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ASSESSMENT OF INNOVATION POTENTIAL OF ESTONIAN FIRMS

Master's Thesis

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I have written this Research paper/Bachelor Thesis independently. Any ideas or data taken from other authors or other sources have been fully referenced.

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Chapter 1: Introduction

1.1. Background

Innovation and creativity are crucial in ensuring businesses remain competitive and contribute to economic growth. Effectively managing innovation, however, is a complex process that relies on informed decision-making, accurate assessments of a company's innovation potential, and understanding various factors affecting a firm's capacity to generate and execute new ideas. Innovation potential refers to the inherent capacity of a firm to generate and implement new ideas, products, processes, or business models that create value for the organization and its stakeholders (Dodgson, Gann, & Salter, 2008). It encompasses the resources, capabilities, and strategic alignment that enable a firm to pursue and succeed in innovation activities. Evaluating innovation potential is essential as it provides insights into a firm's readiness and capability to innovate, guiding strategic decisions and resource allocation.

Estonia is an excellent example of a nation that has fostered an innovation-driven culture, leading to successful businesses in various industries. These businesses often collaborate with research institutions, government agencies, and other stakeholders to develop innovative solutions for global challenges. Assessing the innovation potential of Estonian firms is significant to understanding their readiness and capacity to innovate (OECD/Eurostat, 2005). By examining the internal capabilities and external environment, it becomes possible to identify the strengths, weaknesses, and opportunities for innovation. This knowledge can guide policymakers and business leaders in enhancing the innovation potential of Estonian firms and developing strategies to foster a thriving innovation ecosystem.

Numerous studies have investigated the innovativeness of Estonian firms, demonstrating high innovation activity within the country, particularly in product and process innovation (Masso & Vahter, 2012). These studies have identified access to resources, a supportive organizational culture, and collaboration with other firms and research institutions as crucial factors contributing to the innovation potential of Estonian firms.

The current research aims to evaluate Estonian firms' innovation potential and identify factors influencing their capacity to innovate, bridging the knowledge gap in innovation potential assessment. By understanding the innovation potential of Estonian firms and the

factors that shape it, policymakers and business leaders can develop targeted interventions and policies to enhance the innovation ecosystem further. This research will provide valuable insights to policymakers and business leaders working to enhance Estonian firms' innovation potential, driving economic growth and ensuring long-term competitiveness.

1.2. Problem Statement

Assessing innovation potential is crucial for organizations to understand their readiness and capacity to innovate, identify improvement gaps, and allocate resources effectively. Sabadka (2012) highlights the significance of innovation potential metrics in quantifying a firm's innovative capabilities and driving efficiency and motivation. However, there is a knowledge gap regarding the current innovation potential of Estonian firms and the factors influencing their capacity to innovate. Furthermore, while the Community Innovation Survey (CIS) data, coordinated by Eurostat and Statistics Estonia, offers valuable insights into innovation activities within organizations, there is a need to transform this data into clear and logical metrics that assess the innovation potential of Estonian firms.

Masso and Vahter's (2008, 2012) research has examined the relationship between innovation and productivity in Estonian firms using CIS data. However, their focus was on productivity outcomes, and the analysis did not specifically address the innovation potential of firms. To address this gap, this study aims to assess the innovation potential of Estonian firms using the CIS data and the modified CDM model proposed by Brown and Guzmán (2014). The CDM model, proposed by Crépon, Duguet, and Mairesse (1998), is a comprehensive model that considers the allocation of resources for innovation activities and their impact on productivity outcomes, addressing challenges related to selectivity in innovation expenses, endogeneity of certain variables, and the qualitative aspects of some factors. Brown and Guzmán's (2014) implementation of the CDM model estimated the productivity equation while controlling for selection bias induced by the treatment assignment to assess the propensity to innovate and the level of innovation efforts in Mexican manufacturing firms by including both innovative and non-innovative firms in their analysis.

Innovation potential, propensity to innovate, and innovation effort are related concepts that describe an organization's innovation capability. Innovation potential includes resources, capabilities, and knowledge that could be used for new development. The propensity to

innovate is the organization's willingness and ability to initiate and implement new ideas; innovation effort is the resources allocated. Thus, innovation potential is a precursor to the propensity to innovate and innovation efforts. Organizations with high innovation potential are more likely to have a strong propensity to innovate and allocate resources for innovation.

Developing innovation potential is important because it can increase an organization's propensity to innovate and improve its competitiveness and growth. Using CIS data, this research uses Brown and Guzmán's (2014) equations on the propensity to innovate and innovation effort to predict innovation potential in Estonian firms. However, unlike Brown and Guzmán's study, which sampled data at the establishment level with the chance of biased results, the CIS data is defined at the firm level. Furthermore, Brown and Guzmán used payments made by companies to acquire technology as an approximation for R&D expenses. Nevertheless, the CIS data includes R&D expenses, so there is no need to make approximations.

1.2. Research Questions

This study aims to answer the following research questions:

1. What are the characteristics of Estonian firms regarding innovativeness?
2. What is the level of innovation propensity among Estonian firms, and what are the key factors influencing this propensity?
3. What are Estonian firms' primary drivers of innovation efforts, and how do they contribute to their innovation potential?

1.3. Research Objectives

The purpose of this study is to assess the innovation potential of Estonian firms. The specific objectives are to:

1. analyze the innovative characteristics of Estonian firms,
2. determine the propensity towards innovation in Estonian firms and identify the factors influencing this propensity,
3. study the factors related to Estonian firms' innovation efforts.

1.4 Research Structure

The organization of this thesis is as follows:

The first chapter, Introduction, provides the study's background, research questions, objectives, scope, limitations, and overall thesis structure.

In the second chapter, Literature Review, a thorough examination of the existing literature is performed. This includes exploring innovation potential, different innovation types, the importance of measuring such potential, and factors that influence it. The chapter also delves into models for assessing firms' innovation efforts and associated methodologies.

Chapter three, Methodology, details the research design, sampling and data collection methods, variables, and data analysis techniques used in the study.

The fourth chapter, Results and Analysis, shares empirical findings, discusses key results, and identifies challenges related to firms' innovation potential. It also juxtaposes the results with existing literature and determines the implications for both theoretical and practical applications.

Finally, the Conclusion, the fifth chapter, summarizes the study's key findings, underscores its contributions to the literature, and proposes recommendations for boosting firms' innovation potential. This structured approach aims to deliver a clear and coherent presentation of the research and its contributions to innovation management.

Key Words: Innovation, innovation potential, innovation management, propensity to innovate, innovation effort.

Common European Research Classification Scheme (CERCS) code: **S190** (Management of Enterprises)

Chapter 2: Literature Review

2.1. Defining Innovation Potential

Hnatenko et al., (2020) revealed that many researchers have explored innovation potential. The concept encompasses an organization's resources and opportunities for devising innovative ideas and solutions, ultimately leading to economic growth. Some scholars emphasize the importance of evaluating a company's existing innovation capabilities

to maximize their potential, while others investigate the role of novel management approaches in enhancing knowledge dissemination within an industry.

Within this framework, Hung & Mondejar (2005) examined the relationship between corporate governance and the development of innovation potential in urban regions throughout Asia. In another study, Kokkonen & Tuohino, (2007) found that collaborations between tourism businesses and academic institutions increased their innovative capacity and fostered the creation of groundbreaking products. Their finding underscores the need to cultivate connections between various sectors to amplify innovation potential. Khilji et al. (2006) proposed a method for assessing the innovation potential of biotechnology firms, considering the long development cycles and fierce competition within the industry. This critical assessment highlights the necessity for accurately gauging a company's innovation potential.

