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Title	The State-SME nexus: an innovation-focused analysis and international scaling
Authors	Sima, Yueling
Publication date	2025-06-30
Original Citation	Sima, Y. 2025. The State-SME nexus: an innovation-focused analysis and international scaling. PhD Thesis, University College Cork.
Type of publication	Doctoral thesis
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Download date	2026-11-08 12:57:24
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The State-SME Nexus: An Innovation-Focused Analysis and International Scaling

Thesis presented by

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for the degree of

Doctor of Philosophy

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Submitted to University College Cork in June 2025

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Author Declaration

This is to certify that the work I am submitting is my own and has not been submitted for another degree, either at University College Cork or elsewhere. All external references and sources are clearly acknowledged and identified within the contents. I have read and understood the regulations of University College Cork concerning plagiarism and intellectual property.

Digital signature of the candidate: Yueling Sima

Date: June 30th, 2025

Acknowledgements

My journey began in January 2021, and the four and a half years since have passed both in a blur and moment by moment. It has been a marathon of endurance and a climb toward a summit—a path that started with joy, met its share of doubt and detours, but always led back to progress.

I am deeply indebted to my supervisors: Professor Lawton C. Thomas, Professor Justin Doran, and Doctor Noirin McCarthy, who guided me on this path with such wisdom and generosity. In every meeting, they held nothing back, sharing their knowledge, lifting my spirits, and illuminating the way forward.

My gratitude extends to Professor Ronan Carbery, Doctor Damian Tobin, and Doctor Carol Kelleher, whose annual reviews were always a source of encouragement and actionable advice. I am also thankful for the Spatial and Regional Economics Research Centre, a community where a spirit of harmony and open discussion allowed me to share our research and insights freely. My sincere gratitude to the Irish Central Statistics Office for their invaluable support. Their dedication in collecting and providing such a detailed and rich dataset was instrumental to this research

I am deeply grateful for my year as a visiting scholar at UT Dallas, an experience that opened my eyes to new and exciting fields of inquiry. My sincere thanks to Professor Mike Peng and Professor Sheen S. Levine, whose mentorship was instrumental to our collaboration. I also want to thank Professor Stephan Manning for the conversations, for sharing not only academic resources but also his unique perspectives on writing and research.

To the ladies of CUBS: Drs Julia, Marie, Mapi, Paula, and Stephaine, I started this journey at different times but walked it together, supporting each other through every

challenge. The friendship I have built, through the trials of academia and life, is one I will always treasure. Finally, I owe everything to my family and friends (Mengshuang Chen and Yuanjin Yao). I am profoundly lucky to be surrounded by your unconditional love and support, which has always been the true source of my courage to keep moving forward.

Abstract

Small and medium-sized enterprises (SMEs) are increasingly pursuing international scaling, yet they face formidable resource constraints and barriers to cross-border expansion. This dissertation addresses the critical State-SME nexus, exploring how institutional support systems can effectively empower SMEs to innovate and thrive in international markets. Moving beyond a general assessment of support, this research specifically investigates and compares how distinct initiatives, namely financial funding (government subsidies) and collaborative knowledge-sharing (with public knowledge sources including research institutes and universities), influence SME innovation pathways and subsequent international performance. Grounded in the context of Ireland, a small, open, and innovation-driven economy where SMEs are vital economic contributors, this study provides empirically backed insights into the tailored effectiveness of these support mechanisms, addressing a significant gap in international business literature concerning the nuanced interplay between state support, different types of innovation, and SME internationalization dynamics.

This dissertation develops an integrated framework that bridges macro-level perspectives from National Business and Innovation Systems with micro-level dynamics of the Knowledge-Based View and the Uppsala model of internationalization. It particularly examines meso-level coordination within innovation ecosystems and demonstrates how institutional support can enhance SME knowledge development and facilitate international scaling. Adopting a multi-paper approach, the research combines a systematic literature review with rigorous empirical analyses. These analyses utilize unique and comprehensive panel datasets from the Irish Central Statistics Office, covering the period 2006-2019, which provide detailed firm-level information on innovation activities, international performance, and

engagement with state support. Propensity Score Matching is employed in the empirical chapters to mitigate selection bias and isolate the causal impact of government subsidies and innovation collaboration. The longitudinal nature of the data allows for an examination of dynamic and evolving relationships over time. A multi-dimensional international performance measure is developed, encompassing export decisions, market diversification, product diversification, and export value. This approach captures key facets of international scaling—from initial market entry and expansion across diverse markets and products to overall export growth—aligning with contemporary international business literature on how firms achieve persistent cross-border expansion.

The analysis also explicitly differentiates between radical and incremental innovation, revealing distinct impacts for different support types. General government subsidies, even without explicit R&D mandates, positively influence SME R&D investment, which in turn promotes export decisions. However, the impact of this policy-induced R&D on subsequent export market diversification is less pronounced than the effect of privately funded R&D. In contrast, collaboration with public knowledge sources significantly enhances both incremental and radical innovation within SMEs. Incremental innovation is found to drive export decisions primarily when SMEs engage in this institutional collaboration, whereas radical innovation independently fuels export activity. Notably, institutional collaboration demonstrates a stronger positive impact on export market diversification than a firm's independent innovation efforts, for both incremental and radical innovation outputs. These results underscore the importance of tailored support mechanisms, aligning with the specific innovation types being fostered and the internationalization objectives of SMEs.

The overarching theoretical contribution of this dissertation is a significantly more nuanced, integrated, and empirically grounded understanding of the role of state agencies and public knowledge sources in facilitating SME internationalization through innovation. This is achieved by: (1) refining the conceptualization of state agencies as distinct institutional and organizational actors; (2) integrating micro and macro perspectives to bridge firm-level strategies with national-level systems; (3) highlighting the contingent nature of institutional support, where effectiveness depends on the type of support, the type of innovation pursued and the stage of internationalization; and (4) refining existing internationalization models by incorporating the impact of institutional support and post-entry expansion dynamics, aligning with contemporary perspectives on international scaling.

Chapter 1

Introduction

1.1 Motivation of Study

This dissertation investigates the State-SME nexus, an increasingly critical interface for fostering innovation and enabling international scaling, particularly for Small and Medium-sized Enterprises (SMEs). While internationalization refers to the general process of increasing involvement in international operations, this dissertation focuses on international scaling—a more ambitious trajectory characterized by significant and often rapid expansion in terms of market reach, product scope, and export value (Bohan et al., 2024; Reuber et al., 2021). To empirically investigate this phenomenon, II operationalize international scaling by measuring these core components: export market diversification (market reach), export product diversification (product scope), and export value. This multi-dimensional approach allows me to dissect the pathways through which state support translates into substantial global growth, moving beyond simple measures of export entry.

SMEs stand as vital engines of global innovation, economic growth, and national competitiveness, particularly within the context of dynamic, open economies (Al-Tabbaa & Zahoor, 2024; Bretas et al., 2025). Their agility and entrepreneurial spirit often position them at the forefront of technological advancements and market adaptations (Monaghan et al., 2020). However, the journey of an SME is frequently characterized by a fundamental tension: the imperative to innovate continuously to maintain a competitive edge, and the simultaneous, often daunting, prospect of venturing into international markets to secure growth and scale (Chiappini et al., 2022; Ferreira de Araújo Lima et al., 2020; Tippmann et al., 2023). This inherent tension,

where SMEs are recognized as drivers of economic prosperity yet are significantly constrained by barriers to international expansion such as limited resources, acute risk aversion, and a deficiency in deep knowledge of foreign markets, underscores the critical importance of institutional support (Dvouletý et al., 2021; Kahiya, 2024; Tippmann et al., 2023). Without such support, the vast potential of many SMEs to contribute more fully to both domestic and global economies may remain unrealized (Donnelly et al., 2024; Gimenez-Fernandez et al., 2020; Stojčić et al., 2024).

While the academic and policy discourse widely acknowledges the necessity of institutional support for SME development, a comprehensive and nuanced understanding of its multifaceted impact remains elusive (Cardoza et al., 2016; Chiappini et al., 2022; Dvouletý et al., 2021). Specifically, there is a lack of clarity regarding how different types of support mechanisms—ranging from overarching state agency interventions to direct financial subsidies and knowledge-based collaborations—interact with SME strategies (Child et al., 2022; Kahiya, 2024). Furthermore, the specific pathways through which these supports influence SME innovation, such as their effect on R&D investment levels or their role in fostering distinct types of innovation like incremental versus radical advancements, require deeper investigation (Freel et al., 2019; Kantaruk Pierre et al., 2024; Saridakis et al., 2019). Compounding this, the impact of such support on the various dimensions of SME international performance is often narrowly conceived, frequently focusing on the export decision and value while overlooking the more complex post-entry dynamics of export expansion, including market and product diversification (Freel et al., 2019; Freixanet & Rialp, 2022; Juergensen et al., 2022; Lopez et al., 2022).

To visually represent the core relationships and gaps explored in this dissertation, Figure 1-1 presents a conceptual framework. In this dissertation, the State-SME nexus

is conceptualized as the dynamic interface between SMEs and the institutional support system established by the State. The State-SME nexus is empirically explored through the distinct roles and impacts of state agencies, direct government financial support (subsidies), and collaborations with public knowledge sources (PKS) on SME innovation and international scaling (Borrás & Edquist, 2019; Gupta et al., 2020; Lundvall, 1992; Lundvall, 1999). By unpacking the roles, mechanisms, and effectiveness of these actors, this research provides a nuanced analysis of how the State, through its institutional support system, empowers or constrains SME innovation and international scaling.

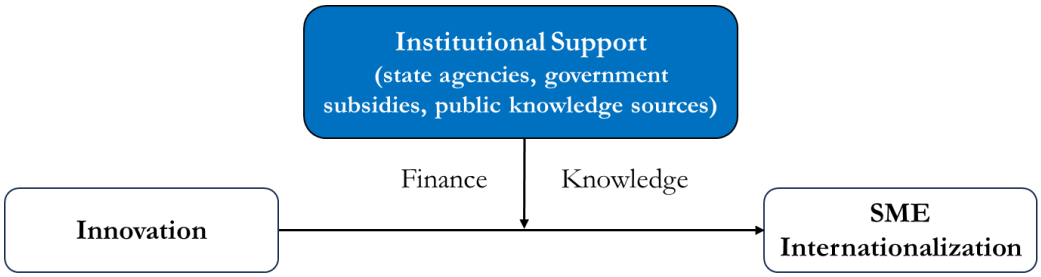


Figure 1-1 Conceptual framework

1.2 Research Question and Objectives

The literature review undertaken in Chapter 2 and 3 further identifies critical gaps in the existing literature. Firstly, it reveals that while different support formats (e.g., financial funding versus collaborations) are acknowledged, their potentially distinct outcomes for SMEs are not sufficiently differentiated or evaluated (Freixanet, 2022). Secondly, the review highlights a persistent focus on export decisions, with a comparative neglect of post-entry international performance, such as expansion in market and product (Juergensen et al., 2022). The gaps which have been identified directly inform the core research questions of this dissertation. Given the identified

complexities and the need to understand the differentiated impacts of support, this dissertation examines the vital and nuanced role of the institutional support system—ranging from state agencies, government, universities to public research institutes—in enabling SMEs to navigate the dual challenges of innovation and internationalization more effectively. Specifically, II ask three questions that probe these differential effects:

1. What is the impact of state agencies on SME internationalization, and through what mechanisms does this impact occur?
2. How do government financial subsidies impact SME innovation and international scaling outcomes (including market and product diversification)?
3. How does innovation collaboration with public knowledge sources (universities, government bodies, and research institutes) impact SMEs' innovation (e.g., incremental versus radical) and international scaling outcomes?

Collectively, this dissertation responds to the need for research that moves beyond simplistic input-output analyses of support, to uncover the contingent and dynamic processes through which institutional support shapes SME innovation and internationalization. The overarching objectives are therefore:

1. To investigate the impact mechanisms of state agency support on SME internationalization.
2. To empirically determine how, and to what extent, government financial subsidies influence SME R&D investment and, crucially, how this translates into distinct international scaling outcomes (i.e., market and product diversification, and export value).

3. To analyse how innovation collaboration with public knowledge sources distinctly influences SMEs' pursuit of incremental versus radical innovation, and how these differentiated innovation outputs subsequently shape varied international scaling outcomes.

This dissertation seeks to address these interconnected gaps by providing a more holistic, multi-level, and mechanism-based understanding of the differential impacts of institutional support on SME innovation and internationalization. Figure 1-2 provides a more detailed schematic of the specific relationships investigated in the empirical chapters of this dissertation, highlighting the pathways from support mechanisms through innovation types to internationalization outcomes.

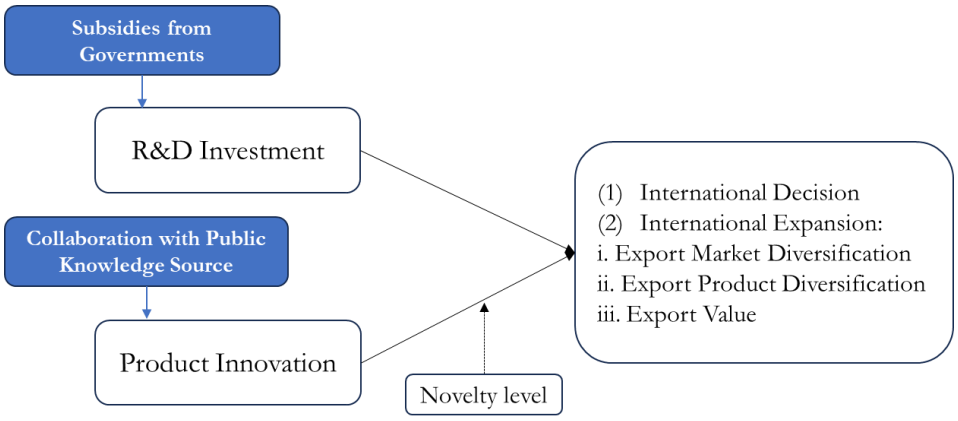


Figure 1-2 Research framework for empirical studies

The dissertation is grounded in, and seeks to extend, several theoretical perspectives. The National Innovation Systems and National Business Systems frameworks provide the macro-institutional lens, highlighting how the structure and quality of public support shape SME access to knowledge, resources, and markets (Hotho, 2014; Lundvall, 1992, 1999, 2010; Meelen et al., 2017; Rana & Morgan, 2019; Whitley, 1998). The Knowledge-Based View (Grant, 1996) and the Uppsala internationalization model (Vahlne & Johanson, 2017) informs the micro-level

analysis in this dissertation. These frameworks explain how firm-specific knowledge generation (often via R&D and collaborations, as highlighted by Zahra et al., 2000; Freixanet et al., 2020) and dynamic learning processes underpin the path to, and nature of, international expansion. and learning processes underpin international expansion (Eerme & Nummela, 2019). Across the studies, an agency-centric perspective is developed, emphasizing the organizational autonomy, capabilities, and relational embeddedness of state agencies and public knowledge institutions as key mediators between policy and firm outcomes, addressing meso-level coordination challenges within the innovation ecosystem.

1.3 Methodology and Data

1.3.1 Primary Methodological Approach: Systematic Literature Review and Propensity Score Matching

To ground the empirical investigation and precisely identify existing knowledge gaps, the methodological approach of this dissertation commences with a systematic literature review. This review, detailed in full in Chapter 2, adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure a transparent and replicable process (Mayo-Wilson et al., 2018; Stornelli et al., 2021). A comprehensive search of the Scopus and Web of Science databases (Harzing & Alakangas, 2016), followed by a multi-stage screening of over 4,000 articles against pre-defined criteria like journal quality, culminated in a final sample of 60 core academic papers (Castro et al., 2020; Debellis et al., 2021; Paul et al., 2017). This rigorous analysis served a crucial dual purpose. First, it informed the development of a novel typology of state agencies. Second, it systematically mapped the field to identify critical gaps in understanding, particularly the lack of comparative analysis

between different support mechanisms (e.g., financial subsidies versus knowledge collaboration) and an overemphasis on the initial export decision at the expense of post-entry expansion dynamics. The subsequent empirical chapters are therefore specifically designed to address these identified gaps using robust quantitative methods.

To rigorously assess the impact of external support on SME innovation and internationalization, II employ Propensity Score Matching (PSM). This quasi-experimental technique, well-developed and validated in the economics literature (Beck et al., 2016; Hottenrott & Lopes-Bento, 2014; Lenihan et al., 2024), allows me to construct a statistically comparable control group by matching firms that received institutional support (e.g., government subsidies in Chapter 4, or collaboration with public knowledge sources in Chapter 5) with similar firms that did not, based on a range of pre-treatment observable characteristics. By mitigating selection bias, PSM enables me to more accurately isolate the treatment effect of the support (Becker, 2015; Lenihan et al., 2024; Mulligan et al., 2022). Critically, this allows me to distinguish between innovation that is policy-induced (i.e., additional R&D investment attributable to subsidies or collaborative innovation outputs attributable to PKS) and private or independent innovation (i.e., what firms would have achieved on their own). This distinction is central to understanding the true value-added of institutional support and is a core element of our analytical approach in both studies, facilitating a clearer understanding of how institutional support translates into specific innovation efforts and subsequent international performance. This approach, combined with detailed operationalization of multi-dimensional international performance used in this study (export decision, market and product diversification, export value) captures key facets of the internationalization process and indicators of international scaling.

This facilitates a clearer comparison of SMEs internationalization stemming from policy-induced versus private innovation.

1.3.2 Ireland offers a particularly suitable context to answer this question

Ireland offers a particularly suitable context for investigating our research questions. As a small, open, and highly globalized economy, there is a strong imperative for indigenous SMEs to innovate and export for growth and survival (Woerter & Roper, 2010). With SMEs accounting for 99.8% of all enterprises and 67.9% of total persons employed (Central Statistics Office, 2022), the Irish government actively promotes SME innovation and internationalization through various support mechanisms, including general subsidies (the focus of Chapter 4) and fostering collaborations with public knowledge sources like universities and research institutes (central to Chapter 5) (Roper & Arvanitis, 2012; Roper et al., 2008; Roper et al., 2016). This creates a rich environment with a significant number of SMEs engaging with these support systems, providing sufficient variation for empirical analysis. Furthermore, the well-developed National Innovation System (Courant, 2021; Larrue, 2021; Roper et al., 2013), coupled with a policy emphasis on export-led growth and the availability of high-quality, firm-level data, makes Ireland an excellent natural laboratory. This specific policy landscape and economic structure allow for a focused examination of how different support mechanisms influence distinct innovation pathways (R&D investment, incremental product innovation, and radical product innovation) and their subsequent translation into various international performance outcomes.

1.3.3 Comprehensive CSO Datasets for Rigorous Analysis

Complementing the suitable Irish context, our ability to rigorously address the research questions is significantly enhanced by access to unique, detailed firm-level

microdata from the Irish Central Statistics Office (CSO). II have constructed comprehensive panel datasets by merging multiple administrative and survey sources, including Trade RMF (2006-2019), which provides records of international performance metrics, including export decisions, the number of export markets and products, and export value; the Innovation in Irish Enterprises survey (2008-2018) which provides precise measures of firms' collaboration with public knowledge sources and different innovation outcomes; the Census of Industrial Production (2006-2016) records firm characteristics (e.g., industry, region, R&D investment and received subsidies); and Business Register (2006-2016) which allows me to calculate every firm's age. These longitudinal datasets allow me to track firms over time, control for unobserved heterogeneity, and establish temporal precedence between support, innovation, and internationalization outcomes, strengthening causal inference. This rich, multi-source data is instrumental in applying our chosen methodologies (including PSM and subsequent panel data models like Heckman selection models) to disentangle the complex relationships under investigation with a high degree of empirical rigor (Carlson & Zhao, 2025; Vendrell-Herrero et al., 2022).

1.4 Contributions

This dissertation aims to make three main contributions to theory and policy. Theoretically, it seeks to advance our understanding in several domains. Firstly, by reconceptualizing state agencies as autonomous organizational actors and proposing a new typology in Chapter 2, it contributes to institutional theory and international business literature, offering a more nuanced lens through which to view these pivotal entities. Secondly, this dissertation advances the Knowledge-based view and the Uppsala internationalization model through the empirical insights of Chapters 4 and 5. It moves beyond general assertions by demonstrating precisely how specific

interventions within the State-SME nexus—namely policy-induced R&D and collaborations with public knowledge sources leading to incremental or radical innovation—act as distinct mechanisms. Our findings show that these mechanisms differentially influence not only SMEs' entry into international markets but also the crucial post-entry phases of market and product diversification, and value creation. This adds significant granularity to the KBV by detailing how externally influenced knowledge assets are developed and refines the Uppsala model by showing how institutional support can accelerate or redirect the learning and commitment processes inherent in international scaling. Thirdly, it underscores the contingent nature of institutional support, demonstrating empirically that its effectiveness is dependent on the specific type of support provided, the nature of innovation being fostered, and the particular dimension of internationalization being targeted. Thereby, it contributes to the National Innovation Systems and National Business Systems literature by illustrating how firm-level heterogeneity, particularly in innovation strategy, influences the way SMEs access and benefit from collaborations with public knowledge sources, thus bridging macro-institutional frameworks with micro-level behavioural evidence. Overall, this dissertation endeavours to provide a multi-level and multi-mechanism understanding of the State-SME nexus, examining the roles of various institutional support and the diverse impacts of their support on SMEs.

From a practical and policy perspective, the research offers actionable insights. It informs policymakers on the design of more effective and targeted support programs for SMEs, highlighting that the nature of support should ideally be aligned with the type of innovation being fostered and the specific internationalization objectives. The findings suggest a need to look beyond mere R&D input additionality or the number of collaborations, towards evaluating the actual international market outcomes

achieved by supported SMEs. For SME managers, the dissertation provides insights into how to strategically leverage different forms of institutional support to bolster their innovation capacity and navigate the complexities of international expansion.

1.5 Structure of Thesis

This dissertation is structured into six chapters, integrating three core research papers. Chapter 1 has provided the overall introduction, outlining the motivation of study, research questions, methodology, contribution, and structural roadmap. Chapter 2, the first paper, titled "State Agencies and SME Internationalization: A Review and Research Agenda," lays the conceptual groundwork regarding the role of state agencies. Chapter 3 provides a focused literature review on SME innovation and internationalization, examining empirical methods and evidence related to the specific support mechanisms (financial subsidies and public knowledge sources collaboration) investigated in the subsequent empirical chapters. This chapter serves to bridge the broader discussion of state agencies from Chapter 2 to the detailed empirical analyses in Chapters 4 and 5. Then, the dissertation moves to its empirical investigations. Chapter 4, the second paper, "The Innovation-Institution Paradox: How Government Subsidies Shape SME International Expansion via R&D," empirically investigates the impact of subsidies on R&D and detailed international performance outcomes. Chapter 5, the third paper, titled "Public Knowledge Sources as Catalysts: How Incremental and Radical Innovation Unlock Pathways to SME Internationalization," continues to examine how collaboration with PKS influences different innovation types and their subsequent internationalization effects. Finally, Chapter 6 provides the overall conclusion to the dissertation, synthesizing the key findings, discussing the integrated theoretical contributions, acknowledging the limitations of the research, and

proposing avenues for future scholarly inquiry. The structure of the dissertation displayed in the figure 1-3.

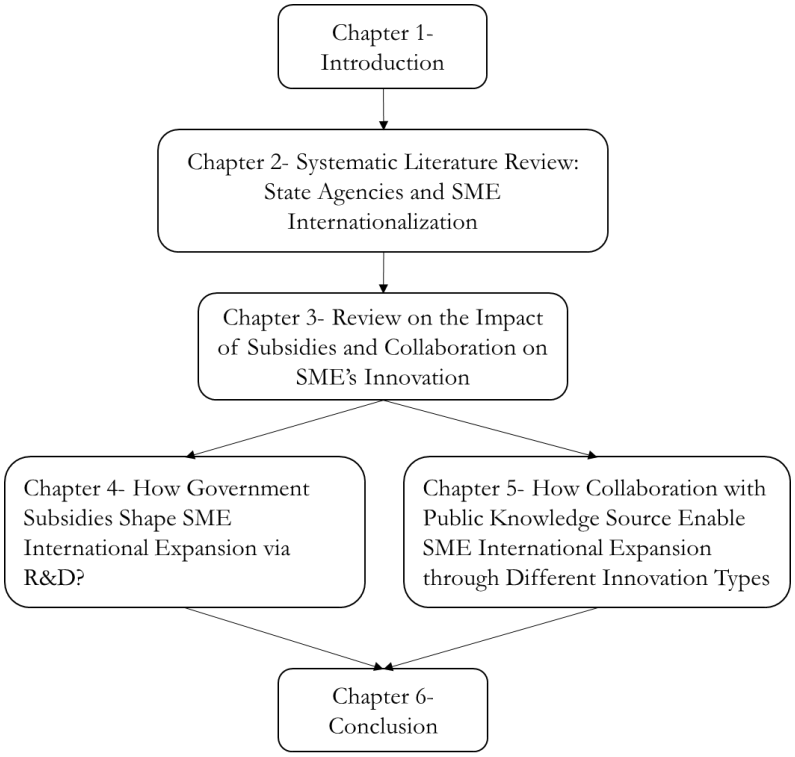


Figure 1-3 Thesis roadmap

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Chapter 2

State Agencies and SME Internationalization: A Review and Research Agenda

Following the broad introduction to the State-SME nexus in Chapter 1, this chapter focuses on a foundational element: the State actors themselves, specifically state agencies. Before examining the impact of specific institutional support mechanisms, it is crucial to understand the nature, diversity, and organizational characteristics of the agencies that often design, deliver, or influence these supports. As such, this chapter systematically reviews the literature on state agencies and their role in SME internationalization to build a nuanced understanding of these pivotal organizations.

2.1 Introduction

The critical role of Small and medium-sized enterprises (SMEs) in driving innovation and economic growth is well-established (Saunila, 2020; Chapter 1). However, their path to international markets is often hindered by significant hurdles such as limited resources, risk aversion, and a lack of in-depth knowledge of foreign markets (Ferreira de Araújo Lima et al., 2020). This inherent paradox – SMEs as drivers of growth yet constrained by international barriers – highlights the crucial role of external support (Srhoj et al., 2023; Kahiya, 2024). State agencies, therefore, become pivotal in supporting SMEs' internationalization efforts. Governments worldwide have established specialized agencies to boost SME exports and growth (Lederman et al., 2010; Juergensen et al., 2020). Examples abound—from Enterprise Ireland, which

bridges government, industry, and academia to support Irish SMEs[1], to the Canada Innovation Corporation, which offers financial assistance, advisory services, and networks to help innovative SMEs scale internationally[2]. Similar roles are played by the Netherlands Enterprise Agency and Scottish Enterprise. These agencies act as crucial intermediaries, providing a range of supports, from financial assistance and advisory services to facilitating access to global networks, and even helping firms weather economic downturns (Atkin et al., 2017; Choi et al., 2023; Van Biesebroeck et al., 2016).

International trade and economic literature mainly focus on the policies perspective, analysing the impact of export boosting policies on national-level export performance **(**Srhoj et al., 2023). This landscape is often dominated by a few large firms, termed "export superstars" (Freund & Pierola, 2015, 2018). Concurrently, SMEs represent a vital and diverse segment of firms, facing unique challenges and possessing significant potential for international growth (Kahiya, 2017). This juxtaposition underscores a critical, yet under-explored, research question: *How do state agencies facilitate internationalization, specifically in the context of SMEs?* To address this, our paper synthesizes fragmented insights from the international trade, economics, and international business literature to systematically evaluate how state agencies implement export-boosting policies, and the value of these policies as tools that state agencies can use to promote exports in smaller firms (Cruz et al. 2018; Volpe Martincus & Carballo, 2010).

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[1] Enterprise Ireland is the government organization responsible for the development and growth of Irish enterprises (mainly SMEs) in world markets (enterprise-ireland.com).

[2] Canada Innovation Corporation implements the National Research Council of Canada Industrial Research Assistance Program, which is Canada's leading innovation assistance program for small and medium-size businesses.

Literature in IB predominantly focuses on the broader institutional context, particularly institutional voids. For example, Child et al. (2022) review the role of context in SME internationalization, acknowledging government and institutions as contextual elements. Dekel-Dachs et al. (2021), in a similar vein, reveal how informal institutions and networks can mitigate the institutional void created by formal institutions, thereby facilitating SME internationalization in developing countries. Furthermore, existing systematic reviews exploring how institutions affect organizations and organizational responses to complex institutions (Greenwood et al., 2011; Marquis & Raynard, 2015) have also largely neglected the specific complex institution of the state and its agencies, which are crucial organizational entities within the institutional context (Leibel et al., 2018).

The ambiguous definition of "state agency", varying across political systems and national contexts, makes it difficult to compare and generalize their effectiveness (Mahoney & Thelen, 2009; Vince et al., 2024). This lack of clarity hinders our ability to understand best practices and optimize the support provided to SMEs, impeding the comparative assessment of these agencies' actions, structures, and strategies (Pollitt & Talbot, 2004; Kuhlmann & Wollmann, 2014). According to Srhoj et al. (2024), addressing this gap in understanding is crucial for developing effective policies and interventions aimed at leveraging state agencies to better support SME internationalization and national export efforts.

This review, therefore, systematically examines the role of state agencies in SME internationalization, addressing key gaps in the fragmented and conceptually inconsistent literature. Specifically, it will explore: 1) the distinct roles state agencies play in different stages of internationalization (Tinits et al., 2022; Kahiya., 2023) 2) the measurable impact of their interventions on SME export performance and market

entry (Srhoj et al., 2023; Atkin et al., 2017); 3) the institutional structures and strategies that enhance (or hinder) their effectiveness (Chen et al., 2018; Dekel-Dachs et al., 2021); and 4) how to achieve greater conceptual clarity in defining and understanding state agencies within the international business context (Cooper et al, 2022; Meyer & Bromley, 2013). In this endeavour, II challenge the prevailing understanding of state agencies, contending that state agencies should be envisaged as entities with organizational autonomy rather than mere departments, bureaucratic structures, or extensions of governmental will.

Anchoring our investigation in SME internationalization, this review makes three theoretical contributions that advance the understanding of state agencies within the international business context, building upon and extending agency theory. First, II theoretically redefine the construct of "state agency," disentangling it from the broader institutional environment. Unlike traditional approaches (Adomako et al., 2020; Child et al., 2022; Liu et al., 2021) that often conflate state agencies with government entities, formal institutions, or informal norms, II argue for a clear distinction between these groups. State agencies are not merely extensions of government bureaucracy but possess organizational autonomy in operations and decision-making (Eriksson & Andersson, 2023; Verhoest et al., 2010). Building on this, II propose a typology of state agencies—agency void, co-option, and co-specialization. This reconceptualization significantly extends previous IB applications of agency theory, which have predominantly focused on the principal-agent relationship between MNE headquarters and subsidiaries (Cavanagh et al., 2017). By shifting the focus to the triadic relationship among government, state agencies, and the firm, II thereby highlight the organizational autonomy inherent in state agency's role.

Second, II provide a structured synthesis of the currently fragmented literature on state agency involvement in SME internationalization. The existing body of research is often characterized by inconsistent terminology of state agencies, varied conceptual frameworks (Verhoest et al., 2010; Cooper et al., 2022), and a lack of cohesive understanding of the role of state agencies in SME internationalization (Kahiya, 2023; Srhoj et al., 2023). II address this by analysing the literature across three distinct, yet interconnected, dimensions: the national level, the organizational level, and the program level. This multi-dimensional framework not only clarifies the current state of knowledge on state agencies in SME internationalization but also allows me to identify critical gaps and unresolved debates (Yin, R.K., 2018). A key gap II highlight is that existing research overlooks how state agencies impact SMEs differently across various internationalization stages (Tinits et al., 2022; Kahiya, 2023; Faroque et al., 2021). Current studies focus too narrowly on initial export decisions and export revenue, neglecting the evolving challenges faced by both SMEs and state agencies as firms progress through more complex stages of international growth, such as market and product diversification (Srhoj et al., 2023; Child et al., 2022).

Third, built on our analysis of state agencies, II advance a research agenda that enhances institutional theory, in international business, by integrating an agency-centric perspective. This agenda fundamentally challenges the traditional, top-down approach that primarily examines how government control influences agency performance. Instead, II advocate for a bottom-up, agency-centric view that recognizes the agency, its dynamism, and potential for change within institutions themselves (Lederman et al., 2010, Pedersen et al., 2023). This contrasts sharply with the prevailing static view of institutions, often characterized by path dependency and structural determinism (Leibel et al., 2018). In conjunction with the significant, yet

varied, impact of export promotion agencies on firm performance (Srhoj et al., 2023; Broocks & Van Biesebroeck, 2017; Munch & Schaur, 2018; Wagner, 2007), II call for future research to further investigate state agencies by examining and applying our typology to enhance their effectiveness and efficiency in supporting SME internationalization.

The rest of the paper is structured as follows. First, I introduce the methodology and framework for the review, which led to the identification of 60 academic articles. After bibliographic analysis of reviewed studies, I assess the current state of knowledge on the definition of state agencies, differentiating them from other concepts (e.g., government, formal, and informal institutions) with which they have sometimes been connected. This allows me to capture the unique attributes of state agencies and position them within institutional theory. Fourth, following an inductive structure along two themes that emerged from the extant literature, I highlight the mechanisms and outcomes of state agencies' influence on SME internationalization across various institutional contexts and levels of analysis (e.g., national, organizational, and program levels). Finally, I provide suggestions for developing a comprehensive understanding of this construct in future research. Specifically, two main opportunities are explained: (i) I explore the potential for understanding state agencies through organizational autonomy and agency theory lens, and (ii) I consider state agencies as autonomous Meso-level institutions in the national institutional environment that has been criticized for failing to account for agency and change (Leibel et al., 2018). I add an organizational-level analysis to the institutional theory lens, providing a new level of analysis that bridges institutions and organizations and presents a novel institutional mechanism of influence within the internationalization process of SMEs

2.2 Context of Study

Since the 1980s, “agencification”—the global trend of transferring government functions to specialized, semi-autonomous organizations—has become a cornerstone of public sector reform (Verhoest et al., 2010). These agencies, now operating across diverse sectors and often with substantial resources, represent a shift towards a more facilitative and catalytic role for government in policy implementation and public service delivery (Hammerschmid et al., 2012; Pollitt & Talbot, 2005; Verhoest et al., 2010; Kuhlmann & Wollmann, 2014, 2025). Some agencification initiatives even explicitly promote professional management, rapid adaptation, and international engagement (Pollitt et al., 2005; Pederson et al., 2023). Despite their increasing importance, a comprehensive and internationally comparative understanding of these state agencies remains elusive. Academic research has traditionally focused on core government ministries and their activities, often overlooking the numerous and increasingly influential agencies operating at the periphery of the state apparatus (Egeberg & Trondal, 2009, Eriksson & Andersson, 2023).

While definitional debates continue, a core conceptualization of state agencies is emerging. They are organizations that are (i) structurally disaggregated from traditional government departments and (ii) operate under more business-like conditions than typical government bureaucracies (Cooper et al., 2022). Examples include Enterprise Ireland, Business Finland, Business France, PROCOMER. Building upon this conceptualization, I leverage agency theory to interpret and categorize state agencies and their role within IB, specifically in the context of SME internationalization.

State agencies can be explained through the lens of agency theory, which permits me to synergize the two primary meanings of the word agency. In most instances, the leadership of a state agency (*agent*) is delegated decision-making authority by the government (*principal*)—acting on behalf of the state—to perform a service. The agency's senior management teams are ultimately accountable for their actions, including how they leverage autonomy within the limits defined by the state (Cavanagh et al., 2017). A further important point in the *agency of agencies* is that effective agents are not mere puppets of the principal but often engage in opportunistic, even self-maximizing behaviours that may run contrary to the interests of the principal (Cavanagh et al., 2017). Therefore, agencies are neither fully subject to nor completely autonomous from the state. The interplay is frequently more akin to oscillations between lower and higher autonomy (Dattée et al., 2022).

