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Fostering Innovation and Entrepreneurship in Poland: An Analysis of Policy Frameworks and Strategic Initiatives

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Abstract: This paper explores Poland's evolving policy frameworks and strategic initiatives aimed at fostering innovation and entrepreneurship, within the context of economic transformation and integration into the European Union (EU). Utilising qualitative document analysis, the study evaluates both macro level strategies and micro level mechanisms that support the development of start-ups and higher value-added sectors. Using policy documents, institutional reports, and academic literature, the analysis identifies key instruments such as the Smart Growth Operational Programme, the Fast Track initiative, and the IP Box tax incentive, that work alongside major institutions such as the Polish Agency for Enterprise Development (PARP) and the National Centre for Research and Development (NCBR). Two illustrative case studies, Ryvu Therapeutics and SDS Optic, demonstrate the tangible outcomes of these initiatives in enabling product innovation, attracting investment, and facilitating global market expansion. While the paper recognises Poland's progress in building an innovation-oriented economy, it also highlights persistent challenges, including fragmented institutional structures, limited industry academia collaboration, and an underdeveloped venture capital ecosystem. Guided by theoretical insights from Wennekers & Thurik (1999), Carree & Thurik (2010), and Urbano et al (2019), the paper argues that financial investment must be complemented by deeper institutional reform to unlock the full potential of entrepreneurship. The findings contribute to policy discourse in transition economies by offering a foundation for future empirical evaluations and proposing strategies for building a coherent, inclusive, and globally competitive innovation system.

Keywords: Poland, Innovation policy, Entrepreneurship, Public support for SMEs, R&D funding, Policy frameworks, EU integration, Strategic Initiatives, Economic development

Introduction

Poland's socio-economic landscape has undergone significant transformation over the past three decades, showcasing exceptional resilience and adaptability. Since transitioning from a centrally planned economy to a market-oriented system in the early 1990s, Poland has achieved steady economic growth and deepened its integration into the EU (Frieden, 2020, pp. 430–432). Today, Poland stands as one of the more dynamic economies in Central and Eastern Europe, benefiting from a burgeoning service sector, a robust manufacturing base, and a strategic geographical position. As Poland continues to shift away from its post-socialist economic foundations toward a model centred on innovation and entrepreneurial dynamism, it becomes increasingly important to understand the underlying mechanisms that link entrepreneurship to sustained economic development.

To contextualise Poland's innovation policy landscape, it is instructive to first examine the country's macroeconomic trajectory and investment in research and development (R&D)

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over the past decade. As illustrated in Figure 1, Poland has exhibited consistent GDP growth between 2015 and 2022, notwithstanding temporary disruptions linked to the COVID-19 pandemic. This resilience reflects the structural robustness of the Polish economy and underscores its capacity to absorb shocks while maintaining upward momentum. Parallel to this economic expansion, Figure 2 demonstrates a gradual increase in R&D expenditure as a percentage of GDP, signalling an enhanced governmental and institutional commitment to innovation-driven development. Together, these indicators suggest a policy environment that increasingly recognises the interplay between sustained economic performance and strategic innovation investment.

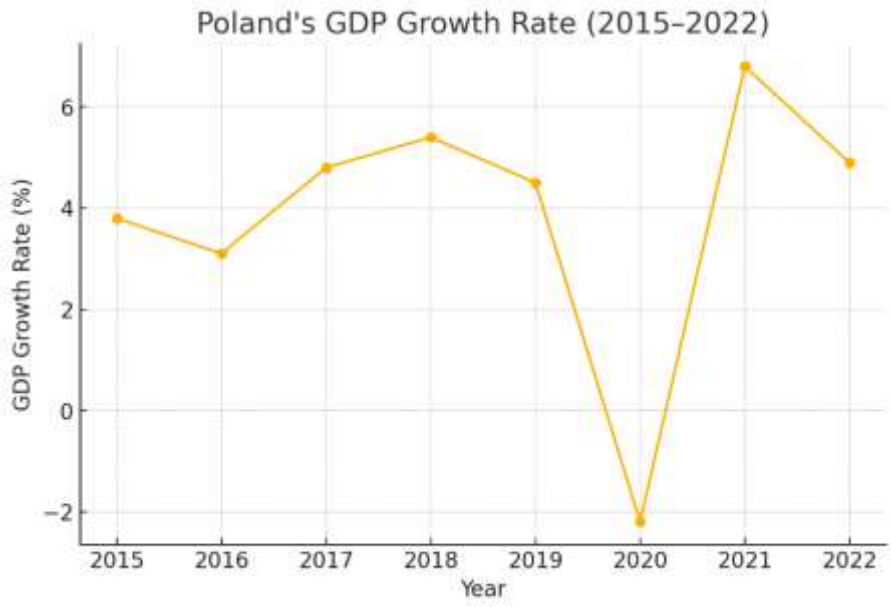

Figure 1: Poland's GDP Growth Rate (2015–2022).