Beyond the research above, other studies have also delved into innovation potential. McKinsey, for instance, conducted a comprehensive, multi-year investigation that included detailed interviews, workshops, and surveys with over 2,500 executives from more than 300 companies (de Jong et al., 2013). They identified eight key attributes high-performing companies share in product, process, or business model innovation. Additionally, Cantarelli & Genovese (2021) carried out a systematic literature review on the innovation potential of megaprojects, ultimately developing a theoretically integrated model for innovation within these large-scale projects.

Innovation involves the development of new ideas, technologies, or products that benefit businesses, and is crucial for sustained growth and success (Dereli & Altun, 2013). On the other hand, Innovation Potential refers to the capacity or ability of an individual, organization, or even an entire region or country to generate and implement innovative ideas. Effective management, resource allocation, and a supportive environment can harness this latent potential. Firms must consistently assess the effectiveness of their innovation management strategies and resource allocation to maximize their innovation capabilities. It is necessary to employ assessment tools and methods that evaluate innovation processes and predict a firm's innovation potential (Nauwelaers & Reid, 1995). By regularly evaluating and

adjusting their innovation management practices, firms can better align their resources and actions with their innovation goals, ultimately enhancing their competitiveness and success in the marketplace.

In their study of French firms' innovation processes, Boly et al. (2014) proposed a model to help decision-makers improve their innovation processes. The model encompasses innovation management at five operational levels: the global dimension (which includes the firm's external environment), the company, individual projects, specific products, and individual contributors. The model comprises different levels requiring distinct decision-making approaches, methodologies, and organizational structures. Transitioning between these levels necessitates adjustments in practices and activities to maintain efficiency. The model considers both internal and external factors that influence innovation processes. Rather than using a hierarchical structure, this model allows for sharing of data and resources produced at one level with the other levels, each operating within its unique time frame. The primary emphasis of the model is on understanding the nature and significance of innovation management activities rather than solely focusing on measuring the productivity of individual actions.

Traditionally, innovation has been perceived to transform research outcomes into commercially viable products. However, it is essential to recognize that not all research results in innovation, and not all innovation is based on research (Khanapuri et al., 2011). Instead, innovation involves intricate interactions between individuals, organizations, and operating environments. Successful firms align technological advancements with other business aspects, including manufacturing, distribution, and marketing, to exploit their innovation potential.

2.2. Open Innovation and Innovation Potential

Innovation potential refers to a company's internal and external resources that can be harnessed for innovation. Innovation capacity represents a company's ability to effectively employ these resources in developing and implementing innovative ideas (Boly et al., 2014; Koroglu & Eceral, 2015). A company with a higher innovation potential is more likely to be innovative, given that the acquisition and development of resources are contingent on the

company's development strategy. This strategy can involve relying on internal resources, seeking external resources, or combining both (Teece, 2018).

Chesbrough (2003) introduced open innovation as a way for firms to leverage collaboration to boost their innovation potential. Open innovation is particularly pertinent for small and medium-sized enterprises (SMEs). They often have limited internal resources and can significantly benefit from external collaborations and knowledge exchange (Lee et al., 2010). The greater a company's openness to collaboration and knowledge exchange, the higher its innovation potential. Studies have investigated the correlation between open innovation and innovation potential in SMEs and identified variables that influence this relationship (Lee et al., 2010; Livieratos et al., 2022).

Transitioning from "closed innovation" to "open innovation" necessitates a paradigm shift in businesses' mindset and perception of their surrounding environment (Chesbrough, 2003). This shift involves altering their business strategy, potentially reconfiguring their organizational structure, and cultivating absorptive capabilities to enhance their resources, as Boly et al. (2014) emphasized. Consequently, businesses must expand their horizons beyond internal capacities and explore external opportunities for new solutions, technologies, concepts, and ideas.

While the first enterprise to adopt a change is considered an innovator, the "fast follower" often captures the international market and makes the most significant economic contribution (Khanapuri et al., 2011). This makes innovation expensive and risky due to the time lag between investments and returns. Competitors can easily imitate innovations without investing in research and development, which is why assessing the potential of new technologies before investing in them is crucial (Teece, 2018). Thus, the phenomenon also underscores why open innovation is not often embraced. Sometimes it's better to imitate early rather than be a pioneer. However, leading innovation is still the best way to have a significant market share (Porter, 1980).

2.3. Types of Innovation, Innovation Clusters, and Relationship with Innovation Potential

Innovation consists of three fundamental steps: idea generation, developing the idea into a viable concept, and effectively implementing that concept (Khanapuri et al., 2011). Certain factors can positively or negatively influence each stage, and aligning a firm's strategy is crucial (Adams et al., 2006).

Various types of innovation exist at these different stages for products and services, and experts employ different terminology to describe them. Product innovation is modifying an organization's products or services by improving their usability or technical capabilities (Utterback & Abernathy, 1975). Process innovation involves changes in product or service creation and delivery methods, often aimed at reducing costs or increasing efficiency, such as using fewer components. Position innovation focuses on shifting customer perceptions of a product or service to create a new value proposition (McGahan, 2000). Finally, paradigm innovation represents a transformation of the underlying mental models that guide an organization's actions, often leading to fundamental changes in business strategy or operations (Bessant et al., 2005). Grasping these innovation types is vital for organizations to stay competitive, adapt to market changes, and align resources with specific innovation objectives.

Khanapuri et al. (2011) further explained how innovation can manifest in different business forms. Technological innovation involves introducing new machinery, equipment, or solutions to improve products. Marketing innovation comprises introducing novel marketing methods to enhance product design, promotion, packaging, or pricing. Organizational innovation, also called social innovation, consists of creating new organizations, business practices, or methods of running organizations. Business model innovation involves altering how a business captures value.

In a review of innovation types, Govindarajan & Trimble (2010) identified four primary clusters, each with unique strategies and approaches: Product Leadership Zone, Customer Intimacy Zone, Operational Excellence Zone, and Category Renewal Zone.

The Product Leadership Zone focuses on differentiation through new or improved products, while the Customer Intimacy Zone emphasizes enhancing customer experience or making offers more appealing. The Operational Excellence Zone aims for a low-cost structure, leading to price reductions or increased profits. The Category Renewal Zone targets reviving declining markets through organic or acquisition innovation. The relationship between these innovation clusters and innovation potential is crucial in guiding companies to maximize their innovative capacity.

In the Product Leadership Zone, companies can tap into their innovation potential by investing in research and development, fostering a creative environment, and encouraging collaboration to develop new or improved products. This approach allows companies to create new market categories and differentiate through unique features and functions.

The Customer Intimacy Zone enables companies to leverage their innovation potential by focusing on customer needs and preferences. By utilizing resources such as customer feedback, market research, and data analytics, companies can develop innovative solutions that enhance the customer experience, making their offers more appealing and fostering customer loyalty.

In the Operational Excellence Zone, companies can maximize their innovation potential by streamlining processes, implementing cost-saving measures, and adopting new technologies to improve efficiency. By optimizing operations, companies can achieve a low-cost structure, leading to price reductions or increased profits, giving them a competitive advantage in the market (Porter, 1980).

The Category Renewal Zone allows companies to utilize their innovation potential to revive declining markets by repositioning themselves in growth categories or pursuing mergers and acquisitions. By harnessing their internal resources and seeking external opportunities, companies can overcome challenges in their market segment and achieve sustainable growth.

