

Literature review: Factors Affecting Product Innovation in ICT Enterprises

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ABSTRACT

The primary purpose of this research is to examine the driving forces behind product innovations in the information and communication technology (ICT) industry. The objective of this research project is to carefully dissect the complexities and multiplicity dimensions of the actors involved in the innovation procedure in the ICT firms located in these countries based on a highly organised mixed-method approach. Outcome expectations are expected to yield results beyond contributing positively to the pool of academic knowledge and practical gains that could be put into use at once within the sphere. We try to give a wide literature about this topic.

1. Introduction

In the context of globalisation and an increasingly competitive business environment, product and technology life cycles are becoming shorter and shorter; innovation plays a central role in the economic and social development of the association of each country. World Bank (2013) also commented that achievements in reducing poverty and increasing income based on the advantages of abundant resources and cheap labour will not last long. To develop sustainably and accelerate economic growth in the future, Vietnam needs to pay more attention to increasing labour productivity based on science, technology, and innovation activities (Parasuraman, 2000). The term innovation is multidimensional when used in many diverse contexts, and there are many academic studies on this topic. The author finds that the current use of the term innovation can be understood in two ways: as a process or as a result. The innovation process is a set of different stages and activities.).

For innovation to be successful, that is, to bring innovative results to the market, businesses need to carry out many different activities. Depending on the nature of the innovation results, these activities may include activities related to science, technology (research and development), organisation, finance, production, or trade to create or intend to create innovative results for businesses. Innovation results are understood as the level of success of an enterprise in applying new ideas, knowledge, and inventions along with combining other resources in the innovation process. It should be noted that success here includes both technical and commercial success. Innovation results exist in diverse forms. According to OECD (2005), innovation results can be divided into four types: product innovation, process innovation, marketing innovation, and organisational innovation (Peris-Ortiz et al., 2018). In this study, product innovation is the dependent variable and is understood as the result of product innovation. Product innovation introduces new or significantly improved goods/services in terms of characteristics. It uses significantly different from previous goods/services introduced by the enterprise and introduced to the market.

To achieve the innovation goals of businesses, especially those operating in the field of science and technology, scholars have emphasised the need to increase knowledge and understanding of

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innovation and control activities and factors affecting innovation. This research focuses on factors affecting product innovation in ICT, where innovation activities are the core for survival and development.

The ICT sector has become a significant engine of development in the world, influencing economic growth, shaping industries and profoundly changing social patterns of thought during the century. New product development is increasingly essential in today's business world to ensure a company's survival and long-term competitive advantage. This contemporary study is based upon an intense investigation by identifying the main factors influencing the innovation processes of such companies as ICT companies in Hungary and Vietnam concerning each other or related organisations.

Today's economy is built around the ICT industry; it forms a fundamental pillar of any global digitisation that transgresses national borders. When comparing Vietnam (an attractive emerging market) with Hungary (which offers stable development of enterprise in the ICT industry), it becomes evident that this country can be an exciting investment place. This paper conducts a comparative analysis of the societal/economic, cultural and institutional conditions that affect product innovation in these countries.

In the current milieu of rapid technological advancements, transpiring at an unprecedented velocity, comprehending the dynamics steering ICT product innovation transcends the realm of a mere strategic advantage; it metamorphoses into an incontrovertible fundamental exigency (Tornatzky et al., 1990). Therefore, this study aspires to elucidate the nuanced forces that influence innovation processes in Vietnam and Hungary. Its ultimate objective is to yield discerning insights that enrich the corpus of academic knowledge and proffer pragmatic and implementable recommendations tailored to the difficulties of ICT enterprises and policy-making authorities operating within these distinctive, albeit interconnected, markets.

The ICT sector is pivotal in global progress, ushering in profound transformations in societal functioning, business operations, and individual interactions (Ramesh et al., 2021). Within this dynamic sphere, the capacity for innovation, particularly in product development, transcends mere competitive advantage to become a strategic imperative (Porter and Heppelmann, 2014). The present research proposal explores the intricate facets of product innovation within the ICT enterprises of Vietnam and Hungary. These two nations occupy distinctive yet influential positions within the global ICT landscape.

