Journal of Business and Management Sciences, 2024, Vol. 12, No. 2, 67-88
Available online at http://pubs.sciepub.com/jbms/12/2/1
Published by Science and Education Publishing
DOI:10.12691/jbms-12-2-1

The Effect of Information Technology on Innovative Performance with Mediation Role of Process Innovation Capability: Evidence from Egyptian SMEs

Hossam M. S. El-gharbawy[1,*], Aiman A. Ragab[2], Mohamed A. Ragheb[3], Mahmoud. Farouk[4]

[1]Arab Academy for Science, Technology and Maritime Transport, Graduate School of Business (AASTMT)
[2]Dean, Graduate School of Business (AASTMT), Egypt
[3]Dean, Cardiff Metropolitan University Programs (AASTMT), Egypt
[4]Dean of information systems and decision support (AASTMT), Egypt
*Corresponding author: hossam.elgharbawy73@gmail.com

Received February 04, 2024; Revised March 06, 2024; Accepted March 13, 2024

Abstract **Purpose** Egypt's strategic plan focuses on addressing new technologies and innovations in the SME sector. Information Technology (IT) is crucial for businesses to thrive in the digital landscape and drives innovation. IT infrastructure, including servers, storage systems, and networking equipment, supports operations. This study aims to evaluate the effect of IT on innovative performance, with the mediating role of process innovation capability. **Objective:** The aim of the study is to find out the impact of Information Technology on Innovative performance with Mediation Role of Process innovation capability: Evidence from Egyptian SMEs. The study will evaluate the role of IT flexibility, IT integration and IT agility in enhancing SMEs` innovative performance, capabilities and fostering their growth in today's technology-driven business environment. **Hypotheses:** This study evaluates variables from multiple perspectives to understand the relationship between Information Technology, Process Innovation capability, and Innovative Performance. IT measures are IT flexibility, integration and agility, aiming to gain deeper insights into the field of interest. **Design/Methodology:** The study proposes a research model based on extensive research and literature review, which simulates variables and their relationships. A research hypothesis is established, followed by quantitative methods to test objective theories. Variables are measured and analyzed using statistical procedures. The final report includes an introduction, literature and theory, methods, results, and discussion. the research population refers' to Egyptian SMEs and applied convenience sampling because of its high efficiency in terms of time, money and effort. **Findings:** In this study, the Amos 25 software package was used to perform the structural equation modelling (SEM) to investigate the inter - relationships between the variables constructs of the hypothesized model. And the results of data analysis showed that the Information Technology is measured by three dimensions (IT flexibility, IT integration and IT agility) significantly influence Innovative performance with Mediation Role of Process innovation capability: Evidence from Egyptian SMEs.

Keywords: *information technology, innovative performance, process innovation capability, Egyptian SMEs*

Cite This Article: Hossam M. S. El-gharbawy, Aiman A. Ragab, Mohamed A. Ragheb, and Mahmoud.Farouk, "The effect of Information Technology on Innovative Performance with Mediation Role of Process Innovation Capability: Evidence from Egyptian SMEs." Journal of Business and Management Sciences, vol. 12, no. 2 (2024): 67-88. doi: 10.12691/jbms-12-2-1.

1. Introduction

Several economies have been building up due to a strong and dynamic SME sector, like the Japanese & Italian economies, which SME sector play an important role in the economic growth. As consumers rapidly shift to online shopping and increasingly prefer rapid and convenient services, smaller businesses will need to adopt digital solutions to remain competitive and survive [1]. According to the survey of American and British enterprises, 90 percent of business leaders contended that IT and digital technology would increasingly contribute to developing the overall business of enterprises in the next ten years [2]. Countries around the world strive for socioeconomic prosperity, a key factor driving the country's economic development is sustainable growth among the local businesses. Based on the fourth Industrial Revolution (IR4.0), it is believed that innovation, with its information and communication technologies, (ICTs) can be the mechanism driving organizations towards increasing their productivity and performance [3].

In this regard, information technology (IT) seems more potent in aiding organizations to grow and become successful through improvements to revenue, reduction in operational costs and organizations' sustainability [4]. An innovation is the "implementation of a new or

significantly improved product (good or service) or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" [5].

An innovation remains a critical component driving organizations to collaborate with external resources [6]. The current study proposes that the process innovation capacity could serve as an enabler for innovation performance. Accordingly, this study posits process innovation capacity as a key driver to innovation performance [7]. Further to the above,

this study also examines the antecedents of process innovation capability which comprise: digitalization vision, IT flexibility, IT integration and IT agility by using IT sensing and IT responding. The purpose of this study is to determine key enablers towards improving innovation performance among local businesses in Egyptian SMEs.

This introduction aims to shed light on the effect of information technology on innovation performance among Egyptian SMEs, while considering the mediation role of process innovation capability. By understanding these dynamics, policymakers, managers, and researchers can gain insights into how to foster a conducive environment for IT-driven innovation in the Egyptian SME sector.

1.1. Problem Definition

Integrating of information technology into an existing organization is a significant and increasingly commonplace challenge. However, we do not know enough about the impact of IT in innovation performance in the organizations, Information technology encompasses a wide range of tools, systems, and processes that enable the acquisition, storage, retrieval, and analysis of information. It includes hardware, software, networks, and other digital technologies. The strategic use of IT has the potential to transform business operations, enhance competitiveness, and foster innovation. The study is aiming to investigate the impact of the utilization of the Information Technology on Innovative performance with Mediation Role of Process innovation capability: Evidence from Egyptian SMEs. The study will evaluate the role of IT flexibility, IT integration and IT agility in enhancing SMEs` innovative performance.

The research is putting the scope to study the above variables on the SME s (Small Medium Enterprise) working in Egypt. In developing countries, small and medium-sized businesses (SMEs) are typically seen as a powerful engine for long-term economic growth and jobs creation.

1.2. Research Questions

The researcher formulated the research questions for the SMEs working in Egypt:

1. What is the impact of IT on Innovative performance in the Egyptian SMEs?
2. What is the impact of IT on Process innovation capability in the Egyptian SMEs?
3. What is the impact of Process innovation capability on Innovative performance in the Egyptian SMEs?
4. What is the impact of process innovation when mediates the relation between IT and innovative performance in the Egyptian SMEs?

1.3. Research Scope

Small and Medium- sized Enterprises (SMEs) has become a cornerstone in national economies. They play a vital role in achieving economic development and eradicating unemployment. One can differentiate between small and medium-sized enterprises by measuring the number of employees and annual revenue. Looking at Egyptian SMEs, they have been growing since the 1990s. SMEs are defined by Egyptian laws as the enterprises whose capital ranges from EGP 50,000 to EGP 1 million with a maximum of 50 employees.

SMEs are indispensable for the holistic growth and development of any economy all over the world [8]. They play a significant role in the commercial activity of any country [9], the multi-facet activities performed by SMEs have directly or indirectly affected the economic acceleration of the country.

In Egypt, there are around 2.5 million SMEs [10] the research population is the front-line managers and executives of organizations operating in Egypt in the privet sector.

2. Literature Review

2.1. Information Technology (IT)

Information technology encompasses a wide range of tools, systems, and processes that enable the acquisition, storage, retrieval, and analysis of information. It includes hardware, software, networks, and other digital technologies. The strategic use of IT has the potential to transform business operations, enhance competitiveness, and foster innovation.

Small and medium-sized enterprises (SMEs) are pushed to introduce new technologies due to different requirements and changes in the business setting. The SMEs' transformation to exploit new technologies is challenging given their lack of resources and the complexity of technological transformation, which encompasses technology assimilation and business model innovation (BMI) [11] .

The current business setting characterized by environmental changes, new requirements, technological development, and new opportunities pushes SMEs to rethink their traditional production methods and introduce new technologies to remain competitive over time [12,13] Information technology is a crucial element in the creation of knowledge and new practices [14] by facilitating the rapid collection, storage, and exchange of knowledge [15]. A well-developed technology integrates new mechanisms and practices [16] that can eliminate barriers to communication among departments in an organization [17]. Firms with ITS can develop new sustainable mechanisms and green product innovation performance.

Recently, the digital economy has stormed the whole world and has attracted considerable attention from governments worldwide. It is gradually becoming the new focus of competition among countries, industries and enterprises. Currently, one of the most pressing challenges for enterprises is the integration and use of digital

technologies and no sector or organization is immune to effects of digital transformation [18].

Digital technologies have now found applications in optimizing production and distribution processes (e.g. artificial intelligence), enhancing managerial decision-making for market entry, targeting new customers more effectively, selecting relevant partners, bolstering advertising strategies, making more informed pricing decisions and predicting demand [19,20]. The Internet of Things (IoT), which entails the integration of sensors capable of collecting and processing data into smart products and devices, enabling them to communicate and interact with one another has also propelled industrial advancement.

Technology and innovation plays a crucial role in explaining the competitive potential of firms However, the implementation of technological innovation is not easy. Successful implementation of any technological initiative depends on its acceptance by the users.

Innovation is the key to maintain competitive advantage in a market and gain leadership. Open innovation is a pioneering mechanism with increasing number of studies in the literature [21] However, the study the explain effect of information technology IT in innovation performance with mediating process innovation capability.

2.2. Innovative Performance

An innovative performance plays an essential role in a successfully surviving business and becomes the key driver of competitive advantage for organizations. In other words, the creation of an innovative mindset develops and captures new value products or services, leads to the implementation of critical thinking solutions to new and old problems, and enables companies to stay ahead of their competitors [22]. SMEs must constantly be able to meet the needs of their customers and survive in the global market via an innovative mindset approach. An innovative mindset should be adopted by an entire organization, from the owner to hourly workers [23]. Innovation efforts encourage firms to produce products and services through social change, a lack of environmental pressures, cost-effectiveness to remain more profitable, to commercialize and compete globally [24]. According to [25]. innovation is "the successful adoption of novel ideas within an organization". Innovative performance helps SMEs gain and maintain a higher competitive advantage [26,27], found that internal R&D collaboration, absorptive capacity, and knowledge-sharing practices significantly affect SMEs' innovative performance.

[28] shown that Information technology is important to the business sector as a management tool to optimize the processing of information to produce goods and services for profit. Technological infrastructure affects the culture, efficiency and relationships of business. It also affects the security of confidential information and trade advantages.