2.3 Method and Review Framework

Focusing on state agencies and SME internationalization, I followed the multistage process outlined by Stornelli et al. (2021) to conduct our systematic review. First, I identified the Scopus and Web of Science databases as our data sources (Harzing & Alakangas, 2016). The second stage was to define the inclusion criteria. I selected the literature for inclusion by conducting searches within these databases using three-level queries. I divided the search terms into three search strings, following the databases' protocols on the Boolean operators "AND" and "OR" and appropriate truncations (*) to identify all relevant studies that use the different search terms, including U.S. and U.K. spelling. The specific search terms used to capture the key elements of our research questions were *internationalization* (e.g., export OR international*), *The role of institutions* (e.g., promotion OR incentive OR grant OR financing OR loan OR subsid* OR information OR regulat* OR polic* OR "state agency" OR "government

agency" OR institution OR government), and *Firms* (e.g., sme* OR "small firm" OR "small enterprise" OR "medium firm" OR "medium enterprise"). This initial search returned 2,892 potential articles in Scopus and 1,213 on the Web of Science. Then, to identify a sample of significantly high-quality contributions, I followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework displayed in Figure 2-1 (Mayo-Wilson et al., 2018; Stornelli et al., 2021)

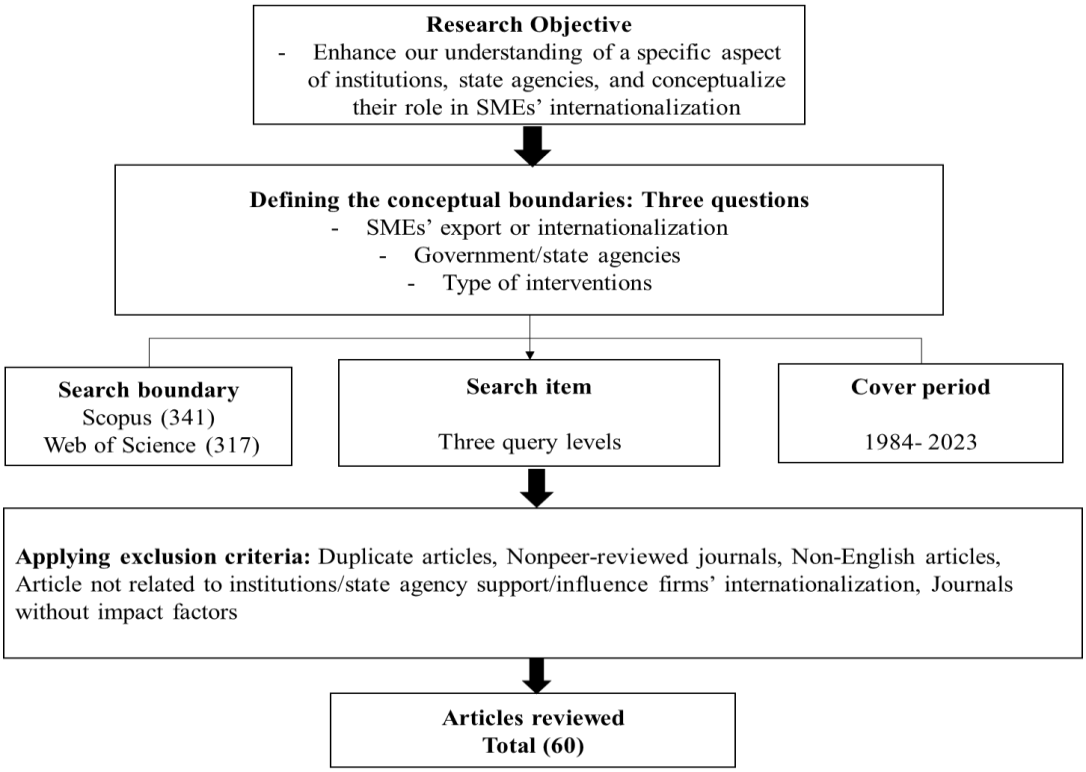


Figure 2-1 PRISMA framework

I applied the inclusion and exclusion criteria in the identification stage. First, I did not restrict the year of publication to include early seminal studies. Second, the search retained articles from journals ranked three or above in the Association of Business Schools Academic Journal Guide 2021 (Castro et al., 2020; Debellis et al., 2021; Paul et al., 2017). This approach of identifying eligible studies through a journal quality index has been adopted by recent literature reviews analysing various manufacturing and management fields (e.g., Juliani & de Oliveira, 2020). Journals within the subject

areas of Business, Management and Accounting, Economics, Econometrics, Finance, Social Sciences, and Decision Science were included. These areas were considered the most relevant to the subject of the review (Child et al., 2022; Liu et al., 2021). Third, I excluded non-English research articles. Fourth, I included both empirical and nonempirical research articles. I recognize that these inclusion and exclusion criteria may have resulted in a small number of potentially seminal texts and relevant papers being excluded. Still, through this process, I believe that I identified a high-quality and credible sample. Once these criteria were applied, our sample consisted of 341 studies in Scopus and 317 studies in Web of Science.

In general, fit-for-purpose criteria are used to validate whether studies meet the intended purpose of the review search (Zahoor et al., 2020). As this study's objective was to identify, categorize, and synthesize literature on the mechanisms through which state agencies in home countries impact SMEs' internationalization, the articles had to include evidence relevant to both of the following criteria: (i) institutions in home countries and (ii) SMEs' export or internationalization. These two criteria require the abstract of an article to mention both firms' internationalization and the impact of institutions on firms' internationalization. Having manually reviewed the title and abstract of each article to determine whether to include it in the review, the number of eligible papers was reduced to 133.

Papers that passed this initial screening were then subjected to the next step: a full-text reading (Bhimani et al., 2019; Hiebl, 2021). During the selection and full-text reading, the articles had to satisfy all the inclusion criteria: (i) internationalization/export performance and/or capability growth of SMEs, (ii) analysis of home countries' institutional background/embeddedness and/or policy impact on SMEs' internationalization and/or exports, and (iii) specific home country institutions (e.g.,

government support and policy or state agencies) that impact SMEs' internationalization and/or exports. The exclusion criteria were the following: (i) the article simply applies institutional distance to test SMEs' internationalization in terms of entry model, especially time and speed; or (ii) it describes the general institutional background but does not focus on analysing the impact of government support, policy or state agencies; or (iii) it focuses on analysing barriers to and/or incentives for SMEs' internationalization.

To this end, this multi-stage process generated a moderate total of 60 papers published in 17 ABS 3 or 4 ranking journals (see Table 2-1). The selected articles were published in journals including the following: *International Business Review, International Marketing Review, Journal of Business Research, Management International Review, Journal of International Management, Small Business Economics, Industrial Marketing Management, International Small Business Journal, Journal of Small Business Management, Journal of World Business, Journal of International Business Studies, Journal of International Marketing, Journal of Technology Transfer, Management and Organization Review, Technological Forecasting and Social change, Technovation, Long Range Planning.* In this regard, Paul and Rialp-Criado (2020) advise including at least 10–20 significant journals in a review paper. In the full-text reading round, I perform a content analysis to understand what is known and unknown about how home-based institutions, specifically state agencies, impact SMEs' internationalization (Gaur & Kumar, 2018).

I acknowledge a potential limitation of our methodology stemming from the initial keyword search and screening process. While I employed a comprehensive set of search terms and consulted leading databases (Scopus and Web of Science), it is possible that relevant studies, particularly those published in specialized journals outside of mainstream international business and management, or those utilizing

alternative terminology, may have been inadvertently omitted. While I attempted to mitigate this risk through our multi-stage process and careful consideration of inclusion/exclusion criteria, I recognize that some relevant research may not have been included in our final sample. This potential for exclusion represents a limitation of our methodology.

Table 2-1 Journal selection

Journal	AJG 2018	Number
International Business Review	3	17
International Marketing Review	3	11
Journal of Business Research	3	8
Management International Review	3	4
Small Business Economics	3	3
Journal of International Management	3	2
Industrial Marketing Management	3	2
International Small Business Journal	3	2
Journal of Small Business Management	3	2
Journal of World Business	4	2
Journal of International Business Studies	4*	1
Journal of International Marketing	3	1
Journal of Technology Transfer	3	1
Management and Organization Review	3	1
Technological Forecasting and Social change	3	1
Technovation	3	1
Long Range Planning	3	1
Total	60	

2.4 Description of Studies Reviewed

2.4.1 Statistical Methods

The samples I reviewed covered qualitative, quantitative, and mixed research methodologies, thereby ensuring a more comprehensive analysis. Quantitative methodologies were predominant in this research landscape, with 37 out of 60 studies employing these techniques, as detailed in Table 2-2. Among these quantitative studies, approximately 70% utilized regression analysis, specifically logistic regression (incorporating probit and logit techniques) and linear regression (including partial and ordinary least squares methods). Furthermore, structural equation modelling and multivariate statistical methods, notably confirmatory factor analysis and principal component analysis, were employed in 11 studies.

Other methods, such as fuzzy-set qualitative comparative analysis, were less common and constituted a small fraction of the methodologies employed. In contrast, qualitative research methodologies, notably case studies and interviews, were adopted in 21 studies. This underscores the value of qualitative approaches in offering in-depth insights into the context and subtleties surrounding the research subjects. Additionally, a mixed-methods strategy, integrating interviews with quantitative analysis technique, was implemented in 3 studies.

Table 2-2 Research methodology and analysis method

Methodology	Analysis methods	Number
Quantitative Research		37
Regression analysis	Logistic regression and linear regression (OLS, PLS)	25

Structural model	Structural equation modelling (SEM)	6
Multivariate statistical	Confirmation factor analysis (CFA) and principal component analysis (PCA)	5
Others	Qualitative comparative analysis (fsQCA)	1
Qualitative Research includes Case studies and interviews		20
Mixed method	Combine interview and quantitative analysis (CFA, OLS, and QCA)	3
Total		60

2.4.2 Multi-dimensional Framework on State Agencies

The definition of state agencies varies considerably across national cultures and political systems (Pollitt & Talbot, 2004; Mahoney & Thelen, 2009; Eriksson & Andersson, 2023), causing ambiguous terminology and inconsistent classification of state agencies. Thus, research on SME internationalization always encompasses formal and informal institutions, government, and state agencies into one concept—institutions (Child et al., 2022). In the book—Autonomy and Control of State Agencies, Verhoest et al. (2010) compare the autonomy, control, and internal management of agencies across states and agencies by two perspectives. First, in most situations, agencies are created and chosen to pursue specific goals, which refers to the instrumental perspective. Second, agencies are created by the principal as acceptable organizations in the institutional environment, which refers to the institutional perspective.

Following these two perspectives, I grouped the review articles into three dimensions (in Table 2-2): (i) with the instrumental perspective, traditionally the most conventional approach, whereby industrial policy, and state-funded export programs

are directly implemented by the state or its established agencies. I integrate state-sponsored initiatives, including export promotion, trade fairs, and policy-driven clusters, within the program dimension. This integration is supported by 25 studies that fall into this category, exemplified by the work of Catanzaro and Teyssier (2021) and Faroque et al. (2021); (ii) following the institutional perspective, research has increasingly recognized the significance and influence of the environment on firms' behaviours. For instance, the national institutional environment and the quality of institutions substantially influence SMEs' export decisions and performance. The direction of exports—from developing markets to developed countries, or vice versa—is determined by institutional differences between home and host countries, affecting the export performance of SMEs. Hence, in this grouping I encompass the national institutional environment and structure, business systems, institutional quality, and the presence of institutional voids and drivers in a structure-centric approach at national dimension. This approach is supported by 18 studies (e.g., Yang et al., 2023; Torkkeli et al., 2019).

However, prior research, including these perspectives, often either concentrates on the tasks and functions that the state aims to achieve through its agencies or highlights the role of these agencies alongside the state as foundational elements within the institutional framework. Such approaches tend to neglect analysing agency-specific characteristics of state agencies that implement programs to fulfil state mandates (Armanios et al., 2017; Liu 2021; Mitchell et al, 2022), yet with varying outcomes influenced by their relationship with the state and, specifically, by their organizational autonomy (e.g. Lederman et al., 2010; Srhoj et al., 2023). To address this oversight and avoid treating agencies as "black boxes," I introduce an agency-centric perspective as our third dimension. This organizational dimension, supported by 17 studies,

emphasizes viewing state agencies as organizations, encompassing export and trade promotion organizations, investment promotion agencies, and government associations (e.g., Schembri et al., 2019; Tajeddin et al., 2023). This offers a more nuanced understanding of their role, internal characteristics, and autonomy within the institutional framework.

Therefore, I integrate the above three perspectives using an agency-centric lens, emphasizing the agency's own characteristics which form the core of our study. This results in three key dimensions (Table 2-3): (1) Micro-program dimension: aligned with instrumental perspective, this dimension focuses on specific agency activities (e.g., export promotion programs, trade fairs) and their direct impact on SME exports (Catanzaro & Teyssier, 2021; Faroque et al., 2021; Lederman et al., 2010; Srhoj et al., 2023). (2) Macro-national dimension: rooted in the institutional perspective, this dimension examines the broader institutional environment (e.g., national business system, regulatory quality) and its indirect influence on SME exports (Michelle Yang et al., 2023; Torkkeli et al., 2019; Lederman et al., 2010). (3) Meso-organizational dimension: central to our analysis, this dimension focuses on the state agency as an organization. It goes beyond activities or context, emphasizing the agency's characteristics, relationships with government, SMEs, businesses, and resources.

Table 2-3 State agencies in three dimensions

Dimensions	Content	Studies
Macro level: National institutional environment	The national business system, institutional framework, institutional impediments/void,	(K. Michelle Yang *et al.*, 2023); (Bai *et al.*, 2022); (Amoako, Akwei and Damoah, 2021); (Bing Wu and Deng, 2020); (Jafari Sadeghi *et al.*, 2019a); (Jean and Tan, 2019); (Torkkeli *et al.*, 2019); (Chen, Saarenketo and Puumalainen, 2018); (Deng and Zhang, 2018a); (Laurell,

	institutional divers/quality, institutional network	2018); (Li, 2018); (Manolopoulos, Chatzopoulou and Kottaridi, 2018); (Rose Narooz and Child, 2017); (Cardoza *et al.*, 2016); (Makhmadshoev, Ibeh and Crone, 2015a); (Mogos Descotes *et al.*, 2011); (Jonsson and Lindbergh, 2010a); (Boisot and Marshall W. Meyer, 2008); (Cheng and Yu, 2008).
Meso level: State organizations	Institutional agents: Export promotion organizations, trade promotion organizations, government, local government, government association	(Baier-Fuentes, Guerrero and Amorós, 2021); (Scuotto Veronica *et al.*, 2020); (Yan, Hu and Liu, 2020a); (Blackburne and Buckley, 2019); (Frances Y.M. Chang and Webster, 2019); (Eerme and Nummela, 2019); (Ryan *et al.*, 2019); (Joe Schembri *et al.*, 2019); (Lindsay, Rod and Ashill, 2017); (Oparaocha, 2015a); (Kim and Park, 2014); (O'Gorman and Evers, 2011); (Zhou, Wu and Luo, 2007); (Prashantham and McNaughton, 2006); (Amesse *et al.*, 2002); (Acs, Morck and Yeung, 2001); (Seringhaus, 1987)
Micro level: Task-related activities	State-sponsored activities: Policy-driven cluster and industrial districts; Trade shows, trade fairs, trade missions, government assistance programs, export programs, export assistance activities	(Onjewu *et al.*, 2023); (N Singh *et al.*, 2023); (M Tajeddin *et al.*, 2023); (Tinits and Fey, 2022); (Falahat, Soto-Acosta and Ramayah, 2022); (Catanzaro and Teyssier, 2021); (Faroque *et al.*, 2021); (Gerschewski *et al.*, 2020); (Malca, Peña-Vinces and Acedo, 2020); (Ahmed and Brennan, 2019a); (Li, Liu and Qian, 2019a); (Njinyah, 2018); (Lucas Figal Garone *et al.*, 2015); (Durmuşoğlu *et al.*, 2012); (Freixanet, 2012); (Richardson, Yamin and Sinkovics, 2012); (Leonidou, Palihawadana and Theodosiou, 2011); (A Toledo, Hernández and Griffin, 2010); (Sousa and Bradley, 2009); (Evers and Knight, 2008); (Timothy Wilkinson and Brouthers,

	2006); (Francis and Collins-Dodd, 2004a); (Guerrieri and Pietrobelli, 2004); (A. H. Moini, 1998); (Reid, 1984).

2.4.3 Country Analysis of State Agencies

Table 2-4 reveals that out of 60 studies, 47 examine single countries across varied regions, with 25 focusing on developing countries with institutional voids (notably Bangladesh, China, Ghana, Malaysia, and Mexico) and 22 on developed countries with well-developed institutions such as Canada, the UK, the US, Estonia, and Ireland. The remaining 13 studies compare multiple countries, analysing the national institutional environments between and within developing and developed countries.

Integrating three dimensions of state agencies and country differences, I reveal a significant gap in macro-level research. While studies examining the national institutional environment (macro-level) frequently analyse developing countries, particularly China, and often employ cross-national comparisons, they tend to neglect the institutional frameworks of developed countries. This omission is particularly problematic given the increasing importance of understanding how SMEs internationalize across different institutional environments. The direction of internationalization, whether from developed to developing markets, or vice-versa, which significantly influences the challenges and opportunities SMEs face, is a central theme in our subsequent analysis (Section 2.4.4). Meso-level state agencies' studies are the least represented, primarily focusing on single-country analyses in developed nations, with only two studies comparing countries. This indicates a severe lack of international comparative analysis focused on state agencies, rather than just policy tools they employ.

Table 2-4 Country analysis on three-dimensions of state agencies

Country	Meso	Macro	Micro	Total
Single Country Study	15	10	22	47
Developing country	5	7	13	25
This includes China (8), Bangladesh (2), Ghana (2), Malaysia (2), Mexico (2), Brazil, Chile, India, Iran, Morocco, Peru, Taiwan/China, Turkey, and Cameroon (as least developing countries).				
Developed country	10	3	9	22
This includes Canada (5), Estonia (2), Ireland (2), the UK (3), the US (2), Australia, Finland, France, Greece, New Zealand, Portugal, Spain, and Sweden.				
Multiply countries study	2	8	3	13
Research on more than one country, including comparing developing and developed countries (6), comparing developing countries (2), and comparing developed countries (5).				

2.4.4 Two Stages of SMEs' internationalization

On SME internationalization, I have delineated two distinct stages: the first entails the internationalization decisions with 13 of 60 papers on this topic, while the second encompasses the international performance with 47 of 60 papers on this (see Table 2-5). In the initial stage, SMEs must surmount many obstacles, including the liabilities of foreignness, outsidership, newness, and smallness (Kahiya, 2017). Three subdimensions describe SMEs' internationalization decisions: (i) the decision to enter foreign markets or not (4 studies); (ii) choices on foreign entry mode, such as export, licensing, joint venture, and wholly-owned subsidiary (4 studies); and (iii) the export pattern, which differentiates between direct exports to wholesalers and end-users and indirect exports through agents and distributors (4 studies) (Bai et al., 2019; Blackburne & Buckley, 2019; Evers & O'Gorman, 2011; Wu & Deng, 2020).

For the second stage, I identified three distinct yet interrelated subcategories of SMEs' international performance: (i) financial outcomes, such as overall foreign sales and export profitability, with 41 papers (Adomako et al., 2020; Cardoza et al., 2016); (ii) the evolution of SMEs in international markets, such as international sales scope (6 studies) (Singh et al., 2023; Yan et al., 2020); and (iii) internationalization speed by capturing the time SMEs take to enter at least one international market from their business establishment (2 studies) (Ahmed & Brennan, 2019; Cheng & Yu, 2008).

Table 2-5 Two stages of internationalization outcomes

Internationalization	Definition and measurement	Sample papers
Export decision (3)	Direct export or indirect export (Direct to wholesalers and clients or indirect to distributors)	(Onjewu et al., 2023); (Evers and Knight, 2008); (Acs, Morck and Yeung, 2001)
Internationalization decision (4)	Decision on entering foreign markets	(K Michelle Yang et al., 2023); (Bai et al., 2022); (O'Gorman and Evers, 2011); (Boisot and Marshall W Meyer, 2008)
Internationalization pattern (4)	Choice on Foreign market entry mode (such as export, licensing, Joint Ventures, and WOS)	(B Wu and Deng, 2020); (Blackburne and Buckley, 2019); (Lindsay, Rod and Ashill, 2017); (Prashantham and McNaughton, 2006)
Internationalization speed (2)	The time taken to enter international market from a business established	(Ahmed and Brennan, 2019b); (Cheng and Yu, 2008)
Export performance (29)	Export likelihood and intensity, market, growth, etc.,	(Falahat, Soto-Acosta and Ramayah, 2022); (Tinits and Fey, 2022); (Catanzaro and Teyssier, 2021); (Faroque et al., 2021); (Malca, Peña-Vinces and Acedo, 2020); (Adomako et al., 2020); (Chang and Webster, 2019); (Li, Liu and Qian, 2019b); (Jafari Sadeghi et al., 2019b); (Jean and Tan, 2019); (Njinyah, 2018); (Deng and Zhang, 2018b); (Li, 2018); (Manolopoulos, Chatzopoulou and Kottaridi, 2018); (L Figal Garone et al., 2015); (Makhmadshoev, Ibeh and Crone, 2015b); (Durmuşoğlu et al., 2012); (Freixanet, 2012); (Leonidou, Palihawadana and Theodosiou, 2011); (Mogos Descotes et al., 2011); (Sousa and Bradley, 2009); (Zhou, Wu and Luo, 2007); (T Wilkinson and Brouthers, 2006); (Francis and Collins-Dodd, 2004b); (Alvarez, 2004); (Amesse et al., 2002); (A H Moini, 1998); (Seringhaus, 1987); (Reid, 1984)

International performance (12)	International sales and markets (Most research use international sales- cannot distinguish whether export or other patterns)	(Mahdi Tajeddin et al., 2023); (S Veronica et al., 2020); (Gerschewski et al., 2020); (Schembri et al., 2019); (Torkkeli et al., 2019); (Chen, Saarenketo and Puumalainen, 2018); (Cardoza et al., 2016); (Oparaocha, 2015b); (Richardson et al., 2012); (Jonsson and Lindbergh, 2010); (Arcelia Toledo, Hernández and Griffin, 2010); (Guerrieri and Pietrobelli, 2004)
Internationalization process (6)	Internationalization inception, value, and market selection (Mainly use export as proxy)	(Nitish Singh et al., 2023); (Yan, Hu and Liu, 2020b); (Baier-Fuentes, Guerrero and Amorós, 2021); (Ryan et al., 2019); (Eerme & Nummela, 2019); (R Narooz and Child, 2017)

2.5 State Agencies and SME Internationalization – An Integrated Framework

Continuing our examination of the impact of state agencies on SME internationalization, I argue that understanding state agency typology is fundamental to explaining variations in their effectiveness. In alignment with our multi-dimensional framework—which builds and extends upon Verhoest et al.'s (2010) instrumental and institutional perspectives—I categorize state agencies based on two key dimensions. First, from an institutional perspective, I examine their structural autonomy, which defines the relationship between state agencies and government. Second, from an instrumental perspective, I analyse their engagement patterns with both governments and SMEs, which helps me understand how state agencies implement policies to influence SME internationalization. This dual categorization allows me to systematically assess how different types of state agencies develop and maintain relationships with both their governmental principals and their SME clients, ultimately affecting their ability to support internationalization efforts.

This typology serves as the foundational lens through which I analyse a three-dimensional framework of agency influence. This integrated approach allows me to move beyond simply examining what policies and programs are implemented to investigating the 'who' – the state agencies themselves – and the 'how' – their internal organizational dynamics and interactions with the broader environment. This approach directly addresses a key gap identified by Srhoj et al. (2023), highlighting the need for a more nuanced understanding of the mechanisms through which export-boosting policies operate and so moves beyond simple assessments of policy implementation. Finally, I integrate these elements to analyse how different types of state agencies

impact SMEs in various internationalization scenarios, considering the relative strength of home and target market institutions.

2.5.1 Agency Theory and a Typology of State Agency

Drawing upon agency theory, traditionally used to analyse relationships within multinational enterprises (Cavanagh et al., 2017), I adapt this framework to illuminate the complex three-way relationship between governments, state agencies, and SMEs. In this adapted model, governments act as principals who delegate internationalization support tasks to state agencies, which serve as agents implementing government policies while simultaneously functioning as service providers to SMEs (the ultimate beneficiaries). The structural autonomy of state agencies from their governmental principals creates a critical dynamic: greater autonomy can enhance agencies' ability to develop specialized expertise, and responsive programs yet may also introduce principal-agent challenges such as mission drift or information asymmetry. This autonomy directly influences how effectively agencies fulfil their dual role—faithfully executing government mandates while addressing SMEs' practical internationalization needs. Building on prior research highlighting the varied effectiveness of export promotion agencies (Lederman et al., 2010), I systematically categorize state agencies based on their organizational autonomy from government and the nature of their engagement with SMEs, providing a more nuanced understanding of why similar agencies often produce different internationalization outcomes.

(1) "Agency Void" state agencies represent the lowest degree of organizational autonomy, functioning essentially as extensions of government departments. Highly integrated within the existing bureaucracy, often residing within ministries, these agencies primarily serve to implement pre-defined policies and distribute funds. Their

core function is not to proactively shape SME internationalization strategies, but rather to act as conduits for existing government directives. This limited discretion stems from their direct accountability to political principals, rather than to the SMEs they are intended to assist.

The defining characteristics of agency void agencies include limited autonomy in decision-making, a strong focus on resource distribution rather than strategic support, and weak engagement with SMEs. Decisions are typically made at higher levels of government, with the agency acting as a mere implementer (Veronica et al., 2020). Resource allocation often follows pre-set criteria, without tailoring individual SME circumstances or internationalization goals (Yan et al., 2020). Interaction with SMEs is often limited to providing basic information or processing applications, lacking a client-oriented approach or proactive feedback mechanisms (Schembri et al., 2019; Reed, T., 2024). As a result, agency void's impact on SME internationalization is primarily indirect, depending on the general business environment rather than targeted firm-specific interventions. Aligning with criticisms of early export promotion agencies in developing countries, agency void entities are often seen as lacking leadership and being overly bureaucratic (Lederman et al., 2010; Schembri et al., 2019; Reed, T., 2024; Kahiya, E.T., 2024).

(2) "Co-option" state agencies represent an intermediate level of autonomy, possessing a degree of structural independence that distinguishes them from agency void entities. While formally separate from government departments and ministries, these agencies maintain close, and often dependent relationships with both the government and industry associations. This dependency stems primarily from their reliance on government funding and approval required for their operations and initiatives. Their core function is to act as intermediaries, facilitating access for SMEs

to resources, networks, and knowledge that would otherwise be difficult to obtain (Prashantham & McNaughton, 2006; Lindsay et al., 2017). However, unlike agencies with greater autonomy, their actions are significantly shaped by the priorities of their key stakeholders, leading to a degree of "capture" by these external interests.

The defining characteristics of co-option agencies include constrained autonomy, a strong intermediary role, and a significant influence from external stakeholders. While structurally independent, their funding and mandate often originate from the government, limiting their freedom of action (Schembri et al., 2019). They excel at connecting SMEs to valuable resources and networks, bridging the gap between the government and the private sector (Prashantham & McNaughton, 2006; Lindsay et al., 2017). co-option state agencies focus on supporting established industries and exploiting existing capabilities, rather than firms oriented. This model reflects a common approach where governments seek to leverage the expertise of the private sector while retaining a degree of control over SME internationalization initiatives.

(3) "Co-specialization" state agencies represent the highest level of organizational autonomy within our typology, distinctly different from both agency void and co-option models. These agencies are characterized by genuine partnerships with government, businesses, and other stakeholders, moving beyond mere policy implementation to actively co-create solutions with SMEs. This collaborative approach is underpinned by significant discretion in resource allocation and program design. Unlike agencies reliant solely on government funding, co-specialization entities often secure funding from diverse sources, including the private sector. This financial independence enhances their responsiveness to market needs, viewing SMEs as valued clients rather than simply beneficiaries of government programs.

The defining characteristics of co-specialization agencies include high autonomy in decision-making, a strong emphasis on collaborative partnerships, diverse funding streams, a focus on exploration and innovation, and a long-term perspective. Their significant discretion allows them to adapt to changing market conditions and tailor support to individual SME needs (Blackburne & Buckley, 2019). They actively engage in shared decision-making with SMEs and other stakeholders, fostering a sense of mutual benefit and shared goals. Their diverse funding reduces dependence on government and allows for greater risk-taking and the pursuit of a wider range of initiatives. Critically, they prioritize supporting SMEs in exploring new markets, developing new capabilities, and adapting to global changes, encouraging innovation and experimentation. This long-term perspective emphasizes building SME resilience and sustainable growth, aligning with recommendations from Kahiya, E.T (2024) and Reed T (2024) for more effective state agencies that emphasize private sector involvement and a market-driven approach.

2.5.2 Three Dimensions of State Agency Influence

Building on this agency typology, I examine how state agencies influence SME internationalization through three interconnected dimensions: (i) national institutional environment, (ii) agency autonomy and resources, and (iii) agency's programs. The national institutional environment shapes the context, influencing agency autonomy and resources (determining their type). In turn, agency autonomy and programs directly affect SME internationalization. For each dimension, I analyse the inputs (e.g., resources) and the mechanisms through which state agencies influence SME internationalization. With framework displayed in the figure 2-2.

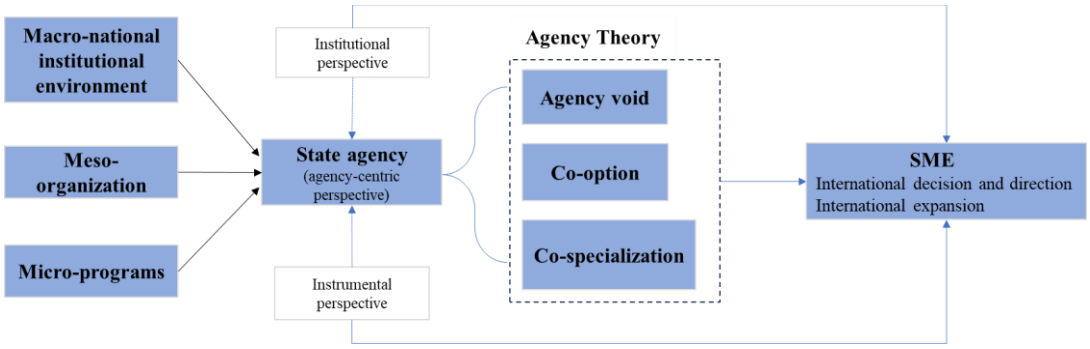


Figure 2-2 Three dimensions of state agencies framework

State Agency and National Institutional Environment

State agencies are embedded within a broader national institutional environment, particularly formal institutions including the codified rules, laws, regulations, and policies that govern economic and social interactions. The input for SMEs' internationalization from the state agency is the overall institutional environment; the mechanism is indirect, operating through the quality and implementation of formal institutions (Child et al., 2022). A strong institutional environment is associated with higher likelihood of SME internationalization (Chen et al., 2018; T. Li, 2018). Weak institutions can be impediments but sometimes lead to "institutional escapism" where firms seek opportunities abroad due to domestic constraints (Jean & Tan, 2019). This institutional context primarily influences the initial "go/no-go" decision for SMEs considering exporting. While strong institutions provide stability, SMEs in weaker institutional environments may also achieve international expansion performance, often leveraging network-based strategies to overcome domestic limitations.

This highlights the context-specific effectiveness of export boosting policies, as emphasized by Srhoj et al. (2023). This nuance is often overlooked in broader studies of institutional impact (e.g., Lederman et al., 2010), which tend to focus on the overall institutional environment rather than the specific challenges of entering weaker

institutional settings. Thus, the type of agency support becomes even more critical in weaker institutional settings as agencies can guide SMEs to essential resources and information (Michelle Yang et al., 2023). For instance, a "co-specialization" agency may help SMEs overcome institutional weaknesses and voids, whereas an agency void entity might tend to assist more established SMEs that already possess government connections, rather than the SMEs most in need of resources. This underscores not only the context-specific nature of EBP effectiveness (Srhoj et al., 2023) but also reveals that the *type* of agency implementing the EBPs significantly impacts their success.

State Agency Autonomy and Resources

This dimension focuses on how the internal structure, resources, and agency type as defined in our typology directly impact an agency's ability to support SMEs under weak and strong institutional environment. Agencies support SME internationalization with direct resources, such as finance, information, networks (Cruz et al., 2018; Catanzaro & Teyssier 2021; Srhoj et al., 2023).

At the organizational level, agency void entities represent a basic form of government support. These entities primarily offer finance, objective and experiential information, advice, and access to networks (Malca et al., 2020). Their mechanism of influence relies on leveraging firms' existing connections with government and officials, providing advantages in acquiring support. The effectiveness of this approach is contingent upon the domestic institutional environment (a macro-level factor) and the firm's existing resources (Yan, Hu & Liu, 2020). While agency void entities can positively impact the initial export decision, encouraging firms to enter markets with

greater physical distance and to choose direct export methods, their impact on long-term internationalization growth is less clear.

Co-option agencies, another meso-level category, represent a more active form of state support. These agencies go beyond simply providing resources; they create platforms to implement government policies and specific programs. They facilitate the delivery and exploitation of finance, knowledge, and information exchange. The mechanism here involves actively connecting SMEs to resources and opportunities. The impact of co-option agencies is influenced by the timing and direction of internationalization (Tinits and Fey, 2022). While they can provide crucial support for the launch of social SMEs, their impact may be limited to the initial growth stages (Veronica et al., 2020). Similarly, they encourage exporting but may inadvertently limit long-term growth by reducing the firm's incentive to develop its own capabilities and networks in international market expansion.

Co-specialization agencies represent the most comprehensive form of meso-level state support. These agencies provide financial support, foster knowledge creation, facilitate information exchange, and, crucially, build trust and reputation for SMEs. Their mechanism of influence involves acting as active assistants to firms, building trust and mitigating the perceived risks associated with international activities. The effectiveness of co-specialization agencies is contingent on their own networks within both the home and host market governments and firms (Blackburne & Buckley, 2019). They assist SMEs in building connections with MNEs and actively encourage export activities. Unlike the other agency types, co-specialization agencies support a broader range of internationalization outcomes, including expansion from developed to emerging markets, increased commitment to foreign markets, and a shift from

exporting to establishing foreign subsidiaries (Ryan et al., 2019). This indicates a more strategic and long-term impact on SME internationalization.

State Agency Programs

In internationalization activities, state agencies typically implement four categorized programs: country image building, export support, marketing, and market research. I focus on the latter three, as they represent direct interaction with SMEs. State agencies deliver financial resources, information, training, and market access to SMEs, reducing costs and barriers (Srhoj et al., 2023, Broocks & Van Biesebroeck; 2017; Kim et al., 2018).

Research mainly focuses on SMEs' decisions to export and choice of mode (Ahmed & Brennan, 2019; Evers & Knight, 2008). Impact of state agency programs on SME international performance is measured in export decision and intensity. Long-term impact might be less direct if support focuses on entry rather than international market and product expansion. While agency programs provide tangible support, their effectiveness depends on the type of agency implementing them. A co-specialization agency is more likely to assist SMEs with market access and training, fostering long-term SME capabilities and adaptation in internationalization process, while an agency void entity may focus on providing finance and market information, which is short-term and less impactful interventions.

2.5.3 A Matrix of State Agency Impact on SME Internationalization

Building on the previous sections, I present a matrix (Figure 2-3) integrating the agency-centric perspective with the broader institutional context. This addresses the need for a more nuanced understanding of how export-boosting policy actually work

through state agencies (Srhoj et al., 2023). I focus on *how* agency characteristics, interacting with the institutional environment, shape SME internationalization.

Two key points emerge regarding SMEs internationalization outcome. First, the challenges faced by SMEs differ significantly depending on whether they are internationalizing from a developing to a developed country, or vice versa. The direction of internationalization decides the assets and liabilities of firms and state agencies. SMEs often cannot dictate the terms of international markets; they must adapt. Therefore, it's crucial for SMEs to understand their existing resources (shaped by their home institutional environment) and the requirements of their target market (the foreign market's institutional environment). To capture these dynamics, our matrix uses two dimensions:

Vertical dimension represents whether an SMEs is entering a foreign market. State agencies can play a crucial role here, helping SMEs overcome challenges in finance, knowledge and networks (Cruz, 2014; Srhoj et al., 2023). Horizontal dimension reflects the relative strength of the SME's home country’s institutional environment compared to the host (foreign) market’s institutional environment. For instance, a weaker domestic environment creates institutional voids, making SMEs more reliant on state agency support (Lederman et al., 2010). Based on these dimensions, I identify four distinct scenarios. Each scenario presents unique challenges and opportunities for SMEs, requiring different types of support from state agencies.

