performance management and weaken accountability.

Monitoring and evaluation (M&E) systems concentrate on inputs rather than the impacts. Current M&E systems across BSIs are diverse and tend to focus on inputs, which does not allow their performance to be measured. In addition, the diverse array of M&E systems and the lack of a common methodology for assessing results make it hard to compare institutions, even of the same type, such as incubators. This, in turn, makes it difficult for potential "customers" of BSIs to compare between them and choose the best ones to collaborate with. Public authorities also lack information as to which institutions are the most effective and efficient, and which need support to improve their performance.

The problem seems to be with the quality of the services BSIs offer, not their availability. Data from the interviews indicate that companies sometimes do not know what they do not know—that is, they do not know what kind of support they need or could use if available. However, in cases where they used support from the BSIs or RDIs, the companies thought that the support offered was too generic and not tuned to their individual needs.

BSIs' responsiveness to business needs has significant scope for improvement. Companies participating in Smart Labs signaled that they were not actively approached by support institutions. This seems to be a major obstacle to developing relationships between companies and BSIs. Companies often do not know BSIs exist, or they don't know how to approach them or use their services. Apart from the awareness-building activities, there are other ways to initiate collaboration between business and BSIs/RDIs, which could be modeled on successful examples of business–science collaboration in the United Kingdom and Belgium (Box 38).

INTERNATIONAL GOOD PRACTICE FOR BUSINESS–SCIENCE COLLABORATION

BOX 38

University of Brighton—Knowledge Transfer Partnerships (KTPs)

Knowledge Transfer Partnerships (KTPs) are considered the gold standard for university/industry collaboration in the United Kingdom. The KTPs, a UK-wide program helping businesses to improve their competitiveness and productivity through the better use of knowledge, technology, and skills, utilize a three-way partnership model with a graduate appointed to transfer knowledge from the university to meet a core strategic need within a company, and knowledge transferred from the company to the university enhancing teaching and the relevance of research. The government provides grants of up to 67 percent for innovative projects that can demonstrate the need for knowledge transfer and that can propose a sound business case.

Target groups and stakeholders

Target groups and stakeholders are primarily SMEs, although large companies, third-sector companies, and some public organizations are also eligible; academics and students with the potential to be "business leaders of tomorrow" are also included.

Quantitative data

There are currently almost 1,000 KTPs in the United Kingdom. Around 100 institutions are active. Projects last between 6 and 36 months, with two years being the average duration. The budget for a typical two-year program is around £120,000, so the current value of the whole national program is in the region of £7.2 million. A single KTP program results in an average increase of over £240,000 in annual profits before tax for the company partner and the creation of three new jobs.

Source: WBCInno (2013).

Belgium's "Baekeland mandates" program

Objective. The purpose of the Baekeland mandates is to support research directed toward achieving a doctorate (PhD) diploma to build up scientific or technological knowledge as a basis for economic applications.

Who? The Baekeland mandates are projects that are assigned to a "consortium" involving a Flemish company and a Flemish university. Other types of knowledge centers (or research institutes, strategic research centers, higher education institutions/university colleges, etc.) can also act as host organizations insofar as they cooperate with an academic promoter affiliated with a Flemish university.

How? At least five partners are involved in a Baekeland mandate: IWT (the innovation agency) which grants the mandate; a company with activities in Flanders that acts as the main applicant and is responsible for co-financing (the company appoints an industrial mentor); the mandate holder; the knowledge center with which the mandate holder is affiliated (a university, research center, higher education institution/university college); and the academic promoter, responsible for the doctoral supervision and who is affiliated with a Flemish university.

Funding. The mandate holder can be an employee of the company or an employee of a university or research center. The program is open to all candidates who are admitted into a PhD program by a Flemish university. The funding program is open to all nationalities and to all academic disciplines. The duration of a Baekeland mandate is four years. A Baekeland mandate provides funding for payroll, operating costs, equipment costs, and fixed costs in relation to one specific employee (the mandate holder). The sum of the nonpayroll costs is maximum €40,000 per year in full-time staffing (or €160,000 for the whole project period). The funding granted by IWT depends on the size of the company. The project can get 10 percent extra support if there is a well-balanced collaboration between several independent companies and at least one partner is an SME. IWT pays the subsidy to the company responsible for the full reimbursement of its partners.

Source: http://www.iwt.be/english/funding/subsidy/BM

Recommendations

System-level and institution-level action is needed to improve BSIs. The innovation support process is like a chain that is only as strong as its weakest link. The success of R&D, commercialization, and innovation depends on many stakeholders: (i) innovators (entrepreneurs who translate research into new products and services), (ii) RDIs that invent new solutions (researchers and institutions), (iii) BSIs that support the innovation process, (iv) dedicated funding sources that are willing to finance risky endeavors, and (v) policy makers who create a favorable legal framework.

BSIs need to improve their organizational management. Various managerial approaches are applied across the world that facilitate BSI operations; one of them is the EFQM presented in Box 39. Polish support institutions could learn from these models about how to better organize their institutions, streamline procedures, structure their work, better understand their strong and weak sides, and encourage cooperation.

BOX 39

EFQM EXCELLENCE MODEL AN ORGANIZATIONAL MANAGEMENT TOOL

The EFQM Framework for Innovation Agencies (Figure 75) has been developed to provide governmental and regional agencies supporting innovation within businesses and academia with a holistic and universal approach toward excellence in managing their strategies. It focuses on nine aspects of the how BSIs function: leadership; strategy; people; partnership and resources; processes, products, and services; customer results; people results; society results; and business results. The EFQM excellence model helps people understand the cause-and-effect relationships between what their organization does, the enabling factors, and the results it achieves.