Also Technological advances in the past few decades have greatly increased the competitive nature of the economic business world. Many companies have responded to these changes by automating their business processes and capturing industry-related information and using it to their advantage. Technology has also forced businesses to remain flexible, adapting their operations to newer and better technological advances [28].

Technological innovation, plays a significant role in promoting the sustainable development of firms, is also crucial to improving the global competitiveness of firms and even countries [29]. The internationalization and competitive globalization of firms has highlighted the more urgent requirements for accelerating scientific and technological innovation [30], which catalyzed global attention to technological innovation [31]. Especially in the era of the digital economy, the values brought by the open digital strategy pose challenges to firms' traditional innovation strategy [32,33]. Digital platforms, such as Alibaba Cloud Internet of Things (IoT) and Huawei Ocean-Connect build digital platform capabilities through information technology, enabling firms to access key external resources and enhance open innovation capabilities [33,34].

Digital platform capabilities refer to firms' abilities to establish connections with stakeholders based on the online platform of information and communication technology [33]. Firms are capable of supplying revolutionary data support and solutions in many areas to enhance the digital value proposition and digital benefits based on digital platforms [34,35]. Although digital platforms provide valuable exchanges between network participants at zero marginal cost [34]. [33] found that start-ups with digital platform capabilities can achieve innovative development. [36] pointed out that firms that still achieve innovation in the dynamic environment usually obtain complete digital platform strategies, which can help them prepare for necessary changes. Discussing the specific relationship between IT-based digital platform capabilities and firm innovation in the digital economy is necessary [37].

Most literature explained the importance of firms' information technology and digital platform capabilities to improve innovation from the perspective of dynamic capabilities. [33] believed that IT and digital platform capabilities could obtain innovation results by improving the alliance network capability of small and medium-size enterprises (SMEs). It is worth noting that digital platforms represent a more sophisticated form of information exchange technology, and they are fundamental in facilitating knowledge exchange between different partners.

According to [38,39] innovation performance covers two dimensions, namely: innovation radicalness and innovation volume. Innovation radicalness refers to innovations that are different from current offerings. Innovation volume, on the other hand, refers to the breadth or volume of innovations generated by an organization. According to [40], scholarship on innovation performance can be traced back to the 1990s. During that period, researchers were mainly examining new product development that was driven by management factors, such as leadership, teamwork, organizational structure and culture. Eventually, a new perspective of the innovation gained momentum, and this eventually became popular as studies began looking at absorptive capacity, and this finally led to innovation performance.

Focusing on innovation performance, [38]. examined the manufacturing sector while [39] studied the SMEs. Both studies considered innovation performance to be a necessity in order to gain "first mover advantage" before

their competitors participate in the game. Apart from that, innovation performance allowed organizations to channel their limited resources towards new product development. This has been endorsed by [40] who revealed that absorptive capacity mediates the relationship between decentralization and innovation performance. [41] affirms that knowledge-based dynamic capabilities influence innovative performance. [42] offers a new perspective that innovative performance can be further enhanced by organizational learning and inter-organizational communication through collaboration; while [43] on the other hand studied specifically the effects of research and development (R&D) collaboration with domestic and foreign partners outlining the types of collaborations that yield greater innovation performance. [39] explained that incremental innovation may help organizations to increase their innovation process. As more and more organizations embraced digital technologies, process innovation capabilities would be better enhanced.

2.3. IT Flexibility

Technology plays an important role in improving organizational competitive advantage, especially through the latest technologies within the IR4.0, such as big data and IoT. IT flexibility is regarded as the ease of modifying a new technology system or environment and the degree of share-ability and reusability of IT architecture. Through the flexibility of IT, organizations can further increase their performance and innovation levels. IT flexibility gives organizations the ability to quickly respond to unpredicted changes [43,44]. IT flexibility is more innovation-oriented and explorative when compared to it being a mere information sharing mechanism. [38] also regarded IT as a critical organizational resource with the potential to deploy innovation activities effectively. They also examined organizational IT strategy and open innovation strategy, and they asserted that greater innovation performance can be achieved when IT strategy is aligned with innovation strategy.

While IT flexibility and IT integration may be regarded as the tenets of IT strategies, IT flexibility also has the power to enable organizations to rapidly and economically adapt IT applications. IT integration facilitates organizations towards exchanging knowledge rapidly with collaborative partners. Based on their analysis, it was discovered that IT flexibility enhances innovation performance – both in terms of radicalness and volume. IT flexibility permitted organizations to develop many new innovations that are not readily available.

[46] explained IT flexibility from the perspective of modular systems theory. They believed that IT flexibility can be mediated by IT capabilities so as to increase competitive performance. Likewise, [47] also examined IT flexibility with strategic alignment that is mediated by connectivity. They discovered that connectivity is a key enabler which enhanced strategic alignment. [38,45] recommended that future studies focus on IT flexibility in other context by comparing it against process innovation capabilities. In this regard, the present study aims to investigate this relationship by formulating the related hypothesis.

2.4. IT Integration

[48,49] explained that IT integration is concerned with the technology of piecing together people's tasks, processes and systems within the supply chain, thereby facilitating effective monitoring and control. This would in turn, lead to greater management, better decision-making and improved performance. IT integration enables effective communications by ensuring that quality information is provided to key stakeholders in a timely manner. The wealth of information exchanged by key players along the supply chain cannot be underestimated. According to [38], IT integration can be defined as the ability of an organization to integrate the data, communication technologies and collaboration applications, with its external collaborative partners.

IT integration has been widely researched, not only in the business and management discipline, but also in many other fields. Nevertheless, marked transition can be easily experienced in the education discipline [50,51]. It has been observed by [52] that leaders and implementers have an important role to play in the success of IT integration.

This improves the process innovation capability, which in turn, leads to new innovations. Therefore, this study intends to investigate this relationship by formulating the related hypothesis.

2.5. IT Agility

Organizational agility has become a key aspect for global success. It allows organizations to respond to business threats and to identify and capitalize on opportunities in a timely manner. IT agility is not a new phenomenon; it has been studied for over two decades. The knowledge gained on IT agility today is vast, compared to twenty years ago. IT agility facilitates a sound decision-making process by providing pertinent data and garnering consensus decision-making [53]. Similarly, [54] also believes that IT agility, with respect to sensing and responding, can detect and later respond to changes rapidly. Sensing includes keeping and anticipating current IT innovations and trends that may affect the core business or provide new business opportunities. Strong sensing capabilities require established processes and dedicated resources to continuously acquire external knowledge and to disseminate this to the entire organization [55]. In contrast, IT responding is concerned with refining established technologies and processes so as to react effectively to the inflicted change.

[56] acknowledged that many studies have forwarded findings which indicate that IT agility enables organizations to perform continuous improvements and to uncover and grab business opportunities quickly and effectively. It is noted that today, IT is a trigger for innovation too. IT agility has been found to be the main driver of IT function's digitization support. IT agility is capable of enabling organizations to quickly modify and correct misalignments; it facilitates IT function to respond clearly to market opportunities.

[56] examined IT agility, IT function's digitization support and the moderating effect of IT ambidexterity. IT agility and IT ambidexterity were viewed as IT

capabilities that act in harmony to create value. In that respect, both IT agility and IT ambidexterity were treated as dynamic capabilities. [56] found that IT agility had a strong positive direct impact on IT function's digitization support, moderated by IT ambidexterity. It turns out that IT agility had a significantly higher impact on the IT function's digitization support that is used for ambidextrous IT orientations when compared to IT functions used for an exploration or exploitation focus.

Digitalization allows greater organizational agility; it also enables greater process innovation capabilities. Therefore, organizational agility is believed to be closely related to business processes and innovation. According to [57] the two most important attributes of IT agility are rapidness and innovativeness. IT agility is regarded as a higher-order dynamic capability that aids organizations into promptly sensing and responding to changes in customers, competitors and government regulations. IT agility has the potential to influence process innovation capability Based on this, the current study aims to investigate this relationship by formulating the related hypothesis.

2.6. Process Innovation Capability

Numerous studies have been conducted on a variety of industries over the years to examine the effects of process innovation capability and performance. [58] for example, examined the relationship between marketing performance and innovation capability and value creation among small and medium enterprises SMEs. [59] studied the effects of virtual skills and collective efficacy on process innovation capability and team performance among backpacker tourism. [60] examined the effects of process innovation on the relationship between business system leveraging and supply chain performance.

[61] revealed that innovation capability can positively influence green procurement implementation in the public sector of the United Arab Emirates (UAE), [62] who asserted that innovation capability was largely perceived as a vital source for generating sustainable competitive advantage. They also examined the determinants of innovation capability and their relationship with organizational performance in the banking sector of Jordan.

Innovation capability can be conceptualized as the potential to create novel and valuable products or knowledge. It is the firm's ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firms and stakeholders. [63] also stated that previous studies had been examining the manufacturing sector in general but no other industries. Thus, it was asserted that there is a need to include the service sector.

This encourages managers to consider information technology as a value network rather than a value chain. Many studies concluded that organizations' ability to increase their level of adaptability to current digital transformations tend to increase their ability to innovate and identify sustainable competitive advantages, ahead of their competitors. This was observed by researchers who examined the role of product and process innovation capabilities on improvement to new product performance.

In the case of process innovation capability, collaborations with research organizations and suppliers were the most important factors, Innovation capability (comprising product innovation capability and process innovation capability) was recognized as one of the most important internal resources that can result in superior firm performance. [64] also recommended that future studies examine process innovation capability and innovation performance. Innovation is about making something new, or changing to something different, while innovation capability is the ability to acquire and assimilate external knowledge which can be turned into new ideas. Innovation has a multidimensional concept that focusses on product, process and service. [65] believe that organizational innovation aids technological innovations. Process innovation capacity acts as an internal resource which enables efficiency of all other resources of an organization and it supports innovation. Therefore, this study aims to investigate this relationship by formulating the related hypothesis.

2.7. Research Hypothesis

In the research, four main hypotheses have been developed to be tested. The hypotheses were developed based on the previously presented literature and the previous research studies conducted in different contexts related to the effect of Information Technology on Innovative performance with Mediation Role of Process innovation capability: Evidence from Egyptian SMEs, the study hypotheses were formulated as below:

H1: Information Technology has an impact on innovative performance in the Egyptian SMEs.

H2: Information Technology has an impact on Process innovation capability in the Egyptian SMEs.

H3: Process innovation capability has an impact in innovative performance in the Egyptian SMEs.