Source: Own elaboration based on World Bank data (2024).

A considerable body of international research underscores the link between entrepreneurship, innovation, and economic performance. Wennekers and Thurik (1999) highlight the multidimensional nature of entrepreneurial dynamics, while Carree and Thurik (2010) argue that entrepreneurship acts as a catalyst for structural transformation and productivity gains. More recently, Urbano, Aparicio, and Audretsch (2019) synthesised 25 years of research, emphasising the critical role of institutional frameworks in shaping innovation trajectories. Together, these studies provide a conceptual anchor for examining how Poland's policy frameworks align with the broader international discourse on innovation led development.

This empirical backdrop reinforces the importance of entrepreneurship as a conduit for translating policy into practice. As Wennekers and Thurik (1999) argue, entrepreneurship is a multifaceted phenomenon that influences economic dynamics at individual, firm, and institutional levels. In the Polish context, the alignment of economic growth and R&D intensification provides fertile ground for entrepreneurial activity, thereby strengthening

national competitiveness and supporting the country's ambition to transition towards a knowledge-based economy integrated within the European innovation ecosystem.

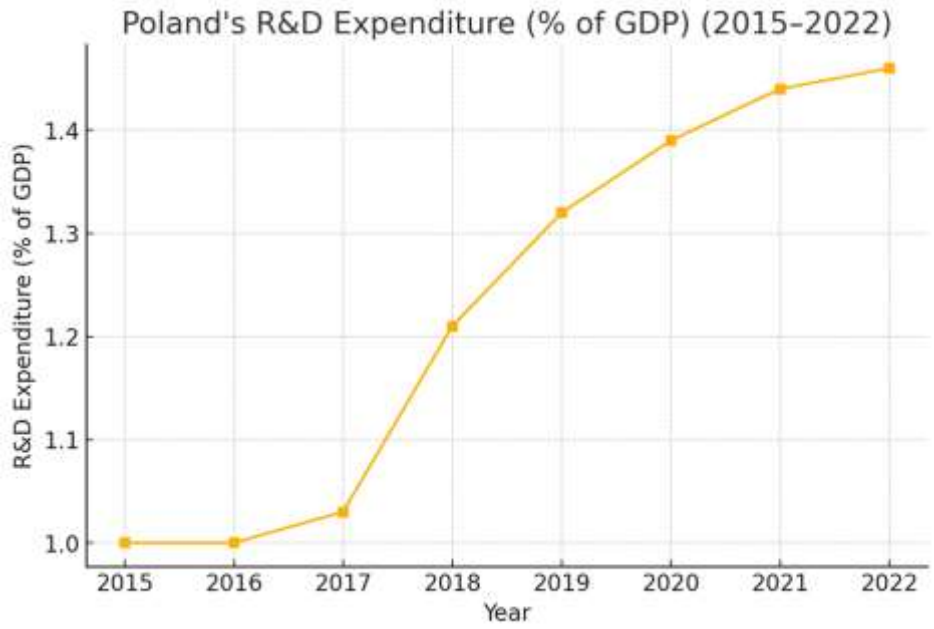

Figure 2: Poland's Research and Development (R&D) Expenditure as a Percentage of GDP (2015–2022).

Source: Own elaboration based on Eurostat data (2024).

EU membership has brought opportunities such as access to larger markets, structural funds for infrastructure and innovation, and stronger ties with Western European economies (Breznitz & Ornston, 2017). At the same time, Poland faces the challenge of ensuring that these benefits are distributed evenly across its regions, with the potential for significant growth and development in rural communities (Ministry of Development, Labour, and Technology, 2017). Addressing these gaps is vital to enhancing Poland's innovation capacity and ensuring long term competitiveness in a rapidly changing global economy.