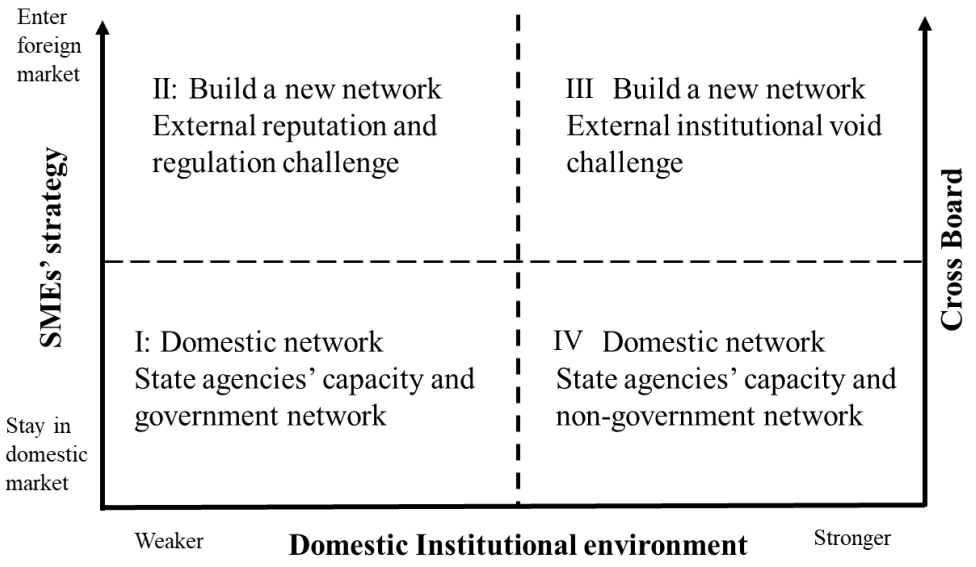


Figure 2-3 State agencies and SMEs' internationalization decision in various institutional contexts

*S*cenario *I: SMEs persist within a weaker domestic institutional environment*. Both state agencies and SMEs grapple with domestic institutional voids. State agencies in the government's core are less governed by universalistic rules, wielding amplified power in domestic market interventions and resource allocation. This domestic institutional void is always related to the agency void, compelling SMEs to rely on state agencies and institutional networks. The primary focus for SMEs is on navigating the domestic market, and state agency influence is largely limited to domestic operations.

Scenario II: SMEs enter a stronger foreign institutional environment. While the SME's home environment may be weak (similar to Scenario I), the target market has strong institutions. This presents SME with external institutional and reputational challenges, requiring them to build new networks in the foreign market. Supporting SMEs in this network formation requires state agencies with higher levels of autonomy, capable of engaging in more exploratory activities (Arregle et al., 2023). Co-option and,

particularly, co-specialization agencies are best suited for this role. For example, these agencies can organize trade fairs, connecting domestic SMEs with foreign corporations. Agencies with foreign branches can leverage their connections with host country governments and businesses to provide SMEs with market access and knowledge. In some cases, the combination of a weak home environment (institutional void) and a lack of agency support (agency void) can drive SMEs to seek opportunities in stronger institutional environments – a phenomenon known as institutional escapism (Jean & Tan, 2019).

*S*cenario *III: SMEs enter a weaker foreign institutional environment.* In contrast to Scenario II, SMEs are entering a market with weaker institutions. This presents significant institutional challenges, as these markets may have less stable regulatory frameworks and governments that intervene more actively in the economy. Resource-constrained SMEs may have difficulty navigating this environment and accessing key actors (Van Biesebroeck et al., 2015). While local SMEs might have an advantage in networking with government officials, foreign SMEs face an external institutional void. To support SMEs in overcoming these challenges, state agencies need significant resources and a high degree of autonomy to engage in exploratory activities. Co-specialization agencies, operating within a broad network of stakeholders, are best equipped to act as "institutional bridges," providing knowledge, trust, and network connections to SMEs (Blackburne & Buckley, 2019; Prashantham & McNaughton, 2006).

*S*cenario *IV: SMEs operate within a stronger domestic institutional environment.* Both the SME's home environment and, if they choose to internationalize, any potential target markets, have strong, well-functioning institutions. The formal institutional system is comprehensive and efficiently enforced. While state agencies may contribute

to maintaining a fair and efficient domestic market, their capacity to provide specialized support for internationalization, particularly in weaker institutional environments, is limited. As a result, SMEs are more likely to rely on non-government networks and resources (Narooz & Child, 2017). Therefore, state agencies have a less direct impact on SME internationalization in this scenario.

Our matrix (Figure 2-3, with specific examples in Table 2-6) details the primary role and impact of each agency type within each scenario. The matrix demonstrates how the institutional environments and the government-agency relationship shape a state agency's resources and autonomy. In turn, an agency's influence on SME internationalization is determined by its specific goals, resources, and, crucially, its level of autonomy. Agency void entities are consistently the least effective, while co-specialization agencies generally have the greatest potential for positive impact, particularly when bridging institutional gaps or navigating in weaker institutional environments. From this analysis, three main findings emerge regarding the interplay between state agency type, institutional context, and SME internationalization.

Table 2-6 Typology of state agencies in four scenarios of SMEs internationalization

Scenario	Home – Host institutional environment	Agency Void	Co-option	Co-specialization
I. Domestically Focused, Resource-Dependent	**Weak Home, Stay Home:** SMEs and state agencies operate in weak institutional environments.	**Primary Role:** Resource provider (often inefficient). **Outcome:** SMEs remain focused on the domestic market due to lack of support for navigating internationalization challenges. **Example:** A small manufacturing firm in a developing country needs government funding but lacks support or access for export.	**Primary Role:** Provide information and connections but limited by reliance on government and established stakeholders. **Outcome:** Slightly better than Agency Void but SMEs still struggle to overcome institutional weaknesses. **Example:** An agency provides basic export information but lacks the resources or connections to help SMEs enter specific foreign markets.	**Primary Role:** Can potentially leverage its network and resources to help SMEs overcome domestic institutional weaknesses but still face challenges in supporting internationalization to equally weak markets. **Outcome:** facilitate some limited internationalization but struggle to support long-term growth. **Example:** An agency helps SMEs access financing and navigate domestic regulations but lacks expertise in specific foreign markets.
II. Bridging Institutional Gaps	**Weak Home, Strong Host:** SMEs from weak institutional environments attempt	**Primary Role:** Resource provider (often inefficient). Largely ineffective due to lack of autonomy and resources.	**Primary Role:** Acts as a bridge, providing information, facilitating connections, and offering tailored support.	**Primary Role:** Proactively builds partnerships and networks in the target market, providing comprehensive support to SMEs.

Scenario	Home – Host institutional environment	Agency Void	Co-option	Co-specialization
	to enter markets with stronger institutions.	**Outcome:** SMEs still struggle to enter the stronger foreign market. **Example:** A SME from a developing country faces significant barriers entering a developed market due to lack of support and inability to navigate regulations.	**Outcome:** SMEs overcome the institutional gap and enter a stronger market. **Example:** An agency the SME from a developing country with partners in a developed country, providing legal and regulatory guidance.	**Impact:** High; facilitates market entry and long-term growth by leveraging its expertise and connections. **Example:** An agency establishes a presence/office in the host market, providing ongoing support to SMEs, including market research, partner identification, and legal assistance.
III. Navigating Weaker Environments	**Strong Home, Weak Host:** SMEs from strong institutional environments enter markets with weaker institutions.	**Primary Role:** Resource provider (often inefficient). **Outcome:** agency provides little value-added; SMEs reply on their own knowledge to enter markets to enter the foreign market with weaker institutions. **Example:** An agricultural firm from a country with strong food safety standards enters a market with weaker regulations; the agency provides basic	**Primary Role:** Provides information and connections, helping SMEs navigate the unfamiliar institutional environment. **Impact:** Moderate can facilitate market entry, but long-term success depends on the SME's own capabilities. **Example:** An agency provides information on local regulations and connects SMEs with local partners but does not provide ongoing support.	**Primary Role:** Leverages its expertise and network to help SMEs adapt to the weaker institutional environment, mitigating risks and building local relationships. **Impact:** High; facilitates market entry and sustainable growth by providing ongoing support and guidance. **Example:** An agency helps SMEs navigate local regulations, build networks with local stakeholders, and adapt their business models to the

Scenario	Home – Host institutional environment	Agency Void	Co-option	Co-specialization
		information, but the firm relies on its own expertise.		specific context to overcome host market institutional voids.
IV. Market-Driven, Limited Agency Role	**Strong Home, Stay Home:** SMEs and agencies operate in strong institutional environments.	**Primary Role:** Resource provider (often inefficient). **Impact:** SMEs rely on market mechanisms. **Example:** A SME cannot access to grant due to its lack of awareness to the support from state agencies.	**Primary Role:** May play a role in promoting innovation and facilitating access to specialized resources. **Outcome:** SMEs are primarily driven by market forces. **Example:** An agency offers support and grants for R&D but does not directly support international market entry.	**Primary Role:** May focus on supporting innovation and fostering collaboration between SMEs and larger firms. **Outcome:** increase SME competitiveness but does not play a central role in internationalization. **Example:** An agency facilitates partnerships between SMEs and multinational corporations in the home market, providing access to global value chains.

First, the agency types as a mediator. While the institutional environment (both home and host) undeniably influences SME internationalization, the type of state agency plays a crucial mediating role. An agency void entity will likely be ineffective even in a relatively strong institutional environment, while a co-specialization agency can significantly enhance SME success even when facing challenging institutional gaps. This highlights the importance of moving beyond a simple "strong or weak institution" dichotomy and recognizing the agency's organizational characteristics as a key determinant of success.

Second, co-specialization in institutional differences. When SMEs face significant institutional differences between their home and target markets (Scenarios II and III), co-specialization agencies are uniquely positioned to provide effective support. Their high autonomy, diverse resources, and collaborative approach allow them to bridge institutional gaps (Scenario II) by providing tailored support, facilitating connections, and building trust. They can also help SMEs navigate weaker environments (Scenario III) by leveraging their expertise and network to mitigate risks and adapt to local conditions. agency void entities, in contrast, are largely ineffective in these scenarios, and co-option agencies have a more limited, intermediary role.

Finally, diminished role in strong institutional environment. In situations where both the home and target markets have strong institutional environments (Scenario IV), the role of state agencies is significantly diminished. SMEs in this context are primarily driven by market forces and have access to resources through private channels. This finding is important because it acknowledges that state agencies are not always the most critical factor in SME internationalization. In strong institutional environments, state agencies might focus on other roles, such as fostering innovation or facilitating collaboration, rather than directly supporting market entry.

Current research at the national level, however, has not adequately differentiated the impacts of governmental bodies from other institutions. Therefore, I argue it is essential to distinguish the state and its agencies from institutional contexts. Absent an agency-centric perspective, IB scholars find it challenging to identify the impact of significant actors—state agencies—in SME internationalization.

2.6 Conclusion

Given the worldwide expansions of "Organization" (Meyer & Bromley, 2013) and continuing discussion on rethinking and redirecting institutions and organizations (Greenwood et al., 2014; Meyer & Höllerer, 2014), our review emphasized the importance of understanding the interrelationship between organizations and institutions. Anchored on a specific institution, I used a well-defined methodological approach and reviewed high-quality peer-reviewed studies on the impact of state agencies on SMEs' internationalization. The literature shows the significant impact of state agencies, not only as an institution but as a hybrid organization. Therefore, this review highlights an often-ignored force, namely state agency, in the institutional environment, that shapes the State-SME nexus. I extend previous applications of agency theory within the subsidiary–headquarter relationship in MNEs into the state agency context, and I challenge the current understanding of state agencies, which are often regarded as puppets of the state in IB, by exploring state agencies' autonomy. In doing so, this review introduces an organizational level analysis into the institutional theory lens, providing a new impact mechanism and analysis between institutions and organizations.

This review, while comprehensive, is subject to two key limitations. First, our methodology's reliance on Scopus and Web of Science databases, coupled with our

focus on journals ranked three or above in the ABS Academic Journal Guide 2021, may have excluded relevant studies published in specialized journals, regional publications, or non-English languages. Second, our analysis primarily focuses on the home country's institutional environment and the role of state agencies within that context. While I acknowledge the importance of the host country's environment and incorporate it into our matrix, a more in-depth examination of the interaction between home and host country agencies, and the potential for cross-border collaboration, is beyond the scope of this review, but represents a fruitful avenue for future research.

2.7 Future Research Agenda

This review has highlighted the critical, yet often overlooked, role of state agencies as organizational actors within the broader institutional environment influencing SME internationalization. We've demonstrated that agency effectiveness is not solely determined by policy design (the "what") but significantly by agency characteristics and autonomy (the "who" and "how"). Building on existing literature (e.g., Srhoj et al., 2023; Lederman et al., 2010; Wagner, 2007; Kahiya, 2024; Reed, 2024) and addressing the gaps identified in our analysis, I propose a future research agenda focused on three interconnected areas: Agency-Centric mechanisms, SME heterogeneity and internationalization dynamics, and methodological and interdisciplinary advancements.

First, a crucial avenue for future research lies in deepening our understanding of agency-centric mechanisms and organizational autonomy. Our review identified a significant gap: a paucity of research directly examining the internal workings of state agencies and how their organizational autonomy shapes their effectiveness. While prior research often treats agencies as "black boxes" implementing export promotion

policies, I have demonstrated that agency type (agency void, co-option, co-specialization) significantly mediates the impact of those policies. Future research should, therefore, move beyond a static view of agencies and prioritize understanding the mechanisms that link agency autonomy to SME internationalization outcomes.

This necessitates investigating how optimal levels of organizational autonomy, in terms of decision-making power, resource allocation flexibility, and program design authority, vary across different agency types, as defined by our typology, and across different stages of SME internationalization, from initial market entry to international expansion. Furthermore, it is essential to identify the specific internal organizational capabilities, such as leadership styles, knowledge management practices, network-building capacity, and the absorptive capacity for market intelligence (Cruz et al., 2018; Reed. T., 2024), that enable agencies to effectively leverage their autonomy and translate it into tangible support for SMEs (Schembri et al., 2019). A principal-agent lens should be employed to examine how governance structures, performance metrics, and accountability mechanisms influence the alignment, or misalignment, of interests between governments (principals), state agencies (agents), and SMEs (beneficiaries), and how these dynamics, in turn, impact agency behaviour and effectiveness (Eriksson & Andersson,2023). Finally, systematic cross-country comparative studies are crucial to understanding how institutional and cultural contexts, including levels of corruption, bureaucratic efficiency, and the nature of business-government relations, shape the formation, evolution, and effectiveness of different agency types, ultimately identifying best practices and contextual contingencies.

Second, future research needs to address the limitations of existing studies that often focus narrowly on aggregate export performance, thereby neglecting the heterogeneity

of SMEs and the dynamics of their internationalization journeys. A more nuanced perspective is required, one that considers how state agencies, and different agency types, influence a broader range of SME internationalization outcomes. These outcomes encompass not only market entry mode choices (e.g., exporting, FDI, joint ventures) but also geographic diversification across diverse markets, product and service diversification within international markets (Van Biesebroeck et al., 2015), innovation activities (product, process, and marketing innovation) undertaken in foreign markets, the development of robust international networks with customers, suppliers, and distributors, and, ultimately, long-term survival and growth in international markets.

This necessitates a deeper investigation into the specific micro-level mechanisms through which state agencies build trust, reduce information asymmetries, and facilitate knowledge transfer for SMEs at different stages of their internationalization process. Researchers should examine how these mechanisms differ across agency types and institutional contexts. Crucially, future work must consider how SME characteristics, such as size, age, industry sector, prior international experience, moderate the relationship between state agency support and internationalization outcomes. This includes investigating whether certain types of agencies are more effective in supporting specific types of SMEs. It is vital to understand how the needs of SMEs and the corresponding roles of state agencies evolve over time as firms progress through different stages of internationalization, and how agencies adapt their support strategies to meet these changing needs.

Third, to address these complex research questions effectively, significant methodological and interdisciplinary advancements are required**.** Future research

should prioritize establishing causal relationships between state agency interventions and SME outcomes. Many existing studies rely on correlational designs that cannot rule out alternative explanations (Srhoj et al., 2023). This necessitates the adoption of rigorous research designs, including quasi-experimental designs like difference-in-differences and regression discontinuity, which can exploit natural experiments or policy changes (Kim et al., 2018). Matching techniques, such as propensity score matching, should be employed to create comparable control groups of SMEs. Where feasible, randomized controlled trials should be considered to isolate the effects of specific agency programs or interventions.

A mixed-methods approach, combining quantitative and qualitative methods, is essential for a comprehensive understanding. Qualitative case studies can provide rich, contextualized insights into the processes and mechanisms through which agencies influence SME behaviour, complementing the quantitative assessment of outcomes. Fostering collaboration between international business and management scholars, economists, political scientists, and public administration researchers is crucial for developing more holistic theoretical frameworks and a deeper understanding of the complex interplay between institutions, organizations, and firm behaviour. Importantly, while international trade and economics literature often relies on large-scale quantitative data to assess the impact of export promotion policies, incorporating the qualitative case study methodologies prevalent in international business research can provide significant benefits. These case studies can offer a deeper, more nuanced understanding of the interactions between state agencies and SMEs, capturing the realistic and often complex mechanisms that drive internationalization success or failure – mechanisms that may be obscured in aggregate data. This approach allows for a richer exploration of contextual factors, agency-specific strategies, and the

dynamic interplay between agency support and SME decision-making. Significant effort still needs to be devoted to developing and validating more nuanced and reliable measures of state agency characteristics (including autonomy, resources, capabilities, and network embeddedness) and SME internationalization outcomes (extending beyond simple export volume).

Having established a conceptual framework for understanding state agencies as diverse organizational actors (the 'who' and 'how' of support), the subsequent step is to delve into the specific types of support ('what') frequently channelled through or influenced by these state systems. Chapter 3 will therefore provide a focused literature review on two prominent support mechanisms—financial subsidies and collaborations with public knowledge sources—examining the existing evidence on their impact on SME innovation and international performance, thereby setting the stage for the empirical investigations in this dissertation.

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Chapter 3

Literature Review for the Empirical Studies: The Impact of Government Subsidies and Public Knowledge Collaboration on SME Innovation and International Performance

Building on the understanding that state agencies are key institutional players with varying characteristics (Chapter 2), this chapter reviews the literature on two specific forms of support central to the State-SME nexus: government financial subsidies and collaborations with public knowledge sources (PKS). These mechanisms represent primary ways through which the state, via its diverse institutional arms, seeks to bolster SME innovation and internationalization.

3.1 Introduction

As established in previous chapters, Small and Medium-sized Enterprises (SMEs) are central to innovation and economic vitality, particularly within small, open economies (Al-Tabbaa & Zahoor, 2024; Czarnitzki & Delanote, 2015; Haddoud et al., 2023). Their journey from idea to market success can be conceptualized through an innovation value chain, encompassing knowledge sourcing, knowledge transformation into innovations, and subsequent knowledge exploitation for performance gains (Roper et al., 2008). This process unfolds within a broader National Innovation System (NIS), which comprises the actors, institutions, and relationships vital for innovative performance (Freeman 1987; Granstrand & Holgersson, 2020; Lundvall, 2007; Robertson et al., 2023). Yet, SMEs face persistent barriers across this chain, including limited financial resources (Perez-Alaniz et al., 2023), restricted

access to specialized knowledge, and liabilities of newness and smallness (Chiappini et al., 2022; Donnelly et al., 2024). In response, governments and public institutions, key actors in the NIS, have implemented support mechanisms like direct subsidies and collaborations with public knowledge sources (PKS) (Dvouletý et al., 2021; Jugend et al., 2020). These interventions aim to enhance SMEs' knowledge capabilities at each stage of the innovation value chain, such as knowledge creation, diffusion, and absorption, which are crucial for transforming ideas into innovation performance (Robertson et al., 2023).

A central theme is the interplay between SME innovation (a key outcome of knowledge transformation) and internationalization (a form of knowledge exploitation). While innovation is often a driver for internationalization (Golovko & Valentini, 2011), the relationship is complex, with resource trade-offs potentially hindering this progression (Freixanet & Rialp, 2022). The mechanisms through which policy-induced knowledge acquisition and transformation translate into specific international performance dimensions remain a critical area for investigation (Freel et al., 2019; Kahiya, 2024).

3.2 Government Subsidies and Their Influence on SME Innovation

Government subsidies are prominent policy instruments designed to address market failures that constrain SME innovation, particularly at the knowledge creation and transformation stages (Dvouletý et al., 2021). The core rationale is that firms, especially SMEs, may underinvest in R&D due to financial constraints, uncertainty, and information asymmetries (Dimos & Pugh, 2016; Perez-Alaniz et al., 2023). The literature largely affirms that subsidies can induce additional R&D investment (which is innovation input additionality), a key internal knowledge sourcing and creation

activity (Beck et al., 2016; Vanino et al., 2019). However, the relationship between financial resources and research as well as innovation is not always straightforward. Perez-Alaniz et al. (2023), examining internal financial resources, find that while these positively impact larger firms' engagement in scientific research and innovation, such resources can even hinder certain innovation types in small firms, suggesting that the effectiveness of financial support like subsidies may be highly contingent on firm size and the specific innovation activity. Dimos & Pugh's (2016) meta-analysis found no evidence of substantial R&D additionality from specific R&D subsidies, raising questions about the direct magnitude of the impact. Yet, the types of innovation fostered vary; subsidies might encourage riskier, radical innovation (Beck et al., 2016) or reinforce incrementalism (Chen et al., 2024), depending on the program design and firm strategy (Hottenrott & Lopes-Bento, 2014). This suggests that the effect of subsidies on R&D investment, and the subsequent innovation outputs, is complex and contingent.

Moreover, beyond direct R&D effects, subsidies can induce behavioural additionality—changes in firm learning and networking (Freel et al., 2019). Thus, understanding how government subsidies influence the innovation input—R&D investments, and how policy-induced R&D compares to private R&D in driving subsequent international outcomes, is crucial.

3.3 Collaboration with Public Knowledge Sources: A Catalyst for SME Innovation

Collaboration with Public Knowledge Sources—universities, public research institutes, and government bodies—is increasingly recognized as a crucial external knowledge sourcing strategy within the innovation value chain and a vital component

of a functioning NIS (Robertson et al., 2023; Roper et al., 2008). For SMEs, such collaborations gateway to advanced, often foundational or exploratory research (Bercovitz & Feldman, 2007), specialized expertise, cutting-edge technologies (Moon et al., 2019), and critical knowledge capabilities, including knowledge creation and absorption, which they frequently lack internally (Lehmann et al., 2022; Roper et al., 2008). This engagement is multifaceted; while universities offer access to foundational or exploratory research (Bercovitz & Feldman, 2007), public research institutes (PRIs) and national labs often focus on developing general purpose technologies (Siegel et al., 2023) and spearheading next-generation industrial capabilities, effectively bridging the "valley of death" between basic research and commercial application (Intarakumnerd & Goto, 2018). These collaborations are not just about creating new knowledge but also about enhancing the firm's ability to "identify, evaluate, assimilate, and upgrade" existing technologies, a role PRIs historically play in helping industries catch up (Intarakumnerd & Goto, 2018). This aligns with the open innovation paradigm, where the strategic integration of external knowledge from diverse PKS complements and enhances internal R&D (Ebersberger et al., 2021; Usman et al., 2018).

The mechanisms and impacts of these collaborations are diverse. Empirical studies suggest that engaging with PKS can empower SMEs to pursue more complex or radical innovations (Chiappini et al., 2022; Mulligan et al., 2022), often by providing novel scientific insights that form the basis of new technological trajectories (Bellucci & Pennacchio, 2016). The specific interaction modes extend beyond formal joint research and consulting to include R&D consortia, spin-offs, and, critically, the mobility of researchers, which is a highly effective, albeit informal, mode of knowledge transfer for PRIs like Germany's Fraunhofer Institutes and Taiwan's

Industrial Technology Research Institute (Intarakumnerd & Goto, 2018). Furthermore, these interactions generate "reverse knowledge flow," where the intermediary agents from the PKS also gain significant technical and business-related skills, creating a mutually reinforcing cycle of benefits (Siegel et al., 2023). This highlights the role of PKS not just as knowledge sources, but as systemic intermediaries that build networks and facilitate interactive learning within the innovation ecosystem (Intarakumnerd & Goto, 2018).

The success of these PKS-SME collaborations, however, is not automatic and hinges on a confluence of factors. Beyond the SME's absorptive capacity trajectories (Bellucci & Pennacchio, 2016; Moon et al., 2019) and strategic alignment, success is deeply influenced by the PKS's own governance, funding models, and regional integration. For instance, strong industry involvement in the governance of PRIs and funding structures that demand industry co-investment, such as the "Fraunhofer model," ensure market relevance (Intarakumnerd & Goto, 2018). Geographical proximity and the "co-location" of PRIs with universities and industry clusters have also proven critical for fostering the face-to-face interaction necessary for deep collaboration (Intarakumnerd & Goto, 2018). Significant hurdles persist, including complexities in intellectual property (IP) negotiation and bureaucracy. However, a deeper challenge lies in the motivational and cultural differences between PKS types. Scientists at federal labs, for example, are often more mission-driven and motivated by a sense of public service, which can lead to "cognitive dissonance" and conflict when pursuing commercialization, a distinct barrier compared to the more curiosity-driven environment of many universities (Siegel et al., 2023).

While the literature has sometimes found the direct impact of PKS collaboration on SME innovation output to be inconclusive, recent causal evidence challenges this view.

The ambiguity can stem from the fact that PKS contributions are often indirect—enhancing a firm's absorptive capacity (Roper et al., 2008)—or involve "upstream" knowledge that requires significant further investment (Bercovitz & Feldman, 2007). However, rigorous case studies using methods like the Synthetic Control Method demonstrate a significant and positive causal impact. For example, the establishment of the Italian Institute of Technology (IIT) led to measurable increases in regional patenting, the local concentration of high-skilled human capital (inventors), and per capita GDP, with clear evidence of knowledge spillovers to local firms (Robbiano, 2022). This suggests that while generalizable, large-scale impacts can be difficult to measure, the effects of a well-integrated PRI can be profound and direct. The challenge, therefore, is not whether PKS collaborations are beneficial, but understanding the specific conditions and mechanisms—from governance and funding to geographical proximity and the management of cultural differences—that translate collaborative potential into tangible innovation and economic growth for SMEs and their surrounding regions.

3.4 Translating Innovation into International Success: The Impact on SME International Performance

A central question is how policy-induced innovation—whether through subsidies influencing R&D or via PKS collaboration shaping innovation types—translates into international outcomes during the knowledge exploitation phase (Freel et al., 2019; Miocevic, 2021). While innovation is a prerequisite for internationalization, the pathways are not fully mapped, especially for diverse international performance metrics beyond export entry.

The export promotion literature (Srhoj et al., 2023) focuses on commercializing existing products, often overlooking the innovation origin. R&D subsidy studies (Dimos & Pugh, 2016; Perez-Alaniz et al., 2023) examine the impacts on innovation but typically not the full spectrum of international performance that follows. The innovation value chain framework (Roper & Arvanitis, 2012; Roper et al., 2008) models the innovation-to-performance chain but often doesn't differentiate policy-induced and private innovation impacts on detailed international expansion. Robertson et al. (2023) link knowledge-based dynamic capabilities to innovation performance within ecosystems, implying international benefits, but the specific translation mechanisms need further study. Ebersberger et al. (2021) highlight the importance of external knowledge for innovation performance (incremental vs. radical), but the subsequent internationalization pathways are not their focus.

Thus, a nuanced understanding is needed of how (a) different sources of R&D (policy-induced vs. privately funded) and (b) different types of innovation (incremental vs. radical, potentially shaped by PKS collaboration) distinctly impact not just export decisions but also subsequent international expansion. The relative effectiveness of these pathways in driving specific international outcomes remains largely untested empirically.

3.5 Synthesis of Evidence and Identified Gaps

The literature, including the innovation value chain (Roper et al., 2008) and national innovation system (Robertson et al., 2023), indicates a positive but contingent link between public support, SME innovation, and international performance. However, critical gaps in understanding specific mechanisms and comparative impacts persist, which Chapter 4 and 5 address.

Firstly, while government subsidies may influence R&D (Dvouletý et al., 2021), and the role of internal finance is complex and size-dependent (Perez-Alaniz et al., 2023), the subsequent impact of this policy-induced R&D on the full spectrum of SME international performance (export decision, market and product diversification, export value) is not well established. Critically, the literature (e.g., Srhoj et al., 2023 on EPPs; Dimos & Pugh, 2016 on R&D subsidy additionality) has not sufficiently compared the internationalization impact of policy-induced R&D versus private R&D across these varied outcomes. Chapter 4 aims to fill this gap by examining how the source of R&D funding (policy-induced vs. private) in knowledge creation and transformation stages affects international expansion.

Secondly, PKS collaboration is a vital external knowledge sourcing strategy within the NIS (Robertson et al., 2023; Roper et al., 2008). While its role in fostering knowledge-based dynamic capabilities and innovation performance is recognized (Ebersberger et al., 2021; Robertson et al., 2023) on open innovation, the specific influence of PKS collaboration in shaping different types of innovation (incremental versus radical) and, crucially, how these collaborative innovation types distinctively translate into multifaceted international performance metrics compared to independently developed innovations, remains under-explored. Chapter 5 will investigate this, examining how PKS collaboration as a specific NIS mechanism influences SMEs' engagement in incremental versus radical product innovation (knowledge transformation), and how these distinct, collaborative innovation types (compared to independent innovations) shape multiple dimensions of SME international performance.

Both studies will employ longitudinal panel data and advanced econometric techniques to address endogeneity and selection bias, providing robust evidence on the contingent, stage-specific, and innovation-type-specific impacts of these policy

interventions on the innovation value chain. The framework of the empirical chapters is displayed as below.

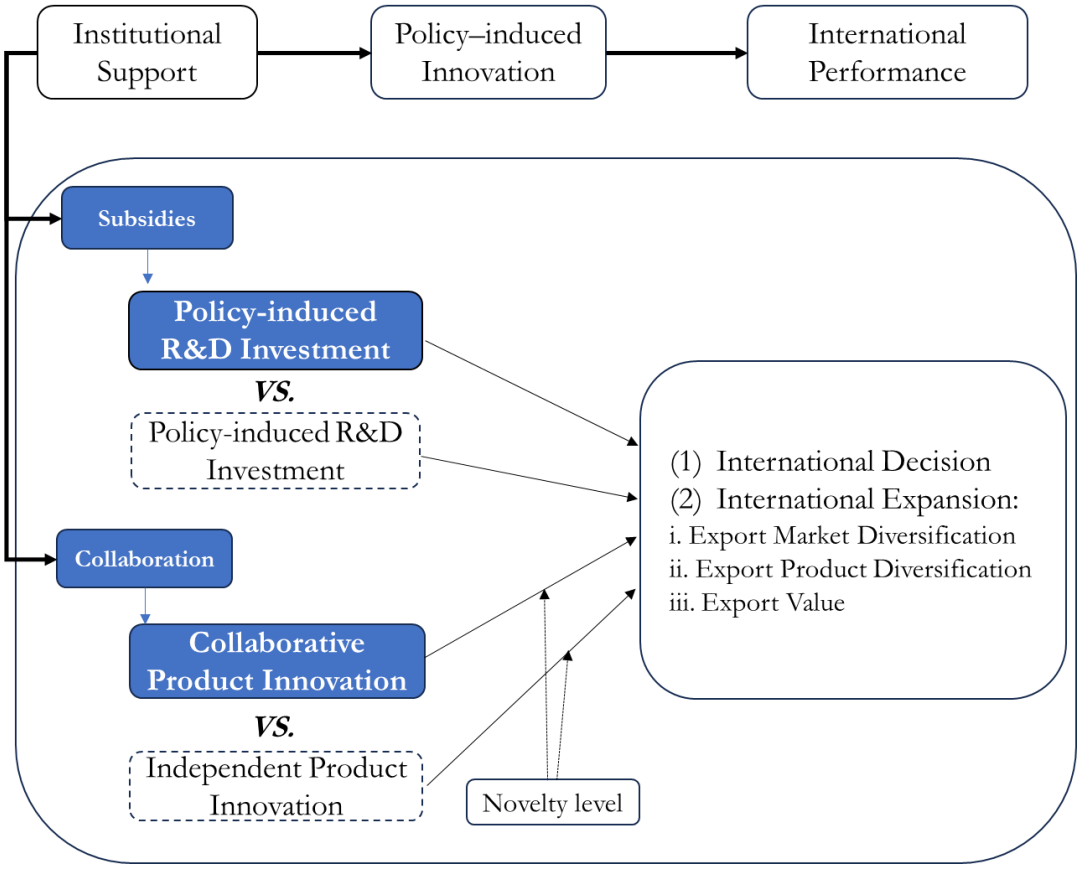


Figure 3-1 Empirical research framework

3.6 Conclusion

In summary, this focused literature review, framed by the Innovation Value Chain, National Innovation System, and Knowledge-based perspectives, has outlined existing knowledge on government subsidies, public knowledge collaboration, SME innovation, and internationalization. It has highlighted that while broad connections across the innovation value chain are acknowledged (Robertson et al., 2023; Roper et al., 2008), and the general effectiveness of certain policies is reviewed (Dimos & Pugh, 2016; Perez-Alaniz et al., 2023; Srhoj et al., 2023), the specific mechanisms through which policy-influenced knowledge sourcing and transformation translate into

detailed knowledge exploitation via international performance remain under-explored. Specifically, the comparative impact of policy-induced versus private R&D, and collaborative versus independent innovation types, on diverse internationalization outcomes requires further elucidation. This dissertation will address these gaps through two empirical studies. Chapter 4 specifically tackles the first set of questions by empirically investigating how general government financial subsidies impact SME R&D investment and, crucially, how this policy-influenced R&D translates into various dimensions of international expansion compared to privately funded R&D. Chapter 5 will then address the second set of questions concerning collaborative innovation.

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Chapter 4

The Innovation-Institution Paradox: How Government Subsidies Shape SME International Expansion via R&D

As highlighted by the literature review in Chapter 3, while the general positive influence of government innovation support is acknowledged, a nuanced understanding of how specific mechanisms like financial subsidies translate into tangible international performance for SMEs, particularly distinguishing the impact of policy-induced R&D from private R&D, remains a critical gap. This chapter empirically investigates this pathway within the State-SME nexus, examining how general government subsidies shape SME R&D investment and subsequently influence their export decisions and post-entry international expansion.

4.1 Introduction

The innovative capacity and economic impact of small and medium-sized enterprises (SMEs) are fundamental to national economic prosperity, particularly within small, open economies (Al-Tabbaa & Zahoor, 2024; Czarnitzki & Delanote, 2015; Haddoud et al., 2023). However, the pursuit of innovation and international activities exposes SMEs to considerable risks and challenges, often exacerbated by their limited resources (Chiappini et al., 2022; Donnelly et al., 2024). In response, governments frequently deploy subsidies[3] to mitigate risks and facilitate innovation, aiming to

[3] These subsidies are operating subsidies, including employment subsidies and operational funding, etc. It covers only operating subsidies paid to the enterprise on a continuing basis (https://www.cso.ie/en/methods/industry/censusofindustrialproduction/). This paper will henceforth refer to general government subsidies as government subsidies. If the subsidies are innovation-oriented, this paper will explicitly indicate the differentiation.

enhance SME competitiveness and initial international market entry (Guo et al., 2016; Mulligan et al., 2022). Such interventions are widely justified for addressing market failures, such as uncertainty and asymmetric information, and for fostering positive externalities (Dvouletý et al., 2021).

Existing literature extensively documents the positive impacts of government subsidies on SME innovation and their initial decisions to engage in international markets (Buffart et al., 2020; Jugend et al., 2020; Mulier & Samarin, 2021; Mulligan et al., 2022). Yet, a significant gap remains in understanding how these subsidies influence SMEs' strategic decisions beyond initial market entry, particularly regarding their ability to diversify into new products and markets (Freel et al., 2019; Ganotakis & Love, 2011; Haddoud et al., 2021).