H4: Process innovation capability mediates the relationship between Information Technology and Innovative performance in the Egyptian SMEs.

2.8. Research Conceptual Model

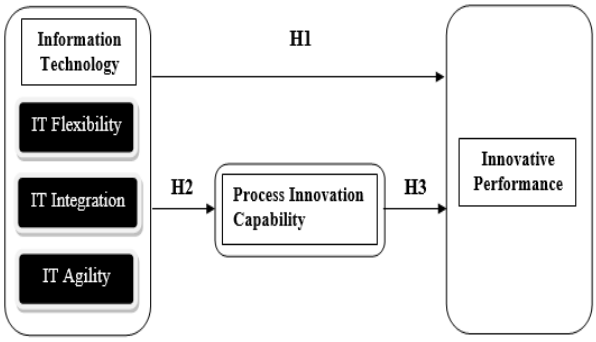

Figure 1. The Conceptual Framework

The conceptual framework was established after analyzing existing theories and models and was applied to the data collection and data analysis. The aim of this research was to gain a deeper insight into the field of interest by examining the relationship between the independent variable (Information Technology), mediator

variable (Process innovation capability) and dependent (Innovative performance) variable.

The variable " Information Technology " is measured by three dimensions (IT flexibility, IT integration and IT agility).

As demonstrated by Figure 1, the diagram is showing the main variables and the Hypothesis under the study.

3. Research Methodology

3.1. Population

The population of the study is defined by [66] as the collection of all items whether of objects or of events or of people, that are to be considered in a given problem situation. For the purpose of this research, the research population refers to Egyptian SMEs.

The dissertation will use a quantitative analysis using questionnaires distributed to specific samples working in EGYPT organizations. The aim of the questionnaire is exploring the relations between different dependent and independent variables and their sub-dimensions and the examining the existence of the mediating variable. where information will be converted into numbers and amounts to analyze the data using statistical techniques.

3.2. Sampling Method

There are two main methods used by researchers to choose appropriate sample: probability sampling and non-probability sampling. In the probability sampling, each case in the entire population has equal chance to be selected [67]. Probability sampling includes different methods, such as simple, stratified, systematic and cluster sampling [66]. Conversely, in the non-probability sampling, each case in the entire population does not have equal chance to be selected; this probability is not known [68].

Non-probability sampling also includes different methods such as convenience, quota and snowball sampling [67]. Among the aforementioned sampling strategies, this study applied convenience sampling because of its high efficiency in terms of time, money and effort. Convenience sampling encourages researchers to access the data through the easiest subjects, such as students, locals or Internet users. Moreover, convenience sampling givescountenance to purposive sample selection which meets the aim and objectives of this study [68] .

3.3. Data Collection

There are several data collection methods in survey strategies. In addition, the interview method can adopt various forms. In this section, firstly, the chosen survey strategy is introduced along with the reasons for the selection.

This research aims to conduct large-scale empirical investigation to validate its theoretical model and hypotheses. To achieve this aim, the self-administered questionnaire was chosen as the data collection method for several reasons.

Questionnaires are considered as one of the most appropriate data gathering tools to collect data from the large samples [68]; this method thus perfectly suits the aim of this study. Also, the questionnaire method is known to be efficient in terms of time and money [67]. Using the questionnaire method is very popular among business researchers [69].

In addition, this method is found convenient for both participants and researchers; participants can answer the questions quickly and researchers can code the questions for analysis in a short period of time [70]. However, telephone or face to face interview methods are not as easy as the self-administered questionnaire method; participants and researchers should arrange a suitable time and location to be able to conduct the research. This makes it difficult for researchers to reach a large audience. Therefore, the questionnaire is selected as the data collection method instead of telephone or face to face interviews.

The questionnaire was divided in two broad categories. The first category is made up of general information and the second category is the body of the questionnaire that includes four sections: first: Information Technology, included three dimensions (IT flexibility, IT integration and IT agility) Second section: Process innovation capability and Third section: Innovative performance. A Likert-scale was used to measure opinions as follows: Strongly Disagree (1), Disagree (2), Not sure (3), Agree (4), Strongly Agree (5).

The unit of analysis for this research is the individual, treating employee in Egyptian SMEs response as an individual data source. This sector is chosen primarily because of its close relationship with the unit in the current period of time.

4. Pilot Study

The research instrument will be pre-tested before final administration to the respondents. According to [66], pre-testing allows errors to be discovered before the actual collection of data begins 1% of the population is considered adequate for pilot study.

In this research, a pilot study was conducted in order to test the employed questionnaire. Testing the questionnaire before using it for data collection is an important step for researchers. Pilot study can be done by identifying a small group of participants who resemble the sample of full study. The aim of pilot testing is to notice the readability problems, to discover confusing instructions, and to uncover questions which make participants uncomfortable [67].

Through pilot tests, researchers can clarify the statements in the questionnaire and improve the flow of content; ultimately it allows researchers to increase reliability and validity of the questions [66]. This study, therefore, conducted a pilot study with 40 participants.

All participants were asked to fill in the questionnaire and provide feedback with regards to clarity and readability of questions in addition to the layout and flow. Consequently, critical feedback was obtained from the participants during the pilot study and the questionnaire was revised based on these comments. Some questions were clarified and some of them were repositioned. In addition, the layout and flow of the questions were edited in order to ensure that participants had no problems answering the questionnaire.

5. Data Analysis and Findings

5.1. Reliability Analysis

According to [67], reliability is most important to quantitative methods where researchers are concerned about whether the measures are stable or not. Reliability refers to the capability of repeating a study in order to reach consistency.

Table 1. The test re-test reliability

Variable	No of Items	Cronbach's Alpha (α)	Mark
IT flexibility	4 Questions	.920	Acceptable
IT integration	4 Questions	.786	Acceptable
IT agility	6 Questions	.921	Acceptable
Process innovation capability	6 Questions	.776	Acceptable
Innovative performance	6 Questions	.906	Acceptable
Overall Reliability	26 Questions	.942	Acceptable

The coefficient alpha, or Cronbach's alpha, is the usual measure of internal consistency of all model variables and the set of variables of the constructed model. Cronbach's alpha determines how all items that measure a specific variable are related to all other items and how all variables are related to each other to construct a model to get stable, consistent data to represent the research model. Cronbach's alpha reliability varies from 0 to 1, and a value of 0.6 or less generally indicates unsatisfactory internal consistency reliability and a value of 0.7 or higher indicates good reliability for the overall model variable's consistency.

According to [71], the closer the reliability coefficient gets to 1.0, the better. In general, reliabilities less than .60 are considered to be poor, those in the .70 range, acceptable, and those over .80 good.

Table 1 includes the test re-test reliability results by analysis of 40 questionnaires.

The minimum Cronbach's Alpha coefficient is .776, the maximum Cronbach's Alpha coefficient is .921 and the overall Cronbach's Alpha coefficient is .942 for the 26 items that were analyzed together. It therefore indicates that the research instrument used for this study is highly reliable as it is more than the generally accepted reliability score of 0.7.

5.2. Validity Analysis

[66] suggested four tests of validity for survey research. They are content validity, face validity, criterion validity and construct validity. Content validity seeks to test precisely the illegibility of the contents of the phenomenon under investigation. Face validity ensures that a test measures what it was set out to measure. Criterion validity is a measure of how well one variable or a set of variables predict an outcome based on information from other variables of the study. Finally, construct validity test how well the constructs measure the theoretical concept under investigation. To test for the content validity, copies of the draft questionnaire were first passed to the researcher's supervisor and three other academics. In order to test the research validity, the Spearman's rho test will be applied.

Spearman's rho, which is often represented with the Greek letter ρ, is designed to measure the strength and direction of the relationship between two ordinal variables, but is also used when one variable is ordinal and the other is interval/ratio. It is exactly the same as Pearson's r in terms of the outcome of calculating it, in that the computed value of rho will be either positive or negative and will vary between 0 and 1 [67].

Table 2 include the research validity test results by analysis of 40 questionnaires:

And the results as shown below indicate that the minimum Spearman's rho is .501 and the maximum Spearman's rho is .902. All have P-Value less than 0.05.

Table 2. include the research validity test results by analysis of 40 questionnaires

Variable	Question	No of Items	Spearman's rho	Significance level
IT flexibility	The IT systems in your organization are organized and integrated to allow for rapid changes	4 Questions	.859	.000
	The IT systems in your organization are highly scalable		.902	. .000
	The IT systems in your organization are designed to support new collaborative innovation relationships easily		.804	.000
	The IT systems in your organization can be easily extended to accommodate new applications or functions		.894	.000
IT integration	IT system in your organization can easily access data from innovation collaborators' systems	4 Questions	.755	.000
	IT system in your organization can provide seamless connection to the innovation collaborators' systems		.753	.000
	IT system in your organization have the capability to exchange real-time information with innovation collaborators		.704	.000
	IT system in your organization can easily aggregate relevant information from the innovation collaborators' databases		.750	.000

Variable	Question	No of Items	Spearman's rho	Significance level
IT agility	The IT team in your organization constantly seeks new ways to enhance the effectiveness of IT use in the organization	6 Questions	.775	.000
	The IT team in your organization anticipates changes and trends in IT that may affect your business		.808	.000
	The IT team in your organization commits resources for sensing new opportunities for the innovative use of IT in the business		.794	.000
	The IT team in your organization capable of and continues to proactively experiment with new IT.		.815	.000
	The IT team in your organization is able to quickly set up the IT infrastructure needed to collaborate with partners in ecosystems		.751	.000
	The IT team in your organization enables to swiftly respond to emerging opportunities in customer needs, markets and emerging		.736	.000
Process innovation capability	Your organization is able to create and manage a portfolio of interrelated technologies	6 Questions	.801	.000
	Your organization continuously develops programs to reduce production/services costs		.689	.000
	Your organization has valuable knowledge for innovating and technological processes		.696	.000
	Your organization assigns resources to the development of product/service department efficiently		.697	.000
	Your organization is able to offer environmentally friendly processes		.501	.000
	Your organization manages development of product/service efficiently		.803	.000
Innovative performance	In the last 3 years, your organization has performed worse/ better than competitors with regards to the number of new products/services launched	6 Questions	.812	.000
	In the last 3 years, your organization has performed worse/ better than competitors with regards to Pioneering the introduction of new products/ services (you were one of the first to introduce a new product/service)		.544	.000
	In the last 3 years, your organization has performed worse/ better than competitors with regards to the effort invested in the development of new products/services, taking into consideration the number of hours, people, teams and trainings		.745	.000
	In the last 3 years, your organization has performed worse/ better than competitors with regards to the number of introduced changes in processes		.810	.000
	In the last 3 years, your organization has performed worse/ better than competitors with regards to Pioneering newly introduced processes (you've been one of the first to introduce new processes)		.688	.000
	In the last 3 years, your organization has performed worse/ better than competitors with regards to Responding to new processes introduced by other companies in your field		.618	.000

5.3. Data Analysis

The data analysis process begins with data cleansing to verify that there are no missing values or outliers in the data. SPSS 25 program was used for data coding and screening in this investigation. The descriptive statistics of the collected data were then analyzed in the following phase. Following that, reliability tests were performed to determine the consistency of measurements.