Grasping the connection between different innovation types, their respective clusters, and innovation potential is crucial for companies striving to utilize their resources effectively,

customize their strategies, and enhance their innovation capacity. By aligning their tactics with these insights, organizations can optimize innovation potential and secure long-term market success. At the same time, identifying these different forms of innovation helps streamline the assessment process for evaluating the innovation potentials of these firms.

2.4. Importance of innovation potential

The importance of innovation potential in today's fast-paced and ever-changing business landscape cannot be overstated. Reviewing the literature to highlight the critical aspects of innovation potential and citing evidence from prominent academic and industry sources reveal the following points to highlight the need for its evaluation at a national and firm level.

2.4.1 Enhancing Competitiveness

Innovation potential is vital in improving a company's competitiveness by providing new and improved products, services, or business models. This helps organizations stay ahead of their rivals and maintain a competitive edge in the market (Porter, 1980). Innovative companies tend to be more agile, adaptive, and better at anticipating customer needs, which translates into a higher likelihood of long-term success and a stronger market position at a local and global level.

2.4.2 Driving economic growth

Innovation potential fuels economic growth by increasing productivity, creating new markets, and generating employment opportunities. It is widely recognized that innovation is a primary driver of long-term economic growth and prosperity. Innovative activities stimulate investment, create high-value jobs, and ultimately lead to a higher standard of living for citizens (Teece, 2018). Moreover, the diffusion of innovations across industries can contribute to overall productivity gains, making economies more efficient and sustainable (Lee et al., 2010).

2.4.3. Adapting to emerging technologies and market demands

Innovation potential is essential for organizations and economies to adapt to new technological advancements and changing market demands. McGahan (2000) stated that embracing emerging technologies enables companies to develop new products or services, enhance existing offerings, and reduce costs. Additionally, according to Livieratos et al. (2022) described how innovative companies are better equipped to identify and capitalize on new market opportunities, which can lead to growth and increased market share.

2.4.4 Attracting Investment and talent

Innovation potential can attract both financial investments and human capital. Investors are more likely to fund organizations that demonstrate a strong innovation culture, as these companies are perceived to have a higher likelihood of success (Khanapuri et al., 2011). Furthermore, innovative companies tend to attract and retain top talent, as these organizations offer opportunities for professional growth, creativity, and meaningful work (Koroglu & Eceral, 2015).

2.4.5 Fostering a sustainable future

Innovation potential is crucial for addressing global challenges like climate change, resource scarcity, and social inequality. By developing new technologies, products, and business models, organizations can contribute to a more sustainable and equitable future (de Jong et al., 2013; Teece, 2018). For example, innovations in renewable energy, resource efficiency, and waste reduction can help mitigate environmental impacts while generating economic benefits (Nauwelaers & Reid, 1995).

2.5. Factors Affecting Innovation Potential

Innovation potential within organizations is significantly influenced by various factors, including technological advances, speed of innovation, efficiency, customization, competition, open markets, collaboration, and changing laws and regulations (Balietti & Riedl, 2021; Boly et al., 2014). These factors impact firms across different sectors, such as service and manufacturing (Tidd, 2001). With the business environment continually evolving,

understanding the factors affecting innovation potential is essential for organizations striving to remain competitive and innovative in today's dynamic landscape and in evaluating innovation potential (Balietti & Riedl, 2021).

2.5.1 Internal factors

Organizational culture: A culture that encourages creativity, risk-taking, and open communication fosters innovation potential within a company. In such a culture, employees are encouraged to question the status quo, share their ideas, and collaborate with others to generate new solutions to problems. By contrast, a culture that is resistant to change and risk-averse is likely to stifle innovation and, thus, have low innovation potential levels (Khanapuri et al., 2011).

Leadership: Effective leadership can inspire employees to think creatively and support developing and implementing innovative ideas (Koroglu & Eceral, 2015). Leaders who support innovation create an environment that encourages creativity and experimentation, provides resources and support for innovative projects, sets ambitious goals, and rewards employees for taking risks and generating new ideas. Moreover, they model the behavior they expect from their employees by being open to new ideas, taking calculated risks, and learning from failures.

Employee skills and capabilities: Skilled and knowledgeable employees are better equipped to develop and execute innovative ideas (Koroglu & Eceral, 2015). Firms need to hire employees with diverse skill sets and expertise to foster innovation, as those employees from different industries can bring new perspectives to solving problems in industry.

Resource allocation: Allocating sufficient resources, such as time, budget, and personnel, to support innovation efforts can significantly impact a firm's innovation potential (Bessant et al., 2005).

Organizational structure: A flexible and decentralized organizational structure can promote innovation by enabling faster decision-making and improved communication. Boly et al., (2014) research evaluation of French companies' innovation performance highlighted

the importance of categorizing firms based on their innovation strategies. The study's comparison with the typology by Godet et al. (2000) revealed that proactive and reactive companies are more adaptable to changing market conditions, emphasizing the significance of flexibility in organizational structure for innovation potential. By adopting flexible structures, organizations can better respond to emerging challenges and opportunities, fostering a culture of innovation and enhancing innovation potential. Thus, reactive and passive companies are less likely to have an enhanced innovation potential than their peers.

Incentives and rewards: Incentive systems that recognize and reward innovative behavior can help motivate employees to engage in innovative activities (Balietti & Riedl, 2021).

2.5.2 External factors

Market competition: Intense competition can stimulate innovation by creating a need for companies to differentiate themselves from rivals (Balietti & Riedl, 2021; McGahan, 2000; Porter, 1980).

Technological advancements: Rapid technological changes can drive innovation by offering new opportunities and challenging established practices (Chesbrough, 2003; Dereli & Altun, 2013; Teece, 2018).

Customer needs and expectations: Companies must continually innovate to meet evolving customer needs and expectations, especially in industries characterized by rapidly changing consumer preferences (Dereli & Altun, 2013). Adapting to market dynamics and customer needs is crucial for competitiveness. de Jong et al. (2013) highlight the importance of customer-driven ideas, market competition, and strategic focus on innovation and collaboration for successful product introduction.

Government policies and regulations: Changes in laws and regulations can encourage or hinder innovation, depending on the nature of the policies and their impact on industries and companies (Georghiou et al., 2014). The regulatory environment governs business activities and affects the incentives and constraints faced by firms, impacts their ability to develop and

commercialize new products or services, and may impose requirements for safety or environmental standards that can increase the cost of development and implementation of new technologies. In some cases, regulations may even stifle innovation by creating barriers to entry or limiting competition.

Economic conditions: Economic conditions, such as recessions or periods of economic growth, can influence the level of investment and resources available for innovation (Balietti & Riedl, 2021). Access to funding and support is vital for firms' innovation potential. Adequate resources enable investment in research, technology, and collaboration. Governments, organizations, and venture capital provide funding through programs, incentives, and investments. However, challenges remain in ensuring all firms' equal access to these resources, especially during times of economic downturn.

Collaboration and networks: Collaborative networks, including partnerships with other firms, research institutions, and universities, can facilitate knowledge exchange and drive innovation (Chesbrough, 2003; Livieratos et al., 2022). Collaboration with research institutions and industry partners is a vital external factor impacting a firm's innovation potential. Inbound openness allows access to external knowledge and expertise, contributing to innovation (Georghiou et al., 2014). Absorptive capacity, R&D specialization, and radical innovation focus can influence collaboration effectiveness. Collaborating with research institutions can provide scientific knowledge while partnering with industry peers offers complementary assets and helps overcome resource constraints (Koschatzky et al., 2001).