Against this backdrop, the central aim of this paper is to explore the extent to which Poland's current policy frameworks and strategic initiatives effectively support innovation and entrepreneurship within the broader context of its economic transformation and EU integration. Specifically, the study seeks to assess the alignment between national innovation policies and the practical needs of emerging enterprises. With a particular focus on high value-added sectors and to evaluate the role of public institutions and funding mechanisms in enabling the commercialisation of research and development outcomes.

These objectives are guided by the following research questions:

- How effective are Poland's current innovation and entrepreneurship policies in supporting the start-up ecosystem?
- To what extent do public funding programmes and institutional structures contribute to measurable innovation outcomes such as product development, international expansion, or job creation?

Poland needs to foster innovation and entrepreneurial capacity to ensure long-term economic resilience and global competitiveness. Investment in R&D remains comparatively low relative to other EU nations, underscoring the urgent need for strategic policies and well-structured funding mechanisms (European Commission, 2020, pp. 112–115).

Addressing these gaps is crucial for maintaining economic momentum and safeguarding Poland's position as a rising European economy. As the country modernises, nurturing an innovative culture and a supportive ecosystem for entrepreneurs will be vital to realising its full potential.

The Polish government and associated agencies have recently recognised that innovation and entrepreneurship are vital engines of economic expansion, employment generation, and broader societal advancement (European Commission, 2016). This has resulted in an increasing array of policies and programmes that have been introduced to nurture these domains. These initiatives aim to bolster R&D activities, attract foreign investment, facilitate technology transfer, and support Small and Medium-sized Enterprises (SMEs) in scaling their operations (Polish Investment and Trade Agency (PAIH). (2021). Furthermore, dedicated funding schemes, such as the National Centre for Research and Development's 'Fast Track' programme, and tax incentives, like the R&D tax credit, are being deployed to encourage private-sector research (National Centre for Research and Development [NCBR], 2025.). Collaborative projects between universities and industry, such as the 'Innovation Bridge' initiative, are expanding Poland's knowledge base and strengthening its innovation capacity.

At the same time, Poland's engagement with EU frameworks, particularly the European Green Deal and the EU's digital transformation agenda, infuses the national innovation landscape with complexity and opportunity (Union of Entrepreneurs and Employers (ZPP). (2024). The European Green Deal encourages member states to pivot towards greener, more resource-efficient economies, prompting Polish policymakers to incorporate sustainability targets into various funding calls and public initiatives (Council of the European Union. (2024). Meanwhile, the ongoing digital shift, accelerated by EU-wide programmes like the Digital Europe Programme, has nudged Poland to enhance its digital infrastructure and equip its workforce with technologically relevant skills (European Commission. (2024). This alignment with broader European objectives, such as the EU's goal of becoming a global leader in digital innovation and the transition to a circular economy, enables Poland to access substantial resources and expertise and positions the country to play a more influential role in the EU's evolving economic and technological ecosystems (Ministry of Development, Republic of Poland (2019). As these policies take root, they are expected to create new pathways for Polish entrepreneurs, facilitate cross border collaborations, and ultimately stimulate higher value-added sectors in the Polish economy.

This paper provides a descriptive evaluation of Poland’s policy framework in terms of its capacity to foster innovation and entrepreneurial activity, focusing on both macro level strategies and micro level mechanisms that drive systemic change. It adopts a qualitative, literature-based policy analysis to examine the institutional and strategic dimensions underpinning Poland’s innovation ecosystem. The analysis draws on primary policy documents, government reports, programme evaluations, and relevant academic literature to map the evolving policy landscape and assess the effectiveness of key initiatives, funding schemes, and organisational roles. Particular attention is paid to how public support structures intersect with private sector needs, highlighting both strengths and systemic limitations. To illustrate real-world outcomes, the study includes two case studies. The first is Ryvu Therapeutics and the

second case study is SDS Optic. Both these case studies exemplify the impact of selected interventions on product innovation, international expansion, and commercialisation success. This exploratory approach seeks to synthesise existing knowledge and offer insight into policy effectiveness, while laying the groundwork for future empirical evaluations that may employ quantitative methods to assess causal impact.

Following this introductory overview, the paper is organised into four main sections. First, it outlines the overarching policy framework shaping innovation and entrepreneurship in Poland. Next, it examines targeted initiatives and funding mechanisms. The subsequent section presents illustrative case studies to highlight real world applications and outcomes. Thereafter, the role of government agencies and related institutions is discussed in greater detail.