Second section, presented a thorough analysis and discussion of findings from data collected through the questionnaire. Structural Equation Modelling (SEM) was employed by using AMOS 25 software in order to validate the theoretical model of the study by examine the causal relationships between Information Technology and Innovative performance mediated by Process

innovation capability.

Hence, two main sections, first, the descriptive statistics of results emanating from a questionnaire survey. These include: reports on analyses of the sample's characteristics for the survey; analysis of the response' rate and demographics analysis, which focuses on presents research variables (Information Technology (IT flexibility, IT integration and IT agility) is considered' as the independent variable, Process innovation capability is considered as the mediator variable and Innovative performance is considered as the dependent variable).

Structural Equation Modelling (SEM) was therefore adopted to examine the causal relationships between Information Technology (IT flexibility, IT integration and IT agility) and innovative performance mediated by Process innovation capability.

5.4. Descriptive Statistics

Descriptive statistics are used to describe the basic characteristics of the data in a study. They provide simple summaries about the sample and measures. Together with demographic analysis and simple graphics, they form the basis of virtually every quantitative analysis of data. Simple frequencies, means, standard deviations, and correlations between variables and histograms are used' to detect coding, errors, identify outliers, and check the distribution' of variables.

The research questionnaire was administered to seven hundred (700) respondents, 436 questionnaires representing 62.3% were returned, and 47 questionnaires representing 6.7% were incomplete or ineligible or refusals and 264 (37.7%) were not reached. There were 389 acceptable responses, a response rate 55.6%, which is highly adequate for the nature of this study. The summary of the analysis of the response rate in Table 3.

Table 3. Analysis of Response Rate

Questionnaire	Respondents	Percentage %)
Questionnaires Distributed	700	100%
unreachable	264	37.7%
Not accepted	47	6.7%
Accepted	389	55.6%

5.4.1. Demographics Analysis

Gender: The frequency of " Gender " indicates that the majority 299 of respondents are " Male" (76.9%), and the second 90 of respondents are "Female "(23.1%).

Age: The frequency of "age" of respondents indicates that the majority (128) of respondents "From 30 and less than 40 years", which 32.9%, The next highest age range is 29.3% have age "From 40 and less than 50 years", and the third age range is 24.7% have "Less than 30 Years".

Education: The frequency of "Education" of respondents indicates that the majority (236) of respondents have "Bachelor" degree, which 60.7%, The next highest Education level is 24.9% have "Master" degree, and the third Education level is 14.4% have "PHD- DBA" degree.

Year of Experience: These are divided in this research into four categories: Less than 1 year, 1 and less than 5 years, 5 and less than 10 years and 10 years and above. The frequency of Year of Experience indicates that the majority (292) 62.7% of respondents have "More than 10 Years" experience, the next highest experience is "From 1 to 5 Years", (89) 19.1 of respondents, 56 of respondents are "From 6 to 10 Years", indicate (12.0%), third highest.

A summary of the demographics of the respondents' selected for the study is presented in Table 4.

Table 4. Demographics analysis

Variables	Description	Frequency	Percentage (%)
Gender	Male	299	76.9
	Female	90	23.1
Age	Less than 30 Years	96	24.7
	From 30 and less than 40 years	128	32.9
	From 40 and less than 50 years	114	29.3
	50 years and above	51	13.1
Education	Bachelor	236	60.7
	Master	97	24.9
	PHD- DBA	56	14.4
Year of Experience	Less than 1 year	65	16.7
	1 and less than 5 years	117	30
	5 and less than 10 years	120	31
	10 years and above	87	22.3

5.5. Research Variables

Information Technology (IT flexibility, IT integration and IT agility) is considered as the independent variable, Process innovation capability is considered as the mediator variable and Innovative performance is considered as the dependent variable.

A frequency' table will be presented for each variable that includes both absolute and relative frequencies. Such frequencies will be a measure of a participation's response opinion towards factors of each dimension with a scale' from 1 to 5, where 1 refers to "Strongly Disagree", which means that employee is totally unsatisfied with a specific' dimension, while 5 refers to "Strongly Agree", which means that the employee is totally satisfied with a specific dimension.

5.5.1. Independent Variable: Information Technology

The variable "Information Technology " is measured by three dimensions (IT flexibility, IT integration and IT agility).

IT flexibility

According to Table 5, see results when: -

" The IT systems in your organization are organized and integrated to allow for rapid changes " (IT flexibility 1).

" The IT systems in your organization are highly scalable " (IT flexibility 2).

" The IT systems in your organization are designed to support new collaborative innovation relationships easily" (IT flexibility 3).

" The IT systems in your organization can be easily extended to accommodate new applications or functions" (IT flexibility 4).

IT integration

According to Table 6, see results when: -

" IT system in your organization can easily access data

from innovation collaborators' systems" (IT integration 1).

" IT system in your organization can provide seamless connection to the innovation collaborators' systems " (IT integration 2).

"IT system in your organization have the capability to exchange real-time information with innovation collaborators" (IT integration 3).

"IT system in your organization can easily aggregate relevant information from the innovation collaborators' databases" (IT integration 4).

IT agility

According to Table 7, see results when: -

" The IT team in your organization constantly seeks new ways to enhance the effectiveness of IT use in the organization" (IT agility 1).

" The IT team in your organization anticipates changes and trends in IT that may affect your business" (IT agility 2).

" The IT team in your organization commits resources for sensing new opportunities for the innovative use of IT in the business " (IT agility 3).

" The IT team in your organization capable of and continues to proactively experiment with new IT" (IT agility 4).

" The IT team in your organization is able to quickly set up the IT infrastructure needed to collaborate with partners in ecosystems" (IT agility 5). " The IT team in your organization enables to swiftly respond to emerging opportunities in customer needs, markets and emerging" (IT agility 6).

Table 5. IT flexibility

	IT flexibility1		IT flexibility2		IT flexibility3		IT flexibility4	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	12	3.1	11	2.8	11	2.8	16	4.1
Disagree	8	2.1	8	2.1	5	1.3	27	6.9
Neutral	84	21.6	58	14.9	41	10.5	107	27.5
Agree	140	36.0	143	36.8	125	32.1	108	27.8
Strongly Agree	145	37.3	169	43.4	207	53.2	131	33.7
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**

Table 6. IT integration

	IT integration1		IT integration2		IT integration3		IT integration4	
	Frequency	Percent	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	16	4.1	18	4.6	8	2.1	10	2.6
Disagree	24	6.2	29	7.5	11	2.8	14	3.6
Neutral	89	22.9	101	26.0	62	15.9	78	20.1
Agree	124	31.9	119	30.6	129	33.2	156	40.1
Strongly Agree	136	35.0	122	31.4	179	46.0	131	33.7
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**

Table 7. IT agility

	IT agility1		IT agility2		IT agility3	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	3	.8	1	.3	3	.8
Disagree	120	30.8	7	1.8	7	1.8
Neutral	207	53.2	120	30.8	131	33.7
Agree	59	15.2	200	51.4	192	49.4
Strongly Agree	3	.8	61	15.7	56	14.4
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**

	IT agility4		IT agility5		IT agility6	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	2	.5	10	2.6	12	3.1
Disagree	8	2.1	125	32.1	117	30.1
Neutral	126	32.4	189	48.6	195	50.1
Agree	189	48.6	65	16.7	65	16.7
Strongly Agree	64	16.5	10	2.6	12	3.1
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**

5.5.2. Mediator Variable: Process Innovation Capability

According to Table 8, see results when: -

"Your organization is able to create and manage a portfolio of interrelated technologies " (Process innovation capability 1).

" Your organization continuously develops programs to reduce production/services costs" (Process innovation capability 2).

" Your organization has valuable knowledge for innovating and technological processes" (Process innovation capability 3).

" Your organization assigns resources to the development of product/service department efficiently" (Process innovation capability 4).

" Your organization is able to offer environmentally friendly processes" (Process innovation capability 5).

" Your organization manages development of product/service efficiently" (Process innovation capability 6).

5.5.3. Dependent Variable: Innovative Performance Variable

According to Table 9, see results when: -

"In the last 3 years, your organization has performed worse/ better than competitors with regards to the number of new products/services launched" (Innovative performance 1).

"In the last 3 years, your organization has performed worse/ better than competitors with regards to Pioneering the introduction of new products/ services (you were one of the first to introduce a new product/service)" (Innovative performance 2).

"In the last 3 years, your organization has performed worse/ better than competitors with regards to the effort invested in the development of new products/services, taking into consideration the number of hours, people, teams and trainings" (Innovative performance 3).

"In the last 3 years, your organization has performed worse/ better than competitors with regards to the number of introduced changes in processes" (Innovative performance 4). "In the last 3 years, your organization has performed worse/ better than competitors with regards to Pioneering newly introduced processes (you've been one of the first to introduce new processes)" (Innovative performance 5).

" In the last 3 years, your organization has performed worse/ better than competitors with regards to Responding to new processes introduced by other companies in your field" (Innovative performance 6).

5.6. Structural Equation Modelling (SEM)

In this study, the Amos 25 software package was used to perform the structural equation modelling (SEM) to investigate the inter - relationships between the 5 constructs of the hypothesized model. The SEM is a statistical technique that allows assessment of both direct and indirect effects of each variable on the other variables.

According to [72], Hypotheses Testing Following a confirmatory factor analysis, the valuation of the structural model through testing of the hypotheses underlying our research model was conducted. The SEM technique was chosen because of the nature of the research model and test hypotheses, and due to the mediating effects.