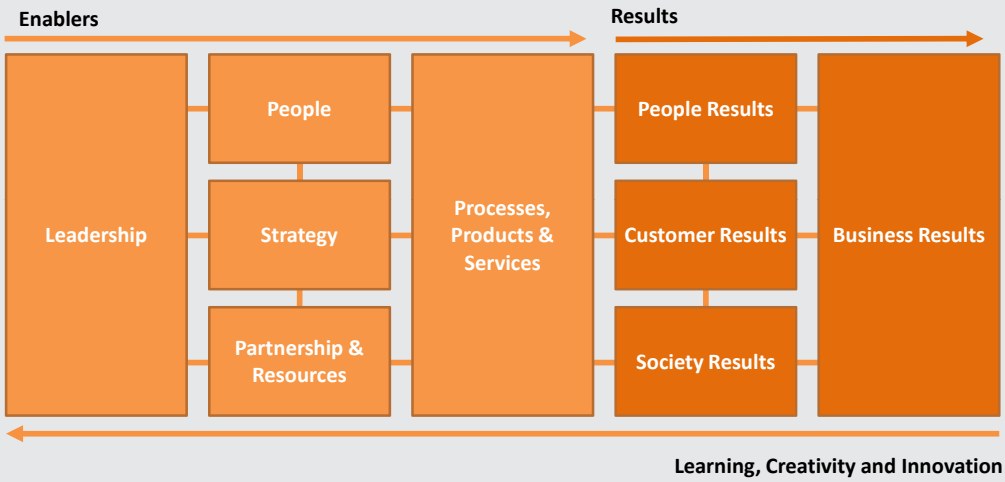
Advantages:

- Comprehensive, pragmatic management tool used by over 30,000 organizations in Europe
- Provides a framework that encourages cooperation, collaboration, and innovation
- Enables an organization to gain a holistic overview of its current level of excellence and prioritize its improvement efforts to maximize its impact
- Can be used for individual agencies, or a group of agencies, forming a learning platform or user group
- Recommended by the leading innovation agencies in Europe,[1] which recognized the EFQM to be an effective method to introduce operational learning and to constantly improve operations

Objectives:

- Promote the use of the model in order to improve agency operations
- Identify and assess good operational practices at organizations providing innovation support services

Figure 75. EFQM excellence model framework



Source: http://www.efqm.org/the-efqm-excellence-model; European Commission (2012e).

Robust monitoring and evaluation requires tools and indicators. Emphasis on M&E has to be balanced between inputs and results. Having only one type of indicator does not allow a full assessment of the performance and does not help in managing the institution. Box 40 offers examples of possible metrics that could apply to BSIs and RDIs, based on the example of monitoring the performance of a technology transfer office. The participatory character of indicator design and target setting is crucial to ensure inclusion in, commitment to, and understanding of the system.

BOX 40

POSSIBLE METRICS FOR A TECHNOLOGY TRANSFER OFFICE (TTO)

Metrics used for R&D collaboration, contract research, and scientific and technological services include:

- Number of, and income generated by, collaborative research projects, contract research projects, and scientific/technological service projects, broken down by funding partners: national and EU subsidies; local, national, and international businesses (if possible, broken down by line of business and location)

Metrics for commercialization of R&D results by patenting and licensing include:

- Number of invention disclosures for university employees
- Number of patents filed for application (the number of new patent applications filed in a given period depends both on the quantity and quality of inventions disclosures and on patent budget available to the university or knowledge technology transfer, or KTT, office)
- Number of patents granted, at both the national and international levels
- Number of license deals, number of patents transferred
- Revenues from licensing/intellectual property royalty income (may include licenses and lump-sum payments, but also full-cost overhead, including IPR transfer share)

Metrics for entrepreneurship:

These are mostly applicable to incubator units (unless specified differently), which are usually not integrated into the KTT offices.

- Number of start-ups accepted
- Number and amount of pre-seed loans granted to start-ups
- Amount of seed and venture capital attracted by start-ups
- Growth of start-ups (FTE, turnover, profits)
- Number of spin-off companies related to IP
- Amount of income and return on investment (ROI) when exit from spin-off companies
- For the university: number of students and researchers participating in entrepreneurship education
- For the university: R&D projects' income from their start-ups

KTT office performance indicators:

- Number of consultancy meetings with researchers and/or businesses (pre-project phase, funding opportunities)
- Number of invention disclosures handled
- Number of and expected income from (publicly funded) projects assisted in the application phase
- Self-financing

Source: WBCInno (2013).

The M&E system should allow comparison of various BSIs. There is a need for a standardized approach to assess the quality of services provided by these institutions that could constitute the basis for ranking BSIs. This could be similar to the World Bank's Doing Business study. The assessment could focus on particular services but also on the overall performance of an institution. Such a comparison could assist both entrepreneurs and decision makers in their selection of potential collaboration partners.

Performance-based agreements could help improve the results of BSIs' work. Performance measurement is an integral part of modern public policy. It stands behind the creation of targets, contracts, and agreements that control service delivery and promote accountability for public resources. Performance agreements/contracts have been

applied in a number of countries, including Finland, the United Kingdom, and Canada, to enhance the effectiveness of public policies. Such an approach could be incorporated between specific BSIs and RDIs and their public stakeholders. There are also a number of reform options specific for RDIs, including introducing new management performance systems, increasing the role of the private sector in their operation, and shifting to results-based funding.[48] Box 41 presents details on performance agreement applied in developed economies.