West, J. and Bogers, M., (2014). Leveraging external sources of innovation: A review of research on open innovation. *Journal of product innovation management*. This growth has fostered a thriving ICT sector, fostered by a conducive business environment, government support, and a vibrant start-up culture (Nguyen et al., 2018). Consequently, Vietnam has emerged as a burgeoning force in ICT innovation, rendering it a compelling subject for an in-depth investigative study (Hall et al., 2009).

However, Hungary is home to an advanced ICT industry where innovations have characterised its operation over several decades. It has carefully developed a firm technological and human base, allowing it to become one of the key technology locations in the centre of Europe. A case study of a high-level, skilful and complex ecology in Hungary's ICT environment could guide the development of cutting-edge product spaces among leaders (Cserháti and Pirisi, 2020)

Carayannis and Campbell (2011) note that the value of this study is embedded in its ability to advance the knowledge of ICT product innovation across various social and economic realities. This study aimed to delve into the driving and hindering reasons for innovations in Vietnam and Hungary to discover insightful information on facilitating ICT companies' making strategic decisions therein, framing policies, and offering guidance to those operating in these countries. In addition, the current study seeks to bridge another evident lacuna within existing literature whose background comprises many empirical investigations that have addressed the driving forces behind ICT innovation, with few having taken it upon themselves to compare emerging and developed markets. Thus, it attempts to fill in this blank space by providing an in-depth analysis of the complex drivers of innovation in both Vietnam and Hungary – thus making a meaningful impact not only on the scholarly sphere but also on the practical aspects of ICT that continue changing rapidly.

2. Literature review

In the context of globalisation, innovation is considered a premise for creating competitive advantage. It is decisive for the survival and development not only in the short term but also paves the way for the long-term future of every business. Previous studies on innovation have shown that innovation helps create benefits for businesses by reducing costs, improving the quality of existing products/services, creating new products/services, or providing new products/services: a business model or better way of distributing goods (Hauser et al., 2006). Therefore, innovation is a prerequisite to maintaining sustainable business development in the domestic or international market.

Much classical literature has provided significant scholarly input into this study's episteme and basic framework –the theoretical foundation. In his breakthrough book of 2003, Chesbrough created an innovative concept in the field of open innovation. He said external interactions were fundamental in initiating innovations within this framework. He presented concrete examples of successful open innovation practices that he referred to with examples like Procter and Gamble Inc. The patent system has been identified as a threat to innovation, especially for the ICT industry, by pioneering research by Jaffe and Lerner (2004). The study proved helpful in making a forceful case for future reforms. With this end goal, West and Gallagher explored the problems characterising open-source projects, intending to examine several firms' involvement in them. West and Gallagher (2006) found their investigations re-emphasising the centrality of good management in the realm of open innovation. In their prophetic work in 2011, Carayannis and Campbell added the novelty of Quadruple and Quintuple Helix models on top of the conventional Triple Helix (Bleicher and Stanley, 2018). The new models clarified that diplomacy and civic participation were critical for developing collaborative innovation ecosystems. Endrődi-Kovács and Stukovszky (2022)' investigation into the impacts of digitalisation on Hungary's ICT companies in 2018 may not be accurate. However, relevant results were lacking in the Literature Review (Endrődi-Kovács and Stukovszky, 2022; Agostini and Nosella, 2020). Finally, the exhaustive review conducted by West and Bogers in 2014 concluded the strategic exploitation of outside sources of innovation. This study provided precious inputs and practical instructions for the companies involved in Open Innovation projects (West and Bogers, 2014).

For the empirical analysis of product innovation within the ICT industry between Vietnam and Hungary, this study leans on an underlying theoretical construct composed of proven theories that shape our scholars' investigation. The first theory was developed by Rogers (1962) based on innovation diffusion theory, a central feature underlying this study. He later revised it and reissued it in 1995 (Rogers, 1995). The underlying theory contributes valuable information on innovation adoption, propagation and even assimilation complexities. This theory is adopted systematically to analyse the fine details of innovation in ICT enterprises in two countries. Such an analysis involves core ideas of the theory, that is, adopter classes, diffusion curves, and characteristics of innovations. Such concepts enable us to explore the velocity and structure of innovation adoption to find crucial factors that affect the evolutionary pathway of innovation adoption and, therefore, give some implications to the result of product innovation (Yang and Gu, 2021).