Table 8. Process innovation capability

	Process innovation capability1		**Process innovation capability2**		**Process innovation capability3**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	15	3.9	12	3.1	14	3.6
Disagree	13	3.3	22	5.7	22	5.7
Neutral	76	19.5	93	23.9	83	21.3
Agree	146	37.5	137	35.2	135	34.7
Strongly Agree	139	35.7	125	32.1	135	34.7
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**
	Process innovation capability4		**Process innovation capability5**		**Process innovation capability6**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	20	5.1	11	2.8	11	2.8
Disagree	22	5.7	15	3.9	16	4.1
Neutral	103	26.5	50	12.9	64	16.5
Agree	122	31.4	129	33.2	129	33.2
Strongly Agree	122	31.4	184	47.3	169	43.4
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**

Table 9. Innovative performance

	Innovative performance1		**Innovative performance 2**		**Innovative performance3**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	11	2.8	10	2.6	13	3.3
Disagree	23	5.9	15	3.9	25	6.4
Neutral	90	23.1	123	31.6	101	26.0
Agree	156	40.1	133	34.2	127	32.6
Strongly Agree	109	28.0	108	27.8	123	31.6
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**
	Innovative performance 4		**Innovative performance 5**		**Innovative performance 6**	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Strongly Disagree	10	2.6	22	5.7	8	2.1
Disagree	22	5.7	39	10.0	28	7.2
Neutral	99	25.4	129	33.2	88	22.6
Agree	144	37.0	108	27.8	143	36.8
Strongly Agree	114	29.3	91	23.4	122	31.4
Total	**389**	**100.0**	**389**	**100.0**	**389**	**100.0**

5.6.1. Measurement Model

Structural equation modelling (SEM) is a multivariate technique which combines multiple regression with confirmatory factor analysis (CFA) to examine the series of dependence relationship simultaneously of the hypothesized model. SEM has two mechanisms, namely measurement model and structural model. The measurement model is basically meant for the reliability and validity of the latent variables and observed variables, and the structural model is concerned with the path strength and relationship among the latent variable [72].

According to [73], The estimations of the parameters and the overall fit index of the measurement model are based on the maximum likelihood (ML) method. The basic conditions assumed for the use of ML estimation are met or closely approximated in the thesis. Further, the sample is sufficiently large (n=389), over the recommended size of 384 cases, the scale of observed variables is continuous, and no violations of multivariate normality are found in the survey responses.

To test the measurement model, a CFA is conducted by using AMOS 25.0. Figure 2 shows the measurement model which consists of 5 latent variables, namely, IT flexibility, IT integration, IT agility, Process innovation capability and Innovative performance

These 5 latent variables are measured by 36 observed variables. As presented in Table 10 the standardized loading of the measurement items to assess the internal consistency of the constructs in the measurement model. The level of internal consistency for each construct was acceptable, with the standardized loading ranging from 0.539 to 0.924 which exceeded the minimum hurdle of 0.50.

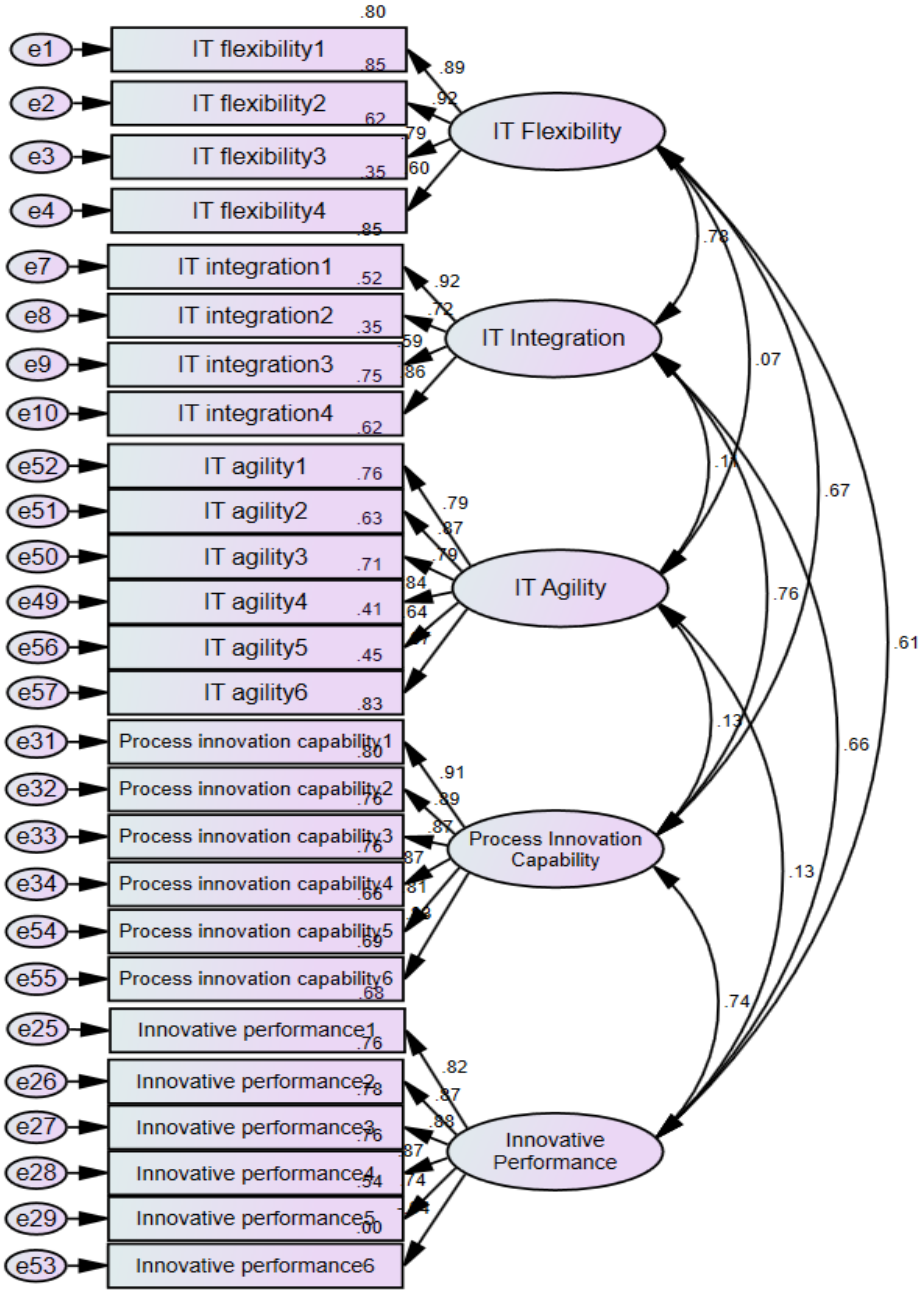

Figure 2. Measurement model – CFA

Table 10. Item Loading

Variable	Construct and Item	Standardized Loading
IT flexibility	The IT systems in your organization are organized and integrated to allow for rapid changes	.894
	The IT systems in your organization are highly scalable	.924
	The IT systems in your organization are designed to support new collaborative innovation relationships easily	.790
	The IT systems in your organization can be easily extended to accommodate new applications or functions	.595
IT integration	IT system in your organization can easily access data from innovation collaborators' systems	.921
	IT system in your organization can provide seamless connection to the innovation collaborators' systems	.718
	IT system in your organization have the capability to exchange real-time information with innovation collaborators	.589
	IT system in your organization can easily aggregate relevant information from the innovation collaborators' databases	.864
IT agility	The IT team in your organization constantly seeks new ways to enhance the effectiveness of IT use in the organization	.789
	The IT team in your organization anticipates changes and trends in IT that may affect your business	.874
	The IT team in your organization commits resources for sensing new opportunities for the innovative use of IT in the business	.791
	The IT team in your organization capable of and continues to proactively experiment with new IT.	.842
	The IT team in your organization is able to quickly set up the IT infrastructure needed to collaborate with partners in ecosystems	.642
	The IT team in your organization enables to swiftly respond to emerging opportunities in customer needs, markets and emerging	.609
Process innovation capability	Your organization is able to create and manage a portfolio of interrelated technologies	.833
	Your organization continuously develops programs to reduce production/services costs	.810
	Your organization has valuable knowledge for innovating and technological processes	.873
	Your organization assigns resources to the development of product/service department efficiently	.871
	Your organization is able to offer environmentally friendly processes	.894
	Your organization manages development of product/service efficiently	.909
Innovative performance	In the last 3 years, your organization has performed worse/ better than competitors with regards to the number of new products/services launched	.823
	In the last 3 years, your organization has performed worse/ better than competitors with regards to Pioneering the introduction of new products/ services (you were one of the first to introduce a new product/service)	.872
	In the last 3 years, your organization has performed worse/ better than competitors with regards to the effort invested in the development of new products/services, taking into consideration the number of hours, people, teams and trainings	.885
	In the last 3 years, your organization has performed worse/ better than competitors with regards to the number of introduced changes in processes	.874
	In the last 3 years, your organization has performed worse/ better than competitors with regards to Pioneering newly introduced processes (you've been one of the first to introduce new processes)	.736
	In the last 3 years, your organization has performed worse/ better than competitors with regards to Responding to new processes introduced by other companies in your field	.539

According to [72], The measurement' model enables the researcher to use several' variables (indicators) for a single independent or dependent' variable. In a Confirmatory' Factor Analysis (CFA), the researcher' can assess the contribution' of each scale item as well as incorporate how well the scale' measures the concept (reliability). The scales are then integrated into the estimation' of the relationships between dependent and independent' variables in the structural model. This procedure is similar to performing a factor analysis of the scale items and using the factor scores in the regression.

Composite Reliability (CR) is used to measure the reliability of a construct in the measurement model. CR is a more presenting way of overall reliability and it determines the consistency of the construct itself [72].

Table 6.3 shows the CR of (IT flexibility = 0.882, IT integration =0.816, IT agility=0.898, Process innovation capability = 0.947 and Innovative performance =0.874). So, it clearly identified that in measurement model all construct have good reliability.

Measurement items have standardized loading estimates of 0.5 or higher (ranging from 0.539 to 0.924 at the alpha level of 0.05, indicating the convergent validity of the measurement model. Discriminant validity shows the degree to which a construct is actually different from other constructs [72].