This study addresses a critical gap by investigating how government subsidies influence SMEs' initial internationalization decisions and subsequent diversification strategies, with innovation playing a mediating role. I use a novel panel dataset constructed by merging the Trade Research Microdata File (Trade RMF), The Census of Industrial Production (CIP), and the Business Register (BR) from the Irish Central Statistics Office (CSO). The Trade RMF provides granular details on firms' exports, including exported commodities, partner countries, and export values, which constitute the key outcome variables. The CIP and BR contribute information on subsidies received, firm sector, location, age, turnover, and productivity, serving as crucial control variables. The resultant unbalanced panel comprises 10,044 firm-year observations spanning 2006 to 2019, enabling a long-term perspective on the policy impact on firm performance. I employ propensity score matching combined with random-effects panel modelling to distinguish the impacts of policy-induced R&D from privately funded R&D. Our analysis reveals a paradoxical outcome: government-

induced R&D significantly boosts SMEs' initial export activities while simultaneously constraining their ability to diversify their products and markets compared to privately funded R&D.

This research makes two primary theoretical contributions. First, it challenges prevailing assumptions about the effectiveness of government subsidies by highlighting the conditions under which such support may unintentionally become a strategic liability rather than an advantage. This insight refines the Knowledge-Based View (KBV), elucidating how externally incentivized knowledge creation can inadvertently restrict strategic agility. Second, I enhance the Uppsala internationalization model by explicitly distinguishing between the initial entry and subsequent diversification phases of internationalization, revealing how different funding sources shape these distinct stages (Tippmann et al., 2023; Vahlne & Johanson, 2020). By rigorously examining the differential impacts of policy-induced and privately funded R&D, this study provides policymakers with valuable insights into optimizing subsidy strategies, ensuring they effectively stimulate both initial international market entry and sustained export diversification.

The rest of the Chapter is organized as follows. Section 4.2 discusses the existing literature regarding the relationship between government subsidies, R&D investment, and international performance, and the logic behind the hypotheses presented. Section 4.3 describes the research context and methodology, including study design, measures, and data used in this paper. Section 4.4 describes our empirical results. Section 4.5 provides a discussion on policy and theoretical implications. Section 4.6 provides a brief conclusion.

4.2 Theory Background and Literature Review

The internationalization of SMEs is typically viewed as an incremental, resource-dependent learning process characterized by cautious expansion of market commitments following the acquisition of enhanced market knowledge (Vahlne & Johanson, 2017). While this established perspective of the Uppsala model emphasizes gradualism, it underestimates the potential for abrupt leaps in international engagement stimulated by external interventions such as government subsidies. This section employs a Knowledge-Based View (KBV), recognizing knowledge as the essential strategic asset driving competitive advantage (Freixanet & Federo, 2023). Critically, I argue that government subsidies can disrupt conventional incremental internationalization by enhancing SMEs' knowledge assets through policy-induced R&D, potentially altering traditional SME internationalization trajectories.

Beyond the Knowledge-Based View (KBV), which foregrounds knowledge as a critical strategic resource, the Resource-Based View (RBV) emphasises that firms' heterogeneous bundles of resources and capabilities underpin sustained competitive advantage. For SMEs, this heterogeneity is often characterised by scarcity: financial, human and organisational resources are limited relative to larger firms, making substantial R&D and international expansion particularly risky and costly.

This scarcity is encapsulated in the notion of the 'liability of smallness', which highlights that smaller firms face disproportionate challenges in absorbing shocks, investing in long-term projects and overcoming market entry barriers. In the internationalisation context, resource-poor SMEs must carefully trade off between investments in innovation and the demands of foreign market entry and expansion. Consequently, the way in which state support and different types of R&D funding

interact with this liability of smallness is central to understanding SMEs' export trajectories.

4.2.1 The Impact of Government Subsidies on Firms' R&D investment

Extant research suggests that SMEs underinvest in R&D due to significant resource and risk barriers (Czarnitzki & Giebel, 2024; Reshid et al., 2025). While government interventions are widely accepted remedies for addressing market failures (Catanzaro & Teyssier, 2021), their effectiveness can be paradoxical. Subsidies might either encourage additional R&D (Beck et al., 2016; Howoldt, 2024; Vanino et al., 2019) or crowd out private investments due to dependency risks (Becker, 2015). Contrary to the cautious perspective on subsidy reliance, I argue that general subsidies, not explicitly earmarked for R&D, these subsidies relax the resource constraints associated with SMEs' liability of smallness, enabling them to allocate more internal funds to R&D (Chiappini et al., 2022; Czarnitzki & Delanote, 2015; Gimenez-Fernandez et al., 2020).Thus, I hypothesize: .

Hypothesis 1: SMEs significantly increase R&D investments when receiving general government subsidies.

4.2.2 The paradoxical influence of policy-induced R&D on SMEs' export decisions

The KBV positions knowledge as foundational for international competitiveness, traditionally emphasizing that internally developed R&D capabilities are critical (Moughari & Daim, 2023; Ramdani et al., 2022). I challenge this by proposing a counterintuitive argument: externally incentivized, policy-induced R&D may surpass privately funded R&D in stimulating SMEs' export initiation. Policy-induced R&D not only bolsters knowledge resources but also mitigates SMEs' perceived risk, thus

paradoxically enabling quicker, less incremental internationalization, contrary to the traditional cautious expansion advocated by the Uppsala model (Cassiman & Golovko, 2011). Accordingly, I formulate:

Hypothesis 2: Policy-induced R&D significantly increases the likelihood of SMEs making an export decision.

4.2.3 The complex effects of policy-induced R&D on post-entry export expansion

Post-entry internationalization encompasses complex strategies of product and market diversification, traditionally viewed as dependent upon gradual experiential learning (Purkayastha et al., 2024; Saridakis et al., 2019). Because market diversification and innovation compete for scarce resources under the liability of smallness, policy-induced R&D may play a different role from private R&D in supporting post-entry expansion.I . I break down firms' international performance into market diversification (MD), product diversification (PD), and export value, which describes SMEs' exporting expansion process (Bodlaj et al., 2020; Miocevic, 2021).

Policy-induced R&D and market diversification

Market diversification requires significant resource allocation and adaptive capabilities (Cirera et al., 2015). The KBV suggests that R&D fosters not only specific product knowledge but also dynamic capabilities, such as enhanced adaptability and innovation capacity (Jaureguy et al., 2023). These capabilities, rooted in a deeper organizational knowledge base, empower SMEs to modify their offerings or operational processes to meet the varied demands and regulatory standards of multiple international markets (Al-Tabbaa & Zahoor, 2024). However, empirical research is mixed and suggests that R&D investment has a positive, no significant, or even adverse impact on diversifying firms' exporting markets (Cirera et al., 2015;

Purkayastha et al., 2024). Because market diversification and innovation activities both demand significant attention and resources, resource-constrained SMEs face trade-offs, meaning they may be unable to prioritize innovation activities and MD simultaneously (Bodlaj & Čater, 2022; Bodlaj et al., 2020; Miocevic, 2021).

Considering the above conflict, policy-induced R&D does not compete for the firm's own resources, providing a critical competitive edge when venturing into new foreign territories (Di Maria & Ganau, 2017). The Uppsala model emphasizes that diversifying into new markets often involves navigating greater psychic distances and making increased resource commitments (Donnelly et al., 2024; Johanson & Johanson, 2021). Policy-induced R&D may equip SMEs with superior knowledge assets and innovation (Perez-Alaniz et al., 2025), thereby, bolster their confidence to commit resources to these unfamiliar markets (Dung Ngo et al., 2024). The experiential learning central to the Uppsala model is thus complemented by R&D-based knowledge, potentially enabling SMEs to take larger, more assured steps in their geographic expansion rather than purely incremental ones. The additional R&D investment from government subsidies also frees internal resources that can be strategically deployed for the demanding tasks of gathering market intelligence and local adaptation in new countries. Therefore, our third hypothesis is:

Hypothesis 3: Policy-induced R&D increases SMEs' export market diversification.

Policy-induced R&D and export product diversification (PD)

SMEs diversify their export product range to achieve economies of scope, address diverse customer segments within their existing or new export markets, and more effectively leverage their accumulated market knowledge with new offerings (Makri et al., 2017; Miocevic, 2021). According to the KBV, R&D directly expands the firm's

technological knowledge base and understanding of product applications (Edeh & Prévot, 2024). This enriched knowledge allows for the creation of novel product-knowledge combinations, leading to a broader portfolio available for export (Kantaruk Pierre et al., 2024). However, the potential resource competition between international diversification and R&D investments persists. Resource-constrained SMEs may not be able to manage both, and some studies suggest that R&D investment could impede a firm's international performance (Freixanet & Rialp, 2022).

Policy-induced R&D, as additional R&D investment incentivized by government subsidies, directly fuels this process by supporting the development of new or significantly improved products. The technological capabilities honed through such R&D can be applied across a wider array of related products, effectively distributing development costs (Tang et al., 2019). In the context of the Uppsala model, introducing new products into export markets represents an escalation of commitment (Vahlne & Johanson, 2017). Policy-induced R&D provides the crucial technological knowledge required for this step, allowing firms to deepen their engagement in established markets by scoping their offerings. The subsidised nature of this R&D also mitigates the financial risk associated with developing new products specifically tailored for export, encouraging SMEs to be more ambitious in their product diversification strategies. This leads to the formulation of the fourth hypothesis, as follows:

Hypothesis 4: Policy-induced R&D increases SMEs' export product diversification.

Policy-induced R&D and Firms' export value

An increase in export value, whether measured by export intensity (the ratio of export revenue to total turnover) or total export revenue, signifies enhanced success and competitiveness in international markets (Haddoud et al., 2021). From the KBV

perspective, Radicic and Djalilov (2019) find that SMEs investing in technological innovation tend to achieve better outcomes in export markets. Such SMEs are likely to be more productive and yield higher profits across a wide range of markets (Paul et al., 2017). However, substantial R&D investment can elevate SMEs' overall cost structure. If not managed efficiently, this can lead to pricing products out of competitive range, adversely impacting their competitiveness in international markets, especially for resource limited SMEs. Empirical evidence further suggests that R&D investments may not always correlate positively with export intensity, showing no significant effect or even a negative impact (Edeh et al., 2020; Leung & Sharma, 2021). In contrast, policy-induced R&D, incentivized by external support, reducing resource constraints and enriching SMEs knowledge base. This enhanced knowledge base helps SMEs to be more innovative to secure and sustain a competitive edge in foreign markets by capitalizing on international opportunities and achieving economies of scale and scope (Fernández-Mesa & Alegre, 2015; Peters & Roberts, 2022). Therefore, I propose our fifth hypothesis:

Hypothesis 5: Policy-induced R&D increases SMEs' export value.

In sum, the KBV and RBV suggest that any increase in knowledge resources via R&D—whether policy-induced or privately financed—should support internationalisation. Yet, the liability of smallness implies that how these investments are structured and governed may matter. Policy-induced R&D could relax short-term financial constraints and trigger export entry, while privately funded R&D, tightly aligned with the firm's own strategic priorities and market learning, may be more effective for sustained, complex commitments such as product and market diversification. This tension underpins the 'innovation–institution paradox' examined

in this chapter: the possibility that government-induced R&D is simultaneously enabling and constraining in SMEs' internationalisation pathways.

This study proposes that government subsidies can act as a catalyst for additional R&D investment within SMEs. This policy-induced R&D, by enriching the firm's knowledge base and bolstering its innovative capacity—key tenets of the KBV—is expected to positively influence its initial decision to engage in exporting, its ability to diversify into new export markets and products, and the overall export value it captures from its international operations. These effects are understood to interact with the incremental learning and commitment processes outlined in the Uppsala model, potentially enhancing the SME's internationalization pathway. Our research framework and hypothesis development summary are displayed in Figure 4-1 and Table 4-1 separately, as below:

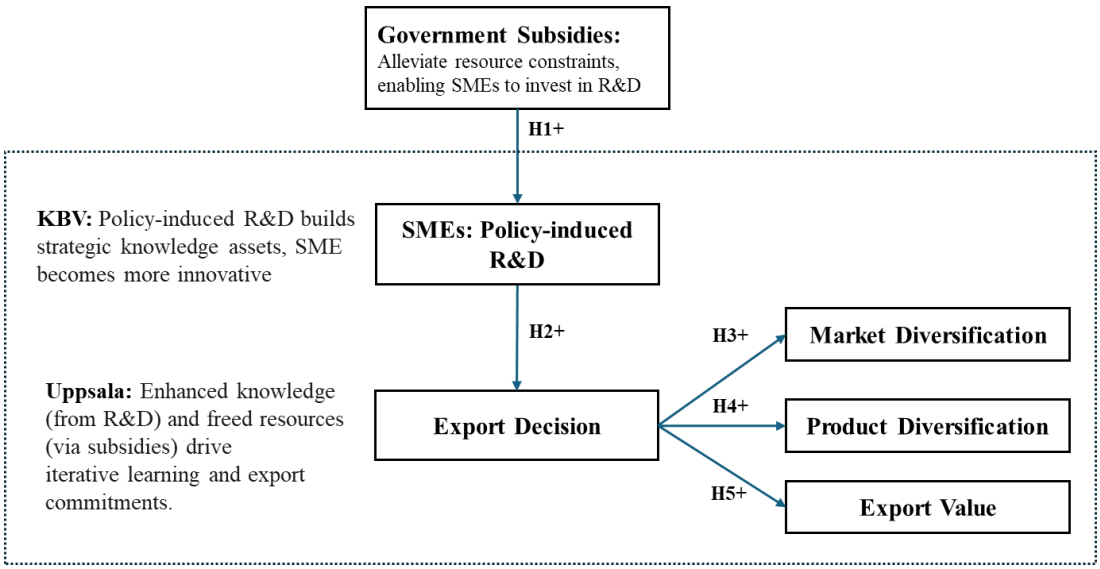


Figure 4-1 Research hypotheses framework

Table 4-1 Theory prediction and hypothesis development

Theory Prediction (KBV & Uppsala Model)	Hypothesis
Government subsidies alleviate SME resource constraints and reduce the perceived risk/cost of R&D, incentivizing	**H1:** SMEs increase R&D investments

firms to allocate these external funds towards knowledge creation activities, thus increasing overall R&D investment.	when subsidised by the government.
KBV: Policy-induced R&D creates a competitive advantage and increase knowledge base. **Uppsala:** Enhanced knowledge base builds confidence and capability for initial or continue export commitments; frees internal resources for export initiation.	**H2:** Policy-induced R&D increases SMEs' export decision (likelihood of export).
KBV: Policy-induced R&D enhances innovation adaptability for diverse market needs and boosts absorptive capacity for assimilating new foreign market knowledge. **Uppsala:** Supports incremental learning and resource commitment to enter additional, often psychically distant, markets; externally funded R&D allows internal resource allocation to market exploration and adaptation.	**H3:** Policy-induced R&D increases firms' export market diversification.
KBV: Policy-induced R&D provides a technological platform for developing related product innovations for export. **Uppsala:** Seeds the knowledge base for product line extensions into existing or new export markets, reducing the perceived risk of developing and launching new export products.	**H4:** Policy-induced R&D increases firms' export product diversification.
KBV: Policy-induced R&D can command premium prices, improve quality, or lead to process efficiencies that reduce costs, enhance export margins. **Uppsala:** Successful export of innovations drives a virtuous cycle of experiential learning and commitment, allowing reinvestment; policy -induced R&D frees resources for complementary value-enhancing activities.	**H5:** Policy-induced R&D increases firms' export value.

4.3 Methodology and Data

4.3.1 Research context and database

SMEs[4] account for more than 99% of the total enterprises in Ireland (CSO, 2020). Unlike MNEs, SMEs with limited resources are reluctant to enter export markets (Mansion & Bausch, 2020). Ireland has strong national competitiveness, including value-added, productivity, and high-tech exports, encouraging innovation and market competition (Bohle & Regan, 2021). Meanwhile, a series of subsidies from the Irish State and the EU provide funding to SMEs on a continuing basis. Therefore, the Irish economy's export orientation and openness provide a suitable context to explore the impact mechanism of government subsidies on SMEs' innovation activities and export performance.

To investigate our research questions, II constructed a unique firm-level panel dataset constructed by merging three distinct micro-databases from the Irish Central Statistics Office (CSO). This unbalanced panel has 10,044 firm-year observations, covering the time from 2006 to 2019. Firstly, II draw on the CSO's Census of Industrial Production (CIP), which is carried out on an annual basis, covering all firms whose whole or primary activity is in industrial production (NACE 2 code, i.e., mining and quarrying, manufacturing, and utilities). This data provides information on i) total operating subsidies a firms received from both State and the EU, which forms our primary treatment variable, ii) a series of R&D-related firm characteristics, such as R&D investment and capitalized value of patents, iii) industrial process (e.g., industrial

[4] In the Irish context, SMEs are defined as enterprises with less than 250 persons engaged. In this chapter, SMEs are further split into Micro-enterprises with less than 10 persons engaged, other small enterprises with between 10 and 49 persons engaged, and Medium-sized enterprises with between 50 and 249 persons engaged: https://www.cso.ie/en/releasesandpublications/ep/p-bii/businessinireland2020/smallandmediumenterprises/

services and labour, and the value of goods produced), and iv) trading dimensions (e.g., turnover, purchases of materials and services and labour costs), covering the period 2006-2016.

Secondly, II use the Trade Research Microdata Files (Trade RMF) data. This dataset is compiled from administrative data from Revenue Commissioners [5], providing principal variables on firms' exports and a corresponding breakdown of exports into commodity code, country of destination for exports, and export value. This detailed firm and product level export information forms the basis of our dependent variables for international performance, including export decision (whether a firm exports), market diversification (count of export destination countries), product diversification (count of exported commodity codes), and export value from 2006-2019. The Trade RMF covers three more years (2017-2019) than the CIP data, allowing me to capture the impact of R&D investment on exports 1-3 years later.

Thirdly, the Business Register (BR) includes all active enterprises in the State, providing information on enterprises' births, which are used to calculate the age of firms, their location at the county level, the main sector of activity, and the number of persons employed. These measures are employed as control variables capturing firms' characteristics, covering the period 2006-2016. By merging the Trade RMF, CIP, and BR data, I I construct an unbalanced panel that allow me to measure Irish firms' information on subsidies, R&D investment, and international performance along with control variables capturing firms' characteristics as previously described.

[5] The Revenue Commissioners (often simply called "Revenue") is Ireland's statutory tax and customs authority, operating within the Department of Finance, https://www.revenue.ie/. This data is derived from administrative datasets (i.e. it is not a survey) and therefore covers all companies which export in Ireland.

Our study focuses on Irish SMEs. Thus, to ensure our sample consists of domestically controlled firms, II only include enterprises whose final ownership resides in Ireland. II also adopted the European Union's definition of SMEs[6], and exclude large firms with 250+ employees from our sample. Given the longitudinal nature of our panel data, II address the potential for firms to transition across this threshold over time. Specifically, a firm is classified as an SME if it reports fewer than 250 employees in year t, and II excluded firms at the point when their employee counts equalled or exceeded 250. Appendix Table A4-1 in the supplementary material displays the description and summary of the three databases above.

4.3.2 Measurement and variables

Based on this panel dataset, II construct several key variables to examine the impact of government subsidies on SMEs' R&D investment and subsequent international performance. First, II measure government subsidies as a binary variable. This variable takes a value of 1 if an SME reports received government subsidies, as recorded in the CIP. Otherwise, it has a value of 0. Second, II assess R&D investments using continuous variables derived from the CIP. Following Miocevic (2021), II measure SMEs' international performance across four variables, including i) Export decision, a binary variable indicating whether the firm exports or not; ii) Diversity of export products, measured as the total number of products a firm exports to foreign markets, capturing the breadth of the firm's export offerings; iii) Diversity of export markets, measured as the total number of the foreign markets to which a firm exports its products and so measures the geographical scope of its international activities; and

[6] According to European Commission, based on the staff headcount criteria, small and medium-sized firms have staff less than 250. https://single-market-economy.ec.europa.eu/smes/sme-fundamentals/sme-definition_en

iv) export value, measured as export revenue normalized by employees, reflecting the intensity of the firm's export engagement. II measure international performance from the year t+1 to year t+3, 1 to 3 years after observing firms' R&D investment. By imposing these year lags between our innovation activities measures and subsequent international performance, II establish clear temporal precedence—R&D investment recorded in CIP in year t must occur before firms' observed trade outcomes in year t + 1, t+2, and t+3. This design feature works on two fronts. First, it aligns with existing literature and mirrors the real-world gestation period required to move from R&D and product development into marketable output, especially in international markets where distribution channels and regulatory approvals can delay market entry (Haddoud et al., 2023; Ramdani et al., 2022). Second, and crucially for identification, as II observe innovation first and exports later, it becomes far less plausible that a firm's measured international performance is driving recorded innovation activity—thereby substantially reducing reverse- causality bias and endogeneity concerns (Haddad & Bergek, 2023). In econometric terms, our lag structure mitigates simultaneity concerns and enhances causal interpretation: by shifting the dependent variable in time, II isolate the impact of past innovation on future international engagement, rather than conflating it with innovation decisions that respond to prior or co-current export outcomes (Falahat et al., 2020).

Finally, II include several firm-level control variables to account for potentially confounding factors, including firm age, number of employees, region, sector, productivity, export status, innovation capability (see Table 4-2 below, Appendix Tables A4-2 and A4-3 in the supplementary material accompanying this paper provide summary statistics and a matrix of correlation for all variables used in our sample). Beck et al. (2016) deem these export-related variables to be key indicators of price and

quality advantages when examining the impact of policy-induced R&D on firms' international performance.

Table 4-2 Definition of variables used in the analysis

Variable	Definition
Stage one dependent variable	
R&D	Continuous variable, firm's R&D investment, measured by the firms' R&D expenditure (in euro) in year t.
Stage two dependent variables	
Export Decision	A binary variable, measures whether the firm's export sales is greater than 0 or not in t+1. As a robustness check, II also measure this variable in t+2 and t+3.
Market Diversification	The count of export markets in year t+1. As a robustness check, II also measure this variable in t+2 and t+3.
Product Diversification	The count of export products in year t+1. For robustness check, II also measure this variable in t+2 and t+3.
Export Value	The firm's export revenue per employee in year t (in thousand Euro).
Treatment variables	
Subsidies	The binary variable equals 1 if the total subsidies a firm receives from the State or Europe Union in the given year is greater than 0; otherwise, the binary variable equals 0.
Control variables both in stage one and two	
C_Firmage	A categorical variable: which measures how long the firm has existed since it was established and equals 1 if a firm is younger than 3 years old (including 3 years old) in the given year, otherwise it equals 2.
Firm size	Number of employees, if the employee number is less than 10, II categorize as 1 (micro-small firm), if the

	employee number is less than 50 but more than 10 (including 10), II categorize as 2 (small firm), if the employee number is less than 250 but more than 50 (including 50), II categorize as 3 (medium-sized firm).
Sector	Categorical variables representing 4 Sectors (defined in Appendix Table A4-4 in Supplementary material)
Region	Categorical variables NUTS2 (defined in Appendix Table A4- 5 in Supplementary material)
Year	Categorical variables: 0 = 2006; 1 = 2007; 2 = 2008; 3 = 2009; 4 = 2010; 5 = 2011; 6 = 2012; 7 = 2013; 8 = 2014; 9 = 2015; 10 = 2016.
Additional control variable in Stage two	
Unit labour productivity	Unit labour productivity (sales per employee), natural logarithm.
Firm age	Firm's age, how long the firm has been existing since it was established, natural logarithm.
Firm size	Number of employees, natural logarithm.
Patent	Capitalized patent value: 1 = Firms in the lowest capitalized patent value quartile in a given year; 2 = Firms in the second lowest capitalized patent value quartile in a given year; 3 = Firms in the second highest capitalized patent value quartile in a given year; 4 = Firms in the highest capitalized patent value quartile in a given year.
Export_control	Total export value: 1 = Firms in the lowest total export value quartile in a given year; 2 = Firms in the second lowest total export value quartile in a given year; 3 = Firms in the second highest total export value quartile in a given year; 4 = Firms in the highest total export value quartile in a given year.

Notes: NACE is the acronym for 'nomenclature statistique des activités économiques dans la Communauté européenne' and is the statistical classification of economic activities used by Eurostat.

4.3.3 Empirical strategy: equation and regression model

A key issue when examining the impact of government subsidies on firms' performance is selection bias. This bias arises because firms self-select into the treatment (Dimos & Pugh, 2016; Perez-Alaniz et al., 2025). For instance, in our study, the observed difference between subsidised and non-subsidised firms could reflect the fact that the subsidised firms are either lower or higher performers (Buffart et al., 2020). In addition, government agencies may select better-performing firms for funding and subsidies, the so-called 'picking winners' strategy (Becker, 2015; Lenihan et al., 2024; Mulligan et al., 2022). To address this endogeneity and isolate the causal effect of subsidies, II employ a two-stage estimation procedures, a common approach in policy evaluation literature (Becker, 2015; Dimos & Pugh, 2016; Freel et al., 2019; Perez-Alaniz et al., 2025). Following Perez-Alaniz et al. (2025) and Mulligan et al. (2022), in stage one, II use propensity score matching (PSM) model to estimate the additional R&D investment undertaken by SMEs due to receiving government subsidies (referred to as policy-induced R&D). In stage two, II then use the estimates of policy-induced R&D from Stage 1 to analyse its impact, compared to privately funded R&D, on SMEs' international performance. As is common in the literature, I refer to firms that receive government subsidies as 'treated' and all other firms as 'untreated' (Mulligan et al., 2022). PSM allows me to construct a robust control group of untreated firms that are statistically similar to treated firms based on observable pre-treatment characteristics, thereby mitigating selection bias and enabling a more accurate estimation of the treatment effect.

Stage 1: Estimating Policy-induced R&D using PSM

In the first stage, I I estimate the probability of a firm receiving a government subsidy using a probit model. II match treated and untreated firms based on their calculated propensity score to receive the treatment. The propensity score is the conditional probability of firm i receiving a subsidy in year t, given a set of its pre-treatment characteristics in year t-1. In this way, II can compare the R&D performance of treated and untreated firms. The probit model is specified in Equation (1), the term $Treatment_{kit}$ is a binary variable equal to 1 if firm *i* received treatment *k (government subsidy)* in year *t,* and 0 otherwise. $X_{i(t-1)}$ is a set of lagged observable firm i's characteristics at year t-1, which are likely to influence both the probability of receiving a subsidy and the stage one outcome variable (R&D investment). These characteristics include firm age, size, industry sector, and region (see previous Table 4-2 for definitions). Using lagged variables ensures that matching is based on characteristics determined prior to treatment. The β_s indicates the model coefficients and ε_{it} is the error term.

$$Treatment_{kit} = \beta_0 + \beta_1 X_{i(t-1)} + \varepsilon_{it} \quad (1)$$

Based on the estimated propensity scores, II match each treated firm with an untreated one. II employ a nearest-neighbour matching algorithm (1:1 matching without replacement) with a calliper set at 0.2 times the standard deviation of the logit of the propensity scores (c=r(sd)*.2=0.0185) to ensure high-quality matches (Perez-Alaniz et al., 2025). This process creates a control group of non-subsidised firms that are statistically comparable to the subsidised firms in terms of their pre-treatment observable characteristics. As reported in Appendix Table A4-6, our matching

procedure achieved a well-balanced distribution of covariates between the treated and control groups.

After successful matching, II estimate the average treatment effect on the treated (ATT) for R&D investment. This represents the policy-induced R&D investment, denoted as $\alpha_{subsidies,it}$ through Equation (2). In doing so, II capture the counterfactual situation of how much a treated firm would have invested in R&D if it had not received that treatment. Then, the mean difference in R&D expenditure between the treated firms and their matched non-treated counterparts is the policy-induced R&D. The calculation is as follows:

$$\alpha_{subsidies,it} = E\left({}^{T}RD_{it} \,|F_{it} = 1\right) - E\left({}^{C}RD_{it} \,|F_{it} = 1\right) \quad (2)$$

In Equation (2), $\alpha_{subsidies,it}$ is the policy-induced R&D for firm i in year t, or the treatment effect. $E\left({}^{T}RD_{it} \,|F_{it} = 1\right)$ is the average R&D investment of firms that received subsidies and $E\left({}^{C}RD_{it} \,|F_{it} = 1\right)$ is the average R&D investments of the matched non-subsidised firms, serving as the counterfactual R&D expenditure for the treated firms had they not received the subsidy. This $\alpha_{subsidies,it}$ can be positive (reflecting additionality), zero (no effect), or negative (indicating crowding-out if matched non-treated firms invest more in R&D than treated ones).

Given both values, it is possible to decompose the observed R&D investment of treated firms (in Equation (3)). For a firm i that received a subsidy, its observed R&D expenditure ($PrivateRD_{it}$) can be thought of as comprising its privately funded R&D component ($PrivateRD_{it}^{C}$) and the policy-induced component ($\alpha_{subsidies,it}$). I estimate the counterfactual privately-funded R&D for subsidised firms. $PrivateRD_{it}^{C}$ could be negative if the estimated policy-induced R&D ($\alpha_{subsidies,it}$) exceeds the firm's total observed R&D ($PrivateRD_{it}$), potentially indicating a strong substitution

effect. For non-subsidised firms, $PrivateRD_{it}^{C}$ is equal to $PrivateRD_{it}$ since treatment effects for this group of firms are zero by the definition (Beck et al., 2016; Mulligan et al., 2022; Vanino et al., 2019) .

$$PrivateRD_{it}^{C} = PrivateRD_{it} - \alpha_{subsidies,it} \quad (3)$$

In conceptual terms, this study interprets $\alpha_{subsidies,it}$ as policy-induced R&D: the component of R&D investment that is attributable to the receipt of government subsidies, i.e., externally incentivised knowledge creation activity. Conversely, $PrivateRD_{it}^{C}$ represents the counterfactual privately funded R&D that the firm would have undertaken in the absence of subsidies. This distinction allows me to separate the effects of knowledge generated under external financial incentives from those of knowledge generated under purely internal strategic choice—an important nuance in understanding how different funding logics shape SMEs' internationalisation behaviour.

Stage 2: Estimating the Impact of R&D Types on International Performance

In the second stage, I investigate how policy-induced R&D ($\alpha_{subsidies,it}$) and counterfactual private R&D $PrivateRD_{it}^{C}$, which are both derived from Stage 1, differentially affect SMEs' international performance in year t+1. I use lagged R&D variables (from year t) to allow for the time it typically takes for R&D investments to translate into SMEs' international performance—from export decision to expansion.

$$Export\ Decision_{it+1} = \beta_0 + \beta_1 \alpha_{subsidies,it} + \beta_2 PrivateRD_{it}^{C} + \beta_3 z_{it} + \varepsilon_{it} \quad (4)$$

$$Export\ Expansion_{it+1} = \beta_0 + \beta_1 \alpha_{subsidies,it} + \beta_2 PrivateRD_{it}^{C} + Mills + \beta_3 z_{it} + \varepsilon_{it} \quad (5)$$

Using a probit model, I begin by examining SMEs' $Export\ Decision_{it+1}$, and then through the two-stage Heckman selection modelling approach, I narrowed our focus to only firms that export in t+1 and continue to examine their export product diversification, export market diversification, and export value. β_1 and β_2 are associated coefficients of policy-induced R&D and private R&D respectively. I also include a number of control variables, the term z_{it}, to capture other determinants of SMEs' export behaviors. z_{it} is a matrix of control variables for firm *i* in time *t,* which includes the same treatment variables as the X_{it} in Equation (1) at stage 1*,* the firms-specific characteristics (e.g., size, age, capital intensity, and productivity). In addition, I also include measures of each firm's competitive advantages (e.g., unit labour productivity and capitalized value of patents) in stage 2. β_3 are the associated coefficients. The term ε_{it} is the error term. I first modelled the export market entry decision using a probit model with robust standard errors, calculating the Inverse Mills Ratio (*Mills* in equation 5). Then, for the subsequent regression analysis conditional on exporting, I used a random effects panel model to control for time-invariant unobserved heterogeneity (Freel et al., 2019).

4.4 Empirical Results

This section presents the results of our two-stage PSM model and two-stage Heckman selection model. Initially, I assess the influence of government subsidies on the aggregate R&D investments of SMEs. Subsequently, our attention shifts to a comparative evaluation of the respective roles played by policy-induced R&D in shaping SMEs' export decision, export product diversification, export markets diversification, and export revenues.

4.4.1 Evaluating the impact of government subsidies on R&D

As described above, I employ propensity score matching to identify the average treatment effect of government subsidies on the treated SMEs. In doing so, I estimate a probit model with a binary dependent variable indicating whether a firm received a subsidy, controlling for important characteristics for selection into the subsidy scheme. All our covariates displayed in Table 4-1, such as firm age, size, region, sector, etc., play crucial roles in selection into the treatment and exhibit a well-balanced distribution after the matching (with the Propensity score outcome displayed in the Appendix Table 4A-6). This signifies the success of our matching process that controlled endogenous issues and selection bias, ensuring a close match for each of our treated firms. The outcome variable of R&D investment is the only variable retaining a statistically significant difference between the treated and control groups. Consequently, I attribute this difference to the treatment – government subsidies. As mentioned in section 4.3, government subsidies may result in firms' R&D investment being lower than would have been the case without public support (Dimos & Pugh, 2016). This is the case when policy-induced R&D is negative and occurs if matched non-treated firms have greater R&D expenditure than treated firms. Therefore, in our two-stage analysis, the monetary amount of R&D expenditure can be negative, which allows me to capture full and over-full crowding-out effects (Lenihan et al., 2024)[7] as described in section 4.3.3.

Table 4-3 PSM results for the impact of government subsidies on firm-level R&D investment

Treatment	Treated	Matched untreated	Difference (α-ATT)

[7] For a more detailed discussion of crowding-out effects in a two-stage model, see Dimos and Pugh (2016) and Becker et al., (2015).

R&D investment	33.3149	8.7052	24.6097***

Notes: * p < 0.1; ** p < 0.05; *** p < 0.01. For ease of interpretation, the results in Table 4-3 are expressed in thousands of Euros. Estimation results based on 1:1 nearest neighbour matching. The α term, which is average treatment effect on the treated, relates to the average policy-induced R&D by government subsidies.

Table 4-3 reports the average treatment effect derived from the probit model utilized for evaluating the impact of government subsidies on SMEs' R&D investment. These results constitute an essential initial phase in our analysis, testing hypothesis 1. The findings in Table 4-3 demonstrate that the treated firms spend over 24,000 euros more than their untreated counterparts on R&D activities. This strongly supports our first hypothesis that government subsidies reduce SMEs' resource constraints and enable them to become more innovative than their non-subsidised counterparts.

4.4.2 Effects of policy-induced R&D on export development performance

Building on the policy-induced R&D generated from government subsidies, this section examines its influence on SMEs' export development performance. This performance is evaluated across four key dimensions: the decision of SMEs to export, the diversification of their export products, the diversification of their export markets, and their overall export value. These dimensions correspond to hypotheses 2 through 5, which are tested using Models I, II, III, and IV, respectively, based on Equation (4).

Model I specifically addresses hypothesis 2, which posits that policy-induced R&D enhances SMEs' propensity to export. The results from the probit model, detailed in the first column of Table 4-4 (corresponding to Model I), substantiate this hypothesis. The findings indicate that policy-induced R&D has a significant and positive effect on SMEs' decision to export, with marginal effects displayed in Table 4-5. For instance,

an increase of €100,000 in policy-induced R&D investment is associated with an average rise of 1.87% in the probability of an SME engaging in exporting.

Turning to export diversification, Models II and III, with results presented in Table 4-4, investigate hypotheses 3 and 4. Consistent with expectations, policy-induced R&D investment demonstrates a positive and significant impact on both the diversification of SMEs' export markets and their export products. Specifically, a €100,000 increase in policy-induced R&D investment is linked to an average increase of 0.182 units in the number of distinct exporting destinations (Model II) and an average increase of 0.443 units in the number of distinct exporting products (Model III). These outcomes provide support for hypotheses 3 and 4.

Finally, the impact of policy-induced R&D on export value (hypothesis 5) is examined through Model IV. The results show a positive and significant effect, where a €100,000 increase in policy-induced R&D investment is estimated to yield an increase of over €3,000 in export income. This finding supports hypothesis 5.