Finally, the conclusion synthesises key findings and proposes potential pathways for enhancing Poland's innovation ecosystem. Methodologically, this study adopts a descriptive, document-based policy analysis approach. It draws on official policy documents, programme evaluations, institutional reports, and academic literature to assess the strategic architecture of Poland's innovation system. While quantitative methods such as difference-in-differences or propensity score matching offer valuable tools for causal inference in innovation policy research, these techniques lie beyond the scope of this exploratory inquiry. Rather, the paper seeks to establish a conceptual foundation for future empirical studies that may evaluate the measurable impact of specific interventions, thereby contributing to more rigorous, evidence-based policymaking.

Policy Framework

Poland's policy framework for fostering innovation and entrepreneurship is shaped by a combination of national strategies, EU directives, and targeted programmes that reflect the country's priorities for economic development. This section overviews the key policies, institutional arrangements, and legislative tools that guide Poland's innovation ecosystem.

One of the cornerstone documents influencing Poland's innovation and entrepreneurship landscape is the Strategy for Responsible Development (SOR), commonly referred to as the Morawiecki Plan (Brusilo, 2020). Introduced in 2017, the SOR sets out long-term objectives for sustainable economic growth, highlighting research, development, and the digital economy as pivotal drivers of transformation. This framework recognises innovation as a cross-cutting theme, underscoring the need for improved collaboration between government bodies, private enterprises, and research institutions.

Additionally, the Act on Innovation (Ustawa o Innowacyjności) and its subsequent amendments have provided a legal basis for offering tax reliefs and financial incentives to businesses engaged in R&D activities (OECD. (2025). This legislation aims to reduce the administrative barriers facing entrepreneurs and to stimulate the commercialisation of research outcomes by Polish universities and research centres.

Poland's membership in the EU has significantly influenced its policy framework, mainly through EU Cohesion Policy and thematic programmes emphasising research and innovation. The Smart Growth Operational Programme 2014–2020 is a prime example, focusing on areas such as R&D capacity-building, technology transfer, and the internationalisation of SMEs (European Commission. (2020.). Under this programme, Poland has received substantial European Regional Development Fund (ERDF) support to enhance innovation ecosystems, modernise infrastructure, and foster collaborations between academia and industry.

Moving forward, the European Green Deal and the Horizon Europe funding schemes further guide Poland's strategic orientation towards sustainability, digital transformation, and cutting-edge technologies (European Commission, 2024). These EU-level priorities have incentivised Polish policymakers to incorporate climate-related and digital targets into domestic initiatives, ensuring alignment with broader European objectives.

PARP oversees a range of programmes to strengthen entrepreneurship, enhance SME competitiveness, and facilitate international market access (PARP, 2025). NCBR bridges research efforts and commercial applications by funding joint R&D projects, supporting start-ups, and fostering public-private partnerships (NCBR, 2025).

At the same time, the Polish Development Fund (PFR) acts as an umbrella institution, coordinating an array of public programmes designed to stimulate entrepreneurship and innovation. Through instruments such as loans, guarantees, and venture capital, PFR helps fuel SME growth and technological advancement, ensuring a comprehensive approach to building Poland's innovation ecosystem.

The Polish government has introduced multiple fiscal incentives designed to reduce R&D costs and risks, including tax credits for research expenditure and IP Box relief measures for income derived from intellectual property rights (OECD, 2023, p. 42). Moreover, sector specific initiatives have been developed in renewable energy, fintech, and e-commerce (Deloitte, 2020), reflecting Poland's strategic goal to diversify its economic base while embracing emerging global trends.

A range of targeted programmes and funding mechanisms underpin Poland's innovation and entrepreneurship landscape, offering direct support to start-ups, Small and Medium-sized Enterprises (SMEs), and research institutions. These initiatives often blend national resources with EU cohesion funds, reflecting Poland's dual focus on domestic priorities and alignment with broader European strategies.

Operational programmes have played a central role in shaping Poland's innovation ecosystem. The Operational Programme Innovative Economy (OPIE), which operated from 2007 to 2013, offered significant support for R&D infrastructure, technology transfer, and the development of innovative products (Dziura, 2013). Its primary focus was enhancing Polish companies' global competitiveness by co-financing research projects and fostering collaboration between universities and industry. Building on this foundation, the Smart Growth Operational Programme (SG OP), initiated for the 2014–2020 period, targeted high-value-added sectors and emphasised technology commercialisation and international expansion for Polish enterprises (Ministerstwo Infrastruktury i Rozwoju, 2015).