BOX 41

PERFORMANCE CONTRACTS
AN EFFECTIVE TOOL FOR ENHANCING THE QUALITY AND RESULTS OF PUBLIC POLICIES

Performance contracts (PCs) are a management tool used to promote savings, effectiveness, and responsiveness.

Objectives: PCs are used to define responsibilities and expectations between parties to achieve mutually agreed results. They are often used to enhance performance and accountability in public-sector agencies, including technology development institutes, research centers, and universities. These key objectives are expressed in performance expectations linked to budget (inputs), service (outputs), impacts (outcomes), and management (corporate capacity). The focus of different objectives affects the type and design of applied agreements. Specifically, they (a) give a strategic focus to the capabilities created, consistent with the institution's mission; (b) prevent confusion resulting from multiple objectives; and (c) generate the financing necessary to carry out basic functions.

Parties: PCs are a signed between a principal (a superior entity in the government hierarchy responsible for public policy) and an agent (a subordinate entity in the same hierarchy, responsible for implementation of public policies).

Types of PCs: framework agreements, budget contracts and resource agreements, organizational performance agreements, chief executive performance agreements, purchaser provider agreements, intergovernmental performance contracts and partnership agreements, customer service agreements

Global application: PCs are increasingly being used in the national and subnational governments of OECD countries. PCs have been used and integrated into the public management and accountability systems in Denmark, Finland, New Zealand, Norway, and the United Kingdom. PCs are also used in Australia, Belgium, Canada, France, Spain, and the United States.

Legal status: Typically, PCs are implemented by administrative or managerial discretion rather than on a statutory or legal basis. They are negotiated between agencies or individuals within the bureaucracy.

Costs: Costs related to PCs may include transaction and compliance costs, such as negotiating and monitoring contracts, assessing and managing risk, and contract enforcement.

Evaluation: PC evaluation includes (a) ongoing dialogue between the parties about performance relative to the targets; (b) annual reporting of results, as part of major evaluations of programs or services; (c) periodic reviews by the principal; and (d) external verification.

Lessons for productive PCs:

- The PC document should be freely negotiated. Otherwise, it will be accepted overtly but resisted covertly.
- There must be a third party to ensure that PCs have been negotiated freely and that they are "fair" to both parties (as well as the nation).
- The evaluation of the PC should be done by a third party to ensure fairness—clearly one party to the contract cannot be the judge of the contract.
- The PC document must clearly specify success indicators and their relative priority. The meaning of success should be clear from the beginning. Otherwise, there will be unnecessary controversy later.
- Adherence to PC commitments should matter. There should be consequences for "good" and "bad" performance. Otherwise, PCs will simply remain paper tigers. There must be an explicit incentive system to motivate people to take PCs seriously.
- The method and modality for collecting and reporting information should be agreed upon before the PC is signed. Ideally, it should be part of the PC.

Source: OECD (2010b).

[48] Racine, Goldberg, Goddard, Kuriakose, and Kapil (2009).

Collectively negotiated growth agreements could support coordination of the innovation system. Sweden is an example of an area where growth agreements have been implemented and contributed to enhanced collaboration among various stakeholders (Box 42). Growth agreements emphasize clear goals and a division of roles that are worked out in a dialogue between a wide range of stakeholders.

BOX 42

REGIONAL GROWTH AGREEMENT

Strengthening the regional authority's role and capacity for coordination of regional business support organizations: Västra Götaland (Sweden)

Background

The Regional Growth Agreement (RGA) aimed to provide a strategy and lead in the coordination of the region's economic development strategy and institutions. The RGA was a three-year development contract that provided a strategic analysis of regional development, set the goals, and established regional priorities through stakeholder dialogue and consensus. The RGA was driven by several principles: inclusive and broad partnership, a systematic and process-based approach, specific regional growth potentials, and sustainable development. The RGA was delivered by Region Västra Götaland, which has evolved from the County Council and taken over responsibility for regional development from the state bodies at the regional level.

Evaluations

The national evaluations concluded that the RGAs have been moderately successful nationally. Specifically, RGAs have raised awareness of growth issues at the regional level, the importance of the regional context to firm competitiveness, and the importance of mobilizing nongovernmental regional and local actors, especially with municipalities becoming more active and cooperating to enhance regional and local competitiveness both domestically and internationally; they have also enhanced opportunities for knowledge sharing and learning and improved the awareness and coordination of regional development resources.

Assessments of Västra Götaland's RGA conclude that it has been an important tool for coordination and cooperation between regional and local actors and contributed, along with favorable global economic factors, to the region's recent economic change, supporting its transition toward a more knowledge-intensive economy.

Evaluations highlighted the need for improved and increased vertical and horizontal cooperation, as well as coordination between actors involved in regional development at the center and in the region. This was addressed in subsequent programs.

Considerations for application in Poland:

- The RGA provides a governance framework for horizontal coordination at the regional level, with the regional authority at its core. Polish regional governments could learn from Region Västra Götaland how to lead and coordinate a number of regional actors from a range of sectors in a coherent and systematic way.
- Making partnership the central principle of the RGA provides a means of engaging relevant stakeholders in the process of strategy development, delivery, and evaluation.
- The Swedish system provides a clear division of labor between various levels of government. A balance has been struck between the need for central authorities to steer the process and deliver on national policy objectives and regional authorities' need for autonomy and flexibility.

Source: OECD (2010b).

There are a number of options for enhancing RDI and BSI capacities. These include efforts to establish strategic partnerships/twinning with high-quality peers in Poland and abroad, certification systems, staff training, and robust performance feedback mechanisms. See Tables 20 and 21 for specific recommendations.