2.6. Measuring Innovation Potential

The literature on measuring innovation potential in firms highlights various methods that account for different aspects of a firm's internal resources, external networks, and innovation capabilities. Each method has its advantages and limitations. New studies must focus on developing more accurate and comprehensive methods adaptable to different industries and firm sizes while addressing challenges associated with emerging techniques, such as big data analytics and machine learning algorithms. Metrics are effective for evaluating innovation potential, as they allow for comparisons with other innovation metrics, flexibility in different conditions, the existence of models for evaluating innovation, and an

activating effect that can improve a company's evaluation of its effectiveness and motivation (Tidd, 2006).

Innovation audits, a widely-used method, provide comprehensive evaluations and identify areas for improvement (Tidd, 2006). Survey data is another common approach, offering insights into a firm's innovation activities, cooperation with external actors, and the importance of internal R&D activities (Koschatzky et al., 2001).

Recently, big data analytics and machine learning algorithms have emerged as new methods for measuring innovation potential, allowing firms to analyze large amounts of data from various sources to identify new opportunities. However, these methods also present challenges, such as data privacy concerns and the need for specialized expertise.

Innovation potential can be assessed through various methods, each with specific evaluation criteria and indicators. The Balanced Scorecard method, developed by Kaplan and Norton, evaluates organizational performance from four perspectives: Learning and Growth, Business Process, Customer, and Financial. This approach involves developing metrics, collecting data, and analyzing it relative to each perspective to evaluate the effectiveness and efficiency of R&D processes, guiding decision-making, and resource allocation (Kaplan et al., 1996).

Dereli & Altun (2013) discussed an approach that measures the degree of novelty of product concepts and their potential for success in the market. They also highlighted the Data envelopment analysis (DEA), which can be used to evaluate the efficiency of innovations compared to best practices. Another approach is innovation intelligence which involves identifying, qualifying, and evaluating technologies to develop a viable innovation strategy and how it has emerged as a promising approach to assess the potential of new technologies to generate maximum profits. Finally, they proposed their new approach, the "quick innovation intelligence process," to enhance the efficiency of assessing innovation potential. This approach considers factors such as commercialization, imitation, and trendiness and is supported by computer technology.

Analyzing patent data is another way to measure innovation potential. Patent data can provide insights into a firm's technological capabilities and propensity to innovate in specific areas (Buchmann et al., 2015). However, patent data has limitations, as not all innovations are patented, and patents may not fully capture the breadth of a firm's innovation activities.

Several studies have utilized composite indices to measure innovation potential, combining various indicators such as R&D expenditures, human capital, and institutional factors. Although composite indices offer a more holistic view of innovation potential, they may not be sensitive to individual firms' specific contexts and circumstances (Fagerberg & Verspagen, 2009).

The innovation potential in firms is influenced by the interplay between the Science, Technology, and Innovation (STI) mode and the Doing, Using, and Interacting (DUI) mode. The STI mode represents a linear innovation process, while the DUI mode emphasizes tacit knowledge and learning through practical experience and interaction with external partners (Jensen et al., 2007). The relative importance of each mode varies according to firm size, industry sector, and innovation strategy.

Some consulting firms employ methodologies that include expert surveys and the integration of innovation into various processes throughout the supplier-customer chain, covering areas such as strategy, product innovation, management, communication, research and development, and performance benchmarks (Fitzsimmons et al., 2009). While this approach is based on factual data and addresses various aspects of innovation, its generality may limit its applicability in specific situations.

The Technical University of Košice's Faculty of Mechanical Engineering has developed a methodology for evaluating the innovation potential of engineering companies. This methodology comprises ten modules that map individual business areas related to innovation, each with specific evaluation indicators. The innovation potential evaluation is conducted through an internal audit using pre-selected criteria and indicators from the model of innovation potential (Habánik & Polák, 2016).

The European Commission developed the European Innovation Scoreboard (EIS) to assess and compare the innovation performance of EU member states using a composite indicator that considers various factors, including research and development, human resources, innovation activities, intellectual property, and finance (European Commission, n.d.). The EIS aims to promote and guide policies and investments that enhance innovation performance and competitiveness in the EU. Policymakers, academics, and business leaders use the regularly updated EIS to track and benchmark EU countries' innovation performance.

Another methodology for assessing innovation potential is the Innovation Capability Assessment (ICA) framework, developed by the Fraunhofer Institute for Production Systems and Design Technology (IPK). The ICA framework assists companies in evaluating their innovation capabilities and identifying areas for improvement through four dimensions: innovation strategy, innovation culture, innovation management, and innovation implementation. The ICA framework employs a self-assessment survey that allows companies to benchmark their innovation capabilities against best practices.

Measuring innovation potential can generally be approached in two primary ways: an integrated level of performance, which evaluates a business's overall performance by focusing on key areas such as business strategy, competitive positioning, critical point identification, risk assessment, and integration of innovation into business activities (O'Connor, 2010); and specialized evaluation of corporate responsibility components, which assesses a business's innovation potential by examining specific areas of the business environment, including products, production processes, supplier relationships, marketing, organizational management, financial management, information technology, and cooperation and networks (Habánik & Polák, 2016).

In the literature, two main perspectives are identified for analyzing innovation potential: the macro and micro perspectives. The macro perspective measures a country or region's capacity to develop and advance by evaluating competitive advantages, available intellectual assets, and material/financial resources (Fagerberg et al., 2007). This capacity can be gauged using metrics such as the number of patent applications and the size of the GDP. Conversely, the micro perspective examines innovation potential indicators within a firm's

departments related to innovation or those affecting innovation performance (Adams et al., 2006). This approach measures research and development, effectiveness of the production process, customer satisfaction, innovation and technology transfer, and employee motivation.

Universities, the OECD, and other organizations have developed a variety of methodologies for measuring innovation potential. These methodologies consider different factors that can influence innovation potential, such as strategy, marketing, technological process, quality and environment, logistics, organization, and human resources (Habánik & Polák, 2016; OECD, 2005). By employing these methodologies, firms can identify their strengths and weaknesses, which can help them develop strategies to enhance their innovation potential and competitiveness.

In recent research, the Crépon, Duguet, and Mairesse (CDM) model (1988) has emerged as a powerful and robust econometric framework for assessing the intricate relationships between innovation input, output, and firm performance. This structural model elucidates the complex causal mechanisms underlying the innovation process, wherein R&D investment decisions (input) yield innovative outcomes (output) that subsequently influence firm productivity (performance). By employing a system of three simultaneous equations, the CDM model effectively disentangles the endogeneity between these key innovation components, allowing for a more comprehensive understanding of the determinants and consequences of innovation. This approach has garnered significant scholarly attention for its ability to provide nuanced insights into the dynamic nature of firm innovation, ultimately advancing our understanding of innovation's role in shaping economic growth and competitive advantage.

2.7 Methods of Measuring Innovation Potentials

2.7.1 Quantitative methods

Key Performance Indicators (KPIs): KPIs are essential for evaluating an organization's innovation potential by offering quantifiable measures related to innovation goals (Parmenter, 2015). These metrics include the patents filed, R&D expenditures, and new product or service revenue. Other KPIs like the percentage of revenue from new products, R&D intensity, and

time to market can also be used to assess the effectiveness of an organization's innovation efforts (O'Regan & Ghobadian, 2004).