The Resource-Based View (RBV) theory was developed by Jay Barney in 1991. This theory underscores the strategic importance of unique, valuable, rare, and non-substitutable resources and capabilities in achieving and sustaining competitive advantage. RBV posits that businesses can gain a competitive edge by focusing on developing and utilising resources and capabilities that are distinct and not commonly owned by other companies. These resources must be valuable, rare, and non-substitutable. Peteraf (1993) highlights the vital role of ratio and non-substitutability in constructing competitive advantage. Empirical research has indeed demonstrated that companies possessing distinctive resources and the ability to manage them can generate higher profits than their competitors. In the context of product innovation in Information and ICT enterprises, RBV becomes particularly significant. RBV emphasises that owning and leveraging distinctive, valuable, rare, and non-substitutable resources and capabilities is the key to gaining and maintaining a competitive edge in the technology industry. ICT enterprises must focus on developing and utilising innovative technical resources, skilled personnel, and flexible production processes to create advanced products and services. These resources may encompass outstanding technical teams, modern technological

infrastructure, flexible development processes, and advanced technology platforms. Teece, Pisano, and Shuen's (1997) study revealed that a company's ability to possess, develop, and protect exclusive resources and capabilities is decisive in creating a competitive differentiation.

A comprehensive viewpoint on innovation ecosystems was also offered by the National Innovation System (NIS) framework, developed by Pavitt in 1995 and built upon by Freeman and Pinter in 1987. The NIS framework emphasises the interdependencies that run throughout different parts of a national innovation ecosystem, going beyond the bounds of individual firms to include more expansive entities like universities, governmental institutions, and collaborative networks (Freeman and Pinter, 1987; Pavitt, 1995). By conducting this study, it is possible to get a significant understanding of the complex interactions of governmental regulations, institutional frameworks, and cooperative networks that influence the development of ICT in each country. This examination explores various topics, such as governmental efforts, the distribution of money for research and development, the structure of university-industry collaborations, and the dynamism of knowledge-sharing networks. The NIS framework's comprehensive perspective enables one to understand the complex processes influencing innovation results in these countries and provides practical advice for enhancing their innovation ecosystems.

These theoretical frameworks strengthen this research, but not inexhaustibly; nevertheless, limits exist too. For example, Rogers's (1962) Innovation Diffusion Theory has been contested for being too simplistic and neglecting subtlety in the innovation diffusion process. Similarly, while the RBV is highly useful, it can fail to encompass all outer variables simultaneously, shaping the innovation process (Barney, 1991). Similarly, the National Innovation System framework may contain everything but could fail to cover the peculiarities of different national contexts (Freeman and Pinter, 1987; Pavitt, 1995, Lundvall B-Å, Lundvall B-A, 2016). This makes the need for a clever and fine-grained attitude when conducting this research even more apparent since this study has to look at how these basic principles dovetail themselves into the conditions peculiar to Vietnam and Hungary.

The international collection and reporting of business innovation statistics is guided by the recommendations provided in the OECD/Eurostat Oslo Manual. The manual provides common concepts, definitions and classifications for measurement. The 2018 edition of the Oslo Manual identifies two types of innovation for firms (Oslo Manual, 2018):

Product innovation: a new or improved good or service that differs significantly from the firm's previous goods or services and that has been introduced on the market. This includes significant improvements to one or more characteristics or performance specifications, such as quality, technical specifications, user friendliness, usability, among others.

Business process innovation: a new or improved business process for one or more business functions that differs significantly from the firm's previous business processes and that has been brought into use in the firm. This concerns the different functions of a firm, including production of goods or services, distribution and logistics, marketing and sales, information and communication systems, administration and management, and product and business process development.

All functions potentially subject to improvements that qualify as innovation.

Business functions are the followings:

1. Production of goods services
2. Distribution and logistics
3. Marketing and sales
4. Information and communication technology
5. Administration and management
6. Product and business process development

We are focusing here the Information and communication technology.