Through its grants and co-financing schemes, start-ups and SMEs gained essential capital for product development, market-entry, and patent registration. In addition, SG OP supported the broader entrepreneurial ecosystem by investing in technology incubators and accelerator programmes, thereby nurturing a more robust and dynamic environment for innovation.

National funding schemes underpin Poland's innovation landscape by offering specialised support for high-potential projects (Narodowe Centrum Badań i Rozwoju, 2021). For example, the Fast Track Programme (Szybka Ścieżka), administered by the NCBR, provides rapid financial assistance to R&D initiatives with strong commercial prospects, enabling companies and SMEs to speed up product development and reduce time to market.

Meanwhile, Bridge Alfa, a venture capital tool managed by NCBR, targets early-stage ventures with elevated risk but substantial growth potential. By partnering with private

investors to share risks, Bridge Alfa helps fill the funding gap that often challenges high-impact, innovative projects.

Tax incentives and IP support mechanisms further bolster Poland's innovation ecosystem by reducing the financial burden associated with research and intellectual property development. (PwC, 2025) One notable instrument is R&D Tax Relief, which allows enterprises to deduct a percentage of eligible R&D costs from their taxable income. This initiative is particularly beneficial for SMEs lacking the capital to invest in long-term research. Another key measure is the IP Box, a reduced tax rate on income derived from qualified intellectual property, encouraging companies to patent locally and invest in domestic R&D. These incentives collectively stimulate continuous innovation, drawing in firms across a spectrum of industries, including software and pharmaceuticals.

In parallel, many start-up ecosystem initiatives focus on nurturing early-stage ventures. Start in Poland, (Polska Agencja Rozwoju Przedsiębiorczości, 2018) for instance, offers incubation, mentorship, and seed funding, leveraging public-private partnerships to connect promising ventures with experienced investors and corporate partners.

Meanwhile, Innovation Vouchers (Bony na innowacje) enable micro, small, and medium-sized enterprises to collaborate on product development or improvement with research entities. By covering the consulting and development costs, these vouchers significantly lower entry barriers for businesses new to R&D activities and foster a supportive environment for entrepreneurial growth.

Complementing these efforts, the PFR and the PAIH offer a range of export-oriented funding instruments, trade missions, and advisory services, enabling Polish enterprises to establish global networks and attract foreign direct investment. Through this comprehensive support, Poland seeks to position its innovative ventures competitively on the world stage.

Poland has implemented a broad array of public initiatives aimed at strengthening innovation and entrepreneurship, reflecting a strategic policy commitment to long-term economic transformation. The Operational Programme Innovative Economy (OPIE), active from 2007 to 2013, laid the foundation by investing over €8.3 billion in R&D infrastructure, technology transfer, and the development of innovative products and processes. This was succeeded by the SG OP, which allocated approximately €8.6 billion between 2014 and 2020 (with extensions into the 2021–2027 framework) to support high-value-added sectors, commercialisation of scientific research, and the internationalisation of Polish enterprises. These large-scale programmes, administered by the Ministry of Development Funds and Regional Policy through agencies such as PARP and NCBR, have helped establish a stable funding architecture for innovation in Poland.

Complementing these structural funds are several targeted instruments designed to address specific gaps in the innovation lifecycle. The Fast Track Programme (Szybka Ścieżka), administered by the NCBR, provides rapid co-financing for high-potential R&D projects, with an estimated annual budget of €300 million. Bridge Alfa, another NCBR initiative, acts as a public-private venture capital mechanism supporting seed-stage investment in deep-tech ventures. Start in Poland, launched in 2016, supports start-up incubation, mentorship, and public–private partnerships, while Innovation Vouchers facilitate collaboration between SMEs and research institutions by offering up to €20,000 per voucher.

Case Study 1: Ryvu Therapeutics

Ryvu Therapeutics, formerly known as Selvita, is a biotechnology company based in Kraków, Poland, specialising in the development of small-molecule therapies for oncology (Ryvu Therapeutics, 2025). Since its establishment, Ryvu has been a significant beneficiary of public innovation funding, securing over PLN 200 million in co-financing for 16 R&D projects primarily through the NCBR Fast Track Programme. This funding has been instrumental in accelerating the company's research, particularly in advancing its lead candidate, RVU120, a CDK8/CDK19 inhibitor currently undergoing multiple Phase II clinical trials for the treatment of hematologic malignancies and solid tumours.