Table 4-4 The link between R&D and firm international performance

Variable	Exporter t1 (1/0)	Market Diversification t1	Product Diversification t1	Export value t1
Model	I	II	III	IV
Policy-induced	0.00790*	0.00182***	0.00443***	0.0331***
R&D	0.000463	0.00026	0.00134	0.0137
Private R&D	0.000256*	0.00609***	0.0117**	0.119
	0.000136	0.000995	0.00326	0.0793
Firm size	0.366***	6.135***	14.89***	4.626
	0.0189	0.803	2.173	38.16
Firm age	0.122***	0.503*	1.936***	14.77
	0.0224	0.27	0.674	11.95
	0.0281	2.004***	4.083***	168.0***

Unit labour productivity	0.0203	0.251	0.583	41.67
2.c_to_ex	0.563***	3.224***	7.798***	36.56
	0.0478	0.753	1.913	22.41
3.c_to_ex	0.972***	8.892***	19.67***	94.51**
	0.0393	1.619	4.130	48.09
Patent	0.153	1.966***	5.288***	41.44***
	0.0957	0.641	1.643	15.88
Mills		12.84***	28.99***	132.5
		2.719	6.818	81.51
Constant	-3.496***	-59.17***	-138.3***	-1,201***
	0.335	8.945	23.15	230.9
Firm fixed effects control		Yes	Yes	Yes
Year fixed effects control		Yes	Yes	Yes
Observations	10,044	2,289	2,289	2,289
Number of firms		1,440	1,440	1,440

Notes: * p < 0.1; ** p < 0.05; *** p < 0.01. Robust standard errors are in parentheses. The policy-induced R&D variables correspond to the α term defined in Equation (2). The number of observations differs between Model I and Models II-IV because the latter models specifically analyse firms after their decision to export, using dependent variables relevant only to this exporting subsample. For ease of interpretation, results in Table 4-4 are expressed in thousands of Euros. Model I is a regular probit model, while Models II, III, and IV are random effects models. All models control firm industry, region, and year; full regression results are available in Appendix A4-7. For market diversification and product diversification variables, one unit represents one additional foreign market or one additional product, respectively.

Table 4-5 Marginal Effects on Export Decision (Probit, t1)

	dy/dx	Std.err.	Z	P>|z|	90% conf.	interval
Policy-induced R&D	.00001878	.0001101	1.71	0.088	7.63e-06	.0001142

Private R&D	.0000609	.0000324	1.88	0.0060	6.068e-06	.000369

Notes: Marginal T-test displayed with confidence level at 90%

4.4.3 Comparison between policy-induced R&D and private R&D

To further distinguish the impacts, a comparative analysis was conducted of policy-induced R&D and private R&D. T-tests were performed separately for each of the four models (I-IV) to determine if statistically significant differences exist in the magnitude of their effects on the international performance dimensions. While initial observations of the coefficients suggested that policy-induced R&D might have a larger impact on export decisions but a smaller impact on market diversification, product diversification, and export value compared to private R&D, the formal t-test results in Table 4-6 provide a more precise differentiation. These tests reveal that policy-induced R&D exerts a statistically significantly weaker impact than private R&D on SMEs' export market diversification (Model II, p=0.0000 in Table 4-6) and on export product diversification (Model III, p=0.0145 in Table 4-6). No such significant differences in the strength of the impact were observed for export decisions (Model I) or export value (Model IV) when comparing the two R&D types.

Table 4-6 Comparison between policy-induced and private R&D in export expansion

Dimension in t+1	**Variable (equality test in t+1)**	**Test Statistic (chi2)**	**Test p-value (Prob > chi2)**
Exporting Market Diversification (II)	Private R&D vs Policy-induced R&D	23.19	0.0000***
Exporting Product Diversification (III)	Private R&D vs Policy-induced R&D	6015	0.0131**
Export Value (IV)	Private R&D vs Policy-induced R&D	1.18	0.2781

Notes: T-test displayed with confidence level at 90%

4.4.4 Robust check with extending export development performance to t+2 and t+3

To validate the persistence of the observed impacts, robustness checks were conducted by extending the time lag between R&D investment and export development performance. Models I through IV were re-estimated, examining the effects of private R&D and policy-induced R&D investment on export outcomes at t+2 and t+3, instead of the original t+1. The results of these checks are displayed in Appendix Table A4-7 and A4-8. For policy-induced R&D, its positive impact on the export decision (Model I) was found to be no longer statistically significant at these extended time horizons. However, its positive and significant effects on export market diversification (Model II), product diversification (Model III), and export value (Model IV) were maintained at both t+2 and t+3. It was also noted that, consistent with previous findings, the coefficients for policy-induced R&D in market diversification remained lower than those for private R&D, even with the extended time lags.

4.5 Discussion

Our study investigates the nuanced pathway through which general government subsidies influence SME export development, mediated by R&D investment. By distinguishing between the initial decision to export and subsequent export expansion (product and market diversification, export value), and by comparing policy-induced R&D with private R&D, our findings offer several important insights grounded in our empirical results.

4.5.1 Government Subsidies, R&D Additionality, and the Export Leap

Consistent with Hypothesis 1, our findings from the PSM analysis clearly demonstrate that government subsidies prompt SMEs to increase their R&D investments. Subsidised firms invested significantly more in R&D (an average of €24,609 more) than their matched non-subsidised counterparts. This supports the premise that general subsidies, even without explicit R&D mandates, can alleviate resource constraints (Czarnitzki & Giebel, 2024; Reshid et al., 2025) and incentivize policy-induced R&D (Beck et al., 2016; Howoldt, 2024), thereby enhancing firms' knowledge base.

This policy-induced R&D, in turn, plays a crucial role in the initial decision to export. Supporting Hypothesis 2, our results show that policy-induced R&D significantly increases SMEs' export propensity in the immediate aftermath (t+1). An additional €100,000 in policy-induced R&D was associated with a 1.87% increase in the likelihood of exporting. This aligns with the Knowledge-Based View (KBV), where enhanced technological knowledge from R&D provides a competitive advantage for overcoming initial entry barriers (Cassiman & Golovko, 2011; Ramdani et al., 2022). These findings are consistent with the RBV argument that relaxing resource constraints allows SMEs to enhance their knowledge base, thereby overcoming the liability of smallness in initial export entry.

It also resonates with the Uppsala model, where such knowledge can reduce perceived risks and encourage the initial commitment to internationalize (Johanson & Johanson, 2021). However, our robustness checks (Appendix Table 4A-7 and Table 4A-8) reveal that this positive impact of policy-induced R&D on the decision to export diminishes and loses statistical significance by t+2 and t+3. This suggests that while subsidies might provide an initial impetus for R&D that helps firms take the first step into

exporting, sustained export engagement or later-stage entry decisions might rely on other factors or more deeply embedded private R&D capabilities.

4.5.2 The Role of R&D in Post-Entry Export Expansion: A Tale of Two R&Ds

Once SMEs begin exporting, the role of R&D in driving the more complex dynamics of international scaling—through market diversification, product diversification, and increased export value—becomes more complex. Our findings generally support Hypotheses 3, 4, and 5, indicating that policy-induced R&D positively influences export market diversification, product diversification, and export value at t+1. Specifically, at t+1, a €100,000 increase in policy-induced R&D was linked to an average increase of 0.182 units of export markets, 0.443 units of export products, and €3,310 in export income per employee. These effects on export expansion (market diversification, product diversification, and export value) persist at t+2 and t+3 according to our robustness checks. This broadly aligns with the KBV, suggesting that ongoing R&D can foster dynamic capabilities (Jaureguy et al., 2023) and new offerings (Edeh & Prévot, 2024) that support expansion.

However, a critical insight emerges when comparing the efficacy of policy-induced R&D with private R&D. While both types of R&D generally support export activities, our t-tests (Table 4-6) reveal statistically significant differences in their impact on certain aspects of export expansion. Specifically, policy-induced R&D has a significantly weaker impact on the scaling dimensions of both export market diversification ($p=0.0000$) and export product diversification ($p=0.0145$) compared to private R&D at t+1. For the export decision and export value, the difference in impact strength between the two R&D types was not statistically significant at t+1.

This differential impact, with policy-induced R&D having a lesser effect on both market and product diversification, is a key finding. It suggests that while government subsidies successfully stimulate additional R&D, this policy-induced R&D may not be as effective as internally driven, privately funded R&D in navigating the complexities of scaling across new markets and products internationally. Market diversification, as per the Uppsala model, often requires deep, experiential market-specific knowledge, network building, and adaptation to greater psychic distances (Donnelly et al., 2024; Johanson & Johanson, 2021), which subsidies may not directly foster. Similarly, effective product diversification for varied international markets may demand a strategic alignment of R&D with nuanced market intelligence and absorptive capacity that is more characteristic of sustained private R&D efforts.

From an RBV perspective, privately funded R&D is more likely to be deeply integrated into the firm's strategic resource deployment and learning processes. For resource-constrained SMEs facing the liability of smallness, such internally driven R&D may be more tightly coupled with market-specific knowledge development and network building, which are essential for diversification. By contrast, policy-induced R&D, while alleviating financial constraints and boosting technological knowledge, may be more generic or project-bound, and less oriented toward the nuanced, tacit market capabilities required for expanding into new products and markets.

Our results empirically substantiate the notion that the type of knowledge and commitment, and by extension the source of R&D funding, matters differently across the stages and types of export commitments. This underscores that not all knowledge is equivalent from an RBV perspective: the source and governance of R&D funding shape how effectively SMEs can deploy knowledge in the gradual, experiential internationalisation process described by the Uppsala model.

Built on our empirical results, I offer two contributions. First, by dissecting international performance into export decisions and subsequent expansion in market, product and export value, I empirically validate the KBV's tenet that knowledge is crucial but also highlight that its impact and the efficacy of its source varies. Policy-induced R&D significantly influences the initial export decision. However, for subsequent export market and product diversification, while policy-induced R&D still has a positive effect, it is significantly less potent than private R&D. This finding lends strong support to our argument that different types of knowledge, or perhaps R&D driven by different motivations, are critical at different internationalization stages. The significantly weaker effect of policy-induced R&D underscores the argument that knowledge of foreign markets and regulations (often gained through experience or targeted private investment) becomes paramount (Purkayastha et al., 2024), and subsidies alone may not adequately build this specific knowledge. This echoes findings that policy support can significantly ease firms' research and innovation knowledge obstacles but is less effective in overcoming market-specific obstacles (Perez-Alaniz et al., 2025). Thereby, I call for a more nuanced evaluation of R&D grants, considering not just R&D input additionality but also the actual export market and product expansion effectiveness (Haddad & Bergek, 2023; Jugend et al., 2020).

Second, I refine the Uppsala stage model by empirically demonstrating the varied impact of R&D (and its funding source) on different export commitments and by explicitly incorporating the government as a significant non-market actor influencing the knowledge-commitment cycle (Coviello et al., 2017). Our findings reveal that government support, through policy-induced R&D, is particularly influential in facilitating the initial decision to export, providing the knowledge impetus for market entry commitment. However, this influence is demonstrably less potent for subsequent,

more complex commitments like diversifications in market and product, where policy-induced R&D has a significantly weaker impact compared to private R&D. This suggests that while government intervention can effectively boost the general technological knowledge needed for entry, it is less effective in fostering the deep, experiential, and often tacit market-specific knowledge and adaptive capabilities required for extensive market and product diversification. This insight aligns with recent extensions of the Uppsala model and the international scaling literature (Tippmann et al., 2023; Vahlne & Johanson, 2020), which emphasize the ongoing need for firms to balance replication of existing advantages with adaptation to new market contexts. Our results thus highlight a limitation in the government's ability to foster deep international expansion through general subsidies that merely top-up R&D, pointing to the need for policies that also facilitate the acquisition of market-specific knowledge and capabilities (Coviello et al., 2017; Vahlne, 2021). The sustained positive effects of policy-induced R&D on export expansion (MD, PD, value) at t+2 and t+3, even if weaker for market and product diversification than private R&D, do suggest a longer-term benefit. However, the initial nudge for export decisions fades by t+2 and t+3, emphasizing the dynamic nature of these supports and the enduring importance of private R&D for sustained expansion.

While our research makes significant contributions, certain limitations open avenues for future research. The binary nature of our subsidy data prevents analysis of subsidy amounts and their direct correlation with the scale of induced R&D or potential crowding-out effects. Our classification of all additional R&D as policy-induced is a consequence of this data structure. Future research with more granular subsidy data could explore these dose-response relationships and the precise mechanisms of R&D additionality versus substitution. Secondly, while I focused on R&D investment as a

key input, distinguishing the types or orientations of R&D projects funded by policy-induced versus private R&D, and how these differentially affect export expansion stages, would be a valuable extension. Finally, as acknowledged, our data does not capture firms' specific market knowledge or detailed resource management capabilities, which our results suggest are critical differentiators, particularly for market and product diversification where policy-induced R&D showed a notably weaker effect compared to private R&D. Investigating how subsidies might interact with or help develop these organizational capabilities is a promising avenue for future research.

4.6 Conclusion

This study investigated how general government subsidies, via their influence on R&D investment, affect SME export development using a unique panel of Irish SMEs (2006-2019). Key findings indicate that general subsidies significantly boost SME R&D investment, creating policy-induced R&D. This policy-induced R&D strongly supports export decisions and positively influences export market diversification, product diversification, and export value. However, a critical finding is that policy-induced R&D has a significantly weaker impact on both export market and product diversification compared to private R&D.

The primary contribution is the empirical demonstration that the source of R&D funding differentially impacts SME internationalization across its various stages and dimensions. This refines theoretical perspectives like the Uppsala model and KBV by highlighting the distinct roles of policy-induced versus privately driven knowledge. These findings also offer important implications for policymakers aiming to enhance the effectiveness of the State-SME nexus in fostering innovation-led export

development. Policy implications point towards the need to consider not just R&D input additionality but also the behavioural additionality of subsidies in promoting sustained, diversified export growth. This underscores the importance for policymakers, particularly in small, open economies, to foster market-specific knowledge and adaptive capabilities alongside general R&D support to enhance SMEs' global competitiveness.

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Chapter 5

Public Knowledge Sources as Catalysts: How Incremental and Radical Innovation Unlock Pathways to SME Internationalization

Chapter 4 revealed that while general government subsidies can stimulate R&D and aid initial export entry, policy-induced R&D showed limitations in driving diversified international expansion compared to private R&D. This highlighted the need to explore other facets of the State-SME nexus and different innovation dynamics. Therefore, this chapter shifts focus to another critical support mechanism—collaboration with public knowledge sources (PKS)—and examines its interplay not with R&D inputs, but with distinct innovation outputs (incremental versus radical product innovation) in shaping SME internationalization trajectories. The central question becomes: under what conditions does PKS collaboration effectively translate different types of innovation into international success for SMEs?

5.1 Introduction

Does collaboration with public knowledge sources (PKS) bolster SME exports in every case? National innovation system (NIS) theory suggests it does. Yet, evidence from recent studies is mixed (Freixanet & Rialp, 2022; Golovko & Valentini, 2011). Our analysis of Irish SMEs reveals a sharper nuance: radical innovation succeeds on its own, while incremental innovation requires PKS support to translate into export gains. Left unguided, incremental efforts can drain scarce resources and divert them from market expansion. This distinction has often gone unnoticed. Existing NIS frameworks typically treat SMEs as a homogeneous cohort that uniformly benefits

from institutional ties, overlooking how innovation novelty—incremental versus radical—interacts with PKS collaboration (Carolina R. Haddad & Anna Bergek, 2023). I contend that this "one-size-fits-all" mindset obscures a critical paradox: only incremental innovation requires PKS to spur internationalization; radical innovation does not.

The adaptability and inventive spirit of SMEs have long identified them as engines of economic growth and technological progress (Owalla et al., 2022). For these firms, product innovation —introducing new goods or services —provides a crucial competitive edge, enabling them to overcome resource and knowledge constraints on the path to global markets (Al-Tabbaa & Zahoor, 2024). Yet, the presumed link between innovation and internationalization remains fragile and theoretically underdeveloped (Simba et al., 2024). While conventional wisdom suggests that innovation opens doors abroad (Carolina R. Haddad & Anna Bergek, 2023), a growing body of work indicates a more paradoxical effect: innovation can either facilitate or obstruct internationalization, depending on resource allocation, alignment with overseas demand, and managerial focus (Freixanet & Rialp, 2022; Piñera-Salmerón et al., 2023). I contend that this 'one-size-fits-all' mindset obscures a critical asymmetry: radical innovation can, under certain conditions, propel SMEs into international markets even without institutional collaboration, whereas incremental innovation requires PKS support to generate export gains. In other words, institutional collaboration is a necessary condition for incremental innovation to translate into internationalisation, but only a complementary (though beneficial) condition for radical innovation.

Among indigenous SMEs, the tension between innovation and internationalization is particularly acute: both strategies compete for the same limited resources, making their

joint pursuit a strategic balancing act (Freixanet & Renart, 2020a; Golovko & Valentini, 2011). This tension further intensifies when I differentiate between incremental and radical innovation. Incremental innovation tends to be lower risk (fine-tuning existing offerings), whereas radical innovation entails higher investment, involves greater uncertainty, and requires longer timeframes for returns (Beck et al., 2016; Doran & Ryan, 2014). For many indigenous SMEs, pursuing radical innovation without external support can be an existential gamble (Freixanet et al., 2020). As a result, these firms often turn to public knowledge sources—universities, government agencies, and public research institutes—for resources, technical expertise, and legitimacy (Chiappini et al., 2022; Hottenrott & Lopes-Bento, 2014; Roper et al., 2008). However, treating such collaboration as universally beneficial oversimplifies a more nuanced institutional reality. Macro-level theories such as NIS and National Business Systems (NBS) highlight the importance of institutional infrastructure (Lundvall, 2010; Lundvall et al., 2002; Whitley, 1998), yet often overlook differences at the firm level. Critics contend that these frameworks neglect the diversity among firms and the varying benefits derived from institutional connections (Carolina R Haddad & Anna Bergek, 2023; Howoldt, 2024; Intarakumnerd & Goto, 2018; Siegel et al., 2023). Indigenous SMEs, characterized by their limited absorptive capacity and context-specific needs, offer a relevant setting for exploring these gaps (Doran & Ryan, 2014; Tavassoli & Karlsson, 2015).

I tackle a crucial yet underexplored question: under what circumstances does institutional collaboration lead to internationally productive innovation, and when does it fall short? Specifically, I ask: How does collaboration with PKS affect incremental versus radical product innovation? Furthermore, how do these types of innovations influence the performance of indigenous SMEs in international markets?

By answering these questions, I make two contributions. First, I show that the link between product innovation and internationalization is neither linear nor uniformly positive. Drawing on matched panel data for 3,176 Irish SMEs, I find that radical innovation drives international performance regardless of whether firms collaborate with PKS. In contrast, incremental innovation only unlocks export opportunities when supported by public institutions. This asymmetry challenges the assumption of a simple additive effect of innovation and institutional support. Instead, I demonstrate their interdependence and conditional effectiveness (Beck et al., 2016; Chen et al., 2024; Falahat et al., 2020).

Second, I advance innovation systems theory by bridging macro-institutional models with micro-level evidence. Our findings indicate that the value of institutional collaboration depends on innovation novelty and a firm's resource position. By focusing on firm–institution interactions, I enhance NIS/NBS frameworks to consider heterogeneity, strategic trade-offs, and context-specific complementarities (Gupta et al., 2020; Lundvall et al., 2002; Whitley, 1998).

Empirically, I compile a novel panel of 3,176 firm-year observations from the Irish Central Statistics Office (2008–2019), integrating trade records, innovation surveys, and business registries. Using propensity score matching, I compare SMEs that engage with PKS to those that do not, isolating the impacts of collaboration on both innovation and internationalization outcomes.

The remainder of this paper proceeds as follows. Section 5.2 develops the theoretical framework and hypotheses. Section 5.3 describes the data, sample, and empirical strategy. Section 5.4 situates our study within the Irish context. Section 5.5 presents the results. Section 5.6 discusses the theoretical and policy implications, and Section 5.7 provides the conclusion.

5.2 Theory and Hypotheses

In line with Schumpeter's (1912) seminal work, innovation encompasses a broad set of changes including: (i) the introduction of new goods, (ii) new methods of production, (iii) the opening of new markets, (iv) the discovery of new sources of supply, and (v) the creation of new organisational forms. Subsequent work in evolutionary economics (Nelson & Winter, 1982) and innovation studies has reaffirmed that these different forms of innovation jointly shape firm-level and system-level dynamics.

In this dissertation I focus on a specific subset of this broader innovation space: technological and product-related innovation, and their manifestation in export markets (new export products and new export destinations). There are three reasons for this focus. First, the microdata available from the CSO (CIP, Trade RMF, IIE) provide reliable, detailed measures of R&D, product innovation and export outcomes, but not of organisational innovations or changes in sourcing structures. Second, for resource-constrained SMEs in a small open economy, product and market-related innovations are often the primary channels through which innovation translates into measurable performance outcomes such as export entry, diversification and export value. Third, concentrating on technological and product innovation allows me to develop a more precise empirical test of how state interventions—through subsidies (Chapter 4) and public knowledge sources (Chapter 5)—affect the knowledge base that underpins SME internationalisation.

This focus does not imply that other forms of innovation (e.g. organisational changes, new sourcing arrangements) are unimportant; rather, they fall beyond the scope of the current empirical design and represent a promising avenue for future research.

5.2.1 National Innovation System and National Business System

The National Innovation Systems (NIS) perspective posits that innovation is not merely an isolated firm activity but emerges from complex interactions among firms, government agencies, universities, and public research institutes within a specific national context (Lundvall, 1999; Lundvall, 2007). It emphasizes the critical role of institutional infrastructure, particularly public knowledge sources (PKS), in providing essential knowledge, funding, and collaborative networks that bolster national innovative capacity (Intarakumnerd & Goto, 2018; Siegel et al., 2023). However, a limitation of the traditional NIS view is its tendency to implicitly treat firms as relatively homogenous recipients of these supports, potentially underemphasizing how smaller, resource-constrained enterprises might engage with and benefit from institutional inputs differently than larger counterparts.

Complementing this view, the National Business System (NBS) framework shifts attention to how firm heterogeneity—shaped by factors like ownership, size, sector, and geography—conditions the access, utilization, and ultimate effectiveness of macro-level institutional resources (Whitley, 1998). While national institutions define the landscape of available support, firm-specific characteristics, such as absorptive capacity and strategic orientation, determine how effectively that support can be accessed and deployed (Lehmann et al., 2022; Zahra et al., 2022). Consequently, although an NIS may make collaborative resources broadly accessible, not all SMEs will benefit equally, nor will they necessarily pursue the same innovative pathways, such as prioritizing incremental versus radical innovation.

Integrating NIS and NBS offers a more nuanced understanding essential for addressing our research questions. The NIS perspective identifies the available macro-level support structures, such as institutional collaborations with PKS. At the same time, the

NBS framework helps explain why firms' unique characteristics and embeddedness lead to differential access and outcomes from these supports (Gupta et al., 2020). Drawing on the NIS emphasis on knowledge infrastructures and transfer mechanisms (Freeman, 1987), I group universities, higher education institutions, government bodies, and public research institutes under the umbrella term Public Knowledge Sources for this study (Chaminade & Edquist, 2006; Lundvall, 1992; Roper et al., 2008; Schot & Steinmueller, 2018). These institutions form the core knowledge infrastructure within Ireland's NIS, offering resources, expertise, and legitimacy that are particularly valuable for resource-constrained SMEs. This integrated NIS/NBS lens allows me to move beyond assumptions of uniform benefits from PKS collaboration (Hotho, 2014; Schrage & Rasche, 2022). It enables me to theorize, first, how partnering with PKS distinctly influences SME engagement in incremental versus radical product innovation (Hypotheses 1a and 1b), and second, how such collaboration subsequently conditions the relationship between these different innovation types and various dimensions of SME international performance (Hypotheses 2 through 5).

Furthermore, following Nelson and Winter (1982) and Nelson (1993), I distinguish between codified and tacit forms of knowledge. Codified knowledge is embodied in patents, publications, standards, blueprints and other formalised artefacts; it is in principle more easily transferable across organisational and geographic boundaries, although issues such as patent thickets and access costs can still pose barriers. Tacit knowledge, by contrast, is embedded in routines, skills and organisational practices, and is often context- or location-specific, making it harder to articulate and transfer.

PKS such as universities and public research institutes primarily generate and disseminate codified scientific and technological knowledge, but they also act as

channels for transmitting tacit knowledge through collaborative projects, joint supervision, and mobility of researchers. For SMEs with limited internal R&D infrastructure, collaboration with PKS can therefore provide access not only to codified technological knowledge—critical for both incremental and radical product improvements—but also to tacit expertise regarding experimental methods, problem-solving routines and regulatory or standard-setting practices.

This distinction is particularly relevant for incremental versus radical innovation. Incremental innovation often relies on cumulative, experience-based improvements and adaptation to specific customer or market contexts; much of the required knowledge is tacit and embedded in firm routines. PKS collaborations can complement this by providing codified technical knowledge and testing facilities, but the SME still needs sufficient absorptive capacity to integrate these inputs into its own routines. Radical innovation, by contrast, typically draws more heavily on frontier scientific and technological knowledge, which is more likely to be codified and originate from universities and public labs. In this case, PKS play a more direct role as sources of the underlying knowledge base and as partners in managing the high uncertainty and risk associated with such projects.

5.2.2 Collaboration with public knowledge sources and innovation novelty

Indigenous SMEs are frequently characterized by significant resource limitations, spanning financial capital, specialized human expertise, and dedicated R&D infrastructure, which collectively constrain their capacity for independent innovation (Freixanet et al., 2020). In this context, engaging with PKS represents a critical strategic avenue, offering SMEs a means to bridge internal capability gaps and enhance innovative potential (Roper et al., 2008). To understand how PKS

collaboration specifically shapes SME innovation under these constraints, I differentiate between two fundamental types of product innovation.

Incremental product innovation involves modifications, refinements, or extensions of existing goods and services. While demanding relatively lower R&D intensity than radical innovation, it still requires specific applied knowledge, access to testing facilities, and adaptation resources often beyond the internal reach of SMEs (Han et al., 2020; Zhongming et al., 2021). Conversely, radical product innovation entails developing entirely new-to-the-market offerings, frequently underpinned by novel technologies. This demands substantial R&D investment, access to cutting-edge knowledge, tolerance for high uncertainty, and longer development horizons – precisely where SMEs typically face acute limitations (Chen et al., 2024; Zhongming et al., 2021; Zhou & Li, 2012).

Collaboration with PKS can directly alleviate SMEs' inherent limitations to pursue innovation. For incremental innovation, PKS can provide affordable access to specialized testing equipment, crucial technical expertise for refinement, vital information on industry standards, or funding for adaptation. Accessing these external resources allows SMEs to overcome internal bottlenecks that would otherwise impede the improvement of existing products (Intarakumnerd & Goto, 2018; Usman et al., 2018), aligning with the NIS view that institutional resources can bridge firm-specific constraints (Roper et al., 2008). Therefore, I propose:

Hypothesis 1a: Collaboration with PKS positively impacts SMEs' incremental product innovation by mitigating resource constraints related to accessing specialized knowledge and facilities for product refinement and adaptation.

The challenges are even more pronounced for radical innovation due to its high costs, risks, and the need for frontier knowledge often residing outside the SME (Stornelli et al., 2021). Here, PKS collaboration becomes particularly vital, offering access to fundamental research, advanced technologies, highly specialized expertise (e.g., university labs), and crucial risk-sharing mechanisms like public R&D grants, which are typically not available internally (Chiappini et al., 2022; Czarnitzki & Delanote, 2015). Such collaboration effectively lowers the often-prohibitive costs and uncertainties associated with transformative projects, enabling resource-scarce SMEs to undertake initiatives likely infeasible independently (Chiappini et al., 2022; Jiang et al., 2022; Mulligan et al., 2022). Thus.

Hypothesis 1b: Collaboration with PKS positively impacts SMEs' radical product innovation by mitigating resource constraints related to high R&D costs, access to foundational knowledge, advanced technologies, and managing high project risk.

This perspective clarifies why collaboration with PKS should be particularly influential for radical innovations, where codified frontier knowledge and risk-sharing are key, but also why it can be necessary for translating incremental innovation into internationally valuable outcomes, given SMEs' limited tacit knowledge and absorptive capacity in foreign markets.

5.2.3 Innovation, PKS Collaboration, and Internationalization under Resource Constraints

While innovation is frequently posited as a driver of internationalization, SMEs confront a distinct dual resource pressure: the simultaneous need to fund costly innovation activities while also financing resource-intensive export expansion creates significant strategic tension (Freixanet & Renart, 2020a; Golovko & Valentini, 2011).

I argue that collaboration with PKS plays a crucial enabling role in helping SMEs navigate this tension and translate innovation into international success through a dual mechanism. First, by alleviating the resource burden associated with the innovation process itself (as outlined in H1a and H1b), PKS collaboration frees up scarce internal financial and managerial capacity that can be redirected towards the demanding activities of internationalization (Child et al., 2017; Child, Karmowska, et al., 2022; Child, Narooz, et al., 2022). Second, PKS partnerships often provide direct external resources critical for overcoming foreign market barriers, such as specialized market intelligence, valuable network contacts bridging geographical and institutional distances, enhanced legitimacy through association with reputable institutions, and access to targeted export support (Donbesuur et al., 2022; Narooz & Child, 2017; Stojčić et al., 2024). This combined effect—easing the internal innovation burden while providing external internationalization support—allows SMEs to more effectively leverage both incremental and radical innovations for global market engagement. I expect this enabling role of PKS collaboration to manifest across various dimensions of international performance, as detailed below.

Collaborative Innovation and Export Propensity

Initiating export activities presents significant hurdles for SMEs, including acquiring market knowledge, establishing legitimacy abroad, and committing upfront financial resources. Incremental innovations, which often lack strong independent market pull, may not be sufficient on their own to overcome these barriers for resource-constrained firms. In this context, the support mechanism of PKS collaboration provides networks, legitimacy, and market entry (Love & Roper, 2001; Radicic & Pugh, 2017). Radical innovations, while possessing greater inherent potential to attract foreign interest (Azar & Ciabuschi, 2017), are exceptionally costly to develop. PKS collaboration, by

mitigating this innovation-side resource drain and potentially offering direct entry support, makes it more feasible for SMEs to pursue radical innovation while simultaneously undertaking the costly process of initiating exports (Hervás-Oliver et al., 2021). Thus, PKS collaboration should increase the likelihood that SMEs successfully leverage both innovation types to begin exporting.

Hypothesis 2: Collaboration with PKS strengthens the positive impact of both incremental and radical product innovation on SMEs' export propensity.

Collaborative Innovation and Export Market Diversification

Expanding into multiple foreign markets intensifies resource demands related to information gathering, adaptation, and logistics (Vahlne & Johanson, 2020). PKS collaboration can facilitate this geographic expansion. For incremental innovations, PKS provides the external knowledge and technical assistance needed to affordably tailor products for diverse market requirements, while the eased resource burden helps manage multi-market operations (Han et al., 2020; Hottenrott & Lopes-Bento, 2014). For radical innovations, PKS support makes the development of unique offerings attractive and feasible across diverse markets, and provides crucial network access to penetrate these varied geographies (Amorós et al., 2021; Azar & Ciabuschi, 2017). Therefore, PKS collaboration should enable both innovation types to drive greater diversification of the export market.

Hypothesis 3: Collaboration with PKS enhances the positive effects of both incremental and radical product innovation on SMEs' export market diversification.

Innovation, PKS Collaboration, and Export Product Diversification

Introducing a wider range of products into international markets is another resource-intensive strategy. PKS collaboration facilitates this by making the development of

new exportable offerings more viable. For radical innovations, which inherently involve new product categories (Borrás & Edquist, 2019), PKS support is often essential to cover the high development costs and risks, thus enabling the creation of new exportable product lines (F. Y. Chang & C. M. Webster, 2019; Roper et al., 2008). For incremental innovations, PKS collaboration can provide the technical support needed to cost-effectively develop export-oriented variants or extensions, while easing the overall resource tension between innovation and international operations allows firms to leverage existing channels for these new product variations (Freixanet et al., 2020; Hottenrott & Lopes-Bento, 2014). Consequently, PKS collaboration should help SMEs leverage both innovation types to diversify their export product portfolios.

Hypothesis 4: Collaboration with PKS enhances the positive effects of both incremental and radical product innovation on SMEs' export product diversification.

Innovation, PKS Collaboration, and Export Value

Capturing greater economic value from exports often requires offering more sophisticated or technologically advanced products that can command premium prices. PKS collaboration enables SMEs to develop such high-value offerings. For radical innovations, PKS support overcomes the significant R&D and knowledge barriers required to create unique, high-value-added products suitable for competitive international markets (Azar & Ciabuschi, 2017; Lachenmaier & Wößmann, 2006; Malik, 2017). For incremental innovations, PKS collaboration provides access to the specialized expertise, advanced materials knowledge, or sophisticated testing capabilities needed to achieve complex quality enhancements or feature improvements that significantly boost the perceived and actual value of exports, overcoming internal SME limitations (Freixanet et al., 2020; Han et al., 2020; Piñera-Salmerón et al., 2023).

By enabling advanced and sophisticated refinements on products, PKS collaboration should help SMEs increase export value via both innovation types.

Hypothesis 5: Collaboration with PKS enhances the positive effects of both incremental and radical product innovation on SMEs' export value.

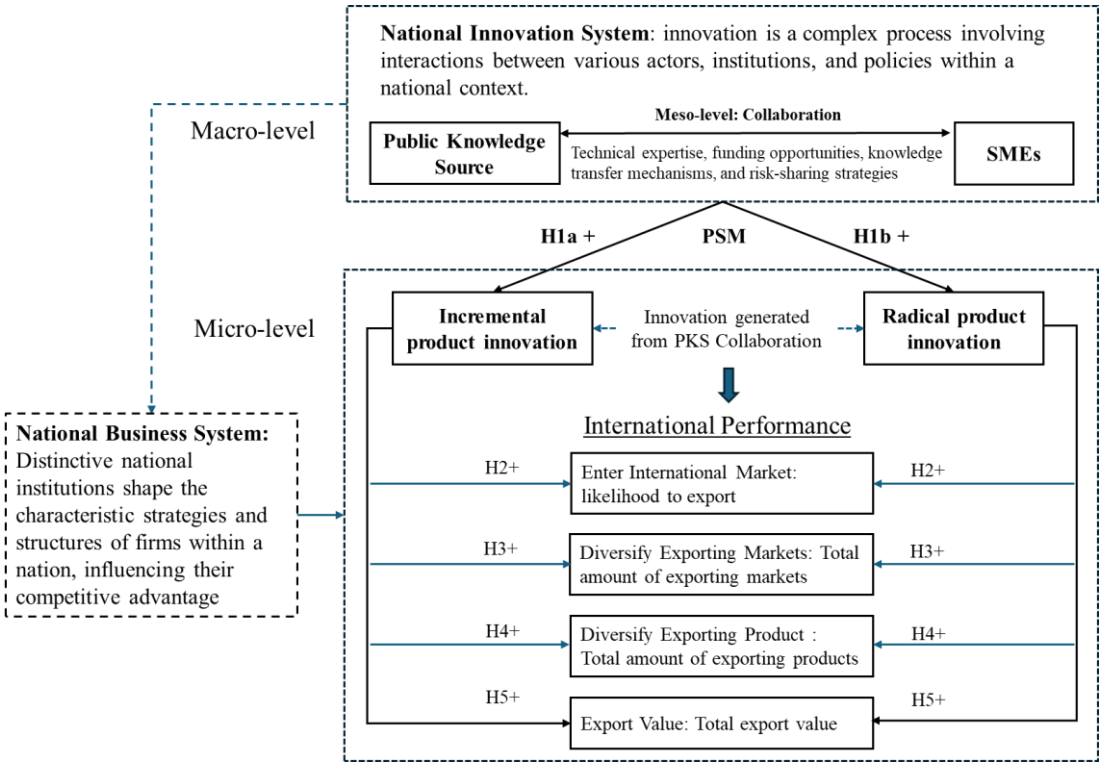


Figure 5-1 Impact of collaboration with public knowledge sources on SMEs' internationalization

5.3 Public Knowledge Sources and Irish Indigenous SMEs

Ireland's national innovation system is structured to encourage extensive collaboration among universities, government agencies, public research institutes, and industry partners. Organizations such as Enterprise Ireland and Science Foundation Ireland actively promote SME innovation through research funding, direct expertise, and collaboration with academic institutions (universities and higher education institutes)

and public research institutes as outlined in the Department of Jobs, Enterprise and Innovation (2020). This rich environment allows for an in-depth examination of the impact of public knowledge sources on SMEs. The presence of both incremental and radical innovation in Irish SMEs allows for a meaningful comparative study of how collaboration with these agencies may shape the trajectory of each type of innovative activity (Hottenrott & Lopes-Bento, 2014). Furthermore, given Ireland's relatively small domestic market, the focus on export-led growth supported by programs and policies designed to enhance international competitiveness creates an environment conducive to examining how innovation and agency support translate into global performance outcomes (Janger et al., 2017).