Table 20. Recommendations for BSIs

Short-term recommendations	Medium-term recommendations
• Map out entrepreneurs' needs and BSIs' services to find gaps in the innovation support system ("no man's land") • Increase funding for BSIs' staff training • Introduce grants to support networking and cross-support between BSIs based on their specialization • Encourage BSIs to experiment with new ideas and tools supporting innovation through competitions ("the best new service award") • Create a system similar to a customer relationship management system for customers of the public support system that keeps track of services provided to an individual company • Launch an online one-stop shop for all innovation and business support services available in the region/country, with public feedback	• Merge BSIs to save costs, enhance service quality and stability, and gain economies of scale • Provide bonus funding for the best BSI performers • Introduce a system of certification for BSIs to ensure minimum quality standards and performance contracts to enhance efficiency • Increase BSIs' international exposure by encouraging staff exchanges, institutional partnerships, and applications for internationally funded programs, as well as hiring international managers and experts and organizing open tender calls in English

Source: The World Bank.

Table 21. RDI-specific recommendations

Short-term recommendations	Long-term recommendations
• Require researchers to participate in inter-institutional and international projects • Promote writing PhD theses in English to broaden their impact and scrutiny • Encourage a larger number of PhD theses to be written for enterprises • Promote the creation of spin-offs and start-ups • Appoint professors with industrial experience and an international track record	• Design a coordinated system of management of RDIs to better align their work and introduce clear goals • Offer scholarships and grants for researchers that pursue applied research • Modify a performance assessment system for researchers and university employees to increase the weight of collaboration with business • Set standardized procedures for valuing RDIs' IPR.

Source: The World Bank.

4.7 Lessons learned and challenges ahead

The proposed EDP has evolved during the course of this pilot. This section presents the main modifications that have been introduced since the commencement of the project. The modifications have been implemented to better suit the Polish context, reflect feedback received from stakeholders, and streamline the proposed model to increase efficiency and avoid duplications. The lessons learned will be important to ensure optimal effectiveness and sustainability of the EDP. They can also serve as a useful reference point for other EDP models in Poland and in the EU.

Firm interviews needed to be streamlined and fine-tuned. Based on the feedback from the interviewed firms and project stakeholders, as well as an analysis of the statistical significance of questions posed, the interview questionnaire was shortened from almost 180 questions to 100 questions. As a result, the length of the interview was reduced from around four hours to around two hours, increasing its appeal to the interviewed firms. The questionnaire was

also modified to better match the reality of Polish SMEs and better reflect an innovation model suitable to the Polish environment. Questionnaire modifications had to be carefully introduced to allow retrospective analysis of newly introduced aspects; sometimes the already-interviewed companies had to be called back to obtain data that were not in the initial form.

Interviews increasingly focused on qualitative, contextual questions. Standard paper-based innovation surveys conducted by GUS and international institutions rarely allow for open-ended qualitative information about companies' innovation drivers. To fill this gap, the questionnaire has been modified to include 20 qualitative, open-ended, and "why" questions to better understand the behavioral drivers of innovation. In addition, each interview has been summarized by the interviewing expert in a "one-pager": a standardized summary note of the meeting with critical contextual and qualitative information about the interviewed company. The "one-pager" includes a description of the technology and business trends perceived by the company ("the next big thing"), business and innovation needs, and potential instruments of public- and private-sector support. The responses to qualitative questions and the content of "one-pagers" were codified to allow for drawing policy-oriented conclusions (for methodology, please refer to the interview manual in Annex 1).

Scheduling interviews with companies proved to be a challenge. Identification of firms that would meet the project's criteria and setting up interviews turned out to be a resource-intensive process. The calendar of meetings changed at a rapid pace and required a lot of flexibility on the side of the Bank's experts and regional consultants. It was also difficult to gather sufficient prior information about each company to ensure that the interview would meet the project's objective. The Bank used multiple sources of information to schedule interviews, including databases from BSIs, Marshal Offices, and a proprietary firm dataset. These sources were helpful, although they had a limited number of firms that matched the project criteria and the 10 specializations selected for the project. For that reason, referrals from the interviewed companies for follow-up meetings with firms in the same value chain (customers, competitors, and suppliers) proved productive and are likely to be one of the main sources of information about potential candidates for interviews.

The quality of the experts' feedback was important. Almost 75 percent of interviewees were satisfied with the interview, based on the postinterview telephone quality check. This is a high success rate, given that questionnaire-based interviews are rarely considered productive by interviewed firms. To sustain high interest in the interviews and receive a large number of interview referrals to other firms, the script increasingly focused on providing the firms with postinterview business and innovation feedback from Bank experts (which were highly ranked in 90 percent of interviews). Uniquely among firm surveys, which are designed to receive rather than to give information, the interviews proved to be a promising method of directly influencing the interviewees' innovation and business strategies. This focus of the interviews should be continued.

Supporting experts' judgment with a scoring mechanism helped select "champions." Experts' qualitative judgment was critical to giving the interviewed companies a specific designation ("champions," "sleeping beauties," and others). Quantitative data on their own are not sufficient to tease out the characteristics of companies, such as innovation mind-set, willingness to take risks, and open-minded attitude, which are key determinants of a company's innovation-based growth potential. To further improve the selection system, a logit regression analysis of the data set helped identify the key characteristics of "champions." Based on these characteristics, a scoring system has been developed to predict which companies could be considered "champions." This can help regional consultants classify companies and provide later support.