The financial support provided by Fast Track allowed Ryvu to de-risk its early-stage projects, invest in laboratory infrastructure, and expand its scientific workforce. These resources enabled the company to achieve significant milestones, including the initiation of four Phase II trials in 2024 and the expansion of its preclinical pipeline. Additionally, Ryvu's growth attracted international partnerships with firms such as BioNTech and Exelixis, enhancing its global visibility. The success of Ryvu demonstrates the strategic value of targeted public funding in fostering high-potential biotechnology ventures and advancing innovative medical solutions within the EU.

Case Study 2: SDS Optic

SDS Optic is an emerging medical technology company based in Lublin, Poland, focused on the development of precision diagnostic solutions at the intersection of biotechnology, photonics, and fibre optics (SDS Optic, 2025). The firm gained notable recognition through its flagship innovation, *inPROBE* a pioneering diagnostic device that allows real-time detection of cancer biomarkers directly in the patient's tissue. This technology aims to significantly reduce the waiting time for results, enhance diagnostic accuracy, and improve treatment outcomes in oncology. As a deep-tech start-up operating in a high-risk, high-potential field, SDS Optic faced the common early-stage challenge of securing sufficient capital to transition from concept to clinical readiness.

To overcome these barriers, SDS Optic secured support through the BRIdge Alfa Programme, an initiative administered by the NCBR in cooperation with private investors. This programme offers seed funding and business mentorship to innovative technology start-ups in Poland. Through this financial backing, SDS Optic was able to invest in advanced laboratory infrastructure and recruit specialist personnel essential for the preclinical development and optimisation of inPROBE.

The BRIdge Alfa support not only facilitated the acceleration of the product's development pipeline but also enhanced the company's credibility in attracting subsequent rounds of private investment. SDS Optic's trajectory underscores the value of public–private funding mechanisms in advancing frontier medical technologies and reinforcing Poland's biomedical innovation ecosystem.

The two case studies demonstrate the critical role of state-backed funding in fostering innovation, de-risking early-stage development, and accelerating the commercialisation of high-impact technologies in Poland. Through targeted initiatives such as the Fast Track and BRIdge Alfa Programmes, the NCBR has enabled emerging companies to overcome financial and technical barriers that often hinder progress in the life sciences sector.

Ryvu leveraged public funding to expand its clinical research capabilities and attract strategic international partnerships, while SDS Optic utilised early-stage capital to advance a groundbreaking diagnostic technology and strengthen its market readiness. Together, these cases underscore how well-designed public funding mechanisms can catalyse scientific advancement, stimulate economic growth, and position Polish firms as competitive players in the global innovation landscape.

Role of Government, Institutions, and Agencies

A collaborative network of governmental bodies, specialised institutions, and public agencies drives the development of Poland's innovation and entrepreneurship landscape. Their combined efforts establish strategic directions, ensure policy coherence, and provide the financial and operational resources necessary for innovative ventures to thrive.

The central government plays a pivotal role in setting the overall agenda for national development, typically articulated through strategic documents such as the Strategy for Responsible Development and periodic updates to innovation and industrial policies (Ministerstwo Funduszy i Polityki Regionalnej, 2022). Within this framework, the Ministry of Development Funds and Regional Policy and the Ministry of Education and Science oversee budget allocations, legislative adjustments, and the coordination of long-term goals related to research, technology commercialisation, and entrepreneurship support.

A network of public agencies serves as the operational arm of Poland's government policies, translating strategic objectives into tangible outcomes. PARP leads various programmes for business growth, from startup incubation to internationalisation initiatives, and offers advisory services, grants, and networking opportunities to help companies broaden their market reach. Meanwhile, the NCBR directs funding towards R&D projects with strong commercial potential, managing schemes like Fast Track and Bridge Alfa to reduce innovation-related risks for established firms and startups. In addition, the PFR provides a suite of financial instruments that ranges from loans and guarantees to venture capital that is ultimately designed to spur SME expansion and investment in emerging technologies, often partnering with private-sector entities to mobilise resources efficiently.