In addition, comprehensive datasets on SMEs' performance, innovation activities, and trade measures are systematically collected by the Central Statistics Office, thus enabling a rigorous empirical investigation. Altogether, Ireland's policy commitments to fostering an innovation ecosystem (Innovation, 2020) and its dynamic pool of indigenous SMEs, provide a rich and fertile ground to explore the interplay between agency collaboration, innovation strategies, and international performance. With comprehensive data collected on SME performance, innovation activities, and international trade, Ireland provides an ideal setting for conducting in-depth empirical analysis and generating actionable insights for policymakers. While grounded in the Irish case, the lessons learned here extend to other small, open economies—emerging economies or economies in transition—seeking to boost SME innovation and enhance export success. By adapting Ireland's collaborative frameworks and data-driven evaluation methods, policymakers worldwide can tailor support mechanisms to their own institutional contexts and firm-level capabilities.

5.4 Methodology

5.4.1 Research Sample and Database

Our data is from the Irish Central Statistics Office (CSO) and combines three complementary micro-datasets. Firstly, I utilize the Trade Research Microdata Files (Trade RMF), which integrate both extra-EU and intra-EU trade-in-goods data from the Revenue Commissioners. The Trade RMF decomposes each firm's export performance by commodity code, export destination country, and the euro value of each export commodity, enabling a detailed assessment of SME international performance over 2011-2019. Secondly, I draw on the Innovation in Irish Enterprises (IIE) survey, Ireland's implementation of the European wide biennial Community Innovation Survey (CIS). Each IIE records firms' innovation activities from year t-2 to t and provides information on i) a firm's collaboration partners, including universities, public research institutes, government bodies; ii) a firm's turnover attributable to radical versus incremental product innovations that include both goods and services; iii) a firm's internal and external R&D inputs and expenditures. Third, the Business Register (BR) provides details on all active enterprises in Ireland from which I derive —firm age, county location, primary industry sector and employment size. By merging The Trade RMF, IIE, and BR, I construct firm-level panel of collaboration, innovation and international performance from 2008 to 2019. As the IIE is collected every two years, our data are organized into five waves as 2008-2010, 2010-2012, 2012–2014, 2014–2016 and 2016–2018, with each linked to export performance in the subsequent year in 2011, 2013, 2015, 2017 and 2019, respectively.

Our study focuses on indigenous SMEs. Thus, to ensure a focus on domestically controlled firms, our sample is restricted to Irish SMEs, defined as enterprises with final ownership residing in Ireland. I adopted the European Union's SME definition,

employing a threshold of 250 employees to distinguish SMEs from larger firms. Given the longitudinal nature of our panel data, I address the potential for firms to transition across this threshold over time. Specifically, a firm is classified as an SME if it reports fewer than 250 employees in year t, and I excluded firms at the point when their employee count exceeded 250. Because the IIE does not include firms with fewer than 10 employees (i.e. micro firms), I exclude these enterprises from our sample. Our final dataset comprises an unbalanced panel of 3,176 firm-year observations. This unique dataset enables me to measure the detailed innovation and international performance of Irish SMEs, facilitating a rigorous comparison between those that collaborate with public knowledge sources and those that do not. Appendix Table 5A-1 in the supplementary material describes our samples and three databases.

5.4.2 Measurement and Variables

Based on this panel dataset, I construct several key variables to examine the impact of collaboration with public knowledge sources on SMEs' product innovation and subsequent internationalization. First, I measure collaboration with public knowledge sources as a binary variable. This variable takes a value of 1 if an SME reports innovation collaboration with at least one public knowledge source, including government, public research institutes, or universities during the three-year observation period from t-2 to t, as recorded in the IIE. Otherwise, it has a value of 0. Second, I assess innovation outputs using continuous variables derived from the IIE, focusing on radical and incremental product innovations. Following established empirical literature on product innovation (Doran & Ryan, 2014; Escrig-Tena et al., 2021; Slater et al., 2014), I differentiate between these two types of innovation as i) Radical product innovation is measured as the ratio of sales revenue in time period t from new-to-market products (goods and services) that the firm introduced during

survey period (year t-2 to t) to total turnover in year t. ii) Incremental product innovation, measured as the ratio of sales revenue in time period t from new-to-the-firm products that were introduced during survey period (year t-2 to t) to total turnover in year t.

Following Miocevic (2021), I measure SMEs' international performance across four variables, including i) Export decision, a binary variable indicating whether the firm exports or not; ii) Diversity of export products, measured as the total number of products a firm exports to foreign markets, capturing the breadth of the firm's export offerings; iii) Diversity of export markets, measured as the total number of the foreign markets to which a firm exports its products and so measures the geographical scope of its international activities; and iv) Export value, measured as the ratio of export revenue per employee, reflecting the intensity of the firm's export engagement. I measure international performance in the year t+1, one year after observing firms' product innovation. By imposing a one-year lag between our innovation measures and subsequent export performance, I establish clear temporal precedence—innovation activities recorded in IIE wave t (covering years t–2 to t) must occur before firms' observed trade outcomes in year t + 1. This design feature works on two fronts. First, it aligns with existing literature and mirrors the real-world gestation period required to move from R&D and product development into marketable output, especially in international markets where distribution channels and regulatory approvals can delay market entry (Haddoud et al., 2023; Ramdani et al., 2022). Second, and crucially for identification, as I observe innovation first and exports later, it becomes far less plausible that a firm's measured export performance is driving recorded innovation activity—thereby substantially reducing reverse-causality bias and endogeneity concerns (Carolina R Haddad & Anna Bergek, 2023). In econometric terms, our lag

structure mitigates simultaneity concerns and enhances causal interpretation: by shifting the dependent variable in time, I isolate the impact of past innovation on future international engagement, rather than conflating it with innovation decisions that respond to prior or co-current export outcomes (Falahat et al., 2020).

Finally, I include several firm-level control variables to account for potentially limiting factors, including company age, employee count, productivity, and R&D investment region, and sector, as detailed in Table 5-1. Summary statistics and a correlation matrix for all variables used in our analysis are presented in Appendix Table A5-2 and A5-3.

Table 5-1 Definition of variables used in the analysis

Variable	Definition
Treatment variables	
Collaboration with public knowledge sources	The binary variable equals 1 if a firm collaborated with government or public research institutes, or universities or other higher education institutions; 0 otherwise in t-2 to t
Dependent variables in stage one: Product Innovation (includes goods and services)	
Incremental product innovation (New-to-firm)	Continuous variables. I measure the ratio of a firm's revenue generated from incremental product innovation to total turnover in year t as incremental product innovation. $PrivateInno_{it}$
Radical product innovation (New-to-market)	Continuous variables. I measure the ratio of a firm's revenue generated from radical product innovation to total turnover in year t as radical product innovation. $PrivateInno_{it}$
Dependent variables in stage two: International performance	
Export Decision	A dummy variable, indicates whether the firm's export sales are greater than 0 or not in t+1
Diversify Export Markets	Total number of markets a SMEs exports to in t+1

Diversify Export Products	Total number of products a SMEs exports in t+1, the calculation of product number based on the eight-digit commodity code classification
Export Value	The firm's total export revenue (in 1,000 euro) per employee at t+1
Control variables in stage one	
Productivity	Unit labour productivity (sales per employee) in the given year t-2, 1 = Firms in the lowest unit labour productivity value quartile in a given year; 2 = Firms in the second lowest unit labour productivity value quartile in a given year; 3 = Firms in the second highest unit labour productivity value quartile in a given year; 4 = Firms in the highest unit labour productivity value quartile in a given year
Internal Research and Development	Firm expenditure on in-house R&D in the given year t: 1 = Firms in the lowest internal R&D value quartile; 2 = Firms in the second lowest internal R&D value quartile; 3 = Firms in the second highest internal R&D value quartile; 4 = Firms in the highest internal R&D value quartile
Control variables in Stage Two	
Productivity	Unit labour productivity (sales per employee) in the given year t, natural logarithm.
Internal Research and Development	Firm expenditure on in-house R&D in the given year t, natural logarithm
External Research and Development	Firm expenditure on external acquisition of R&D and expenditure on acquisition of another existing external knowledge in the given year t, natural logarithm
Control variables in the same format in stage one and two	
Sector	Categorical variables representing 4 Sectors (defined in Table A5-4 in Supplementary material) NACE code
Region	Categorical variables NUTS2 (defined in Table A5-5 in Supplementary material)

Firm size	Number of employees in year t-2, natural logarithm
Wave	Categorical time variable (t-2, t) in IIE covering 1= (2008, 2010); 2= (2010, 2012); 3= (2012, 2014); 4 = (2014, 2016); 5 = (2016, 2018)

Notes: To ensure adequate balancing properties were met during matching, continuous variables (Internal Research and Development, and Productivity) were coarsened in stage 1 but remain in the natural logarithm in stage 2. This was necessary because achieving balance via exact matching on continuous variables can be challenging. NACE is the acronym for 'nomenclature statistique des activités économiques dans la Communauté européenne' and is the statistical classification of economic activities used by Eurostat.

5.4.3 Empirical Method: Equation and Regression Model

When examining the impact of collaboration with public knowledge sources on firms' performance, a critical methodological challenge is addressing selection bias. This issue arises because firms self-select into the treatment (Dimos & Pugh, 2016). In our study, the observed difference between innovation output generated from collaboration with public knowledge sources and firms' independent innovation output could reflect the fact that firms collaborating with public knowledge sources have higher or lower innovation capability (Buffart et al., 2020). I employ a propensity score matching model to for correct selection into treatment, controlling for potential endogenous problems and correcting selection bias. Following Freel et al. (2019) and Mulligan et al. (2022), I apply two-stage estimation procedures, which have been developed and commonly acknowledged as addressing the selection issue into treatment. Our treatment is whether a firm collaborates with public knowledge sources or not, and I refer to firms that have collaborated as 'treated' and all other firms as 'untreated' (Mulligan et al., 2022).

In stage one, I use a probit model to calculate each firm's propensity score on the probability of receiving a treatment—collaboration with public knowledge sources. I match treated firms with untreated firms based on the calculated propensity score. In Equation (1), the term $Treatment_{it}$ is a dummy variable indicating whether firm i collaborates with public knowledge sources in time t. X_{it} is a set of independent variables for firm i in time t. These variables include firm characteristics, such as age, size, innovation capability, productivity, industry, region, etc.as displayed in Table 5-1. Beck et al (2016) deem these variables to be key indicators of a firm's ability to gain institutional support and our propensity scores are calculated based on these firm characteristics. The β_s indicates model coefficients and ε_{it} is the error term.

$$Treatment_{it} = \beta_0 + \beta_1 X_{it} + \varepsilon_{it} \quad (1)$$

Based on the possibility of each firm receiving the treatment from Equation (1), I apply a 1:1 nearest-neighbour matching. Specifically, each firm in the treatment group is matched to a control-group firm with the closest propensity score. To enhance match quality, I impose a small calliper (+/- 0.23 σ) [8] around each treated firm's score, ensuring that only control firms within this range are selected (Lenihan et al., 2024; Perez-Alaniz et al., 2025). This approach aims to create comparable groups by matching each treated firm with a non-treated firm of similar characteristics, thereby isolating the effect of collaboration with public knowledge sources. I then examine how this collaboration influences two distinct product innovation outcomes—incremental and radical innovation—focusing on the revenue generated from each of type of innovation of a firm. Based on the same propensity scores, I separately estimate the impact of collaboration on incremental and radical product innovation. For a given

[8] σ is the standard error of the propensity score.

type of innovation outcome m in year t, I define the treatment effect on the treated, denoted $\alpha_{m,it}$, as the difference between the observed innovation outcome of a collaborating firm and the counterfactual scenario if the same firm did not have this collaboration. The calculation is as follows:

$$\alpha_{m,it} = E\left({}^{T}Inno_{it} \,|F_{it} = 1\right) - E\left({}^{C}Inno_{it} \,|F_{it} = 1\right) \quad (2)$$

I calculate the impact of collaboration with public knowledge sources on SMEs' incremental product innovation and radical product innovation as $\alpha_{m,it}$, which I regard as collaboration-induced innovation (the collaborative radical and incremental product innovation that is induced by collaboration with public knowledge sources). Concurrently, I consider $PrivateInno_{mit}^{C}$, the independent product innovation that firm i would have achieved in the absence of any collaboration, as displayed in Equation (3). As described earlier, our propensity score matching procedure ensures that the only systematic difference between paired firms is their collaboration status, allowing me to treat the non-collaborating firm's incremental and radical innovation ratios (measured by innovation-derived revenue) as the "baseline" or "own" innovation capacity for the collaborating SME. Thereby, I can compare $\alpha_{m,it}$, the observed innovation ratio of the collaborating firm, and $PrivateInno_{mit}^{C}$, the baseline from its matched control firm.

Note that $PrivateInno_{mit}^{C}$ can be negative if the sum of the estimated treatment effects ($\alpha_{m,it}$) is larger than the observed incremental (or radical) product innovation (Beck et al., 2016). Treatment effects may be negative if control firms show a higher innovation revenue ratio than the treated firms (Lenihan et al., 2024)[9]. For non-treated

[9] For a more detailed discussion of crowding-out effects in a two-stage model, see Dimos and Pugh (2016) and Becker et al., (2015).

firms, $PrivateInno_{mit}^{C}$ is equal to $PrivateInno_{mit}$, by definition, the treatment effect is zero in the absence of collaboration (Becker, 2015).

$$PrivateInno_{mit}^{C} = PrivateInno_{mit} - \alpha_{m,it} \quad (3)$$

In the second stage, I turn to our main analysis of whether and how the estimated firm-specific and time-specific treatment, via innovation, affects the international performance of firm *i*. I distinguish between collaborative and independent product innovation $\alpha_{m,it}$ and $PrivateInno_{mit}$ and between incremental and radical innovation. This yields four distinct variables: i) collaboration-induced incremental innovation, ii) independent incremental innovation, iii) collaboration-induced radical innovation, and (iv) independent radical innovation. I then compare how each of these four innovation types affects SMEs' international performance—from export decision to expansion.

$$Export\ Decision_{it+1} = \beta_0 + \beta_{1m}\alpha_{m,it} + \beta_{2m}PrivateInno_{m,it}^{C} + \beta_3 z_{it} + \varepsilon_{it} \quad (4)$$

$$Export\ Expansion_{it+1} = \beta_0 + \beta_{1m}\alpha_{m,it} + \beta_{2m}PrivateInno_{m,it}^{C} + Mills + \beta_3 z_{it} + \varepsilon_{it} \quad (5)$$

Note that, as discussed earlier, in equations (4) and (5) I allow a lag in the relationship between product innovation and international performance, allowing time for innovation outcomes to potentially materialize before impacting international performance. I started with SMEs' $Export\ Decision_{it+1}$, estimating using a probit model. Through two-stage Heckman selection modeling approach, we, then, narrowed down our focus to only firms that export in year t+1 and continue to measure their export product diversification, exporting market diversification, and export value. β_{1m} and β_{2m} are the associated coefficients for collaborative product innovation and independent product innovation respectively. I also include several control

variables, the term z_{it}, to capture other determinants of SMEs' export behaviors. z_{it} is a matrix of control variables for firm *i* in time *t,* which includes the all variables as the X_{it} in Equation (1) at stage 1*,* the firms-specific resources (e.g., size, age, region, sector), and indicators of firms' competitive advantages (e.g., productivity and internal R&D investment in a natural logarithm, as noted in Table 5-1). In addition, I also include each firm's external R&D expenditure as an additional control in stage 2. β_3 are the associated coefficients. I first modeled the export market entry decision using a probit model with robust standard errors, calculating the Inverse Mills Ratio. Then, for the subsequent regression analysis conditional on exporting, I used a random effects panel model to control unobserved heterogeneity (Freel et al., 2019).

5.5 Empirical Results

5.5.1 The impact of collaboration with state-funded research institutions

As described above, I employ matching estimation to identify the average treatment effect of collaboration with public knowledge sources on the treated SMEs. In doing so, I estimate a probit model with a binary dependent variable indicating whether a firm collaborated with public knowledge sources, controlling for important characteristics which determine selection into the collaboration. All our covariates, such as firm age, size, innovation capacity, productivity, region, and sector, play crucial roles in the selection into the treatment and exhibit a well-balanced distribution after the matching (detailed results of the balancing properties are presented in Table A5-6, A5-7, and A5-8 in the Appendix). These results demonstrate that our matching procedure effectively controlled for endogeneity and selection bias, yielding closely comparable control firms for each treated firm. The outcome variable is the only variable retaining a statistically significant difference between the treated and control

groups. Consequently, I attribute this difference to the treatment – collaboration with public knowledge sources.

Table 5-2 The impact of collaboration on firm-level radical & incremental innovation

Treatment	Treated	Matched untreated	Difference (α, ATT)
Radical innovation	14.4844	8.2668	6.2176***
Incremental innovation	10.5026	6.2963	4.2063**

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. For ease of interpretation, the results in Table 5-2 are the sale shares from radical and incremental product innovation, expressed in percentage %. Estimation results based on 1:1 nearest neighbour matching. The α term relates to the difference between treated and untreated firms. This difference can be attributed to collaborating with public knowledge sources.

Table 5-2 reports the average effects of collaborating with public knowledge sources on SMEs' product innovation and these results constitute an essential initial phase in our analysis. Regarding radical innovation, the findings in Table 5-2 demonstrate that the treated firms have a 6% higher ratio of revenue generated from radical innovation to total turnover than their untreated counterparts. As for incremental product innovation, the finding shows that the treated firms have a 4% higher ratio of revenue generated from incremental innovation to total turnover than their untreated counterparts. This supports our first hypothesis, which states that SMEs benefit from collaborating with public knowledge sources to increase their innovation capability and commercialize their product innovation—both via radical and incremental innovation.

5.5.2 Collaborative Innovation and Export Strategy

This section tests how collaboration with public knowledge sources, through what I call collaborative innovation, shapes SMEs international performance. In doing so, I distinguish collaborative innovation deriving from partnerships with public knowledge sources from independent innovation, which represents the firm's own innovation efforts without collaboration, and additionally differentiate between radical and incremental product innovations. For firms that do not collaborate with public knowledge sources, all innovation variables related to collaborative innovation are zero, and "independent" represents the firm's entire innovation efforts as I described in the PSM in methodology.

Using a two-stage Heckman selection modelling approach, I first estimate firms' export decisions using a probit model in stage one. This allows me to correct for selection bias in the second stage, in which I estimate the remaining three models—export-market diversification, export-product diversification, and total export value—among the subset of firms that self-select into exporting. The inverse Mills ratio is calculated based on the first stage probit estimates and used as a control variable in the second stage, thus adjusting for the non-random selection of SMEs into export activities.

Our results in Table 5-3, Models I, II, III, and IV built on Equation (4) and (5) present the nexus between the type (radical and incremental) and source (collaboration with public knowledge sources or independent) of product innovations and SMEs' international performance, providing examinations of hypotheses 2 to 5 (Full regression in the displayed in Table A5-9).

Table 5-3 Product innovation and international performance

Variables	Model I Equation (4) Export Decision	Model II Equation (5) Market Diversification	Model III Equation (5) Product Diversification	Model IV Equation (5) Export Value
Independent incremental innovation	0.00134	0.00312	0.0329*	4,431*
	(0.00200)	(0.00899)	(0.0171)	(2,277)
Collaborative incremental innovation	0.00897***	0.0638***	0.0485	24,224***
	(0.00347)	(0.0239)	(0.0297)	(8,547)
Independent radical innovation	0.00467**	0.0165	0.0445**	9,603***
	(0.00211)	(0.0116)	(0.0202)	(2,966)
Collaborative radical innovation	0.00916***	0.0635***	0.0721**	25,682***
	(0.00346)	(0.0191)	(0.0320)	(7,949)
lnfirmsize	0.231***	2.141***	3.308***	353,123**
	(0.0311)	(0.511)	(0.927)	(165,931)
lnfirmage	0.104***	0.499	1.832*	186,983**
	(0.0383)	(0.491)	(1.001)	(87,191)
lnulp	0.192***	1.696***	2.731***	759,338***
	(0.0231)	(0.438)	(0.908)	(181,727)
lninternalrd	0.111***	0.849***	0.714**	268,303***
	(0.0146)	(0.191)	(0.339)	(76,674)
lnexternalrd	-0.00127	-0.111	-0.234	20,727
	(0.0199)	(0.102)	(0.192)	(35,682)
2012.year	1.311***	9.516**	6.022	2.176e+06
	(0.399)	(4.008)	(6.478)	(1.387e+06)
2014.year	1.379***	10.35***	10.39*	2.606e+06*
	(0.303)	(3.833)	(6.239)	(1.428e+06)
2016.year	1.454***	10.76***	9.902	2.788e+06*
	(0.304)	(3.924)	(6.453)	(1.466e+06)
2018.year	2.733***	22.43***	28.34***	8.165e+06***
	(0.266)	(6.127)	(9.923)	(2.381e+06)
mills		9.597***	12.39**	4.279e+06*

				**
		(3.054)	(5.241)	(1.225e+06)
Constant	-5.127***	-44.17***	-73.48***	-1.975e+07***
	(0.566)	(14.88)	(24.77)	(5.587e+06)
Observations	3,176	1743	1,743	1,743
Number of firms		1,067	1,067	1,067

Notes: Robust standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1

Model I explicitly tests Hypothesis 2, which predicts that collaboration with public knowledge sources through radical and incremental innovations enhances firms' probability of exporting. Results reported in Table 5-3 column 2 strongly support this hypothesis, indicating significant positive marginal effects from both collaborative incremental and radical product innovations (both p <0.01). Independent radical innovation also significantly enhances the propensity to export (p < 0.05). However, independent incremental innovation has no statistically significant effect. These results underscore the effectiveness of collaborative innovation—both incremental and radical—in guiding SMEs into export markets.

With the sample refined to SMEs that export, Models II, III, and IV subsequently evaluate the implications of innovation on firms' export-market diversification, export-product diversification, and total export value. In Model II, I find that only collaborative forms of innovation—both radical and incremental (both p<0.01)—significantly promote greater export-market diversification, supporting hypothesis 3. Notably, independent radical and incremental innovation has positive but not statistically significant associations with market diversification, highlighting the

considerable constraints indigenous SMEs face in independently expanding into new geographic markets without external partnerships.

In contrast, Model III provides a distinctly different pattern concerning export-product diversification. Both independent incremental ($p<0.1$) and radical innovation ($p<0.01$) positively influence product diversification. However, while collaborative radical innovation similarly promotes diversification, collaborative incremental innovation, although positive, fails to reach statistical significance. Thus hypothesis 4 is only partially supported. These findings suggest that, under resource limitations and market uncertainties, SMEs' independent innovation investments tend to focus on expanding within existing markets through product diversification, rather than attempting to enter unpredictable new foreign markets.

Finally, in Model IV, which analyses export value, I find consistent beneficial effects across all types of innovation: collaborative radical innovation, collaborative incremental innovation, independent radical innovation, and independent incremental innovation. Each type of innovation significantly increases the firm's total export revenues. Among these innovation types, collaborative innovations—both incremental and radical—exhibit particularly pronounced effects, pointing to substantial gains that SMEs can realize through external collaboration, which supports hypothesis 5. In summary, Table 5-4 describes our theory-based hypotheses, which were supported or partially supported by the empirical results.

Table 5-4 Theory prediction, hypothesis and empirical results

Theory Prediction	**Hypothesis**	**Support**
PKS collaboration mitigates SME resource constraints by providing access to specialized knowledge and facilities	**H1a:** Collaboration with PKS positively impacts	Yes

needed for incremental product refinement and adaptation.	SMEs' incremental product innovation.	
PKS collaboration mitigates severe SME resource constraints (cost, risk, knowledge access) enabling the pursuit of radical innovations otherwise infeasible.	**H1b:** Collaboration with PKS positively impacts SMEs' radical product innovation.	Yes
PKS collaboration alleviates dual resource pressures (innovation and export costs) and provides external resources (knowledge, networks, legitimacy), lowering barriers for SMEs to initiate exporting based on their innovations.	**H2:** Collaboration with PKS increases SMEs' export decision through both radical and incremental product innovation.	Yes
PKS collaboration mitigates SME resource constraints related to developing/adapting innovations for multiple distinct foreign markets, enabling export market diversification.	**H3:** Collaboration with PKS diversifies SMEs' export markets through both radical and incremental innovation.	Yes
PKS collaboration mitigates SME resource constraints associated with developing new product lines or export-oriented variants, enabling export product diversification.	**H4:** Collaboration with PKS diversifies SMEs' exported products through both radical and incremental innovation.	Partial
PKS collaboration mitigates SME resource constraints in developing advanced or highly refined products, enabling higher value capture from exports.	**H5:** Collaboration with public knowledge sources enhances the value of SMEs' exports through both radical and incremental innovation.	Yes

Taken together, these results illustrate distinct strategic roles for different innovation types and sources within SMEs' international performance. Collaborative innovation consistently facilitates entry into exporting, provides avenues for market diversification, and significantly enhances export revenue. Independent radical innovation encourages export decision, diversifies export products, and boosts export value—but without assisting firms to geographically diversify their markets. Independent incremental innovation alone neither drives SMEs to export nor expands their foreign-market penetration significantly; its positive contributions become apparent primarily once a firm is already internationally active. From this refined perspective, collaborative innovation emerges as strategically vital, especially for helping SMEs overcome resource constraints and achieve diversified export-market growth. A t-test comparing independent and collaborative innovation highlights the significant difference in their impacts displayed in Table 5-5.

Table 5-5 Comparison between collaborative and independent innovation

Dimension	**Variable (equality test)**	**Test Statistic (chi2)**	**Test p-value (Prob > chi2)**
Export Decision	Independent incremental innovation vs Collaborative incremental innovation	4.63	0.0315
	Independent radical innovation vs Collaborative radical innovation	1.71	0.1909
Exporting Market Diversification	Independent incremental innovation vs Collaborative incremental innovation	10.37	0.0013

	Independent radical innovation vs Collaborative radical innovation	11.36	0.0007
Exporting Product Diversification	Independent incremental innovation vs Collaborative incremental innovation	0.34	0.5597
	Independent radical innovation vs Collaborative radical innovation	1.26	0.2626
Export Value (per employee)	Independent incremental innovation vs Collaborative incremental innovation	7.76	0.054
	Independent radical innovation vs Collaborative radical innovation	7.24	0.0071

5.6 Discussion

Drawing upon the National Innovation System (NIS) framework, which emphasizes collaborative networks and institutional support for facilitating knowledge transfer and innovation (Freeman, 1987; Nelson, 1993; Lundvall, 1999; Usman et al., 2018), this study examines the role of public knowledge sources on SMEs' incremental and radical innovation activities and their subsequent impact on the journey towards international scaling. Consistent with Hypothesis 1a and Hypothesis 2, our empirical results confirm that collaborative incremental innovation significantly increases firms' likelihood of initiating export decisions. Conversely, incremental innovation conducted independently—representing internal firm-specific improvements rather than market novelties—does not show significant effects on firms' decisions to export. This finding underscores the critical importance of institutional resource networks, as reflected in the National Business System (NBS) perspective (Whitley, 1998), in enabling indigenous SMEs to leverage incremental product innovations for

international market entry—the crucial first step towards international scaling. Without this collaborative support, the pathway to scaling appears closed for incremental innovators. Specifically, the NBS framework highlights how national institutional environments shape firm-level capacity and incentives to leverage available innovation supports; thus, without adequate access to external resources such as expertise, funding, or research collaborations, internal incremental efforts are unlikely to drive export market entry effectively. This finding highlights the complementary relationship between macro-level institutional environments (NIS) and micro-level firm characteristics and needs (NBS), reinforcing previous insights on the strategic necessity of institutional knowledge transfers (Intarakumnerd & Goto, 2018; Usman et al., 2018).

Regarding radical innovation, defined as product developments that result in entirely novel products or significantly advanced technologies, I observe a somewhat different and particularly compelling pattern. Our results indicate that radical product innovations significantly enhance export probability, whether they arise through collaboration with public knowledge sources or independently from within the SMEs' own innovative efforts. This aligns well with previous empirical studies that suggest radical innovations yield market-oriented breakthroughs which offer a unique value proposition and naturally facilitate international competitiveness as well as opportunities for market expansion (Azar & Ciabuschi, 2017; Chen et al., 2024). Yet, taken further, this finding also introduces an interesting counterpoint to previous theoretical arguments highlighting significant resource constraints and risks typically associated with radical innovations (Freixanet & Renart, 2020b). While resource constraints are undoubtedly severe for SMEs, our analysis suggests that internally driven radical innovation activities, even without direct external collaboration, can still

position indigenous SMEs as competitive exporters. Thus, although collaborative support remains beneficial by reducing market-entry risks and expanding firms' capabilities, SMEs might nevertheless possess sufficient internal dynamism and resilience to engage successfully embark on their international scaling journey when undertaking radical innovations. These outcomes challenge certain assumptions in Teece's (2014) dynamic capabilities perspective, which suggest that internally developed incremental innovations alone may be sufficient to prompt firms' internationalization decisions. Our findings instead highlight the critical role that external resources play in facilitating incremental innovations, whereas radical innovations exhibit a more independent potential to drive SME international pursuits.

Further exploring the journey beyond initial export entry, Hypotheses 3, 4, and 5 explicitly investigate how collaborative versus independent innovation affects the distinct dimensions of international scaling: the diversification of export markets (market reach), the diversification of exported products (product scope), and export value. I demonstrate through robust t-tests that collaborative incremental and radical innovations result in significantly greater diversification of SMEs' exporting markets compared to independent innovation efforts. This observation aligns with earlier scholarship suggesting that institutional partnerships enhance SMEs' international competitiveness by providing strategic knowledge, market-specific insights, and access to advanced technologies (Chang & Webster, 2019; Colli et al., 2014). By comparison, firms conducting product innovation solely through internal efforts face constraints on entering new and geographically diverse markets, indicating that external collaborations uniquely enable SMEs to overcome geographical market-penetration barriers.

For product diversification, however, our results present a somewhat nuanced view. Both collaborative and independent radical innovations significantly foster product portfolio diversification among exporting SMEs. Interestingly, independent incremental innovation also significantly diversifies export products, while collaborative incremental innovation, although positive, remains statistically insignificant. These mixed results can be partially explained by recognizing the different functions of innovation types, as incremental innovation typically refines existing product categories rather than fundamentally expanding product portfolios (Falahat et al., 2020; Freixanet et al., 2020). SMEs relying on internal incremental innovation, facing marginal returns from previously established export channels, are perhaps incentivized to diversify within existing product lines to maintain market competitiveness. Therefore, while collaborative incremental support may significantly enhance market diversification, internal incremental innovation appears to be more immediately effective in promoting product-level diversification within SMEs' existing export markets.

In terms of total export value, our empirical evidence consistently confirms positive impacts across all types and sources of innovation: both collaborative and independent variants of incremental and radical innovation significantly increase SMEs' export revenues. The significant impact associated with collaborative innovation—both radical and incremental—emphasizes again the crucial role institutional knowledge and resources play in increasing SMEs' profitability in international contexts.

From a theoretical standpoint, this study significantly extends the application of the NIS concept, supported by insights from the NBS framework, by explicitly differentiating between incremental and radical innovations arising from different innovative channels—collaborative versus independent. Emphasizing the dual view

of NIS and NBS, I illustrate how indigenous SMEs respond heterogeneously within a shared national institutional framework. Specifically, our findings highlight the synergy between macro-level institutional support and micro-level strategic orientations, suggesting that public collaboration mechanisms have differential influences based on innovation novelty. The analysis underscores that incremental innovation substantially benefits from clear external support structures, whereas radical innovations may depend less strictly on external assistance, though they remain positively enhanced by institutional resources. This integration refines earlier conceptualizations by revealing more specific conditions under which institutional knowledge transfers foster SMEs' internationalization (Hotho, 2014).

Theoretically, these results extend NIS/NBS perspectives in two ways. First, they show that the institutional effectiveness of public knowledge infrastructures is contingent on innovation novelty and SME resource constraints. Incremental innovators, facing the liability of smallness and limited internal knowledge stocks, depend heavily on PKS to access both codified and tacit knowledge required for export entry and market diversification. Radical innovators, by contrast, can sometimes leverage their idiosyncratic knowledge base and dynamic capabilities (Teece, 2014) to internationalise independently, although PKS collaboration enhances their ability to diversify geographically and increase export value. Second, by explicitly distinguishing between collaborative and independent innovation channels, I demonstrate that institutional support is not merely additive to firm capabilities; its value depends on how it interacts with the firm’s existing resource base and strategic orientation.

The study also clarifies and expands prior theoretical insights within the innovation-internationalization literature (Freixanet et al., 2020; Teece, 2014).I underline the

crucial differentiation between incremental and radical innovational pathways, demonstrating not only that SMEs' international trajectories differ significantly according to these distinctions, but also that these differences influence how firms effectively deploy external institutional support. The finding that incremental innovation requires robust public collaboration to motivate SMEs' export entry offers important theoretical consideration for future research on SME internationalization strategies and policy implications.

Finally, the insights provided by this study hold considerable policy relevance for enabling SME international scaling. Our empirical evidence strongly suggests that policy initiatives and national innovation strategies should prioritize business-institutional collaboration structures tailored specifically toward helping incremental innovators achieve market entry and subsequent geographic scaling, given their reliance on external resources for international market entry and diversification. Similarly, enhancements in radical innovation capabilities, although seemingly less dependent upon external assistance for initiating exports, nevertheless also see considerable performance improvements through effective collaboration networks. Policymakers should therefore focus on delivering adaptable and context-sensitive innovation supports to SMEs, carefully calibrating policy investments and incentives according to innovation novelty and firm resources. This targeted policy approach promises significant potential to enhance SMEs sustained international scaling in rapidly evolving global marketplaces.

5.7 Conclusion

This study refines NIS by introducing firm-level heterogeneity (via NBS) and showing that institutional benefits are contingent on innovation novelty and SME resource

position.. Drawing on a matched panel of 3,176 Irish indigenous SME-year observations, I disentangle the relationship between public knowledge source collaboration, innovation novelty, and international performance. Our findings reveal two important asymmetries. First, while radical innovation robustly facilitates SMEs' initial export entry even without institutional collaboration, incremental innovation significantly increases export propensity only when SMEs partner with public knowledge sources. This indicates incremental innovation alone fails to overcome the barriers to foreign market entry unless combined with external institutional support. Second, radical innovation conducted independently primarily diversifies export products rather than markets, as SMEs under resource constraints target existing international markets. However, collaborative radical innovation significantly supports diversification into new geographic markets. Similarly, incremental innovation in collaboration strongly enhances export market diversification but, counterintuitively, does not significantly widen SMEs' product portfolios beyond what independent incremental innovation achieves.

These counterintuitive results have two implications. First, it calls into question blanket policy prescriptions that treat all innovation as uniformly export-enabling. Second, it demonstrates that institutional support is not merely additive to firm capabilities - it is conditional on the nature of innovation pursued and on the dimension of internationalization considered. Once SMEs enter global markets, both incremental and radical innovations contribute to exporting product diversification and value creation, but do not effectively enable SMEs to expand into more geographic markets. Under this condition, institutional collaboration emerges as a pivotal condition for SMEs' exporting geographical diversification.

Theoretically, I extend NIS and NBS frameworks by showing how innovation type conditions the State-SME nexus through the institutional effectiveness of public knowledge infrastructure. I move beyond the assumption of firm homogeneity and offer a micro-founded, interactionist view of how resource-constrained SMEs benefit from institutional ties in fundamentally different ways. In doing so, I contribute to a more contingent and dynamic understanding of how public systems interact with firm-level strategies to enable international scaling.