Innovation Indices and Rankings: Innovation indices and rankings facilitate comparing innovation performance across various organizations, industries, or regions by relying on aggregated quantitative data (Hollanders & Es-Sadki, 2014). Examples include the Global Innovation Index (GII) and the European Commission's Innovation Scoreboard, which use multiple innovation indicators to generate comprehensive rankings (Dutta et al., 2021; European Commission, 2021).

Innovation Ecosystem Assessment: An organization's innovation potential can also be assessed by examining its innovation ecosystem, which includes external factors such as collaborations with universities, research institutions, suppliers, and customers (Adner & Kapoor, 2010). By evaluating these partnerships and networks, organizations can identify potential areas of improvement and leverage external resources to foster innovation (Jackson, 2011).

2.7.2 Qualitative methods

Surveys and Interviews: Surveys and interviews are qualitative methods for gathering rich, detailed data on an organization's innovation processes and capabilities (Yin, 2017). By engaging directly with employees, managers, and other stakeholders, researchers can obtain first-hand accounts of experiences, opinions, and perceptions related to innovation (Adams, Bessant, & Phelps, 2006). These methods can help identify innovation barriers, uncover opportunities for improvement, and provide insights into the effectiveness of existing innovation strategies (O'Connor & Rice, 2013).

Case Studies and Best Practice Analysis: Case studies and best practice analysis involve an in-depth examination of specific instances of successful innovation within enterprises or industries (Eisenhardt, 1989). By analyzing these cases, researchers can identify common patterns, processes, and factors that contribute to successful innovation (Yin, 2014). These insights can then inform the development of innovation strategies and practices within other enterprises, ultimately enhancing their innovation potential (Tidd et al., 2005).

Ethnographic Studies: Ethnographic studies comprehensively understand an organization's innovation culture by observing and documenting employees' and stakeholders' everyday experiences and behaviors (Hammersley & Atkinson, 2007). This method allows researchers to uncover implicit knowledge, practices, and beliefs that shape an organization's innovation potential, which may not be readily accessible through traditional survey or interview techniques (Van Maanen, 2011).

Expert Panels and Delphi Technique: Expert panels and the Delphi technique involve soliciting opinions and feedback from experts in the field of innovation (Dalkey & Helmer, 1963). These methods can assess the organization's innovation potential by gathering insights on industry trends, technological advancements, and best practices (Rowe & Wright, 1999). By incorporating expert opinions, organizations can develop a more informed understanding of their innovation capabilities and identify areas for improvement (Skulmoski, Hartman, & Krahn, 2007).

In conclusion, both quantitative and qualitative methods play critical roles in assessing an organization's innovation potential. Quantitative methods, including Key Performance Indicators (KPIs), innovation indices, and innovation ecosystem assessments, provide measurable, data-driven insights that allow organizations to track their innovation performance, benchmark against competitors, and identify areas for growth and improvement. On the other hand, qualitative methods such as surveys, interviews, case studies, ethnographic studies, and expert panels offer an in-depth, context-specific understanding of an organization's innovation processes, culture, and experiences. These approaches enable researchers to uncover hidden barriers to innovation, identify opportunities for improvement, and gain insights into the effectiveness of existing innovation strategies. By combining quantitative and qualitative methods, organizations can develop a comprehensive, multi-faceted understanding of their innovation potential. This holistic approach enables decision-makers to identify strengths and weaknesses in their innovation capabilities, tailor their strategies to address specific challenges, and ultimately enhance their ability to innovate and maintain a competitive edge in the marketplace.

Chapter 3: Methodology

3.1 Research Design

This study employs a cross-sectional survey research design to explore the innovation potential of firms in Estonia. The research used the Estonian Community Innovation Survey (CIS) data from 2018 and 2020. Statistics Estonia surveyed on behalf of the Estonian Ministry of Economic Affairs and Communications and the European Union. The survey collected data from firms with at least ten employees.

3.2 Sample and Data Collection

This study's target population is all Estonia firms participating in the 2018 and 2020 CIS surveys. The sample consists of a random selection of firms from the target population. The final sample size is approximately 1,600 firms. The data for this study is collected from the 2018 and 2020 CIS surveys, which include questions related to innovation potential, innovation efforts, and other factors that may influence innovation. The survey data is obtained from Statistics Estonia.

3.3 Variables and Data Analysis

The analysis utilized the CDM model, a system of equations that systematically explores the relationship between innovation inputs and outputs, such as patents, new product sales, and the emergence of novel products or processes. Extensively employed in the literature, the CDM model has been the foundation for cross-country studies conducted by organizations like the OECD. Traditionally, CDM model applications measure innovation output as the proportion of new products in total sales and estimate the model exclusively for innovative enterprises. However, this study implemented a modified model encompassing all firms and incorporating indicator variables for product and process innovation. This approach is essential since all firms exert some innovation effort, even when unreported (Masso & Vahter, 2011).

Brown and Guzmán (2014) delineate the CDM model into four equations across two levels: (1) a firm's decision to invest in R&D; (2) the intensity of a firm's innovation efforts; (3) the knowledge production function linking R&D intensity with innovation; and (4) the productivity function with innovation as an input. The first level of equations was estimated using the Heckman methodology, controlling for selection bias induced by treatment

assignment. This study emphasized the determinants of innovation propensity and innovation effort, which constitute part of the modified first-level model estimation equations.

Brown and Garwin (2014) employed Heckman's two-step estimation method (1979) to estimate both Propensity to Innovate (dtec) simultaneously and Innovation Effort (letec) functions. They used a probit specification for the first function and an Tobit model for the second function to eliminate potential selection bias (Janz et al., 2004). A pool-type estimate was applied, where constants (β0, α0) were equal among the cross-section elements of the two equations. The innovation effort prediction ieli,t and the inverse Mills ratio (Xi,t) were obtained and utilized in the subsequent equation to estimate the investment in innovation as determined by macroeconomic conditions, market structure, and firm characteristics.

Equation 1: Propensity to Innovate (dtec)

$dtec_{i,t} = \beta_0 + X_{1,i,t}\beta_1 + \varepsilon_{1,i,t}$

Where: i = 1, 2, 3… 1,600 firms and t = 1, 2, 3 year
$X_{1,i,t}$ = exp, size, novel, divinnova; and
$\varepsilon_{1,i,t}$ = error term

Equation 1 aims to estimate the impact of various factors on a company's propensity to innovate. The equation includes the following variables:

1. dtec = The dependent variable (dtec) is a binary variable that equals 1 if the firm invested in new technology and zero if it did not.
2. exp = The percentage of exports in the firm's turnover used to estimate the positive effect of exports on innovation. Firms focusing on global markets are more likely to introduce new products due to increased competition and learning processes.
3. size = The binary variable size equals 1 for large companies with over 200 employees. The literature suggests a positive correlation between size and innovation, although the correlation might not be linear.
4. novel = The binary variable indicating if a firm indicates the presence of a new product or process innovation.

5. divinnov = innovative industries. The dummy variable identifies firms with higher innovation expenditures than the average.

In their research, Brown and Garwin (2014) also formulated an equation to estimate the amount of investment in innovation by a company, which is determined by macroeconomic conditions, market structure, and the company's features. This equation was developed to determine the resources a company can allocate to innovation after deciding to innovate.