In addition to national entities, regional authorities and local innovation centres contribute significantly to Poland's entrepreneurial ecosystem. Many voivodeships operate their development agencies, delivering region-specific funding and tailored support programmes. These bodies address local economic challenges, promote regional specialisations (e.g., agri-tech or advanced manufacturing), and foster closer ties among academia, industry, and local government.

The government also encourages the formation of innovation clusters that are geographical concentrations of related industries, research institutions, and service providers. By facilitating joint R&D activities, shared infrastructure, and knowledge transfer, these clusters boost local competitiveness and create robust ecosystems for technology-driven ventures. Initiatives like Startup Poland further connect entrepreneurs with mentors, investors, and policymakers, building a community that advocates for business-friendly regulations and entrepreneurial culture.

Lastly, legislative reforms and tax incentives complement institutional efforts to attract domestic and foreign investment in R&D. Adjustments to intellectual property rights regulations, streamlined business registration processes, and simplified tax schemes all

contribute to a climate where innovation can flourish. Governmental bodies help maintain Poland's momentum in building a dynamic, future-oriented economy by continually refining these regulations in response to market feedback.

The roles of government, institutions, and agencies collectively form the backbone of Poland's support system for innovation and entrepreneurship. They ensure that policy directions remain coherent, adequate channelling funding, and continually assessing and updating strategic programmes to meet evolving market needs.

Although the primary aim of this paper is to provide a descriptive overview of Poland's innovation policy framework and associated initiatives, a deeper analysis of the quantitative impacts of these policies can offer valuable insights for academics and practitioners. Existing research on innovation policy effectiveness in the European context often utilises econometric techniques. For example, difference-in-differences estimations, propensity score matching, or panel data regressions are ideal to properly gauge how public interventions influence R&D outputs, firm performance, or regional development. A more systematic review of such studies, specifically on Poland's case, would help identify methodological approaches, data sources, and persistent gaps in understanding which interventions work best.

Several scholarly articles and EU evaluations have explored the link between public funding and innovation outcomes in Central and Eastern Europe. While these works generally find positive correlations between policy measures and firm-level productivity or patenting activity, the causal pathways are not always clearly established. The literature often highlights the need for more robust impact assessments that can rule out selection biases or external shocks. In Poland's context, challenges such as regional disparities, limited venture capital markets, and fragmentation of support structures may dilute the overall impact of large-scale initiatives. Investigating these structural factors through rigorous causal studies would clarify why Poland lags leading EU nations in specific innovation metrics despite significant policy investments.

Moreover, causal impact assessment plays a key role in refining policy recommendations. By identifying which programmes produce measurable outcomes. Metrics such as increases in patent filings, revenue growth among SMEs, or improved labour productivity can empower policymakers to react and allocate resources more effectively and tailor initiatives to local or sectoral needs. Equally, econometric approaches can uncover unintended effects or inefficiencies, prompting targeted revisions of existing frameworks.

Proposed Explanation for Poland’s Innovation Lag

Although Poland has introduced numerous programmes and funding mechanisms to boost innovation and entrepreneurship, the country continues to trail leading EU nations. This persistent gap suggests that existing policy measures, while extensive, may not fully address the structural conditions necessary for sustainable, high-level innovation outputs. One of the core impediments appears to be the fragmented nature of Poland’s innovation ecosystem. Multiple agencies named throughout this paper operate overlapping or parallel programmes with limited coordination. This institutional fragmentation generates administrative redundancies, diluted accountability, and considerable complexity for businesses and academic institutions navigating the system. The absence of a unified strategic framework, where government, regional authorities, and private stakeholders work in concert, may undermine the effectiveness of even well-funded initiatives.

In addition to administrative inefficiencies, Poland's R&D ecosystem suffers from limited integration between academia and industry. Despite increased public funding and new collaboration incentives, much of the country's academic research remains poorly aligned with market needs. The weak linkage between research institutions and firms hinders the translation of scientific outputs into commercial applications, while academic researchers often lack sufficient incentives to pursue entrepreneurial ventures or engage in technology transfer. This issue is compounded by relatively low private-sector R&D expenditure, which constrains firm-led innovation and limits the scalability of new technologies. Furthermore, Poland's innovation landscape is challenged by an underdeveloped private venture capital sector. While public programmes like Bridge Alfa provide crucial seed funding, follow-on capital for scale-up phases remains scarce, often forcing high-potential start-ups to stagnate or seek funding abroad. Parallel to financial barriers, the shortage of advanced STEM and digital competencies that is further exacerbated by regional disparities in education and the lack of robust lifelong learning frameworks that leads to the restrictions in the development of high-tech sectors.