For policymakers, the findings underscore the need for a targeted, not uniform, approach to supporting SME internationalization through Public Knowledge Source collaboration. Specifically, PKS collaboration appears essential for incremental innovators to achieve initial export entry and subsequent market diversification; without it, these firms struggle. Policies should therefore prioritize facilitating PKS access for these SMEs to translate incremental improvements into global sales. Conversely, while radical innovators may enter export markets independently, PKS collaboration significantly boosts their ability to diversify into new geographic markets and enhance export value. Thus, even for firms with breakthrough innovations, fostering PKS partnerships is key for maximizing global reach and returns.

While our focus on Irish SMEs provides a rich empirical setting, future research should test these dynamics in other institutional contexts with varying innovation system maturity and SME composition. Additionally, exploring the roles of other actors - such as private accelerators, industry networks, or cross-border collaborations - can deepen our understanding of how institutional heterogeneity shapes innovation-led internationalization.

Viewed alongside the subsidy-based mechanisms analysed in Chapter 4, the findings here suggest a meaningful distinction between ‘blunt’ and ‘sharp’ policy instruments.

General subsidies, captured in Chapter 4 as a binary treatment, act as blunt tools that relax financial constraints and induce additional R&D but do not finely target the specific knowledge and networks required for diversified international expansion. In contrast, PKS collaborations constitute sharp instruments: they directly connect SMEs to specialised, often tacit knowledge and international networks, enabling more precise support for particular innovation trajectories (incremental versus radical) and specific dimensions of internationalisation (export entry, market diversification, product diversification, value). Chapter 4 and 5 together provide a comprehensive empirical foundation for understanding the multifaceted State-SME nexus. Chapter 6 will now synthesize these distinct empirical strands to articulate the overall contributions and implications of this dissertation

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Chapter 6

Conclusion

This dissertation has explored the intricate dynamics of the State-SME nexus, providing an innovation-focused analysis of how institutional support influences SMEs' international scaling. Recognizing SMEs as vital economic engines often constrained by significant resource and knowledge limitations, this research systematically investigated how distinct support mechanisms—namely state agency interventions, government financial subsidies, and collaborations with public knowledge sources—interact with firms' internal innovation processes to shape their ability to enter and expand in global markets. The overarching aim was to move beyond simplistic assessments of support effectiveness, offering a more nuanced, context-sensitive, and mechanism-driven understanding of this crucial State-SME nexus (Child, Karmowska, et al., 2022; Dvouletý et al., 2021). The journey through the preceding chapters has revealed a central, unifying theme: the effectiveness of the State-SME nexus is profoundly contingent. It is not a monolithic entity but a dynamic interface where the type of state agency, the mechanism of support, the novelty of the innovation, and the specific international scaling objective all interact. This concluding chapter synthesizes these findings to build a cohesive, multi-level understanding of this critical relationship.

6.1 Unpacking the State-SME Nexus for Innovation and International Scaling

To properly dissect this nexus, I first deconstruct the notion of the State as a monolith. Chapter 2 laid the foundational argument that the State in the State-SME nexus is, in fact, multifaceted, a conclusion reached by systematically reviewing the literature on

state agencies. It established that the nature and effectiveness of support are profoundly shaped by the characteristics and autonomy of state agencies themselves, a point often under-explored in broad institutional analyses (Child, Karmowska, et al., 2022). The proposed typology (agency void, co-option, co-specialization), grounded in the public administration literature (Grandy & Hiatt, 2020; Verhoest et al., 2010), highlighted that an agency-centric view is critical for understanding how policies designed to boost SME innovation and internationalization are translated into practice, and, ultimately, how effectively the State-SME nexus functions.

This agency-centric perspective provides a crucial lens for interpreting the dissertation's empirical findings (Abdelnour et al., 2017; Clegg, 2010; Emmenegger, 2021; Miller, 2005; Yesilkagit & Van Thiel, 2012). While the data did not allow for a direct test of agency type, the results from Chapters 4 and 5 align powerfully with the proposed typology. The broad, general financial subsidies analysed in Chapter 4—which boosted R&D inputs but showed weaker effects on complex scaling dimensions like market diversification—are characteristic of support delivered by 'co-option' agencies. Such agencies often act as intermediaries, distributing resources according to broad government mandates but may lack the deep, specialized knowledge to guide firms through nuanced international expansion (Lederman et al., 2010). In stark contrast, the knowledge-intensive partnerships with Public Knowledge Sources (PKS) in Chapter 5, which proved highly effective for driving market diversification, are emblematic of 'co-specialization' relationships. These findings suggest that PKS collaborations function as a form of co-specialized support, where the state facilitates the co-creation of knowledge and capabilities tailored to specific firm needs (Mulligan et al., 2022). Therefore, this dissertation's empirical results can be interpreted as

demonstrating the differential impacts not just of support types, but of the underlying agency models that deliver them.

At first glance, the empirical findings present a potential tension: Chapter 4 concludes that policy-induced R&D (from subsidies) is weaker than private R&D for driving market diversification, while Chapter 5 finds that collaborative innovation (from PKS) is stronger than independent innovation for the same outcome. This is not a contradiction, but rather the dissertation's central empirical contribution. It reveals that the mechanism of support is paramount (Freel et al., 2019). General subsidies act as a blunt instrument of resource provision; they effectively fuel R&D investment but less effectively build the market-specific knowledge or adaptive capabilities needed for complex geographic scaling. In contrast, PKS collaboration acts as a sharp instrument of knowledge co-creation; it provides not just resources, but the targeted expertise, networks, and legitimacy that directly address the challenges of diversifying into new markets (Child et al., 2017). This fundamental difference explains why one form of state-supported innovation appears less effective for scaling, while another is highly effective.

This differential impact is clearly illustrated in the comparative summary of findings presented in Table 6-1. For instance, comparing the second row (Private R&D) with the first (Policy-induced R&D) shows that while both support market entry, private R&D is significantly more potent for driving market and product diversification. This highlights the limitations of purely financial support for deep scaling. However, comparing the fourth row (Independent Incremental Innovation) with the third (Collaborative Incremental Innovation) tells the opposite story. Here, independent efforts fail to drive market entry or diversification, but collaboration turns incremental innovation into a powerful engine for both. This demonstrates that for less novel

innovations, the ‘sharp instrument’ of PKS collaboration is not just beneficial—it is essential. Collectively, these comparisons underscore that the State-SME nexus is most effective when the support mechanism is precisely aligned with the firm's innovation strategy and scaling objective.

Table 6-1 Comparison of institutional support impact

	Export Decision (Likelihood)	**Export Market Diversification**	**Export Product Diversification**	**Export Value (per employee)**
Policy-induced R&D	Positive Significant	Positive Significant (Weaker than Private R&D)	Positive Significant (Weaker than Private R&D)	Positive Significant
Private R&D	Positive Significant	Positive Significant	Positive Significant	Positive (Not significant)
Collaborative Incremental Innovation	Positive Significant	Positive Significant (Stronger than Independent Incremental innovation)	Positive (Not significant)	Positive Significant (Stronger than Independent Incremental innovation)
Independent Incremental Innovation	Positive (Not significant)	Positive (Not significant)	Positive Significant	Positive Significant
Collaborative Radical Innovation	Positive Significant	Positive Significant (Stronger than Independent radical innovation)	Positive Significant	Positive Significant (Stronger than Independent radical innovation)
Independent Radical Innovation	Positive Significant	Positive (Not significant)	Positive Significant	Positive Significant

Collectively, the central theme of this dissertation crystallizes: the State-SME nexus is a critical enabler of SME innovation and international scaling, but its effectiveness is not absolute. It is not a straightforward input-output system where support automatically leads to desired outcomes. Instead, its effectiveness in fostering innovation-led international scaling is profoundly contingent upon the interplay of several elements. The nature of the state agency delivering support is paramount, as established in Chapter 2. Furthermore, the specific type of support and the innovation mechanisms it triggers, such as policy-induced R&D from subsidies examined in Chapter 4, have different strengths and weaknesses for internationalization compared to knowledge collaborations shaping innovation outputs, as explored in Chapter 5. The novelty of the innovation itself—whether it is an R&D investment, an incremental improvement, or a radical breakthrough—and its funding or collaborative source, also dictates its international leverage. Finally, the particular dimension of international scaling being targeted, from initial export decisions to more complex market and product diversification and value enhancement, responds differently to these varied innovation pathways.

6.2 Theoretical Contributions

This dissertation's primary theoretical contribution is a more nuanced, integrated, and empirically grounded understanding of the State-SME nexus, achieved by demonstrating the contingent effectiveness of institutional support. I show that the impact of state intervention is not uniform but is conditioned by the interplay between the agency delivering support, the support mechanism itself (financial vs. knowledge-based), the novelty of the firm's innovation, and the specific dimension of international scaling being pursued. This overarching contribution is realized through three more specific advancements.

First, this dissertation contributes to International Business and SME Internationalization by refining our understanding of the institutional environment by offering an agency-centric view of state support (in Chapter 2), moving beyond treating institutions as a homogenous backdrop (Child, Karmowska, et al., 2022; Child, Narooz, et al., 2022; Dong et al., 2022; Wu et al., 2022). It contributes to a more nuanced understanding of the State-SME nexus, emphasizing the organizational dynamics of support delivery. By distinguishing between the effects of policy-induced R&D (Chapter 4) and collaborative innovation (Chapter 5), I add critical granularity to the Uppsala and Knowledge-Based View models (Grant, 1996; Vahlne & Johanson, 2017). I demonstrate that the knowledge-commitment spiral is affected differently by distinct state-influenced knowledge inputs; financial support may trigger the initial commitment to export, but collaborative, co-created knowledge appears essential for the subsequent, more complex commitments of geographic scaling.

Second, to Innovation Studies, this research underscores the contingent value of institutional collaboration (like PKS engagement in Chapter 5) for innovation outcomes and their subsequent market exploitation (Bellucci & Pennacchio, 2016; Freixanet & Rialp, 2022; Hewitt-Dundas et al., 2019; Zhang et al., 2024). Meanwhile, comparing the impact of financial funding (policy-induced vs. private R&D) and the impact of collaboration with public knowledge source (collaborative and independent product innovation) on international decision and expansion, it offers insights into how different institutional support formats shapes firms' innovation inputs and their subsequent market exploitation differently (Al-Tabbaa & Zahoor, 2024; Kantaruk Pierre et al., 2024; Perez-Alaniz et al., 2025). Collaborative innovation has a significantly stronger impact on international market diversification than independent innovation, and policy-induced R&D has significantly weaker impact on international

market diversification than private R&D. It shows that the innovation-internationalization link is moderated by innovation type and the nature of institutional engagement, providing a more granular, innovation-focused analysis than often found in the literature.

To Public Policy and Institutional Theory**,** the dissertation challenges simplistic views of policy implementation by emphasizing agency autonomy and the behavioural additionality of support (Haddad & Bergek, 2023). Our findings question the universal efficacy of R&D subsidies, a topic of long-standing debate (Dimos & Pugh, 2016), by showing their limitations for international scaling. It provides a micro-foundational perspective on how macro-level innovation systems and the State-SME nexus translate into firm-level innovative behaviours and international scaling efforts, highlighting the importance of policy design that recognizes firm heterogeneity and specific innovation pathways.

6.3 Practical and Policy Implications

The findings of this dissertation carry significant implications for policymakers and practitioners aiming to enhance SME innovation and facilitate their international scaling. Perhaps the most salient insight is the clear imperative to move beyond one-size-fits-all approaches to SME support. The evidence strongly suggests that differentiated and targeted policies are required, recognizing that the needs of SMEs vary significantly based on their innovation strategies—such as a focus on incremental versus radical innovation—and their current stage of internationalization (Srhoj et al., 2023). For instance, support for incremental innovators might need to be more directly coupled with international market access programs, given their demonstrated reliance on collaboration to successfully internationalize.

Furthermore, while fostering R&D inputs is evidently important, as shown by the impact of subsidies, policy design should also aim to cultivate the capabilities within SMEs to translate these innovations into sustained international commercial success. This involves supporting the development of crucial market-specific knowledge and adaptive capacities, areas where the impact of policy-induced R&D showed limitations in driving diversified international scaling. The design, autonomy, and client-orientation of state agencies delivering support also emerge as critical policy levers. Effective agencies within the State-SME nexus are characterized by flexibility, relevant expertise, and a responsiveness to the nuanced needs of the SMEs they serve. Finally, a strategic policy focus should extend beyond merely facilitating initial export entry to encompass the subsequent, more complex phases of international scaling, such as market and product diversification, where different types of innovation and tailored support mechanisms may prove more effective.

6.4 Limitations and Future research

While this dissertation offers valuable insights into the State-SME nexus and its role in innovation-focused international scaling, it is important to acknowledge its limitations, which concurrently illuminate promising avenues for future scholarly inquiry. The empirical investigations were primarily focused on the Irish context. Although Ireland provides a highly relevant "small open economy" laboratory, caution is warranted when generalizing specific quantitative effects to vastly different institutional environments and stages of economic development. Future cross-country comparative studies are therefore essential to test the contingency arguments advanced here within diverse national settings.

Another limitation pertains to the granularity of certain data; for example, the binary measure for subsidies utilized in Chapter 4 precluded a more detailed analysis of dose-response relationships between subsidy amounts and their impact. Future research leveraging more fine-grained data on support intensity could explore these dynamics more thoroughly. Moreover, while this dissertation examined key forms of institutional support, the complex ecosystem influencing SME innovation and international scaling undoubtedly involves other actors and mechanisms, such as private sector intermediaries and emerging digital platforms, whose roles merit further investigation (Monaghan et al., 2020).

Building upon these considerations, future research could fruitfully explore the dynamic interface through which support flows within the State-SME nexus, offering deeper insights into learning processes and the long-term efficacy of support. Investigating the impact of combined or sequenced support interventions, for instance, how initial R&D subsidies might prepare SMEs for more effective utilization of subsequent export promotion services—presents another compelling research direction. There is also considerable scope for deeper qualitative investigations into the black box of how SMEs internally absorb, adapt, and strategically leverage different forms of external support to drive their innovation and internationalization efforts. Finally, exploring the transformative role of emerging digital technologies in reshaping the State-SME nexus, support delivery mechanisms, and SME pathways to international scaling remains a pertinent and rapidly evolving area for future inquiry.

The journey of an SME from a domestic entity to a successful international player, achieving significant international scaling, is complex, challenging, yet vital for economic dynamism (Reuber et al., 2021). This dissertation has contributed to a deeper, innovation-focused analysis of how the State-SME nexus—through state

agencies, financial subsidies, and public knowledge collaborations—can act as a crucial catalyst in this journey. By dissecting the types of support, the nature of innovation, and the varied dimensions of international performance, this research underscores that effective assistance is rarely a one-size-fits-all proposition. Instead, it requires a sophisticated appreciation of the specific needs of SMEs, the strategic intent behind different innovation pathways, and the design of institutional mechanisms that are both supportive and enabling. As SMEs continue to navigate an increasingly interconnected and competitive global landscape, the insights gleaned from this research offer valuable guidance for fostering their resilience, innovativeness, and ultimately, their successful international scaling.

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Appendix

Appendix for Chapter 2

Table A2 - 1 State agency, input, mechanism, and outcome of SME internationalization integration

Dimensions (60)	Sub-dimensions	Input content	Mechanism	Contingent	Internationalization decision	Internationalization growth
Macro - National institutional structure (18)	Institutional impediments: mainly in developing countries	Uncertain legal system, business regulations, and governmental policies (Adomako S et al., 2020; Jonsson & Lindbergh, 2010); ineffective laws to protect our company's intellectual property (Jean & Tan, 2019)	The political and legal systems caused unlawful and unfair competitive practices to force SMES to exit from their home country.	Business network stability can compensate for formal institutions' deficiencies, Internationalization direction;	(Positive) Institutional impediments cause firms to escape from the domestic market (Wu & Deng, 2020), speed firms' internationalization process, and export to the market with further physics distance.	(Negative) Corruption, bureaucracy, and regulatory framework complexity cause firms' lower export growth and performance (Manolopoulos et al., 2018; Donbesuur F et al., 2020)
	Institutional drivers: comparing developed and developing countries	Formal institutions and universalistic rules (Government effectiveness, Regulatory quality, and Tax administration) to facilitate	Facilitate firms' access to finance, information, and network		(Positive) Better-developed home country formal institutions are found to have a supportive impact on the venture's likelihood of	(Positive and Negative) Better-developed formal institutions have a supportive impact on firms' internationalization level, but SMEs from lower

		firms' access to finance, information, and network; Property rights protection			internationalization (Chen et al., 2018; T. Li, 2018).	institutional quality countries show better international growth and performance (Reference).
Micro - State-sponsored activities (24)	Government policy and trade show	Financial support and policy information for specific firms and industry	Create a platform for firms to explore opportunities and build a network	It depends on the firm's awareness and activeness to maintain the network	Increase the international activities	N/A
	Export related promotion	Finance, information, and host market knowledge, training	The government provides direct funding and information	Internationalization degree; Combination of export promotions; Government's self-serving motivations	Positive in encouraging SMEs to engage in export activity	Positive in SMEs' export, the lower the internationalization degree, the better impact outcome/performance
Meso - Organizational level (18)	Government and agencies (Agent void)	Finance, information (objective and experiential, political), advice, and network	Firms' networks with government, government agencies and officials provide access to information and	Domestic institutional environment (Macro); firms' resources	Positive impact export decision and go to market with bigger physical distance; choose direct export instead of indirect export	N/A; positive impact

			advantages in acquiring support			
	State Agencies (Co-option)	Provide finance, knowledge, and information exchange	State agencies create platforms to implement government policy and specific programs, delivering and exploiting resources and information	Internationalization time and direction	Support for the launch of social SMEs but limited to their growth stage; It encourages export but limits its growth as the firm's skills	Increase short-term export but decrease long-term export capability and network with MNEs
	State Agencies (Co-specialization)	Provide finance support, knowledge creation, information exchange, build trust and reputation	State agencies as firms' assistants, building trust and lowering the risk in firms' international activities	Internationalization direction and State agencies' networks government and firms in the home and host markets	Assistant SMEs build networks with MNEs and engage in export activities	Expand from developed markets to emerging markets; increase commitment and change from export to building subsidiaries in foreign markets

Table A2 - 2 Meso-level state agencies analysis

Paper Title	Author	Country	State Agencies	State Agencies Related to the Government	Theory Lens	The Role of State Agencies	Findings on How It Impacts SMEs
Does triple helix collaboration matter for the early internationalization of technology-based firms in emerging Economies?	Baier-Fuentes et al. (2021)	Mexico	Government agents, public programmes (TechBA, CONACYT, NAFIN, ProMexico), Mexican Ministry of Economy, State of Nuevo León	Part of the Triple Helix. National and program-specific levels. Government promotes innovation and internationalization, but institutional voids exist.	Triple Helix Model, International Entrepreneurship and Knowledge-Based View.	Provide funding, resources, networks, knowledge. Act as intermediaries.	*Positive:* Facilitate access to resources, knowledge, and networks. Help overcome institutional voids. Collaboration with universities and industry enhances the positive impact.

International social SMEs in emerging countries: Do governments support their international growth?	Scuotto et al. (2020)	China	Local governments, public institutions, Central Government	Primarily *local* governments (provincial/municipal) with significant autonomy. Central government provides funding and broad policy. Strong government control but increasing support for social enterprise.	Behavioural theory (prevalence, relevance, urgency, accessibility, radicalness)	Provide initial support (funding, resources). Act as regulators (sometimes inefficient).	*Positive:* Initial support helps launch. *Negative:* Bureaucracy, inconsistent growth support, and changing policies hinder internationalization. SMEs need entrepreneurial skills and external networks to overcome governmental limitations.
The international market selection of Chinese SMEs: How institutional influence overrides psychic distance	Yan, Hu & Liu (2020)	China	Local and provincial governments, State-owned banks, Trade commissions, Commerce organizations.	Strong government influence on the economy. Formal institutions (government support) and informal institutions (*guanxi*) are intertwined. Government agencies provide support and guidance, but *Guanxi* is crucial for accessing resources and navigating the system.	Institutional Embeddedness Perspective, Psychic Distance.	Provide information, resources, favourable policies, and act as "infomediaries". Create a supportive environment for internationalization, but *Guanxi* is essential for effectively leveraging this support.	*Positive:* Home institutions (formal and informal) can *override* psychic distance, enabling SMEs to enter distant markets. *Guanxi* provides access to information, trust, and resources, facilitating international market selection. Formal and informal institutions interact.

Influence of Innovativeness, Environmental Competitiveness and Government, Industry and Professional Networks on SME Export Likelihood	Chang & Webster (2019)	Australia	Australian Bureau of Statistics, Government agencies (not explicitly named, but implicitly involved in data collection and policy)	The ABS is a national statistical agency. Government agencies are implicitly involved in providing support and creating a regulatory environment for SMEs.	Resource-Based View, Network Theory, and Institutional Theory.	Provide information, advice, financial assistance, and create regulations. ABS provides statistical data.	*Positive:* Government networks have the *strongest* positive impact on export likelihood. Industry networks have a weaker positive impact. Professional networks have no significant impact. Innovativeness is positively related, while environmental competitiveness is not.
The international business incubator as a foreign market entry mode	Blackburne & Buckley (2019)	China	China-Britain Business Council (CBBC) - a British export promotion organization working closely with the British government.	CBBC is a quasi-governmental organization. The Launchpad scheme is supported by the UK government and works within the broader context of Chinese government regulations and policies. Acts in tandem with the home government.	Internationalization Process Theory, Resource-Based View, Transaction Cost Economics, Institutional Theory.	Provides a low-risk, high-control entry mode; facilitates knowledge accumulation, network building, and market testing; acts as a "steppingstone" to deeper market commitment.	*Positive:* Reduces liabilities of foreignness, accelerates internationalization, provides access to resources and knowledge, and lowers the cost of commitment. Facilitates a faster switch to FDI. Offers a safe way to explore the market.

Local horizontal network membership for accelerated global market reach	(Ryan et al., 2019)	Ireland	Animation Ireland (industry association, government-funded)	Government-funded representative body tasked with promoting and coordinating activities of Ireland's animation enterprises.	Social capital, Coopetition, Network theory	Intermediary, orchestrating and coordinating activities, promoting the industry, connecting firms to foreign markets, providing market intelligence.	Active membership in a local horizontal network, mediated by the industry association, facilitated accelerated acquisition of foreign market knowledge and customers for born global firms. The association provided legitimacy and reputational effects.
How do European trade promotion organisations manage their stakeholders?	(Schembri et al., 2019)	14 European countries	Trade Promotion Organizations (TPOs)	Mostly public agencies under direct administration of respective ministries in charge of trade issues; governments are primary funders. Operate with varying degrees of autonomy.	Stakeholder theory	Bridging and facilitating domestic firms (especially SMEs) to trade in foreign markets, providing market information, linkages to partners, technical advice, marketing events, and trade policy advocacy.	TPOs' strategies are significantly influenced by their stakeholders (government, domestic firms, foreign trade offices). Effective stakeholder management (funding diversification, service customization, FTO specialization) enhances TPOs' salience and their ability to support SMEs' internationalization.
Capitalising on knowledge from big-science centres for internationalisation	(Eerme and Nummela, 2019)	Estonia	European Space Agency (ESA) (Big-science centre, not a traditional state agency, but a major public	Funded by member states, large-scale research infrastructure and procurement programs operate. Provides a platform for international collaboration.	Internationalization process theory, Resource-based view	Facilitator of access to knowledge, resources, and networks. Provides funding, legitimacy, and opportunities for collaboration with	Collaboration with the ESA provided SMEs with access to diverse types of knowledge (market, marketing, technological). This knowledge, combined with the ESA's reputational effect, facilitated international expansion,

			procurement entity)			other firms and research institutions.	but not always in a linear or planned way. Resource-seeking was a primary driver for internationalization.
Institutional and resource configurations associated with different SME foreign market entry modes	(Lindsay, Rod, & Ashill, 2017)	New Zealand (SMEs entering India)	NZ government agencies (e.g., NZTE - New Zealand Trade and Enterprise), diplomatic offices, trade commission.	These agencies are directly part of, or closely linked to, the New Zealand government, representing its interests and providing official support for internationalization.	Resource-based view (RBV); institutional theory.	Provide resources (financial, advisory); facilitate access to networks and information; help navigate host country institutional pressures; provide legitimacy.	Different configurations of resource reliance (internal vs. external) and institutional exposure (home vs. host) are associated with different entry modes. Home country support is crucial.
SMEs and international entrepreneurship: An institutional network perspective	(Oparaocha, 2015)	Sweden and Finland	Uminova, Finpro, Tekes, Vinnova, Enterprise Europe Network, embassies, ministries of trade/industry, national trade	These are a mix of government agencies, publicly funded but operationally independent organizations, and industry-specific associations, all forming part of the institutional support network.	Institutional theory; network perspective.	Provide business support services (advisory, knowledge, financing, partner search, market information, innovation subsidies); act as network nodes.	Institutional networks positively influence SME internationalization, with effects intertwined across different stages. Networks provide key resources and facilitate market entry.

			delegation, Swedish Trade Council.				
Network intermediaries in the internationalization of new firms in peripheral regions	(O'Gorman & Evers, 2011)	Ireland	Bord Iascaigh Mhara (BIM) (Irish Government's seafood support agency)	Government agency responsible for supporting the development of the seafood industry. Receives funding from the Irish government and the EU. Has a specific mandate to assist firms in that sector.	Network perspective, with emphasis on intermediary network actors.	Information mediation (identifying opportunities, facilitating introductions, providing market knowledge), resource provision (developing export capacity).	The EPO played a crucial role in facilitating early internationalization by providing access to resources and information. The ability of the EPO to influence firm internationalization was contingent upon the strength of EPO's international market networks and its relationship with the local firms. Created a potential for regional dependency on the EPO.
Internationalization and the performance of born-global SMEs: the mediating role of social networks	(Zhou, Wu, & Luo, 2007)	China	Guanxi networks (though not explicitly state agencies, they function as a crucial para-institutional mechanism in	Guanxi represents an informal, culturally embedded system of reciprocal relationships and social connections, substituting for formal institutional support in the context of weak formal institutions.	Social network theory; internationalization ; guanxi.	Facilitate information exchange (market opportunities, advice, experiential learning); provide referral trust and solidarity; reduce transaction costs.	Guanxi networks mediate the relationship between internationalization (both inward and outward) and firm performance, particularly export growth and profitability growth.

			the Chinese context).				
Economic Effects and Spin-offs in a Small Space Economy: The Case of Canada	(Amesse et al., 2002)	Canada	Canadian Space Agency (CSA), European Space Agency (ESA, for one part of the analysis), various provincial governments (collaborating on the STEAR program).	CSA is a federal government agency directly responsible for Canada's space program. ESA is an intergovernmental organization. Provincial governments collaborated on program delivery.	Not explicitly stated, but implicitly draws on technology transfer, economic impact analysis, and potentially industrial policy perspectives.	Funding and managing space programs (including R&D); setting strategic priorities; fostering collaboration between industry, research organizations, and government.	Canadian space programs, particularly through focused initiatives like STEAR and participation in ESA, generated significant economic benefits (direct and indirect), technological spin-offs, and supported the growth of a largely SME-based space industry.
Entrepreneurship, globalization, and public policy	(Acs, Morck, & Yeung., 2001)	Canada	Export Development Corporation (EDC)	It is a Canadian state-owned enterprise that provides Canadian exporters with financial assistance such as trade credit arrangements and default insurance.	Entrepreneurship, Innovation, Globalization, and Multinational enterprise	The provision of trade credit insurance and other financial products.	EDC-like agencies might distort SME behavior by encouraging *direct* exporting when *indirect* exporting (through partnerships with MNEs) might be more efficient

							and beneficial for both the SME and the overall economy.
The role of informational assistance in small firms' export involvement	(Seringhaus, 1986)	Canada	Federal government and the province of Ontario	The eighteen services and programs that make up such assistance for this essay are categorized as nine with objective information attributes and nine with experimental information qualities.	Export Marketing, Information, Export Marketing Expertise	The delivery of information objective, experiential and contribution.	The usefulness of external export marketing information assistance diminishes with increasing export involvement.

Appendix for Chapter 4

Table A4 - 1 Database source and summary

Database	Description	Variables included
Trade	The Trade RMF is based on extra-EU trade in goods statistics as derived from administrative data of Revenue Commissioners (via the Single Administrative Document) and intra EU trade in goods statistics which are collected by Revenue Commissioners (via the Intrastat Survey), covering 2006-2019.	The principal variables are date, company VAT number, trade flow (import/export), commodity code (CN), invoice value, net mass and/or supplementary units, country of destination/consignment for exports/imports respectively, country of origin for imports, and statistical value.
CIP	The statistical population covers all Enterprises wholly or primarily engaged in industrial production from 1991 onwards from a survey of 3,800 enterprises, covering 2006-2016.	The principal variables are Turnover, Gross Value Added, Purchases, Stocks, Capital Assets, Employment, and Earnings.
BR	The Business Register is a register of all enterprises that are active in the State. There is no lower size limit, but for practical reasons, Business Demography data is based on enterprises that are registered with the Revenue Commissioners, covering 2006-2016.	Value-Added Tax (VAT), employer, Corporation Tax or Income Tax registrations, plus quarterly files of VAT activity,
Data source: Irish Central Statistics Office (CSO) 2006-2019		

Table A4 - 2 Summary statistics

Variables	N	Mean	SD	p1	p99	t-value
exportert1	10508	.22	0.414	0	1	54.396
product diversificationt1	10508	2.792	12.878	0	67	22.227
market diversificationt1	10508	1.43	5.483	0	28	26.732
export valuet1 emp	10508	20.623	156.216	0	443.729	13.533
Private R&D	10508	21.843	155.514	0	494	14.398
Policy-induced R&D	10508	1.74	91.520	-1	3	1.949
ln firmsize	10508	2.375	0.930	.693	5.075	261.714
ln firmage	10047	2.632	0.822	.693	4.06	321.086
unit labour productivity	10508	4.631	0.875	2.485	7.209	542.404
c patent	10508	1.687	1.488	0	3	116.166
c to t ex	10508	.909	1.283	0	3	72.693
year	10508	4.362	3.493	0	10	128.03
Regional Authority	10506	4.408	2.324	1	8	194.375
Nuts	10508	5.251	0.731	4	6	736.224
NACE 2-digit code	10508	23.353	8.326	8	38	287.513
sector	10508	3.182	0.611	2	5	533.787
Total subsidies	10508	4.009	87.970	0	47	4.672
subsidies=1, no subsidies=0	10508	.164	0.370	0	1	45.427
mills	10044	1.471	0.525	.209	2.616	280.486

Table A4 - 3 Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) Private R&D														1.000
(2) Policy-induced R&D	0.011													1.000
(3) ln_firmsize	0.162	0.042												1.000
(4) ln_firmage	0.080	0.009	0.332											1.000
(5) lnulp	0.086	0.034	0.176	0.062										1.000
(6) c_to_t_ex	0.110	0.033	0.189	0.077	0.275									1.000
(7) c_patent	-0.131	-0.011	-0.237	-0.363	-0.026	-0.061								1.000
(8) region	0.008	0.021	-0.011	-0.012	0.023	-0.061	0.014							1.000
(9) nuts2_new	-0.017	-0.024	-0.035	-0.031	0.027	-0.056	0.045	-0.524						1.000
(10) nace2	-0.050	0.012	-0.196	-0.197	-0.083	-0.117	0.090	-0.013	0.052					1.000
(11) sector	-0.041	-0.003	-0.044	-0.144	-0.012	-0.068	0.039	-0.008	0.001	0.603				1.000
(12) os_t	0.051	0.079	0.069	0.017	0.033	0.039	-0.024	-0.006	0.002	0.001	0.022			1.000
(13) subsidies	-0.000	0.044	0.010	0.040	0.110	0.121	-0.079	-0.006	-0.010	-0.009	-0.014	0.103		1.000
(14) mills	-0.207	-0.052	-0.700	-0.288	-0.318	-0.553	0.219	0.015	0.062	0.142	0.088	-0.056	-0.073	1.000

Table A4 - 4 Sector code and definition

Sector	Definition
2	B – Mining and Quarrying
3	C- Manufacturing
4	D – Electricity, Gas, Steam and Air Conditioning Supply
5	E – Water Supply; Sewerage, Waste Management and Remediation Activities

Table A4 - 5 Region code and definition

Region	County included
1= Border	Donegal, Sligo, Leitrim, Cavan, Monaghan
2= Dublin	Dublin
3= Mid-East	Wicklow, Kildare, Meath, Louth
4= Midland	Longford, Westmeath, Offaly, Laois
5= Mid-West	Clare, Tipperary, Limerick
6= South-East	Waterford, Kilkenny, Carlow, Wexford
7=South-West	Cork, Kerry
8= West	Galway, Mayo, Roscommon

Table A4 - 6 PSM match score

Variables	Subsidy
1bL.age_cat	0
	(0)
2L.age_cat	0.0308
	(0.0836)
0bL.size	0
	(0)
1L.size	0.000153
	(0.379)
2L.size	0.140
	(0.382)
3L.size	-0.515
	(0.394)
2.year	0.219**
	(0.0850)
3.year	0.503***
	(0.0883)
4.year	0.714***
	(0.0914)
5.year	0.197*
	(0.119)
6.year	0.280**
	(0.120)
7.year	0.133
	(0.124)
8.year	0.526***
	(0.0861)
9.year	0.608***
	(0.0829)
10.year	0.576***
	(0.0857)

3.Sector	0.862***
	(0.197)
4.Sector	0.848***
	(0.249)
5.Sector	0.830***
	(0.210)
4.Region 4	0.0780
	(0.0649)
5.Region 5	0.000824
	(0.0498)
6. Region	-
Constant	-2.247***
	(0.434)
Observations	4,519

Notes: * p < 0.1; ** p < 0.05; *** p < 0.01. Estimation results based on 1:1 nearest neighbor matching. The α term relates to the average policy-induced R&D by government subsidies.