Equation 2: Innovation Effort (letec) Determinants

$$letec_{i,t} = \alpha_0 + X_{2,i,t}\alpha_1 + \varepsilon_{2,i,t}$$

Where: i = 1, 2, 3… 1,600 firms and t = 1, 2, 3 year
$X_{2,i,t}$ = promote, p&t, funding, exports, novel, collab, tech, acredit, year 2018, year 2020; and
$\varepsilon_{2,i,t}$ = error term

Equation 2 includes the following variables:
The variables used in this study to estimate the amount of investment in innovation made by companies are as follows:

1. *let*ec = The technology expenditures on logarithms, which represents the dependent variable. This variable includes all expenditures involved in innovation efforts firms make, even if they are not reported as R&D spending.
2. promote = marketing, brand building, and advertising expenditures on logarithms, which aims to estimate the positive effect of innovation on the firm's efforts to gain clients and increase its market share.
3. p&t = patents and trademarks, a binary variable equal to 1 if the firm has intellectual property rights, having registered a brand, a patent, or both. This variable helps to analyze the importance given in literature regarding its appropriability-related innovation activities.

4. funding = debt and equity funding replaces direct foreign investment in the original equation as a binary variable equal to 1 when the firm has an equity stake of more than 25% from an external source and 0 if it does not.
5. exp = percentage of exports in the firm's turnover.
6. novel = The binary variable indicating if a firm indicates the presence of a new product or process innovation.
7. collab = cooperation among firms in the corporations as a proxy, assuming that information and cooperation are as responded by the firms.
8. tech = tech replaces technology transfer in the original equation and reflects the firms' response to investing in a new tech machinery, equipment, or software not used in the enterprise.
9. acredit = access to credit financing from public financing to the firms.
10. year18: year 2018.
11. year20: year 2020.

The data analysis was conducted using the statistical software package SPSS and R.

3.4 Limitations

The limitations of this study include the reliance on self-reported survey data, which may be subject to bias, and the cross-sectional nature of the study design, which does not allow for causal inference. Additionally, the sample size may not represent Estonia's entire population of firms.

Chapter 4: Result and Discussion

4.1 Innovation and firm characteristics

Examining the Community Innovation Survey (CIS) dataset, encompassing a sample of 1,600 firms and their innovation activities from 2018 to 2020 analyzes various aspects of firm innovation. As displayed in Table 1, the dataset provides information on adopting new product and process innovations (Product, Process) and investing in previously unused machinery or software technology (Tech). Furthermore, the dataset investigates firms' engagement in collaborative R&D efforts (Collab), the implementation of new organizational

structures (Reorg), the introduction of innovative business practices to optimize workflow (Streamline), and the utilization of novel marketing methods for promotion (Promote) during the specified time frame.

Table 1

Innovation variables definition and adopting firms.

	Definition	Firms (%)
Tech	Purchase of machinery, equipment or software based on new technology not used before in the enterprise	23.5
Product	Introduction of new or improved goods or service	28.9
Collab	Cooperation with other enterprises on R&D	16.8
Promote	Introduction of new marketing methods for promotion, packaging, pricing, product placement or after sales services	19.5
Streamline	Introduction of new business practices for organizing procedures or external relations	15.5
Reorg	Introduction of new methods of organizing work responsibility, decision making or human resource management	26.1
Process	Introduction of new methods of producing goods or providing services including methods of developing goods or services	40.4

Source: Statistic Estonia, 2023

Table 2

Correlation matrix Kendall's Tau correlation coefficient at 1% level significance (N = 1,600)

	Tech	Product	Collab	Promote	Streamline	Reorg	Process
Tech	1.000						
Product	0.165	1.000					
Collab	0.176	0.208	1.000				
Promote	0.194	0.266	0.214	1.000			
Streamline	0.187	0.164	0.255	0.514	1.000		
Reorg	0.208	0.203	0.259	0.479	0.506	1.000	
Process	0.233	0.152	0.238	0.336	0.305	0.409	1.000

Around 15% of the Estonian firms in the sample reported adopting at least one of these innovations. Most of them focused on introducing new or improved processes (40.4%) and creating enhanced products or services (28.9%), like the findings in a study by Battisti

and Stoneman (2010) on innovative UK firms. In contrast, the least reported innovation involved streamlining business practices and external relations. In Table 2, Kendall's tau-b correlation coefficient, a non-parametric measurement of association, is used to examine the relationship between the different innovation variables. The results show that adopting one innovative practice or technology is connected to adopting others. However, the strength of this connection varies across different innovations. In simpler terms, adopting one innovation tends to be related to adopting other innovations, but the degree of association differs among them.

Table 3 shows the characteristics of the sampled Estonian firms distinguished into innovating and non-innovating firms, classified based on the firms' responses to the question if they introduced a new innovative product or process within the three-year period of 2018 - 2020. The distribution of firms across different size categories reveals that small firms (1 – 49 employees) constituted the largest proportion of innovators. In contrast, non-innovating firms were more prevalent in the larger size categories, particularly in the small and medium-sized categories. Larger firms are generally considered to have greater resources and capabilities for innovation, while smaller firms may be more agile and adaptable, enabling them to respond quickly to changes in the market and explore new opportunities. The data reveal dissimilarities with the empirical evidence from Koschatzky, Bross, & Stanovnik (2001), whose findings showed a stronger representation of non-innovators among firms in small-size classes in the Slovene manufacturing industry. Additionally, the data showed an observed increase in firms in each size category between 2018 and 2020. This suggests a growing entrepreneurial ecosystem in Estonia, which can contribute to higher innovation potential across the economy (Carree & Thurik, 2010).

Table 3

Characteristics of innovating and non-innovating firms

	Innovators		Non-innovators	
	Number of Firms	%	Number of Firms	%
Size				
Small (1 – 49)	264	36.28	443	63.72
Medium (50 – 199)	191	25.43	527	74.57
Large (200 – 999)	77	43.05	90	56.25
Very large (>1,000)	6	75.00	2	25.00

	1600	538	33.63	1062	66.37
Funding (Equity/Debt)	389	241	61.95	148	38.05
Patent and trademarks	289	207	71.62	82	28.37
Collaboration	264	155	58.71	109	41.29
Technology	1150	538	46.78	612	53.22
Credit access	379	101	26.65	278	73.35
Innovation expenditure	538		33.63		
Average 2020					
Advertising per person*			2,529.31*		1972.85*
Std error			818098.63		
Innovation per person*			1,772.41*		
Std error			60874.25		
Capital per person*			8,990.55*		
Std error			5169676.529		

Note: * in Euros

Source: Based on Statistic Estonia CIS data, 2020

In terms of funding, innovating firms showed a higher presence in equity and debt financing, indicating the significance of financial resources in supporting innovation efforts (Statistic Estonia, 2020). This finding aligns with previous research highlighting the positive relationship between funding and innovation (Coad, Segarra, & Teruel, 2016). Further assessment of the firms' financing reveals that out of 72 firms that successfully obtained equity financing, 50% used it for R&D purposes, indicating a strong link between equity financing and R&D investment. On the other hand, four firms were unsuccessful in securing equity financing, highlighting potential challenges some firms face in accessing this funding source. Furthermore, a substantial number of firms, 1,496 in total, have yet to attempt to obtain equity financing, indicating a possible lack of awareness or interest in pursuing this avenue for funding innovation.

Regarding debt financing, 379 firms successfully obtained it. However, 16 firms were unsuccessful in obtaining debt finance, suggesting potential difficulties some firms face in accessing this form of financing. Moreover, many firms (1,177) never attempted to secure debt financing, indicating a reliance on other funding sources or a lower emphasis on debt financing for innovation.

Public financing played a notable role in supporting innovation efforts. A total of 1,572 firms received financial support from the local region, with 142 of them utilizing it for

R&D. Additionally, the national government and the European Union's Horizon 2020 program provided financial support to the same number of firms, with 405 of them using the funds for R&D. This highlights the importance of government support in promoting innovation activities within Estonian firms.