Regional consultants required coaching, incentives, and close coordination to participate actively in the project. Initially, it proved difficult to engage consultants working at BSIs to conduct interviews and support the EDP project. First, they often did not feel fully prepared to conduct interviews and engage in a dialogue with company CEOs. They voiced concerns about insufficient skills and knowledge to deliver high-quality feedback to the interviewed companies. Second, even though firm interviews provided BSIs with an opportunity to reach new potential "customers," learn new skills, and fulfill the core mission of their institutions, RCs needed additional financial incentives to conduct interviews. They were not convinced that there would be funding available for the EDP from the national and regional authorities. Third, many RCs in general seemed to be skeptical of the usefulness of RIS3 and the EDP. In response to

these concerns, the Bank organized a number of workshops for RCs to explain the objectives of the project, the project's requirements, the likely sources of financing, and benefits to the RCs and BSIs. In the end, the Bank selected a small group of five to seven RCs in each of the regions based on their commitment, skills, and willingness to join the project. The Bank also hired an RC coordinator in each of the regions to conduct interviews and to coordinate other RCs. As a result, 20 RCs conducted firm interviews on their own, for a total of almost 140 interviews in the four regions, above the project's expectations.

Going forward, interviews could be used in modified ways. Although the interviews provide a tested way to audit companies, based on international good practice and a rigorous and replicable methodology, national and regional authorities can adjust the interview process to their needs. For instance, the questionnaire could be shortened to focus only on the key barriers to innovation-based growth and require only about an hour-long interview, complemented by additional modules (on the quality of management practices, for instance) or focused on specific parts of the company's business. Moreover, the interview could emphasize more the strategic feedback from the experts aimed at increasing firms' capacity to conduct an innovation process on their own.

The quality of the interviewing experts and the postinterview analysis will be key. Interaction with the top management of a company and the need to provide feedback require that the interviewing experts are credible partners with substantial professional experience and a comprehensive understanding of the public innovation support system. It will also be critical to ensure that the information from the interviews is properly analyzed and used in policy making.

Smart Labs proved to be a key element of EDP. Smart Labs designed and tested during the project provided a fast, flexible, and efficient way to assess the R&D/innovation-based potential of a selected economic activity and thus help validate, deepen, or modify existing smart specializations. Participation in SLs was driven by a bottom-up process of selecting companies with high growth potential, minimizing the power of vested interests. Thanks to the careful selection of participants, the quality of the information gained from them tended to be high, ensuring that the process delivered quick results. "Champion" companies welcomed the invitation to join the SLs (there was almost a 100 percent success rate among the companies invited to the SLs) and took an active role in discussions.

Smart Labs also helped meet additional objectives. Aside from its main focus on smart specializations, the Smart Lab process on CNC machines also (i) helped create a new network of firms, scientists, BSIs, and public-sector officials, focused on the development of the CNC area; (ii) generated new knowledge among stakeholders and the business community through, for instance, the BTR, SWOT analysis, and discussion of industry-specific key success factors; (iii) helped guide public and private technology and business development strategies; and (iv) is likely to generate new R&D&I projects that will be submitted to regional, national, and international innovation programs.

Smart Labs can help set directions for business development. Value-chain analyses (VCAs) conducted during Smart Labs proved to be a promising tool to analyze the directions for development of a business area. VCAs can help identify the elements of the value chain with the highest added value and discuss the roadmap for moving up the value chain. This approach was successfully tested during the project during a series of Smart Labs on nanotechnology in Slaskie, which helped identify the main development challenges for this young sector and offer policy recommendations on how to develop it further.

Business and technology roadmaps provide added value. BTRs promise to become a new public good in Poland, providing much-needed knowledge on the technology and business trends in selected industries. The BTR elicited substantial interest among the participants of the national Smart Lab on CNC, for which the BTR was prepared. The participants emphasized the usefulness of the BTR in expanding their knowledge about the industry and wider technology and business trends. The national smart specialization working group No. 17 on "automation and robotics" decided to use the BTR as a key element of the development vision for this national smart specialization. Following the preparation of the first blueprint BTR on CNC, the participants of the Smart Lab on the "foundry industry" in Swietokrzyskie are now interested in preparing a follow-up BTR for their own sector. Going forward, it will be important to ensure that BTRs are published online to share knowledge among all market players, guide their investment decisions, help coordinate with other firms, and align their strategic development plans with smart specializations.

Going forward, SLs can complement working groups at the regional and national levels. The added value of SLs lies in their flexible format, fast turnaround, quick results, and limited life span. As such, they could be a useful instrument to quickly assess the innovation-based development potential of a large number of existing and/or emerging regional and national business areas and provide timely inputs into the existing EDPs at the regional and national levels. Unlike the working groups, SLs are not meant to become permanent institutions, unless the participants decide to transform them into cooperation networks (such as clusters) and knowledge-sharing platforms.

High quality of participants and experts and immediate feedback are key. SLs are likely to be successful only if they feature participants (entrepreneurs and scientists) that rise high above the industry average. They should be moderated by experienced professionals who carry credibility among the private-sector participants. Finally, all participants, and especially the private sector, expect timely and productive feedback after each of the SLs, in the form of meeting summaries, clear action plans, and a vision of how the SL can provide added value going forward.