Table A4 - 7 Regression full table with time lag T+1, T+2, and T+3

Variables	(1) Export 1/0 t1	(2) Export 1/0 t2	(3) Export 1/0 t3	(4) Product Diversification t1	(5) Product Diversification t2	(6) Product Diversification t3	(7) Market diversification t1	(8) Market diversification t2	(9) Market diversification t3	(10) Export Valuet1	(11) Export Value t2	(12) Export Value t3
Private R&D	0.000256*	0.000288**	0.000470***	0.0117***	0.0128***	0.0111***	0.00609***	0.00603***	0.00544***	0.119	0.123	0.123
	(0.000136)	(0.000143)	(0.000175)	(0.00326)	(0.00363)	(0.00407)	(0.000995)	(0.00102)	(0.00116)	(0.0793)	(0.0895)	(0.0891)
Policy-induced R&D	0.000790*	0.000661	0.000501	0.00443***	0.00322**	0.00351***	0.00182***	0.00246***	0.00104***	0.0331**	0.0419***	0.0618***
	(0.000463)	(0.000407)	(0.000447)	(0.00134)	(0.00128)	(0.00133)	(0.000260)	(0.000370)	(0.000306)	(0.0137)	(0.0148)	(0.0178)
ln_firmsize	0.366***	0.386***	0.400***	14.89***	18.17***	15.32***	6.135***	6.315***	5.679***	4.626	-14.87	-39.20
	(0.0189)	(0.0188)	(0.0191)	(2.173)	(2.421)	(2.538)	(0.803)	(0.808)	(0.811)	(38.16)	(40.26)	(52.86)
ln_firmage	0.122***	0.0907***	0.0668***	1.936***	2.423***	1.664**	0.503*	0.528*	0.457*	14.77	11.71	13.73
	(0.0224)	(0.0219)	(0.0218)	(0.674)	(0.668)	(0.698)	(0.270)	(0.277)	(0.275)	(11.95)	(12.85)	(15.91)
lnulp	0.0281	0.0277	0.0410**	4.083***	4.287***	4.067***	2.004***	1.989***	1.936***	168.0***	174.3***	189.5***
	(0.0203)	(0.0206)	(0.0205)	(0.583)	(0.612)	(0.631)	(0.251)	(0.250)	(0.248)	(41.67)	(44.59)	(59.59)
2.c_to_t_ex	0.563***	0.446***	0.365***	7.798***	10.65***	7.573***	3.224***	3.488***	2.599***	36.56	15.84	-2.544
	(0.0478)	(0.0478)	(0.0499)	(1.913)	(2.166)	(2.198)	(0.753)	(0.802)	(0.752)	(22.41)	(22.22)	(26.07)
3.c_to_t_ex	0.972***	0.908***	0.843***	19.67***	25.47***	19.79***	8.892***	8.855***	7.947***	94.51**	60.17	23.16
	(0.0393)	(0.0387)	(0.0395)	(4.130)	(4.682)	(4.787)	(1.619)	(1.703)	(1.590)	(48.09)	(48.18)	(57.25)

c_patent	0.153	0.237**	0.323***	5.288***	7.165***	3.657**	1.966***	2.817***	2.176***	41.44***	40.01**	35.37**
	(0.0957)	(0.119)	(0.119)	(1.643)	(1.752)	(1.566)	(0.641)	(0.850)	(0.765)	(15.88)	(16.78)	(17.46)
1.year	-0.0891	-0.0171	-0.113*	-3.182***	-3.946***	-2.680***	-1.242***	-1.333***	-0.983***	-37.54***	-37.88***	-31.50**
	(0.0616)	(0.0603)	(0.0594)	(0.647)	(0.694)	(0.802)	(0.276)	(0.269)	(0.334)	(11.68)	(13.18)	(14.64)
2.year	0.456***	0.493***	0.416***	13.83***	17.22***	13.24***	5.906***	5.856***	5.126***	44.82	32.98	8.608
	(0.0819)	(0.0796)	(0.0790)	(2.491)	(2.673)	(2.692)	(0.938)	(0.953)	(0.915)	(31.56)	(34.69)	(38.79)
3.year	0.593***	0.515***	0.465***	16.15***	19.07***	15.11***	7.018***	6.735***	6.018***	141.1**	119.0**	135.5*
	(0.0871)	(0.0863)	(0.0856)	(2.746)	(3.020)	(3.080)	(1.046)	(1.081)	(1.049)	(56.51)	(56.44)	(76.27)
4.year	0.127	0.243***	-0.636***	-7.504**	-12.65***	-7.665*	-3.292**	-3.766**	-3.320**	-37.13	-2.197	31.57
	(0.0855)	(0.0834)	(0.0975)	(3.598)	(4.036)	(4.269)	(1.487)	(1.509)	(1.461)	(45.70)	(46.65)	(55.38)
5.year	0.903***	0.450	0.761**	17.53***	21.87***	12.49***	6.786***	8.939***	7.455***	118.8**	139.5**	146.6***
	(0.301)	(0.372)	(0.369)	(4.882)	(5.333)	(4.618)	(1.952)	(2.577)	(2.346)	(50.09)	(54.80)	(54.55)
6.year	0.0371	0.360	0.644*	17.51***	20.74***	10.98**	6.532***	8.715***	7.152***	98.99**	130.8**	132.8**
	(0.305)	(0.370)	(0.368)	(4.969)	(5.406)	(4.747)	(1.976)	(2.606)	(2.381)	(50.42)	(55.43)	(56.30)
7.year	0.888***	1.124***	1.255***	31.71***	38.94***	22.88***	12.62***	14.76***	12.43***	194.8***	190.6***	159.8**
	(0.294)	(0.362)	(0.362)	(5.659)	(5.989)	(5.595)	(2.139)	(2.771)	(2.495)	(56.92)	(59.75)	(65.81)
8.year	0.684**	0.905**	1.152***	29.54***	34.04***	22.28***	11.83***	14.17***	11.88***	181.8***	170.2***	158.7**
	(0.295)	(0.363)	(0.361)	(5.489)	(5.794)	(5.375)	(2.108)	(2.724)	(2.452)	(54.15)	(56.97)	(62.18)
9.year	0.633**	0.870**	1.214***	28.20***	37.92***	24.72***	12.71***	14.98***	12.61***	189.6***	190.6***	172.4***
	(0.294)	(0.362)	(0.362)	(5.597)	(6.060)	(5.526)	(2.144)	(2.760)	(2.481)	(55.14)	(57.12)	(63.45)
10.year	0.662**	1.028***	1.189***	27.52***	35.79***	23.98***	11.71***	14.08***	11.77***	193.4***	199.7***	177.4***
	(0.296)	(0.364)	(0.363)	(5.610)	(5.925)	(5.468)	(2.091)	(2.713)	(2.449)	(57.23)	(61.35)	(67.56)
2.region				-2.174	-2.727	-2.153	-0.302	-0.742	-0.938	-81.22**	-91.64**	-113.6**

				(1.887)	(1.995)	(1.967)	(0.745)	(0.718)	(0.746)	(38.60)	(41.35)	(54.60)
3.region				-4.790**	-5.511**	-4.987***	0.0851	-0.238	-0.838	-60.21	-65.06	-85.46
				(2.002)	(2.193)	(1.886)	(0.880)	(0.827)	(0.822)	(42.77)	(45.69)	(59.39)
4.region				-3.304	-4.201*	-2.405	-0.799	-0.682	-1.090	-83.00**	-95.82**	-115.0*
				(2.292)	(2.433)	(2.625)	(0.939)	(1.099)	(1.056)	(41.63)	(44.73)	(59.00)
5.region				-1.808	-2.460	-0.782	-0.0738	-0.432	-0.718	-71.29*	-74.12	-90.38
				(2.447)	(2.457)	(2.788)	(0.829)	(0.845)	(0.952)	(41.23)	(46.81)	(59.22)
6.region				-4.427***	-5.075***	-3.078*	-0.797	-1.395*	-1.240	-93.54**	-107.0**	-128.0**
				(1.663)	(1.827)	(1.871)	(0.737)	(0.790)	(0.817)	(40.61)	(43.43)	(57.69)
7.region				-3.553**	-3.612**	-2.207	-0.366	-0.559	-0.870	-82.07*	-104.3**	-145.1**
				(1.634)	(1.738)	(1.749)	(0.701)	(0.714)	(0.725)	(48.51)	(51.12)	(68.19)
8.region				0.0941	-0.689	0.638	-0.496	-0.796	-0.853	-79.80**	-93.96**	-115.7**
				(2.918)	(2.967)	(3.124)	(0.785)	(0.803)	(0.840)	(35.01)	(37.39)	(48.85)
10.nace2	-0.482**	-0.121	-0.123	10.01***	12.49***	7.361*	4.893***	5.569***	4.656***	157.2***	139.3***	125.1***
	(0.239)	(0.268)	(0.270)	(3.444)	(3.855)	(4.230)	(1.362)	(1.337)	(1.367)	(38.79)	(39.74)	(44.90)
11.nace2	0.719**	0.938***	0.860**	28.66***	37.76***	22.59***	18.84***	19.92***	14.16***	217.3*	164.6	133.9
	(0.326)	(0.352)	(0.345)	(7.288)	(7.869)	(8.610)	(4.005)	(4.145)	(4.193)	(126.0)	(126.0)	(145.3)
12o.nace2				-	-	-	-	-	-	-	-	-
13.nace2	-0.0686	0.152	0.0545	23.47***	27.45***	21.27***	12.87***	12.96***	10.55***	146.4***	96.49**	57.92
	(0.259)	(0.288)	(0.294)	(5.058)	(5.627)	(5.969)	(2.273)	(2.265)	(2.162)	(45.93)	(44.82)	(55.95)
14.nace2	-0.306	0.00632	-0.0321	21.00***	24.75***	16.77***	7.742***	8.126***	6.707***	140.3***	116.7***	101.2**
	(0.254)	(0.281)	(0.283)	(4.454)	(4.959)	(4.875)	(1.506)	(1.553)	(1.515)	(40.83)	(42.05)	(47.71)

15.nace2	-0.285	0.0466	0.0915	24.29***	28.30***	20.51***	10.28***	10.81***	9.544***	200.3***	177.0***	148.2**
	(0.242)	(0.271)	(0.272)	(4.808)	(5.362)	(5.597)	(1.775)	(1.859)	(1.816)	(50.47)	(52.33)	(61.43)
16.nace2	-0.813***	-0.490*	-0.583**	3.426	2.845	1.321	1.917*	2.251**	2.065**	77.46**	87.68***	92.13**
	(0.252)	(0.279)	(0.283)	(2.435)	(2.719)	(2.902)	(0.979)	(0.953)	(0.992)	(30.16)	(33.89)	(37.94)
17.nace2	-0.185	-0.00267	0.0480	19.71***	24.00***	18.27***	9.553***	9.995***	9.211***	74.96*	60.01	46.03
	(0.259)	(0.285)	(0.284)	(4.364)	(4.846)	(5.206)	(1.732)	(1.737)	(1.777)	(45.15)	(47.08)	(56.89)
18.nace2	-0.698***	-0.430	-0.436	6.892**	7.277**	4.447	3.082***	3.281***	2.423**	65.43**	57.36*	50.30
	(0.243)	(0.272)	(0.274)	(2.704)	(2.936)	(3.155)	(0.938)	(0.927)	(0.954)	(29.25)	(32.52)	(36.93)
20.nace2	-0.272	0.0666	0.0592	24.71***	28.55***	21.34***	12.48***	12.80***	11.57***	152.8**	142.3**	119.1
	(0.246)	(0.274)	(0.275)	(4.865)	(5.187)	(5.388)	(2.291)	(2.332)	(2.318)	(62.48)	(68.62)	(73.82)
21.nace2	-0.241	0.0177	0.118	21.52***	25.56***	18.68***	11.25***	10.76***	10.34***	83.21	61.47	43.38
	(0.307)	(0.330)	(0.331)	(6.755)	(6.847)	(6.763)	(3.011)	(3.380)	(2.996)	(63.19)	(67.50)	(75.77)
22.nace2	-0.416*	-0.174	-0.151	18.37***	20.68***	15.19***	8.056***	8.216***	7.223***	128.4***	122.1***	112.0***
	(0.238)	(0.267)	(0.269)	(3.510)	(3.877)	(4.231)	(1.319)	(1.331)	(1.351)	(33.33)	(35.52)	(39.69)
23.nace2	-0.625**	-0.344	-0.246	15.07***	16.95***	12.60***	6.030***	6.103***	5.455***	93.23***	83.46**	74.24*
	(0.246)	(0.274)	(0.276)	(3.212)	(3.591)	(3.874)	(1.217)	(1.187)	(1.211)	(31.74)	(33.72)	(38.21)
24.nace2	-0.534**	-0.208	-0.206	12.16***	13.26***	9.590**	4.612***	5.100***	3.905**	46.74	49.20	27.99
	(0.259)	(0.287)	(0.289)	(3.775)	(4.202)	(4.347)	(1.416)	(1.530)	(1.521)	(40.28)	(44.91)	(48.55)
25.nace2	-0.440*	-0.112	-0.169	17.14***	19.98***	14.64***	6.476***	6.919***	5.614***	102.6***	93.10***	80.29**
	(0.239)	(0.268)	(0.270)	(3.447)	(3.803)	(4.181)	(1.210)	(1.189)	(1.184)	(32.14)	(33.83)	(38.24)
26.nace2	-0.0601	0.205	0.292	36.28***	42.48***	33.46***	15.86***	16.32***	14.85***	156.9***	126.2**	96.95
	(0.243)	(0.272)	(0.274)	(6.132)	(6.894)	(7.036)	(2.325)	(2.355)	(2.333)	(54.77)	(55.91)	(63.62)
27.nace2	-0.236	0.0504	-0.0296	26.28***	31.91***	24.73***	11.17***	12.40***	11.18***	99.60**	85.66*	61.34

	(0.257)	(0.284)	(0.287)	(4.685)	(5.410)	(5.626)	(1.803)	(1.896)	(2.004)	(48.01)	(50.32)	(59.35)
28.nace2	-0.101	0.178	0.304	35.15***	40.87***	31.87***	14.05***	14.41***	12.56***	189.0***	171.8***	150.0**
	(0.236)	(0.266)	(0.267)	(6.158)	(6.715)	(7.233)	(2.158)	(2.120)	(2.112)	(55.04)	(59.28)	(67.63)
29.nace2	0.130	0.202	0.0888	26.76***	31.95***	25.97***	11.30***	11.92***	11.70***	153.4***	135.2***	109.1*
	(0.251)	(0.280)	(0.282)	(5.230)	(5.675)	(6.207)	(1.779)	(1.782)	(1.797)	(47.37)	(49.20)	(55.80)
30.nace2	-0.573	-0.109	-0.142	28.35***	24.86***	26.18***	11.84***	12.78***	12.59***	92.44**	3.768	34.43
	(0.426)	(0.427)	(0.411)	(5.340)	(3.702)	(5.994)	(1.966)	(2.142)	(3.511)	(38.29)	(55.66)	(46.68)
31.nace2	-0.531**	-0.180	-0.227	15.86***	18.09***	13.08***	6.160***	6.560***	5.449***	93.65***	83.51**	64.98*
	(0.246)	(0.274)	(0.277)	(3.315)	(3.712)	(4.003)	(1.176)	(1.166)	(1.207)	(30.80)	(32.80)	(37.09)
32.nace2	-0.0525	0.110	0.0840	35.24***	39.90***	32.72***	15.14***	15.93***	13.87***	184.4***	168.3***	147.3***
	(0.263)	(0.291)	(0.292)	(7.179)	(7.816)	(8.623)	(2.633)	(2.711)	(2.620)	(49.12)	(51.05)	(57.00)
33.nace2	-0.387	-0.238	-0.104	22.20***	24.49***	21.02***	8.103***	8.487***	7.918***	126.8***	107.8**	99.16**
	(0.249)	(0.279)	(0.280)	(4.734)	(4.967)	(5.710)	(1.528)	(1.458)	(1.471)	(39.83)	(42.29)	(47.42)
34.nace2	-0.410	-0.227	0.240	33.93***	39.29***	32.52***	14.41***	13.95***	14.27***	187.0***	154.7***	121.7*
	(0.639)	(0.647)	(0.567)	(6.120)	(6.587)	(6.992)	(2.115)	(2.124)	(2.064)	(55.47)	(57.96)	(66.05)
35.nace2				9.686*	10.24*	6.734	2.049	3.037	2.462	-77.60	83.01	135.0
				(5.122)	(5.275)	(5.295)	(2.076)	(2.035)	(2.090)	(110.0)	(127.5)	(181.0)
36.nace2	0.641	0.392	0.382	27.66***	31.67***	23.94***	11.51***	11.93***	10.13***	196.0***	174.8***	153.5***
	(0.448)	(0.391)	(0.399)	(4.660)	(5.127)	(5.577)	(1.729)	(1.706)	(1.711)	(44.83)	(47.12)	(52.93)
37.nace2	-0.438	-0.135	-0.252	11.47***	13.79***	8.978**	5.033***	5.893***	4.493***	62.04	46.08	35.89
	(0.268)	(0.293)	(0.298)	(3.611)	(3.782)	(4.201)	(1.647)	(1.546)	(1.476)	(49.03)	(54.48)	(66.50)
38.nace2	0.246	0.0473	-0.0269	3.511	4.929	0.612	1.353	1.585	0.754	93.08***	72.91**	65.44*
	(0.444)	(0.387)	(0.394)	(2.752)	(3.085)	(3.393)	(1.053)	(1.042)	(1.028)	(30.70)	(32.53)	(37.04)

39.nace2				4.393	6.996	3.080	0.369	1.580	0.901	-119.2	-251.9	-325.4
				(3.370)	(4.640)	(4.001)	(1.447)	(1.143)	(1.163)	(108.5)	(162.7)	(208.7)
40.nace2				22.09***	25.28***	18.30**	8.955***	8.993***	7.310***	-83.95	-104.9	-140.9
				(5.865)	(6.882)	(7.244)	(2.459)	(2.664)	(2.598)	(118.8)	(125.7)	(146.8)
mills				28.99***	38.53***	27.82***	12.84***	12.78***	10.91***	132.5	78.09	21.80
				(6.818)	(7.712)	(8.071)	(2.719)	(2.782)	(2.679)	(81.51)	(83.22)	(100.5)
3.sector	0.797***	0.729**	0.621**									
	(0.265)	(0.295)	(0.295)									

Notes: * p < 0.1; ** p < 0.05; *** p < 0.01. Robust standard errors are in parentheses. The policy-induced R&D variables correspond to the α term defined in Equation (2). The number of observations changes in each model due to missing values in the dependent variables. For ease of interpretation, the results in the Table are expressed in thousands of Euros.

Table A4 - 8 Comparison policy-induced R&D and private R&D

Dimension	Variable (equality test)	Test Statistic (chi2)	Test p-value (Prob > chi2)
Exporting Market Diversification T1	Private R&D vs Policy-induced R&D	23.19	0.0000***
T2		14.56	0.0001***
T3		16.62	0.0000***
Exporting Product Diversification T1	Private R&D vs Policy-induced R&D	6.15	0.0131***
T2		8.32	0.0039***
T3		4.45	0.0349**
Export Value (per employee) T1	Private R&D vs Policy-induced R&D	1.18	0.2781
T2		0.83	0.3614
T3		0.48	0. 4878

Appendix for Chapter 5

Table A5 - 1 Datasets source and summary

Database	Description	Variables included
Trade	The Trade RMF is based on extra-EU trade in goods statistics as derived from administrative data of Revenue Commissioners (via the Single Administrative Document) and intra EU trade in goods statistics which are collected by Revenue Commissioners (via the Intrastat Survey).	The principal variables are date, company VAT number, trade flow (import/export), commodity code (CN), invoice value, net mass and/or supplementary units, country of destination/consignment for exports/imports respectively, country of origin for imports, and statistical value.
CIS	The Community Innovation Survey is designed to collect information on different types of innovation, various aspects of the development of an innovation, objectives of innovative activities, sources of information, and public funding or expenditure on innovation	The principal variables are new-to-market innovation, new-to-firm innovation, innovation expenditures, innovation collaboration, which includes government, universities, public research institutes, private research institutes etc.
BR	The Business Register is a register of all enterprises that are active in the State. There is no lower size limit, but for practical reasons, Business Demography data is based on enterprises that are registered with the Revenue Commissioners.	Value-Added Tax (VAT), employer, Corporation Tax or Income Tax registrations, plus quarterly files of VAT activity,

Notes: Data from Irish Central Statistics Office (CSO) 2008-2019

Table A5 - 2 Summary statistics

Variables	N	Mean	SD	p1	p99	t-value
Export decision	4788	.483	.5	0	1	66.83
Export product diversification	4788	6.791	17.562	0	75	26.756
Export market diversification	4788	4.296	9.798	0	52	30.336
Export value	4788	133944.15	1238893.45	0	1826380.5	7.481
Independent incremental innovation	3949	5.2	13.899	0	75	23.508
Collaborative incremental innovation	4788	.332	6.604	-10	24	3.479
Independent radical innovation	3955	5.398	15.638	0	100	21.711
Collaborative radical innovation	4788	.501	7.756	-10	30	4.472
lnfirmsize	4788	3.418	.838	2.303	5.371	282.114
lnfirmage	4788	3.108	.689	1.099	4.779	312.24
lnulp	4779	9.762	3.496	2.557	14.768	193.015
lninternalrd	3686	1.859	2.492	0	7.867	45.291
lnexternalrd	3278	.715	1.599	0	6.347	25.602
year	4788	2014.254	2.687	2010	2018	51876
county code	4788	13.109	10.31	1	34	87.982
sector cis	4788	5.232	2.667	3	13	135.73
mills	3176	.777	.483	.069	2.728	90.682

Table A5 - 3 Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Inde-Incr-Inn	1.000												
(2) Co-Incr-Inn	-0.214	1.000											
(3) Inde-Radi-Inn	0.109	0.048	1.000										
(4) Co-Radi-Inn	0.057	-0.123	-0.204	1.000									
(5) lnfirmsize	0.016	0.035	-0.008	-0.029	1.000								
(6) lnfirmage	-0.054	-0.016	-0.112	-0.060	0.081	1.000							
(7) lnulp	0.037	-0.035	0.031	-0.078	-0.060	0.023	1.000						
(8) lninternalrd	0.276	0.056	0.406	0.101	0.139	-0.111	-0.018	1.000					
(9) lnexternalrd	0.170	0.059	0.236	0.132	0.098	-0.052	-0.030	0.490	1.000				
(10) year	-0.116	-0.009	-0.047	-0.011	0.004	0.071	-0.462	-0.115	-0.087	1.000			
(11) county_code	0.027	0.000	0.034	-0.000	0.012	-0.014	-0.047	0.081	0.015	-0.047	1.000		
(12) sector_cis	-0.051	-0.017	0.017	-0.041	-0.045	-0.099	0.044	-0.085	-0.025	0.130	-0.253	1.000	
(13) mills	-0.060	-0.051	-0.169	-0.007	-0.239	-0.166	-0.273	-0.283	-0.101	-0.409	-0.152	0.251	1.000

Legend: Inde-Incr-Inn: Independent incremental innovation; Co-Incr-Inn: Collaborative incremental innovation; Inde-Radi-Inn: Independent radical innovation; Co-Radi-Inn: Collaborative radical innovation

Table A5 - 4 Sector code and definition

Sector	Definition
2	B – Mining and Quarrying
3	C- Manufacturing
4	D – Electricity, Gas, Steam and Air Conditioning Supply
5	E – Water Supply; Sewerage, Waste Management and Remediation Activities

Table A5 - 5 Region code and definition

Region	County included
1= Border	Donegal, Sligo, Leitrim, Cavan, Monaghan
2= Dublin	Dublin
3= Mid-East	Wicklow, Kildare, Meath, Louth
4= Midland	Longford, Westmeath, Offaly, Laois
5= Mid-West	Clare, Tipperary, Limerick
6= South-East	Waterford, Kilkenny, Carlow, Wexford
7=South-West	Cork, Kerry
8= West	Galway, Mayo, Roscommon

Table A5 - 6 Probit model on treatment possibility

Variables	**Collaboration with public knowledge sources through internal R&D**
2.c_internalrd	1.130***
	(0.0887)
3.c_internalrd	1.286***
	(0.0830)
1.c_ulp	0.102
	(0.0979)
2.c_ulp	0.0738
	(0.132)
3.c_ulp	0.160
	(0.135)
2.year_new	-0.0417
	(0.141)
3.year_new	0.300**
	(0.152)
4.year_new	0.376**
	(0.156)
5.year_new	1.085***
	(0.109)
2.size	0.201***
	(0.0573)
3.sector_cis	0.156
	(0.361)
4.sector_cis	0.984**
	(0.485)
5.sector_cis	0.160
	(0.406)
7.sector_cis	-0.119
	(0.365)
8.sector_cis	0.448

	(0.387)
10.sector_cis	0.184
	(0.377)
11.sector_cis	-0.0645
	(0.464)
13.sector_cis	0.769**
	(0.382)
4.NUTS2	0.140*
	(0.0740)
5.NUTS2	0.225***
	(0.0605)
Constant	-2.853***
	(0.366)
Observations	4,788

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table A5 - 7 Propensity score test on matching outcomes on incremental innovation

Variables	Treated	Control	% Bias	t	p > t	V(T)/V(C)
2.c_internalrd	0.19689	0.19689	0	0	1	.
3.c_internalrd	0.62953	0.62953	0	0	1	.
1.c_ulp	0.29534	0.29534	0	0	1	.
2.c_ulp	0.17098	0.17098	0	0	1	.
3.c_ulp	0.17358	0.17358	0	0	1	.
2.year_new	0.11399	0.11399	0	0	1	.
3.year_new	0.16062	0.16062	0	0	1	.
4.year_new	0.16839	0.16839	0	0	1	.
5.year_new	0.39637	0.39637	0	0	1	.
2.size	0.3886	0.3886	0	0	1	.
3.sector_cis	0.72798	0.72798	0	0	1	.
4.sector_cis	0	0	0	.	.	.
5.sector_cis	0.00259	0.00259	0	0	1	.
7.sector_cis	0.14767	0.14767	0	0	1	.

8.sector_cis	0.01036	0.01036	0	0	1	.
10.sector_cis	0.06218	0.06218	0	0	1	.
11.sector_cis	0.00518	0.00518	0	0	1	.
13.sector_cis	0.04404	0.04404	0	0	1	.
4.NUTS2	0.18912	0.18912	0	0	1	.
5.NUTS2	0.35751	0.35751	0	0	1	.
Ps R2	LR chi2	P>chi2	MeanBias/ MedBias	B	R	%Var
0.000	0.00	1.000	0.0/0.0	0.0	1.00	.

* Variance ratio (V) outside [0.82; 1.22] flagged with *

* if B>25%, R outside [0.5; 2]

Table A5 - 8 Propensity score test on matching outcomes on radical innovation

Variable	Treated	Control	% Bias	t	p > t	V(T)/V(C)
2.c_internalrd	0.19689	0.20774	-2.6	-0.32	0.749	0.93
3.c_internalrd	0.62953	0.65422	-5.2	-0.5	0.618	0.93
1.c_ulp	0.29534	0.28571	2.1	0.27	0.784	0.95
2.c_ulp	0.17098	0.17532	-1.3	-0.17	0.868	0.98
3.c_ulp	0.17358	0.17662	-0.9	-0.12	0.903	0.98
2.year_new	0.11399	0.12338	-2.8	-0.36	0.716	0.92
3.year_new	0.16062	0.15584	1.3	0.16	0.872	0.97
4.year_new	0.16839	0.16883	-0.1	-0.01	0.995	1
5.year_new	0.39637	0.38896	1.5	0.18	0.86	0.98
2.size	0.3886	0.37662	2.5	0.31	0.754	0.97
3.sector_cis	0.72798	0.72403	0.9	0.11	0.911	0.99
4.sector_cis	0	0	0	.	.	.
5.sector_cis	0.00259	0.0026	0	-0.01	0.995	1
7.sector_cis	0.14767	0.14805	-0.1	-0.01	0.994	1
8.sector_cis	0.01036	0.01169	-1.2	-0.15	0.881	0.89
10.sector_cis	0.06218	0.06494	-1.3	-0.15	0.878	0.96
11.sector_cis	0.00518	0.00519	0	-0.01	0.995	1
13.sector_cis	0.04404	0.04416	-0.1	-0.01	0.995	1
4.NUTS2	0.18912	0.18831	0.2	0.03	0.977	1
5.NUTS2	0.35751	0.35325	0.9	0.12	0.902	0.99
Ps R2	LR chi2	P>chi2	MeanBias/ MedBias	B	R	%Var
0.001	0.03	0.999	1.1/0.9	5.2	0.93	.

* Variance ratio (V) outside [0.82; 1.22] flagged with *

* if B>25%, R outside [0.5; 2]

Table A5 - 9 Regression on innovation and internationalization

Variables	**Model I** Export Decision	**Model II** Market Diversification	**Model III** Product Diversification	**Model IV** Export Value
Independent Incremental Innovation	0.00134	0.00312	0.0329*	4,431*
	(0.00200)	(0.00899)	(0.0171)	(2,277)
Collaborative Incremental Innovation	0.00897***	0.0638***	0.0485	24,224***
	(0.00347)	(0.0239)	(0.0297)	(8,547)
Independent Radical Innovation	0.00467**	0.0165	0.0445**	9,603***
	(0.00211)	(0.0116)	(0.0202)	(2,966)
Collaborative Radical Innovation	0.00916***	0.0635***	0.0721**	25,682***
	(0.00346)	(0.0191)	(0.0320)	(7,949)
lnfirmsize	0.231***	2.141***	3.308***	353,123**
	(0.0311)	(0.511)	(0.927)	(165,931)
lnfirmage	0.104***	0.499	1.832*	186,983**
	(0.0383)	(0.491)	(1.001)	(87,191)
lnulp	0.192***	1.696***	2.731***	759,338***
	(0.0231)	(0.438)	(0.908)	(181,727)
lninternalrd	0.111***	0.849***	0.714**	268,303***
	(0.0146)	(0.191)	(0.339)	(76,674)
lnexternalrd	-0.00127	-0.111	-0.234	20,727
	(0.0199)	(0.102)	(0.192)	(35,682)
2012.year	1.311***	9.516**	6.022	2.176e+06
	(0.399)	(4.008)	(6.478)	(1.387e+06)
2014.year	1.379***	10.35***	10.39*	2.606e+06*
	(0.303)	(3.833)	(6.239)	(1.428e+06)
2016.year	1.454***	10.76***	9.902	2.788e+06*

	(0.304)	(3.924)	(6.453)	(1.466e+06)
2018.year	2.733***	22.43***	28.34***	8.165e+06***
	(0.266)	(6.127)	(9.923)	(2.381e+06)
1.county_code	-0.682**			
	(0.274)			
2.county_code	-0.675***	-4.004	0.998	137,666
	(0.187)	(3.269)	(3.121)	(208,691)
3.county_code	-0.515***	-1.879	4.198	239,044
	(0.199)	(3.462)	(3.366)	(158,817)
4.county_code	-0.714***	-3.301	3.475	-175,955*
	(0.201)	(3.403)	(3.958)	(106,374)
5.county_code	-0.536**	-2.206	-0.185	133,892
	(0.222)	(3.671)	(3.178)	(222,026)
6.county_code	-0.336	-1.739	5.568	786,264***
	(0.218)	(3.600)	(3.671)	(257,293)
7.county_code	-0.440*	-2.596	1.711	1.718e+06*
	(0.260)	(3.599)	(3.673)	(1.032e+06)
8.county_code	-0.354	4.151	0.441	724,299***
	(0.301)	(5.102)	(3.173)	(258,733)
9.county_code	0.387	-0.977	2.757	1.634e+06***
	(0.482)	(3.939)	(4.413)	(518,210)
10.county_code	-0.304	-2.030	4.051	846,353***
	(0.219)	(3.479)	(3.765)	(275,387)
11.county_code	-0.458**	-3.323	2.660	334,266*
	(0.215)	(3.319)	(3.070)	(189,962)
12.county_code	-0.612**	-2.256	8.518**	879,630
	(0.281)	(4.457)	(4.165)	(700,018)
13.county_code	-0.635***	2.382	4.410	20,425
	(0.236)	(5.056)	(3.932)	(158,248)
14.county_code	-0.492*	-5.009	-0.781	743,943*
	(0.263)	(3.371)	(3.168)	(417,579)
15.county_code	-0.571**	-0.499	2.709	158,338
	(0.227)	(4.167)	(4.596)	(127,004)
16.county_code	0.349	8.807**	8.949**	2.336e+06***
	(0.263)	(4.410)	(4.150)	(698,201)
17.county_code	-0.982***	-6.233*	-3.857	-1.008e+06***
	(0.225)	(3.611)	(3.388)	(258,678)
18.county_code	-0.503**	-2.252	6.602	489,192*
	(0.202)	(3.370)	(5.413)	(270,666)

19.county_code	-0.419*	0.356	2.714	424,334
	(0.248)	(4.139)	(3.673)	(285,840)
20.county_code	-0.524**	-9.222**	1.523	399,321**
	(0.256)	(4.346)	(3.541)	(174,037)
21.county_code	-0.618**	0.425	13.23	411,531*
	(0.247)	(4.579)	(8.348)	(220,305)
22.county_code	-0.876***	-2.975	1.672	-551,435***
	(0.261)	(3.864)	(4.126)	(205,457)
23.county_code	-0.730***	-2.970	-2.018	243,649
	(0.277)	(4.287)	(3.846)	(402,090)
24.county_code	-0.237	2.722	6.660	1.047e+06***
	(0.266)	(3.592)	(4.449)	(378,384)
25.county_code	-0.718***	-4.576	1.974	439,688
	(0.275)	(3.461)	(4.782)	(377,004)
26.county_code	-0.332	0.548	18.91**	814,577***
	(0.228)	(3.816)	(8.732)	(262,374)
27.county_code	-0.425*	6.337	9.929	675,915***
	(0.239)	(5.412)	(6.289)	(203,951)
28.county_code	-0.161	1.277	7.582	900,738**
	(0.360)	(5.793)	(5.887)	(397,132)
29.county_code	-0.654***	-2.494	5.618	225,203
	(0.241)	(3.476)	(4.147)	(166,037)
30.county_code	-0.262	-3.477	0.00568	845,567***
	(0.281)	(3.476)	(3.497)	(304,246)
31.county_code	-0.208	-3.836	7.790	1.094e+06***
	(0.301)	(3.712)	(5.137)	(350,368)
32.county_code	-0.0934	5.597	7.524*	670,807
	(0.287)	(5.204)	(4.414)	(427,497)
33.county_code	-0.194	-2.224	3.889	1.340e+06***
	(0.225)	(3.432)	(3.548)	(368,757)
34o.county_code	-			
35o.county_code	-			
3.sector_cis	1.056***	8.375***	11.07***	2.918e+06***
	(0.401)	(2.496)	(3.428)	(833,939)
4.sector_cis	0.529	0.785	10.24**	1.293e+06*
	(0.593)	(2.625)	(5.105)	(759,884)
5.sector_cis	0.633	0.0366	3.188	1.789e+06***
	(0.459)	(2.537)	(2.986)	(633,372)

7.sector_cis	0.601	3.937*	17.53***	1.718e+06***
	(0.401)	(2.047)	(3.101)	(587,794)
8.sector_cis	0.560	2.056	10.80**	1.384e+06**
	(0.418)	(2.457)	(4.833)	(564,055)
10.sector_cis	0.289	2.404	10.30***	742,698*
	(0.412)	(2.120)	(3.435)	(439,419)
11.sector_cis	-0.348	-1.430	8.236	3.596e+06
	(0.451)	(4.421)	(8.586)	(3.382e+06)
13.sector_cis	0.357	0.945	4.817	797,613*
	(0.428)	(2.181)	(3.792)	(466,148)
34.county_code		-2.396	9.518*	1.406e+06***
		(3.592)	(5.157)	(433,269)
mills		9.597***	12.39**	4.279e+06***
		(3.054)	(5.241)	(1.225e+06)
Constant	-5.127***	-44.17***	-73.48***	-1.975e+07***
	(0.566)	(14.88)	(24.77)	(5.587e+06)
Observations	3,176	1,743	1,743	1,743
Number of firms		1,067	1,067	1,067

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0

Table A5 - 10 T-test on marginal effect of innovation on international performance

Dimension	Variable	Test Statistic (chi2)	Test p-value (Prob > chi2)	Marginal Effect (dy/dx)	Std. Err.	z	Marginal effect P>|z|	90% Conf. Interval Lower	90% Conf. Interval Upper
Export decision (Export propensity)	Independent vs collaborative incremental innovation (equality test)	4.63	0.0315						
	Independent incremental innovation				0.0006492	0.67	0.503	-0.0006	0.0015
	Collaborative incremental innovation			0.0029148	0.001126	2.59	0.01	0.0011	0.0048
	Independent vs collaborative radical innovation (equality test)	1.71	0.1909						
	Independent radical innovation			0.0015188	0.0006839	2.22	0.026	0.0004	0.0026
	Collaborative radical innovation			0.0029774	0.0011188	2.66	0.008	0.0011	0.0048
Exporting Market Diversification	Independent vs collaborative incremental innovation (equality test)	10.37	0.0013						

(total amount of export markets)	Independent incremental innovation			0.0031207	0.0089896	0.35	0.728	-0.0117	0.0179
	Collaborative incremental innovation			0.0638116	0.0238632	2.67	0.007	0.02456	0.1031
	Independent vs collaborative radical innovation (equality test)	11.36	0.0007						
	Independent radical innovation			0.0164847	0.0115683	1.42	0.154	-0.0025	0.0355
	Collaborative radical innovation			0.0635314	0.0190513	3.33	0.001	0.0321	0.0949
Exporting Product Diversification (Total amount of export product, with identical product code)	Independent vs collaborative incremental innovation (equality test)	0.34	0.5597						
	Independent incremental innovation			0.033	0.171	1.92	0.054	0.0048	0.061
	Collaborative incremental innovation			0.049	0.030	1.63	0.102	-0.0003	0.097
	Independent vs collaborative radical innovation (equality test)	1.26	0.2626						
	Independent radical innovation			0.0445	0.020	2.21	0.027	0.011	0.078
	Collaborative radical innovation			0.072	0.032	2.25	0.024	0.019	0.125

Export Value (per employee)	Independent vs collaborative incremental innovation (equality test)	7.76	0.054						
	Independent incremental innovation			4431.344	2277.124	1.95	0.052	685.81	8176.88
	Collaborative incremental innovation			24223.93	8546.825	2.83	0.005	10165.66	38282.21
	Independent vs collaborative radical innovation (equality test)	7.24	0.0071						
	Independent radical innovation			9603.125	2965.558	3.24	0.001	4725.27	14481.03
	Collaborative radical innovation			25681.63	7949.05	3.23	0.001	12606.61	38756.65