The Average Variances Extracted (AVE) should always above 0.50 [72]. Table 6.3 shows that average variances extracted (AVE) of the particular constructs (IT flexibility = 0.658, IT integration =0.614, IT agility=0.597, Process innovation capability = 0.750 and Innovative performance =0.588) are more than 0.500. Overall, these measurement results are satisfactory and suggest that it is appropriate to proceed with the evaluation of the structural model.

Table 11. Item Loading

Variable	Composite Reliability CR	Average Variances Extracted AVE	Maximum Reliability MaxR(H)	IT Agility	IT Flexibility	IT Integration	Innovative Performance	Process Innovation Capability
IT Agility	0.898	0.597	0.913	0.773				
IT Flexibility	0.882	0.658	0.923	0.067	0.811			
IT Integration	0.861	0.614	0.910	0.109†	0.779***	0.784		
Innovative Performance	0.874	0.588	0.930	0.126*	0.606***	0.665***	0.767	
Process Innovation Capability	0.947	0.750	0.951	0.126*	0.669***	0.758***	0.742***	0.866

Furthermore, the existence of discriminant validity was shown in the model. According to [74], to guarantee the discriminant validity, the square root of the AVE measures must be superior to all the correlations among all the constructs. As Table 11 shows, the square root of the AVE (main diagonal) is in all cases superior to the correlations among the constructs, which shows discriminant validity.

In addition, [75] indicate that discriminant validity is evident when the correlation between the two constructs is not higher than their respective composite reliabilities (CR). Table 11 shows that the correlations have values inferior to their respective reliabilities. Therefore, all the constructs support the discriminant validity of the scales used.

5.6.2. Assessment of Multicollinearity

Multicollinearity refers to a situation in which one independent variable is actually a combination of the other variables or when the independent variables are highly correlated (Pallant, 2016). The occurrence of multicollinearity among the exogenous latent constructs can potentially affect the estimates of regression coefficients and the statistical significance tests [72].

Specifically, multicollinearity upturns the standard errors of the coefficients, which leads to decrease in the predictive power of the independent variables on the dependent variables [76]. This is due to the reason that the variables cancel out each other.Tolerance and Variance Inflation Factor (VIF) were examined to identify multicollinearity issue. [77] recommended that multicollinearity is a concern if VIF value is higher than 5 and tolerance value is <0.20. Table 4.10 indicates that multicollinearity did not exist among the exogenous latent constructs as all VIF values were <5 and tolerance values exceeded 0.20 as suggested by [77]. Thus, multicollinearity is not an issue in the present study. Table 12 shows the VIF values and tolerance values.

Table 12. Assessment of Multicollinearity

Variable	Tolerance	VIF
IT flexibility	.488	2.048
IT integration	.486	2.056
IT agility	.994	1.006

5.6.3. Model Fit

In SEM, there is several Fitness Indexes that reflect how fit is the model to the data at hand. However, there is no agreement among researchers which fitness indexes to use [72] recommend the use of at least one fitness index from each category of model fit. There are three model fit categories namely absolute fit, incremental fit, and parsimonious fit.

The model fit indices like the Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Degrees of Freedom (DF), Chi-Square/ Degrees of Freedom χ^2/DF), Chi-Square χ^2) and Root Mean Square of Error Approximation

(RMSEA) were chosen to evaluate the model fit [78]. The model fit indices of the structural model and the cut-off value of those fit indices are presented in Table. The goodness-of-fit statistics show that the structural model fit the data reasonably well.

Table 13 provides the Goodness of Fit (GOF) Measures.

Table 13 Goodness of Fit Measures

Name of Category	Goodness of Fit Measures	Name of index	Level of acceptance
Absolute Fit	Chi-Square	χ^2	> 0.05
	Root Mean' Square Error of Approximation	RMSEA	<.08
Parsimonious Fit	Degrees of Freedom	DF	≥ 0
	Chi-Square/ Degrees of Freedom	χ^2/DF	≤ 3
Incremental Fit	Comparative Fit' Index	CFI	≥ .90
	Tucker Lewis Index	TLI	≥ .90

According to [73], Model estimating is commonly achieved in research using Weighted Least Squares (WLS), Generalized Least Square (GLS), Asymptomatic Distribution Free (ADF), and Maximum Likelihood Estimating (MLE). However, the estimations of the parameters and the overall fit index of the measurement model are based on the maximum likelihood (ML) method. The basic conditions assumed for the use of ML estimation [73] are met or closely approximated in the study.

Table 14 provides the measurement model result – CFA

Measurement Model Summary

The 5 factor was subjected to CFA using the AMOS software. DF was 283 (it should be more than 0), χ^2/DF has a value of 2.071, that is less than 3.0 (it should be less

than or equal 3.0). The RMSEA was .053 (it should be less than 0.08). The TLI index was .954 which is very close to 1.0 (a value of 1.0 indicates perfect fit). The CFI was .960. All indices are close to a value of 1.0 in CFA, indicating that the measurement models provide good support for the factor structure determined through the CFA. Table 14.

Table 14. Measurement' model result

Goodness of Fit Measures	Name of index	Model Result	Remark
Chi-Square	χ^2	585.967	accepted
Degrees of Freedom	DF	283	accepted
Chi-Square/ Degrees of Freedom	χ^2/DF	2.071	accepted
Comparative Fit' Index	CFI	.960	accepted
Tucker Lewis Index	TLI	.954	accepted
Root Mean' Square Error of Approximation	RMSEA	.053	accepted

5.6.4. Structural Model

Structural equation modelling (SEM) is a family of statistical models that seek to explain the relationships among multiple variables. In doing so, it examines the structure of interrelationships expressed in a series of equations, similar to a series of multiple regression equations. These equations depict all of the relationships among constructs (the dependent and independent variables) involved in the analysis. Constructs are unobservable or latent factors represented by multiple variables (much like variables representing a factor in factor analysis). Thus far each multivariate technique has been classified either as an interdependence or dependence technique, SEM can be thought of as a unique combination of both types of techniques because SEM's foundation lies in two familiars multivariate techniques: factor analysis and multiple regression analysis [72].

According to [78] Structural equation modelling includes many key steps. In addition to data collection, the steps are model Specification, Identification, Estimation, Testing and modification.

Figure 3 shows the Structural Model (Final Result)

5.6.5. The Structural Model Validity-final Result

Table 15 provides the structural' model (final Result)

Table 15. Structural' model - final Result

Goodness of Fit Measures	Name of index	Model Result	Remark
Chi-Square	χ^2	925.246	accepted
Degrees of Freedom	DF	395	accepted
Chi-Square/ Degrees of Freedom	χ^2/DF	2.342	accepted
Comparative Fit' Index	CFI	.938	accepted
Tucker Lewis Index	TLI	.931	accepted
Root Mean' Square Error of Approximation	RMSEA	.059	accepted

Structural Model Summary

The results of structural' model using the AMOS software, shows that DF was 395 (it should be more than 0), χ^2/DF has a value of 2.342, that is less than 3.0 (it should be less than or equal 3.0). The RMSEA was .059 (it should be less than 0.08). The TLI index was .931 which is very close to 1.0 (a value of 1.0 indicates perfect fit). The CFI was .938. All indices are close to a value of 1.0 in CFA, indicating that the measurement models provide good support for the factor structure determined through the CFA. Table 15.

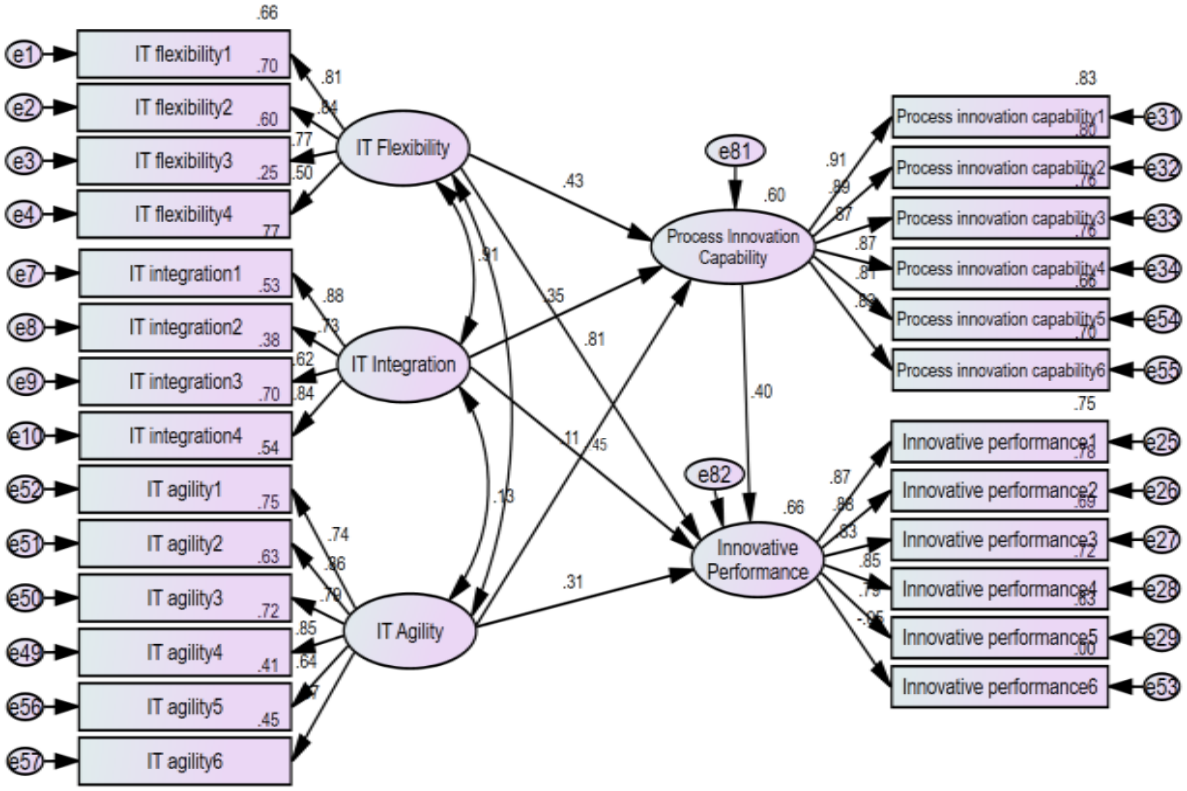

Figure 3. Structural Model

5.6.6. Direct and Indirect (Mediating) Effects

According to [72]. The relationships between the latent variables indicate that the significance and strength of each of the hypothesized effects developed for this research model accurately, capturing a well model fit for the model. Overall, the fitness of a model measurement exceeded the common acceptable level.