Collaborative efforts were prevalent, as many firms partnered with other enterprises (123), clients (198), consultants (161), suppliers (262), competitors (50), universities (165), and research institutions (59) within Estonia, across and outside the EU and EFTA countries. 123 reported cooperating with firms' partners in Estonia, while 174 reported cooperation with firms outside Estonia.

Interestingly, none of the firms received tax credits or allowances specifically targeted for R&D or other activities. This may suggest a potential area for improvement in the tax incentives and allowances provided by the Estonian government to encourage innovation. Additionally, legislation and regulation were identified as factors influencing innovation activities. Legislation related to product safety and consumer protection, the environment, intellectual property, and employment had varying impacts on firms' innovation efforts, either facilitating or increasing costs associated with innovation. It is crucial for policymakers to carefully assess the impact of legislation and regulations to ensure they foster an innovation-friendly environment while addressing societal concerns.

Innovating firms were more inclined towards patent and trademark acquisition, collaboration, and technology adoption than non-innovating firms. These findings support existing literature emphasizing the importance of intellectual property protection, collaborative activities, and technological advancements in fostering innovation (Grimpe & Hussinger, 2014). Access to credit was found to be higher among innovators, underscoring the role of financial support in facilitating innovative activities.

On analysis of the firms' age, most Estonian firms were established between 2001 and 2013, with only 1% being under five years old. Younger firms might be more innovative due to their adaptability and openness to new ideas (Coad et al., 2013). However, older firms can also possess valuable experience and knowledge facilitating innovation (Cefis & Marsili, 2006). The data suggests that Estonia has a mix of young and old firms, which could foster a dynamic business environment and contribute to the overall innovation potential.

Investments in various operational areas, such as tangible assets, marketing, staff training, product design, software development, and intellectual property rights (IPRs), can significantly impact firms' innovation potential (Damanpour & Gopalakrishnan, 2001). Table 4 presents data on Estonian firms' operational expenditures in 2020.

Table 4

Operational Expenditure in 2020

Operational Costs	Max	Mean	Median
Machinery, equipment, building, and tangible assets	171697884	1097292.63	96999.50
Marketing, branding, advertising	14293107	197665.20	14371.00
Staff training and salaries	89340	17828.24	3450.00
Product design	4038240	51055.96	2000.00
Software and database costs	60783000	339782.20	18950.00
Purchasing and licensing IPRs	7972100	73607.57	0.00

Most Estonian firms invest in various areas that contribute to innovation potential. Many firms focus on tangible assets, such as machinery, equipment, and buildings, with only 2.7% reporting no expenditure. Investments in marketing and advertising are also common, although 11.8% of firms reported no spending in this domain. Staff training and salaries receive attention, as these investments can improve employee skills and foster innovative activities. Approximately 55.1% of Estonian firms allocate resources to product design, a critical aspect of innovation. Moreover, firms demonstrate varying levels of investment in software development and data analysis, which can contribute to innovation potential by developing new software and improving business processes. However, a significant proportion of Estonian firms (60.6%) reported no expenditure on intellectual property rights (IPRs), suggesting room for improvement in their innovation strategies.

4.2 Propensity to innovate and innovation effort

Table 6 displays the results from Equations 1 and 2, estimating the propensity to innovate and innovation effort determinants equations. The findings reveal several factors influencing a firm's propensity to innovate and the determinants of its innovation efforts.

Regarding the propensity to innovate, the coefficient for innovating firms is positive and significant (0.787, $p<0.05$), suggesting that firms with a history of innovation are more

likely to continue their innovative activities (Cohen & Levin, 1989). Moreover, large firms with over 200 employees exhibit a significantly higher propensity to innovate (1.200, p<0.00), which aligns with the notion that larger firms have greater resources and capacity for innovation (Schumpeter, 1942).

Table 5

Results from the propensity to innovate and innovation effort determinants equations

	Coeff.	P>z	Elasticities
Propensity to innovate (dtec)			
% of exports	0.005	0.45	
large firms with >200 employees	1.200	0.00	
novel	0.092	0.067	
Innovative industries	0.787	0.05	
Year	0.000	0.211	
Constant	0.25	0.321	
Innovation Effort Determinants (letec)			
promote	0.062	0.031	0.92
patent and trademarks	1.10	0.014	0.88
funding	0.713	0.02	0.30
% of exports	0.510	0.123	0.75
novel	-0.092	0.067	1.15
collaboration	0.68	0.091	0.52
tech	1.35	0.001	1.62
access to credit	0.40	0.167	0.48
Year2018	0.055	0.89	0.00
Year2020	0.080	0.76	0.00
Constant	0.150	0.421	

Source: Results from propensity to innovate and innovation effort determinants equations. (Heckman Methodology: Panel pool in two steps)

Wald test of indep. eqns. (rho = 0): chi2(l) = 45.67, Df (l): 3, Prob > chi2 = 0.0012

In terms of innovation effort determinants, advertising expenditure positively influences innovation efforts (0.062, p<0.031), with an elasticity of 0.92, supporting the idea that marketing investments can promote awareness and adoption of innovative products and services (Kotler & Armstrong, 2010). A positive relationship is also observed between the percentage of exports in firms' turnover and innovation efforts (0.510, p<0.123), with an

elasticity of 0.75, indicating that firms with higher export orientation tend to invest more in innovation (Wagner, 2007).

The coefficient value for funding in the innovation effort determinants equation is 0.713 (p-value = 0.02), indicating a significant positive relationship with innovation efforts. The elasticity value of 0.30 suggests that a 1% increase in funding leads to a 0.30% increase in innovation efforts. Studies by Coad, Segarra, and Teruel (2016) confirm the importance of funding in driving innovation. These studies found that higher funding levels correlated with greater innovation efforts, including increased R&D expenditure, the introduction of new products, and improved innovation performance.

Interestingly, firms introducing novelty show a negative, albeit insignificant, coefficient (-0.092, $p<0.067$) with an elasticity of 1.15, possibly reflecting the complex relationship between novelty and innovation efforts. This complex relationship may be due to challenges such as increased risks and uncertainties linked to novel ideas, difficulty securing resources and support for groundbreaking projects, or the potential for novelty to divert attention from a firm's primary focus. Patents and trademarks have a positive and significant impact on innovation efforts (1.10, $p<0.014$), with an elasticity of 0.88, which supports the role of intellectual property rights in fostering innovation (Griliches, 1990).

Furthermore, collaboration (0.68, $p<0.091$) and technology (1.35, $p<0.001$) positively affect innovation efforts, with elasticities of 0.52 and 1.62, respectively. This finding is consistent with the literature on the benefits of inter-firm collaboration and technology adoption for innovation (Tether, 2002). Access to finance has a positive but insignificant effect on innovation efforts (0.40, $p<0.167$) and an elasticity of 0.48, reflecting the importance of financial resources for innovation (Hall, 2002).

The Wald test of independent equations (rho = 0) yields a chi-square value of 45.67, with 3 degrees of freedom and a probability of 0.0012, indicating that the two equations are not independent and should be considered jointly (Greene, 2003).

Chapter 5: Conclusion

Estonian firms exhibit varied innovation activities, with a significant portion focusing on implementing new or improved processes and products, indicating a commitment to operational efficiency and innovative solutions. The Community Innovation Survey data

analysis further reveals a broad adoption of technology and collaboration amongst these firms, suggesting a willingness to form partnerships and embrace advanced technologies. This diverse innovation landscape also includes young and old firms, each contributing unique aspects - agility and adaptability from younger firms and experience and knowledge from older ones.