2.1. Research objectives and question

Research objectives

Objective 1: Identification of Principal Catalysts: This objective meticulously identifies and elucidates the primary catalysts propelling product innovation within ICT enterprises in both nations. It aligns with the Innovation Diffusion Theory by focusing on the factors expediting the adoption and diffusion of innovations within organisations.

Objective 2: Government Policy Impact Assessment: The second objective comprehensively examines the influence exerted by government policies, regulatory frameworks, and institutional support mechanisms on the trajectory of ICT innovation in Vietnam and Hungary. This objective resonates with the Resource-Based View (RBV) by exploring how external factors, such as government policies, can shape the resource landscape for innovation.

Objective 3: Exploration of Comparative Dynamics: The tertiary objective extensively explores the comparative dynamics inherent in ICT product innovation. This venture seeks to discern and elucidate the distinctive challenges and opportunities innately woven into the multifaceted fabric of the ICT innovation landscapes of each country. It faithfully mirrors the foundational tenets of the National Innovation System (NIS) theory, thus explicitly acknowledging the pivotal role played by contextual factors in determining innovation outcomes.

Objective 4: Provision of Practical Guidance: The final phase of this research encompasses the provision of pragmatic insights and proposals. The resultant findings and recommendations serve as invaluable guiding principles for strategic decision-making processes undertaken by ICT companies, government authorities, and other stakeholders with vested interests in both the Vietnamese and Hungarian contexts. These policies are thoughtfully designed and meticulously structured to create an enabling environment conducive to creativity while simultaneously promoting the ICT sector's growth and development.

Research Questions

To achieve these aims, this study is guided by the following research questions:

- What specific factors drive product innovation within ICT enterprises in Vietnam and Hungary?
- How do government policies and institutional frameworks shape product innovation in Vietnam's and Hungary's ICT sectors?
- In what ways do the determinants of ICT product innovation differ between Vietnam and Hungary?
- How does the comparative analysis inform practical insights that could contribute towards improving ICT innovations, especially between the two countries?

3. Methodology

3.1. Modelling approach

Multiple Regression Analysis

Method: At its core, multiple regression analysis represents an indispensable statistical technique that undertakes to meticulously scrutinise how an array of innovation drivers, including but not limited to collaborative innovation, governmental policies, technological readiness (Parasuraman, 2000), perceived relative advantage, and the perceived complexity of innovations, collectively coalesce to exert their influence on the prediction and determination of product innovation outcomes.

Objective: The fundamental purpose of this analytical exercise resides in identifying statistically significant predictors that demonstrate a correlative impact on the dynamics of innovation success. This discernment paves the way for a nuanced understanding of the potency and directionality of these influential relationships.

Comparative Analysis

Method: The methodology employed for comparative analysis is diligently harnessed to unearth the nuances encapsulated within the innovation determinants that distinguish or align between the geographical spheres of Vietnam and Hungary.

Statistical Tests: Appropriate statistical tests, which may encompass the utilisation of t-tests or ANOVA techniques, are astutely selected and deployed contingent upon the inherent nature of the data. This comparative analysis aims to spotlight the unique contextual factors intrinsic to each country, thereby illuminating the distinct influences shaping innovation outcomes.

Mediation Analysis

Method: The Mediation Analysis method harnesses the potency of established statistical techniques, including the adept utilisation of structural equation modelling (SEM) or mediation analysis packages inherent in widely recognised statistical software applications such as SPSS or R. The comprehensive workflow of this analysis spans the selection of pertinent variables, rigorous data preparation, meticulous testing of mediation hypotheses, a reasonable assessment of statistical significance, and the estimation of effect sizes.

Objective: This analytical endeavour operates along a dual trajectory: Identification of Mediation Relationships: A primary facet of this analysis involves meticulously determining the existence and nature of mediation relationships, notably those involving the perceived relative advantage variable. The central objective herein is to unravel the intricate interdependencies characterising the relationships between innovation drivers and the resultant product innovation outcomes within the ICT enterprises in Vietnam and Hungary.

Understand Mechanisms: Gain a deeper understanding of how and why innovation drivers influence product innovation outcomes through mediator variables, contributing to a more comprehensive insight into ICT innovation dynamics.