Direct effects

Table 16 and Figure 3 present the results; the individual tests of significance of the relationship between the variables. It reveals that,

$H1_{.1}$: As expected, a relationship between IT flexibility and Innovative performance (β = 0.807, CR (Critical Ratio) = 26.431, CR > 1.96, p = 0.000, p<0.05). Therefore, (H1.1: IT flexibility has an impact on Innovative performance in Egyptian SMEs.) is supported.

$H1_{.2}$: IT integration has an impact on Innovative performance in Egyptian SMEs. (β = 0.447, CR (Critical Ratio) = 6.247, CR > 1.96, p = 0.000, p<0.05). is supported, as it predicts that " There is a relationship between IT integration and Innovative performance. ".

$H1_{.3}$: IT agility has an impact on Innovative performance in Egyptian SMEs. (β = 0.305, CR (Critical Ratio) = 12.124, CR > 1.96, p = 0.000, p<0.05). is supported, as it predicts that " There is a relationship between IT agility and Innovative performance. ".

Based on the results of "**$H1_{.1}$:** IT flexibility has an impact on Innovative performance in Egyptian SMEs", "**$H1_{.2}$:** IT integration has an impact on Innovative performance in Egyptian SMEs" and "**$H1_{.3}$:** IT agility has an impact on Innovative performance in Egyptian SMEs", "**H1:** Information Technology has an impact on Innovative performance in Egyptian SMEs" is supported.

Moreover, the result shows that:

$H2_{.1}$: IT flexibility has an impact on Process innovation capability in Egyptian SMEs. (β = 0.428, CR (Critical Ratio) = 2.395, CR > 1.96, p = 0.017, p<0.05). is supported, as it predicts that " There is a relationship between IT flexibility and Innovative performance.".

$H2_{.2}$: IT integration has an impact on Process innovation capability in Egyptian SMEs. (β = 0.351, CR (Critical Ratio) = 17.489, CR > 1.96, p = 0.000, p<0.05). is supported, as it predicts that " There is a relationship between IT integration and Innovative performance.".

$H2_{.3}$: IT agility has an impact on Process innovation capability in Egyptian SMEs. (β = 0.111, CR (Critical Ratio) = 6.473, CR > 1.96, p = 0.000, p<0.05). is supported, as it predicts that " There is a relationship between IT agility and Process innovation capability. ".

Based on the results of "**$H2_{.1}$:** IT flexibility has an impact on Process innovation capability in Egyptian SMEs.", "**$H2_{.2}$:** IT integration has an impact on Process innovation capability in Egyptian SMEs." and "**$H2_{.3}$:** IT agility has an impact on Process innovation capability in Egyptian SMEs", "**H2:** Information Technology has an impact on Process innovation capability in Egyptian SMEs" is supported.

The result shows that H3: Process innovation capability has an impact on Innovative performance in Egyptian SMEs. (β = 0.403, CR (Critical Ratio) = 3.283, CR > 1.96, p = 0.001, p<0.05). is supported, as it predicts that " There is a relationship between Process innovation capability and Innovative performance. ".

Table 16. Hypothesized path of the final structural equation model

Hypothesized path			Estimate	Critical Ratio (C.R)	P-Value
Process innovation capability	<---	IT flexibility	.428	2.395	.017
Process innovation capability	<---	IT integration	.351	17.489	.000
Process innovation capability	<---	IT agility	.111	6.473	.000
Innovative performance	<---	IT flexibility	.807	26.431	.000
Innovative performance	<---	IT integration	.447	6.247	.000
Innovative performance	<---	IT agility	.305	12.124	.000
Innovative performance	<---	Process innovation capability	.403	3.283	.001

Results shows in Table 17 show that the estimated structural model corroborated the seven hypotheses, as Information Technology (IT flexibility, IT integration and IT agility)

Construct explained 60.0% of Process innovation capability variance (R^2 = 0.600), Besides, Information Technology (IT flexibility, IT integration and IT agility) through Process innovation capability explained 66.1% of Innovative performance variance (R^2 = 0.661).

Table 17. Coefficient of determination

Variables	Coefficient of determination R^2
Process innovation capability	.600
Innovative performance	.661

Indirect (Mediating) effect

In order to test the mediating effects, this thesis employed the bootstrapping procedure and identified whether the direct relationship of Information Technology and Innovative performance through Process innovation capability is statistically significant.

According to [79] mediation analysis, the researcher must first establish that there is statistical significance between the dependent and independent variables. there must be a positive and significant relationship between the relationship between (Information Technology (IT flexibility, IT integration, and IT agility and Innovative performance). Secondly, the researcher must show that there is a statistical significance between the independent variable and the mediating variable. there must be a positive and significant correlation between (Information Technology (IT flexibility, IT integration and IT agility) and Process innovation capability).

Then, the researcher must illustrate a statistical significance between the mediating variable and the dependent variable. there must be a positive and significant correlation between Process innovation capability and Innovative performance. Finally, the researcher must look at the direct effect after controlling for the mediating variable. If the inclusion of the mediator

nullifies the direct relationship, there is full mediation; otherwise, mediation is partial or absent. The direct effect results Table 18 confirm that:

-The direct effect between IT integration and Innovative performance is statistically significant.

-The direct effect between IT flexibility and Innovative performance is statistically significant.

-The direct effect between IT agility and Innovative performance is statistically significant.

-The direct effect IT integration and Process innovation capability is statistically significant.

-The direct effect between IT flexibility and Process innovation capability is statistically significant.

-The direct effect between IT agility and Process innovation capability is statistically significant.

-The direct effect between Process innovation capability and Innovative performance is statistically significant.

Table 18. Standardized Direct Effects

Variables	IT Agility	IT Integration	IT Flexibility	Process Innovation Capability
Process innovation capability	.111	.351	.428	.000
Innovative performance	.305	.447	.807	.403

Then, Table 19 and Table 20 reveals:

1. a statistically significant indirect effect between IT flexibility and Innovative Performance Through Process innovation capability (P = 0.015, P<0.05), The results of the mediation effect indicate that there is partial mediation effect of the Process innovation capability between the relationship of IT flexibility and Innovative performance. Therefore, (H4.1: Process innovation capability mediates the relationship between IT flexibility and Innovative performance in Egyptian SMEs)is supported.

2. a statistically significant indirect effect between IT integration and Innovative performance Through Process innovation capability (P = 0.006, P<0.05), The results of the mediation effect indicate that there is partial mediation effect of the Process innovation capability between the relationship of IT integration and Innovative performance. Therefore, (H4.2: Process innovation capability mediates the relationship between IT integration and Innovative performance in Egyptian SMEs) is supported.

3. a statistically significant indirect effect between IT agility and Innovative performance Through Process innovation capability (P = 0.006, P<0.05), The results of the mediation effect indicate that there is partial mediation effect of the Process innovation capability between the relationship of IT agility and Innovative performance. Therefore, (H4.3: Process innovation capability mediates the relationship between IT agility and Innovative performance in Egyptian SMEs) is supported.

Based on the results of "H4.1: Process innovation capability mediates the relationship between IT flexibility and Innovative performance in Egyptian SMEs, H4.2: Process innovation capability mediates the relationship between IT integration and Innovative performance in Egyptian SMEs and H4.3: Process innovation capability mediates the relationship between IT agility and Innovative performance in Egyptian SMEs. Therefore, (H4: Process innovation capability mediates the relationship between Information Technology and Innovative performance in Egyptian SMEs) is supported.

Table 19. Standardized Indirect Effects

Variables	IT Agility	IT Integration	IT Flexibility	Process Innovation Capability
Process innovation capability	.000	.000	.000	.000
Innovative performance	.145	.141	.172	.000

Table 20. Mediating Significant

Mediating Pass	Significant (P value)
Effect IT flexibility on Innovative performance Through Process innovation capability	.015
Effect IT integration on Innovative performance Through Process innovation capability	.006
Effect IT agility on Innovative performance Through Process innovation capability	.006

A summary of the standardized path coefficients and direction of the hypothesized paths is shown in Table 6.8, Table 6,12 and Table 21 The significance' of the path coefficients has been analyzed using one-tailed significance ($p < 0.05$). It shows that all the hypothesized paths were supported by the result and significant at 5% significance level.

Table 21. Summary of Results

Hypotheses	Results
H1: Information Technology has an impact on Innovative performance in Egyptian SMEs.	Supported
$H1_{.1}$: IT flexibility has an impact on Innovative performance in Egyptian SMEs	Supported
$H1_{.2}$: IT integration has an impact on Innovative performance in Egyptian SMEs	Supported
$H1_{.3}$: IT agility has an impact on Innovative performance in Egyptian SMEs	Supported
H2: Information Technology has an impact on Process innovation capability in Egyptian SMEs.	Supported
$H2_{.1}$: IT flexibility has an impact on Process innovation capability in Egyptian SMEs	Supported
$H2_{.2}$: IT integration has an impact on Process innovation capability in Egyptian SMEs	Supported
$H2_{.3}$: IT agility has an impact on Process innovation capability in Egyptian SMEs	Supported
H3: Process innovation capability has an impact on Innovative performance in Egyptian SMEs.	Supported
H4: Process innovation capability mediates the relationship between Information Technology and Innovative performance in Egyptian SMEs.	Supported
$H4_{.1}$: Process innovation capability mediates the relationship between IT flexibility and Innovative performance in Egyptian SMEs	Supported
$H4_{.2}$: Process innovation capability mediates the relationship between IT integration and Innovative performance in Egyptian SMEs	Supported
$H4_{.3}$: Process innovation capability mediates the relationship between IT agility and Innovative performance in Egyptian SMEs	Supported

6. Conclusion

IT empowers Egyptian SMEs with vast information, enabling them to identify opportunities, develop

innovative products, stay competitive potential to drive growth and competitiveness. It also facilitates collaboration, knowledge sharing, and innovation, fostering a culture of best practices.

Furthermore, IT enables SMEs to reach wider markets and customers. Digital technologies, such as e-commerce platforms, social media, and online marketing tools, offer Egyptian SMEs the ability to expand their customer base beyond geographical boundaries. This increased market reach provides SMEs with opportunities to test and launch new products, gather customer feedback, and iterate their offerings based on real-time data. By leveraging IT, SMEs can engage with customers more effectively, tailor their products to specific market segments, and deliver personalized experiences, all of which contribute to improved innovation performance.