The project corroborated the critical importance of national- and regional-level cooperation. The smart specialization agenda and the EDP concept are still new to Poland and relatively weakly mapped out, which encourages experimentation with different solutions. Regional and national authorities are still looking for optimal ways to improve the EDP and increase its impact. The regions emphasize a voluntary character of the collaboration mechanism that does not impose a single EDP mechanism on them, does not compromise their own selection of regional smart specializations, and does not burden them with additional tasks and costs. Hence, the cooperation mechanism proposed in the project stresses an information exchange between national and regional stakeholders and is financed and conducted by the national level (the KIS Coordinator in the Ministry of Development) through regional consultants. An informal information flow should be ensured through regular meetings of units responsible for managing EDPs at the national and regional levels. Finally, the cooperation mechanism should provide open access to EDP-related results so any interested party can use it.

Stronger emphasis on the role of BSIs in the innovation system is required. Interviews and Smart Labs pointed to BSIs' shortcomings in the delivery of innovation and business-related services. To address this issue, the Bank—together with SOIPPP, the association of innovation-oriented BSIs—organized a series of four workshops (one in each region) targeted at BSIs to better diagnose the current situation and enhance the efficiency of BSIs. The main takeaways from the workshops were that there is a large scope for improvement in setting clear goals for BSIs, enhancing the incentive framework, and strengthening monitoring and evaluation. Monitoring and evaluation, based on results-based performance management, will be particularly important going forward.

Crowdsourcing tested within the project faced challenges. The Bank sent out more than 1,000 invitations to respond to an online survey built around a shortened and streamlined version of the interview's questionnaire (22 questions out of 100; 10 minutes estimated response time). The overall response ratio was low, around 1 to 3 percent, although it was higher for firms that had been previously exposed to the Bank (the success ratio among the previously interviewed firms reached 15 percent, and for Polish firms in Silicon Valley that were first contacted by phone, the success rate was close to 30 percent). The Bank also experimented with various incentives to entice firms to respond (for instance, it promised the participating firms a free coaching session with Bank experts), but the impact was small. Follow-up phone conversations revealed that most firms were not used to interacting with the public sector and responding to surveys; they were also skeptical as to the impact of their responses on policies.

Going forward, proper incentives for firms to participate in crowdsourcing will be vital. Online surveys have so far not been widely used by the administration in Poland to interact with the private sector, especially to provide feedback. As a result, both a low level of trust and a low level of dialogue have been established. To change this, it will be important for the public sector to start using online surveys on a regular basis. Incentives for firms to participate in the surveys will be key. These could include, for instance, information on how the participating company compares with peers or access to industry-specific reports. Above all, however, it will be critical to show the impact: many firms did not fill out the survey because they did not believe it would have any use for policy making.

Innovation maps produced within the project helped identify key priorities for business innovation spending. NCBR, with the support of the Bank, has produced the first set of innovation maps based on more than 1,000 applications received so far within the new open-ended, "fast track" innovation support program started in April 2015. They

showed that "health and medicine" (NABS 7) is the key technology that the private sector wants to invest in; "electronics and IT engineering" is in turn the key business area of declared investment (OECD 2.2), followed by "mechanical engineering" and "material engineering." The maps also showed that most applications were received from the Mazowieckie and Slaskie regions.

Going forward, innovation maps should become a default option for all innovation support institutions. Following the NCBR's example, which has now decided to use innovation maps in all of its application processes, other public support institutions at the national level (PARP) and the regional level (ROP/RIS units in each of the regions) can produce their own innovation maps to support policy making. Given the small administrative and technical effort required, innovation maps can be used universally around the country. The resulting innovation maps should also be available to the public (posted on the respective websites) to help guide the developmental visions of the private sector.

Champions Clubs provide useful networking for knowledge-sharing and training. Interviews and Smart Labs showed that companies were not strongly networked, and often the best companies did not know one another. Champions Clubs aim to fill this gap. The challenge is to bring together the best entrepreneurs, who are usually busy. It is then necessary to provide them with an attractive offer that encourages them to participate. Training sessions and lectures by successful entrepreneurs are good magnets; however, they should not be supply driven and financed by the public administration (except the initial meetings that would serve as an example to the business community). Entrepreneurs should take on the financing of the Champions Clubs and should manage the quality and suitability of the trainings and lectures.

"SO WHAT?"—Conclusions and Recommendations

The proposed EDP "made in Poland" seems to meet the objectives of the smart specialization policy. It offers a new way to conduct innovation policy based on a bottom-up process of entrepreneurial discovery, which helps select, validate, modify, and eliminate smart specializations. It also helps identify new smart specializations by analyzing business and technological trends, as well as innovation potential perceived by companies participating in EDP. The proposed EDP engages the whole set of stakeholders, the quadruple helix, and puts companies at the center of innovation policy. It also helps synchronize regional, cross-regional, and national smart specialization policies. Finally, based on the assessment of business needs, it helps the public sector adjust its support instruments accordingly. The case of CNC technology has provided a successful example of a national smart specialization that was identified through a bottom-up process.

The EDP can help enhance the quality of public innovation policy. It is one of the first systemic attempts in the European Union to involve the private sector in the development of a country's innovation priorities, smart specializations. It can help find an optimal balance between top-down and bottom-up innovation policy making. Both are needed, but the bottom-up, private-sector-based approach to innovation policy needs improvement. If properly implemented, the new approach promises to increase the impact of public support on enterprise innovation, accelerate productivity growth, and increase social welfare.

It will be critical to ensure that the smart specializations fully translate into implementation. In the previous EU budget perspective (2007–2013), as documented in World Bank reports, there was sometimes a disconnect between the government's policy objectives and the final results. Due to the inherent risk aversion, insufficient capacity, and often suboptimal selection processes, the beneficiaries of public support were on the whole less risky, less innovative, and less in need of support than what the support programs envisaged. Going forward, it will be important for the regional- and national-level support instruments, especially the flagship matching grants, to be fully aligned with the smart specialization policy. The results of the support need to be constantly monitored through rigorous impact evaluation systems.