Qualitative Analysis

A theme analysis will be utilised for the qualitative aspect of the study that will involve analysing textual data. This involves establishing a structured pattern where underlying themes of determinants on the innovation of ICT firms are analysed. Open coding and Axial coding approaches shall be applied to explore the qualitative data.

3.2. Data Collection

Surveys: Structured surveys targeting ICT professionals, including management, innovation experts, and product development personnel, will be conducted. The survey design will be rigorous, with questions meticulously crafted to capture the intricacies of innovation drivers, government policies, organisational strategies, and intellectual property management. The survey sample size is 400-500 participants from the two countries.

Document Analysis: When conducting document analysis for this particular segment, I shall carefully analyse governmental policy papers, industrial reports, and internal corporate documents. This will take a more detailed approach, using qualitative coding to gather the crucial aspects of how regulatory and institutional factors affect innovation in ICT.

3.3. Model and Hypotheses

The Dependent Variable in this study pertains to the Rate of Product Innovation within the ICT sector.

Under the framework of Innovation Diffusion Theory (IDT), several Independent Variables are considered:

- **Innovation Diffusion Inward (H1+):** It is postulated that the inward diffusion of innovations, characterised by their dissemination within an organisation, exerts a positively significant influence on the rate at which innovative practices are adopted.

- **Innovation Diffusion Outward (H2+):** We hypothesise that the outward diffusion of innovations, influenced by prior instances of innovative practices, significantly contributes to an accelerated adoption rate.

- **Innovation Diffusion Combined (H3+):** Our proposition suggests that the cumulative impact of diverse innovation diffusion collectively and significantly enhances the rate at which innovative practices are adopted.

- **Internal Research and Development (R&D) Intensity (H4+):** We hypothesise that a heightened intensity of internal R&D endeavours significantly and positively correlates with the adoption rate of innovative practices.

Within the purview of the Resource-Based View (RBV), the following Independent Variables are examined:

- **Resource-Based View (H5+):** It is hypothesised that possessing distinctive resources and capabilities, as underscored by RBV, markedly enhances the rate at which innovative practices are adopted.

- **Intellectual Property Protection (H6+):** Our postulation suggests that robust intellectual property protection significantly contributes to an elevated adoption rate of innovative practices.

In the context of the National Innovation System (NIS), the study explores the following Independent Variables:

- **Scale (H7+):** We hypothesise that a larger scale of the national innovation system significantly and positively influences the rate at which innovative practices are adopted.

- **Degree of Industry Diversity (H8+):** Our postulation posits that a heightened degree of industry diversity within the national innovation system substantially enhances the rate of adoption

- **Internationalisation (H9+):** It is hypothesised that increased internationalisation within the national innovation system significantly and positively impacts the rate at which innovative practices are adopted.

Several Control Variables are considered in this study:

- **Firm Size (Control-Firm Size):** Firm size is included as a control variable to mitigate its potential influence on the adoption rate.

- **Market Competition (Control-Market Competition):** Market competition is considered a control variable to assess its impact on the adoption rate.

- **Technological Infrastructure (Control-Technological Infrastructure):** Technological infrastructure is a control variable to evaluate its role in adoption dynamics.

- **Government Regulations (Control-Government Regulations):** Government regulations are added as a control variable to examine their influence on the adoption rate.



Figure 1. The dependent variable in the research and the related hypotheses

Summary

This research endeavours to meticulously discern and expound upon the principal catalysts propelling innovation in ICT product development. The discerned drivers encompass an array of pivotal factors, including the perception of relative advantage, technological preparedness, the intricacy of innovative undertakings, policies nurturing innovation, and collaborative ventures with external entities. Pursuing these determinants aligns coherently with the overarching objective of unravelling the multifaceted dynamics governing innovation within ICT organisations and Vietnam and Hungary's broader national innovation systems.

Also, the research will assess of how government policies and institutional support mechanisms impact innovation outcomes within Vietnam's and Hungary's ICT sectors. It seeks to uncover how government initiatives, such as tax incentives for research and development, influence the adoption of innovative practices within these countries.

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