These structural challenges reflect broader theoretical insights into the entrepreneurship growth nexus. Carree and Thurik (2010) argue that entrepreneurship acts as a vital engine of economic transformation, enabling structural adjustment, technological advancement, and employment generation in response to shifting macroeconomic conditions. Their framework highlights the importance of entrepreneurial entry, firm-level dynamism, and the removal of institutional barriers that constrain market responsiveness. All of which are directly applicable to Poland's current innovation environment. Despite the presence of well-intentioned programmes such as Fast Track and Bridge Alfa, Poland's fragmented institutional landscape, weak university and industry linkages, and limited venture capital infrastructure continue to restrict the optimal functioning of entrepreneurial forces.

Applying Carree and Thurik's theoretical lens reinforces the conclusion that financial support alone is insufficient; rather, a coherent, integrated innovation ecosystem is essential to facilitate the emergence, growth, and sustainability of entrepreneurship as a driver of long-term economic development.

Although this paper focuses on qualitative and descriptive analysis, future research should complement this approach with rigorous econometric evaluation to enhance the empirical grounding of innovation policy studies in Poland. Methodologies such as difference-in-differences estimation, panel data regression, or matching techniques could be employed to assess the causal impact of specific programmes such as the Fast Track or Bridge Alfa initiatives on firm-level outcomes including patent filings, employment growth, and revenue generation. These quantitative assessments would not only validate the effectiveness of current policy instruments but also support the recalibration of resource allocation to maximise impact. Integrating such methods into subsequent research could significantly strengthen the foundation for evidence-based policymaking within Poland's innovation landscape.

The need for such methodological refinement becomes even more apparent when viewed through the theoretical lens offered by Urbano, Aparicio, and Audretsch (2019), whose comprehensive review of the literature underscores the pivotal role of formal and informal institutions in shaping entrepreneurial dynamics and, by extension, economic growth trajectories. Their findings resonate with the Polish context, where despite the proliferation of policy initiatives and funding mechanisms, institutional fragmentation and limited ecosystem integration continue to constrain the full activation of entrepreneurial potential. Applying their

framework suggests that effective innovation policy requires more than financial investment, what is required is the creation of a coherent, supportive institutional environment.

For Poland, this entails not only enhancing inter-agency coordination and reducing bureaucratic complexity but also fostering stronger synergies among academia, industry, and government. Such reforms are critical to ensuring that entrepreneurship becomes a sustained driver of innovation-led growth.

Conclusion

Poland's trajectory from a centrally planned economy to a market driven system has laid the groundwork for its integration into global networks of innovation and entrepreneurship. Through initiatives such as the Smart Growth Operational Programme, targeted funding instruments like Fast Track, and institutions such as PARP and the NCBR, Poland has demonstrated a clear ambition to foster robust R&D activity, nurture emerging ventures, and strengthen global competitiveness that are aligned with broader European agendas like the European Green Deal and digital transformation strategies.

However, this paper's descriptive evaluation also highlights persistent challenges, including uneven regional development, comparatively low R&D spending, and gaps in workforce skills. Importantly, the hypothesis introduced here suggests that despite robust public interventions and policy frameworks, Poland continues to lag leading EU nations in innovation performance due to fragmented institutional structures, all of which reduce the effectiveness of large-scale programmes and funding mechanisms. Addressing these structural coordination gaps, incentivising deeper research and industry collaboration, and reinforcing the domestic venture capital market may be crucial steps in elevating Poland's innovation ecosystem to match the country's economic aspirations.

The core message remains that Poland's drive for innovation and entrepreneurship is multifaceted, reflecting coordinated efforts among national, regional, and EU stakeholders. Building on these foundations will require continual refinement of policy instruments, targeted support for high-potential sectors, and a stronger emphasis on inclusive growth to ensure that innovation benefits are widely shared. This paper contributes to the discourse on economic development strategies in transition economies by illustrating how a country with a legacy of central planning can adapt to contemporary global trends while still grappling with institutional and market-based limitations. Future research that employs robust causal analysis could deepen our understanding of why these challenges persist and how policy interventions might be recalibrated to yield the greatest return on investment, thereby bridging the gap between Poland's ambitions and its actual innovation outcomes.

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