The EDP has to be adjusted to the local needs and the institutional and cultural environment. There is no one-size-fits-all solution, and any EDP needs to reflect the differences in traditions and endowments of each region, as reflected in various approaches to EDP within Poland and the EU. However, although the approaches to EDP can be different, the final objective has to be the same: to unlock the growth potential of a region based on entrepreneurial discovery and efficient support for new, innovation-based economic activities.

There is as much value in the EDP process itself as in the results. The main objective of the EDP is to help identify priorities for the national and regional innovation policy. That said, there is also a lot of value in the process itself: it helps align the public and private sector along the same vision of development, centered on the selected smart specializations and corresponding business and technological opportunities. It thus helps to concentrate scarce resources and reach a critical mass of investment. It also helps create networks, knowledge, and added value that might not be generated if the private and public sectors were not to cooperate so closely.

The quality of the grant-selection process is especially important. Analysis of selected support programs in the previous EU budget perspective (2007–2013) suggested that the quality of the selection process was critical to ensure that results of public intervention were in line with the objectives. It is thus strongly recommended that in the current EU budget perspective all innovation support institutions move away from the paper-based system of grant applications from enterprises, which puts a premium on the form rather than on the substance of applications, which are often prepared by external consultants focused on gaming the system. The system should move to a professional investment panel-based system, where the panel members from both the private and public sectors would directly interact with the entrepreneurs, without intermediaries. The MoED, PARP, and NCBR have proven that such a system can work and is likely to provide much better results in selecting the most innovative and commercially promising projects. Their example should be emulated.

The overall business environment will be critical to entrepreneurial discovery. The World Bank's national and subnational Doing Business rankings provide an easily accessible tool for monitoring the quality of the business environment around the country. As reflected in the Subnational Doing Business 2015 ranking, there are substantial differences in the business environment in the regions (Bydgoszcz is ranked number 1, Gdansk is 18). A high-quality business environment, especially in terms of ease of firm entry, start-up, and exit, is a necessary (if not sufficient) condition for the emergence of a robust pipeline of innovative ideas.

EDP-specific conclusions and recommendations

Firm interviews are an integral part of the EDP. Direct contact with entrepreneurs ensures access to information that is otherwise unavailable. An interview conducted by an experienced expert with a CEO/owner of a company provides invaluable quantitative and qualitative information and allows for better assessment of a company. Impersonal surveys (paper-, computer-, or phone-based) do not always fully reflect the reality of the innovation system due to their impersonal character, which does not allow follow-up questions and does not encourage firms' top management to fill in the survey. Without interviews, the EDP will be less likely to deliver quality information and meet its objectives.

The main recommendations from the firm interviews include the need to (i) hire top-quality consultants to conduct interviews, (ii) designate a key institution responsible for managing the interview process and analyze the data, and (iii) introduce innovation and management practices training programs for innovative SMEs. In the medium term, it would be recommended to adjust public support instruments to the specific needs of enterprises identified through the interviews and introduce a tailored and sophisticated support program for "champions" and "sleeping beauties." Finally, it would be critical for public administration to continue to use firm interviews as a key tool to proactively reach out to business.

Smart Labs are a key proposed element of the EDP and smart specialization policy. The main aim of Smart Labs is to help validate, specify in more detail, and/or modify existing smart specializations, as well as identify emerging ones. Smart Labs are designed to quickly test the potential of a business area and prepare a midterm strategy for its development. This is achieved in several steps. SLs start at the regional level but, if needed, may be transformed into interregional or national initiatives. The whole process should take no more than six months and be repeated for all new areas of interest. At every stage the SL can result in a "by-product" in terms of individual or joint R&D&I project applications to regional operational programs, NCBR, and Horizon 2020.

Smart Labs benefit from an informal, flexible, open, and transparent process. Formalizing the SL process by introducing internal regulations or creating a one-size-fits-all process should be avoided. SLs depend on their participants; some groups of firms are already more networked and organized, whereas some are not at all organized. This diversity requires flexible management of the SL process and adjusting it to the needs of individual groups. For instance, an SL moderator should be able to access public financing on a competitive basis to invite or hire external experts with specific expertise needed by the SL participants. SL participants appreciate the informal character of SLs; they prefer to focus on outcomes and not on the process.

The key recommendations from the Smart Labs include the need to (i) focus on the quality of participants in the Smart Lab sessions, (ii) clearly communicate the next steps of the SL process and expected results to manage participants' expectations, and (iii) publish the summarized results of each SL online to generate public knowledge and reduce the coordination failure among the sector's stakeholders. In the medium term, it would be important to (i) build a pool of consultants able of moderating SL sessions around the country, (ii) generate trust in the SL process by acting upon SL results, and (iii) expand the use of BTRs and disseminate them online.

Innovation maps help obtain valuable information from enterprise applications for public support. This is a new way to analyze thousands of grant applications sent by firms from all over the country, which contain valuable information about areas with large innovation and business potential. Key recommendations for the future include introducing innovation maps as the default option in most public support programs at the national and regional levels, increasing the level of detail of innovation maps by gathering more detailed information regarding OECD and NABS classifications, and developing a synchronized database of applications for funding from all support institutions, including PARP and NCBR.