Large Estonian firms, specifically those with over 200 employees, demonstrate a higher propensity to innovate. This is consistent with the resource-based view that larger firms have more resources for innovation. Furthermore, firms with prior innovation history maintain this trajectory, indicating an inherent innovation capability and a learning-by-doing effect.

Key factors affecting innovation propensity include advertising expenditure and export orientation. Advertising expenditure positively impacts innovation efforts, reinforcing marketing investments' role in promoting innovative products and services. Firms with higher export orientation tend to invest more in innovation, underscoring the significance of global market exposure in driving innovation.

Funding is a significant driver of innovation efforts among Estonian firms. Increased funding positively impacts innovation, with firms obtaining equity and debt financing demonstrating heightened innovation efforts. However, some firms struggle with accessing such funding, suggesting a need for improved accessibility.

Intellectual property protection, such as patents and trademarks, also boosts innovation efforts. They encourage firms to invest in innovation and protect their creations from imitation. Collaboration and technology adoption are key innovation drivers, emphasizing benefits of knowledge sharing, resource pooling, and external expertise access.

Despite positive influences, challenges exist. For example, none of the sampled firms received tax credits or allowances for R&D, revealing a potential government support gap. Policymakers should also carefully assess legislation and regulations' impact to ensure they promote innovation while addressing societal issues.

In conclusion, Estonian firms have a strong innovation potential, with larger firms and those with an innovation history highlighting the importance of resources and accumulated knowledge in driving innovation.

To bolster innovation among Estonian firms, the following recommendations are proposed:

1. Improve access to equity and debt financing, including venture capital.
2. Increase government support via tax credits, grants, and subsidies for R&D to stimulate innovation.
3. Encourage collaboration among firms, universities, and research institutions for knowledge sharing and joint research.
4. Enhance intellectual property protection to safeguard firms' innovations.
5. Raise awareness of innovation support programs and funding sources.
6. Cultivate an innovation culture through education, promoting risk-taking and learning from failures.
7. Regularly evaluate the effect of policies on innovation, enabling evidence-based decision-making and continuous enhancement.

Implementing these strategies can enhance Estonia's innovation capacity, foster a robust entrepreneurial ecosystem, and position it competitively in the global knowledge-based economy.

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Resümee

EESTI ETTEVÕTETE INNOVATSIOONIPOTENTSIAALI HINDAMINE

Elem Oghenekaro

See võimaldab hinnata Eesti ettevõtete innovatsioonipotentsiaali, kasutades Ühenduse Innovatsiooniuuringu (CIS) andmeid ning Créponi, Dugueti ja Mairesse'i (CDM) mudelit, mida on muutnud Brown ja Guzmán. Uuring täidab lünga teadmistes praeguse Eesti ettevõtete innovatsioonipotentsiaali ja nende innovatsioonivõimekust mõjutavate tegurite kohta.

Uuringu eesmärgid on:

- Analüüsida Eesti ettevõtete innovatiivseid omadusi.

- Määrata kindlaks Eesti ettevõtete innovatsioonile suunatus ning tuvastada seda mõjutavad tegurid.

- Uurida Eesti ettevõtete innovatsioonipüüdlustega seotud tegureid.

Brown ja Guzmán (2014) hindasid kahte võrrandit, mis hindavad 1,600 ettevõtte innovatsioonile suunatuse ja innovatsioonipüüdlusi, kes osalesid Ühenduse Innovatsiooniuuringus aastatel 2018-2020. Innovatsioonipotentsiaal viitab ressurssidele, võimekustele ja teadmistele, mida saab kasutada uueks arenguks, ja seega on see eelduseks innovatsioonile suunatusele ja innovatsioonipüüdlustele. Tulemus annab väärtuslikku teavet ettevõtete omaduste, innovatsioonile suunatuse ja innovatsiooni ajendite kohta. Uuring valgustab innovatsiooni olukorda Eestis, pakkudes soovitusi poliitikakujundajatele, ettevõtetele ja teadlastele.

Eesti ettevõtted näitavad mitmekesist innovatsiooni tegevuste maastikku. Ühenduse Innovatsiooniuuringu (CIS) andmestiku analüüs näitab, et märkimisväärne osa Eesti ettevõtteid prioriteerib uute või parendatud toodete ja protsesside kasutuselevõttu, rõhutades seeläbi operatiivset efektiivsust ja innovatiivseid lahendusi.

Nende ettevõtete vaheliste partnerlussuhete ja tehnoloogia kasutuselevõtu levimus näitab nende avatust koostööle ja arenenud tehnoloogiatele. Lisaks soodustab Eesti ärikeskkond innovatsioonipotentsiaali eri vanuses ettevõtete seas. Nende ettevõtete innovatsioonipotentsiaali uurimine toob esile tegurid, mis mõjutavad nende innovatsioonikalduvust. See näitab, et suuremad ettevõtted (üle 200 töötaja) on rohkem innovatsioonile suunatud, mis on kooskõlas ressursipõhise vaatega.

Andmed rõhutavad ka innovatsiooni kumulatiivset olemust, kus varasemate innovatiivsete tegevuste ajalugu näitab kalduvust selliseid püüdlusi jätkata. Uuring toob esile ka peamised mõjutajad innovatsioonikalduvusele ja jõupingutustele. Reklaamikulutused mõjutavad innovatsioonipüüdlusi positiivselt, rõhutades turundusinvesteeringute rolli innovatiivsete toodete ja teenuste edendamisel. Peale selle investeerivad rohkem innovatsiooni need ettevõtted, kelle käibest suurem osa tuleb eksportidest, mis näitab globaalse turu avatuse tähtsust. Rahastamine on innovatsioonipüüdluste oluline ajend. Suurenenud rahastamine mõjutab märkimisväärselt innovatsiooni Eesti ettevõtetes, rõhutades finantsressursside rolli innovatsiooni toetamisel. Ettevõtted, kes saavad omakapitali ja võlakapitali, on rohkem innovatsioonile orienteeritud, mis näitab finantsilise toetuse tähtsust. Siiski seisavad mõned ettevõtted silmitsi raskustega nende vahendite kättesaadavuses, mis näitab vajadust parema juurdepääsetavuse järele.

Intellektuaalomandi kaitse patentide ja kaubamärkide kaudu soodustab innovatsioonipüüdlusi. Lisaks soodustavad oluliselt innovatsiooni koostöö ja tehnoloogia kasutuselevõtt, peegeldades teadmiste jagamise, ressursside koondamise ja välise ekspertiisi kasutamise eeliseid. Siiski püsivad väljakutsed. Ükski uuritud ettevõtetest ei saanud maksukrediite ega soodustusi R&D tegevuse eest, mis näitab potentsiaalset lünka valitsuse toetuses. Peale selle võivad seadusandlus ja regulatsioon mõjutada innovatsioonitegevusi erineval viisil, nõudes seadusandjatelt hoolikat hindamist, et tagada soodne innovatsioonikeskkond.

Kokkuvõttes näitavad Eesti ettevõtted tugevat innovatsioonipotentsiaali, keskendudes uutele protsessidele ja toodetele, koostööle ja tehnoloogia kasutuselevõtule. Suuremad ettevõtted ja need, kellel on innovatsiooniajalugu, rõhutavad ressursside ja teadmiste tähtsust innovatsiooni edendamisel..

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