Crowdsourcing is a new way to develop public–private dialogue. Online surveys are a simple, cheap, and effective method of reaching enterprises that usually do not engage in dialogue with the public sector. Information obtained through crowdsourcing can be useful for quick modification of support instruments, gathering information about the quality of public services, and identifying companies with innovative potential. The results of the pilot project suggest the need for public administration to systematically use crowdsourcing to build a new platform for dialogue, provide incentives for companies participating in the survey, and cooperate on crowdsourcing with the private sector, including consulting firms, to reach a large number of businesses.

The proposed EDP can be replicated fully or partially, on a voluntary basis, by the regions. The EDP model designed and tested at the request of the Ministry of Economic Development is not mandatory for any of the regions because the latter are autonomous in their decision making, and there are many ways to carry out EDPs. Every region, though, is expected to develop a well-functioning EDP as part of the ex ante conditionality of the EC for the thematic objective No. 1. The proposed EDP is modular and can be replicated by the regions in its entirety or in individual elements only. Regions that have already developed EDPs and do not intend to utilize the proposed EDP could share their experience on how they have managed to meet the same objectives. Exchange of such knowledge could help further enhance the efficiency of EDPs around the country and strengthen their impact.

Efficient cooperation between the national and regional levels will be key. Successful EDPs will require strong cooperation, collaboration, and commitment among all public-sector stakeholders. The proposed EDP, in line with the spirit and the letter of smart specialization policies, assumes that all stakeholders have the same mission—to promote the economic development of their regions and of Poland as a whole—and are ready, willing, and able to closely cooperate to fulfill this mission, regardless of institutional, legal, and resource bottlenecks.

The EDP process will be as efficient as the quality of the institutions and people who operate it. The success of the smart specialization and of the underlying EDP process, which is a new form of sophisticated industrial policy, will require leadership, top-notch skills, and capacity to be able to work directly with firms, identify emerging smart specializations and "champions," and support their development along the way. There is thus a need to increase the capacity of innovation support units at every level and in each institution. Given the specific, high-risk nature of innovation support, the people involved cannot be run-of-the-mill civil servants, but must be carefully selected people with the appropriate skills, risk appetite, and openness to working closely with the business sector. Once selected, sufficient funds should be available to provide high-quality training, based on successful international blueprints.

There is a need to fundamentally reform business support institutions (BSIs). The lessons learned from the EDP project suggests that, with notable exceptions, BSIs on the whole do not seem to function efficiently, provide sophisticated services needed by innovative companies, or have sufficient incentives to work with companies. Going forward, it would be critical to enhance the efficiency of BSIs (as well as RDIs) by: (i) increasing the capacity of their employees, (ii) clarifying objectives, (iii) introducing strong incentives, and (iv) adopting robust and transparent monitoring and evaluation mechanisms. Adoption of performance-based agreements should be encouraged, following the example of, for instance, Finland, the United Kingdom, and Canada. In addition, governance systems need to be restructured to ensure that BSIs are managed by experienced professionals with strong leadership skills and backgrounds in business. Finally, BSIs could benefit from a capacity-building program, including by creating strategic partnerships with international peers, training of staff by reputable experts, and organizing knowledge-sharing events on best practices.

Robust monitoring and evaluation frameworks will be key for continuous improvement of the EDPs. No institution is likely to succeed without knowing what it does well and what it does badly. The same applies to the smart specialization policy and the EDP process. Key elements of the new system, and especially smart specializations, require a systematic monitoring, evaluation, and reporting processes followed by a robust feedback loop from the evaluation results to policy changes. This will help enhance the quality of information provided to policy makers as to which programs work well and which do not and thus should be terminated. It will also improve the overall transparency of the public support system and help involve a larger number of stakeholders.

Finally, the public administration should lead by example. The EDP provides an opportunity for the Polish administration to learn new ways to understand and act upon business needs and potential. The approach promises to fundamentally improve how innovation policy functions and enhance the efficiency of innovation investment. But for

the EDP to become sustainable, bottom-up entrepreneurial discovery needs to be embedded in the administration's culture. The best way is to start leading by example: there is no reason why the administration could not be more technologically savvy, up-to-date, and committed to innovation than large swaths of the private sector. Table 22 summarizes the main recommendations.

Table 22. Main recommendations

Short-term	Medium-term
• Implement the proposed elements of the EDP to complement the existing national-level process • Create a well-staffed and well-funded EDP coordination unit at the MoED • Introduce a robust national–regional EDP cooperation system • Hire top-quality consultants to conduct national EDP • Designate a key institutional partner for the national EDP • Develop a standardized blueprint for information sharing for all the regions, for voluntary but recommended use • Introduce professional investment panels as a default option for all relevant innovation support instruments • Introduce innovation and management practices training programs for innovative SMEs • Adjust public support instruments to the specific needs of enterprises, especially those with high-growth potential	• Invest in capacity building of innovation support institutions • Consider reducing the number of national smart specializations, including by merging them where appropriate • Introduce clear guidelines for performance management of business support institutions; consider developing a nationwide ranking • Introduce "open data" across the innovation system: all information collected during the EDP process should be made public by default • Introduce rigorous impact evaluation methods on most innovation support instruments • Expand demand-led innovation: use public procurement to drive innovation • Open up to the world: introduce English in calls for proposals; invite international experts • Lead by example: encourage public administration to become a leader in the use of technology

Source: The World Bank.

Annexes

Annexes to the report are available on the World Bank website at www.worldbank.org/poland/innovation/edp

Annex 1. Firm-level interviews: methodological manual

Annex 2. Summary information on the interview process and Smart Labs

Annex 3. Business Technology Roadmap (BTR) report

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