Lastly, IT can enhance the overall agility and adaptability of Egyptian SMEs. In a rapidly changing business environment, SMEs need to be responsive to market dynamics and customer demands. IT solutions enable SMEs to quickly adapt their strategies, modify their processes, and pivot their business models.

In this research, the model proposed Based on the conceptual framework concerning the relationship between the independent variable (Information Technology), mediator variable (Process innovation capability) and dependent (Innovative performance) variable.

The variable " Information Technology " is measured by three dimensions (IT flexibility, IT integration and IT agility)

Shown below Figure 4:

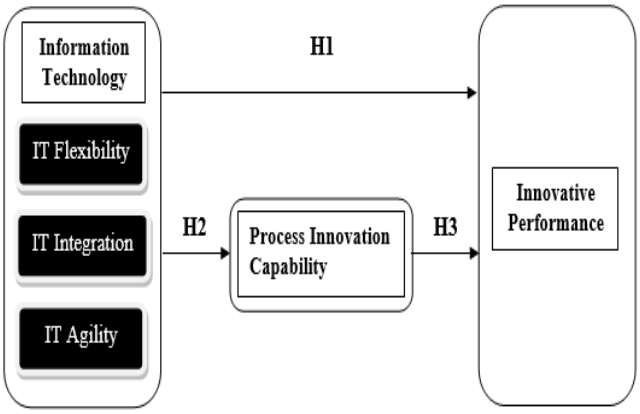

Figure 4. The Proposed Model

The empirical results presented demonstrate that this model explains

The relationship between the variables of the proposed model, and this will contribute to the following conclusions that will lead to answers to research questions evolved about SMEs working in Egypt.

1. What is the impact of IT on Innovative performance in the Egyptian SMEs?

For many organizations, information technology IT can be a driving factor of change and had a significant impact on the innovative performance of small and medium-sized enterprises (SMEs) in Egypt some key ways in which IT has influenced innovation in Egyptian SMEs:

-Enhanced Communication and Collaboration by IT tools such as email, instant messaging, and video conferencing have improved communication,

-Access to vast amounts of information and knowledge through the internet. This has enabled them to stay updated with the latest trends, market demands, and technological advancements,

-Improved Efficiency and Productivity such as enterprise resource planning (ERP) software, customer relationship management (CRM) tools, and project management software, SMEs can allocate more time and resources to innovation-related activities,

-Market Research and Analytics using IT has facilitated market research and data analysis, allowing SMEs to gather insights about customer preferences, behavior, and market trends,

-E-commerce and Digital Marketing; IT has enabled SMEs to expand their customer base through e-commerce platforms and digital marketing strategies, allowing them to showcase innovative products,

-Cloud computing offers SMEs affordable access to advanced IT infrastructure and services, enabling them to focus on innovation activities, thereby reducing their overall IT costs,

- Enhanced Customer Experience; IT has enabled SMEs to personalize their interactions with customers through various channels, such as websites, mobile apps, and social media platforms.

2. What is the impact of IT on Process innovation capability in the Egyptian SMEs?

Information Technology (IT) has had a significant impact on the process innovation capability of small and medium-sized enterprises (SMEs) in Egypt. Here are some key ways in which IT has influenced process innovation in Egyptian SMEs:

-Automation and Streamlining; SMEs can streamline their business processes through IT tools like ERP software, which automates functions like inventory management, procurement, production planning, and financial management, reducing manual errors and enhancing efficiency.

-Data Management and Analysis; IT aids in SMEs by enabling data collection, storage, and analysis through data management systems and analytics tools,

-Supply Chain Management; IT has significantly improved supply chain management in SMEs by facilitating real-time information sharing, inventory management, demand forecasting, and logistics optimization.

-Quality Control and Assurance; IT enhances quality control and assurance in SMEs through quality management software and digital tools, enabling timely defect identification and corrective actions.

-Continuous Improvement and Lean Practices; IT aids in continuous improvement methodologies like Lean and Six Sigma, enabling process data analysis, waste identification, and improvement initiatives.

-Process Standardization and Replication: IT standardizes processes across SME units, ensuring consistency, reducing variation, and replicating successful practices, enhancing efficiency, reducing errors.

The impact of IT on process innovation capability in Egyptian SMEs varies based on factors like adoption level, availability of skilled IT professionals, sector, and innovation culture, but IT significantly enhances process innovation and competitiveness.

3. What is the impact of Process innovation capability on Innovative performance in the Egyptian SMEs?

The process innovation capability of small and medium-sized enterprises (SMEs) in Egypt has a significant impact on their innovative performance. Here are some key ways in which process innovation capability influences innovation in Egyptian SMEs, specifically in the tube industry:

-Efficiency and Cost Reduction; Process innovation enables SMEs to optimize operations and improve efficiency. It involves implementing efficient production, supply chain management, and quality control measures.

-Productivity and Output Improvement; Process innovation in the tube industry can boost productivity and output for SMEs by implementing new technologies, automation, and improved workflow processes.

-Quality Enhancement; Process innovation involves continuous improvement and quality control measures, enhancing the quality of tube products for SMEs. This enhances market recognition and success of the SME.

-Flexibility and Adaptability; Process innovation allows SMEs to adapt to market changes and customer demands by continuously improving and refining their processes.

-Speed to Market; Process innovation in SMEs can significantly shorten the time needed to develop new tube products, thereby reducing lead times, accelerating time-to-market, and maximizing market opportunities.

-Collaboration and Knowledge Sharing; Process innovation often involves collaboration with external partners, suppliers, or research institutions, enabling SMEs to access specialized knowledge and technologies.

-Continuous Improvement Culture; Process innovation in SMEs fosters a culture of continuous improvement by encouraging employees to identify and suggest improvements, leveraging collective knowledge and experience.

The impact of process innovation capability on innovative performance in Egyptian SMEs in the tube industry may vary based on factors like adoption level, technology integration, skilled personnel access, and industry context, but it significantly enhances their competitiveness.

4. What is the impact of process innovation when mediates the relation between IT and innovative performance in the Egyptian SMEs?

Process innovation can play a significant mediating role between Information Technology (IT) and innovative performance in Egyptian SMEs. Here's how process innovation can impact the relationship between IT and innovative performance:

- Enhancing IT Implementation; Process innovation in SMEs can enhance the implementation of IT solutions by improving existing processes, creating a supportive environment, and aligning workflows and structures.

-Leveraging IT for Process Optimization; process innovation allows SMEs to optimize their operations by leveraging IT tools and systems. This can streamline operations, automate tasks and improve efficiency. Integration of ERP systems, CRM software, and data analytics tools.

-Enabling Data-Driven Innovation; IT solutions offer SMEs valuable data and analytics capabilities, enabling process innovation. By incorporating data collection, analysis, and utilization, SMEs can generate actionable insights, identify trends, and make informed decisions.

-Facilitating Collaboration and Knowledge Process innovation in SMEs fosters collaboration and knowledge sharing among employees, departments, and stakeholders through IT-enabled platforms.

-Improving Agility and Adaptability; Process innovation in SMEs allows them to adapt to market changes and technological advancements by creating flexible structures that leverage IT capabilities. This combination enhances their performance in the dynamic Egyptian business landscape.

Process innovation in Egyptian SMEs optimizes IT solutions, enables data-driven innovation, facilitates collaboration, improves agility, and drives continuous improvement. By innovating processes and leveraging IT capabilities, SMEs can unlock their full potential for innovation and enhance performance.

In conclusion, the effect of information technology on innovation performance for Egyptian SMEs encompasses improved communication, market intelligence, customer experience, risk management, and sustainability. By embracing IT, SMEs can drive collaboration, gain market insights, enhance customer interactions, manage risks, and contribute to a sustainable future.

6.1. Contributions of Research

In this study, it utilized the measurement tools studied in previous researches for the three main variables, and built a new model including an each variable as a separate construct the purpose of doing that is to study all the relationship between all components of each variable trying to enrich the literature with enough data on how to stimulate the ability of the organization to glorify the ability of information technology as independent variable and is measured by three dimensions (IT flexibility, IT integration and IT agility), mediating variable (Process innovation capability) and dependent (Innovative performance) variable.

Many researches have been conducted on building the conceptual model that describes. The relationship between the 3 variables under the scope in this study, with no complete definition in depth has been made for the effect of information technology IT on Innovative performance with Mediation Role of Process innovation capability: Evidence from Egyptian SMEs The findings of the study added new understanding to the literature affirming that information technology IT and Process innovation capability are determinants of Innovative performance and that information technology IT develops better capabilities of Innovative performance by enhancing its Process innovation capability on the Egyptian SMEs.

The findings of this dissertation have several implications for SMEs working in the Egyptian market. The study results highlighting the relationship between information technology and the Innovative performance suggest that SMEs in Egypt should be aware of the mediating effect of Process innovation capability for advanced Innovated performance. SMEs should ensure proper improvements of each component or dimension of IT by three dimensions (IT flexibility, IT integration and IT agility) and Process innovation capability to have the best practice of the Innovative performance.

6.2. Limitations of Research

While this research has successfully investigated the

effect of Information Technology on Innovative performance with Mediation Role of Process innovation capability: Evidence from Egyptian SMEs there are several limitations that need to be acknowledged.

1. The data for the research was collected from SMEs working in EGYPT, that can assume a wide range of variation between the responses depending on the volume and sector the SME is operating at Egypt
2. Due to limited information about the topic in Egypt, the study depended on data collected from previous researches and published reports within the context of the study to build up the dissertation framework.
3. Data were generated among the SME's operating in Egypt. Therefore, the results are limited to this Egyptian framework and caution should be exercised in attempting to draw generalizations to other contexts.

6.3. Direction for Future Research

1- Studying the proposed model's success to explain the variable " Information Technology " as measured by three dimensions (IT flexibility, IT integration and IT agility) future researches should be conducted to enhance the predictive power of independent variables, through investigation of other factors that might explain the innovative performance in Egypt for example strategic risk management in Egypt.

2- Process Innovation capability as mediating variable in the study; more studies should be conducted to tackle down additional dimensions that can be used in improving the innovative performance.

3- Future researches should be conducted about the impact of the variables in this study for each sector of business separately as it might be having more insights for how to increase the innovative performance differentiated by the sector of business.

4- As the culture and communication of the staff is a common factor between the variables, the researcher suggests a focusing study on the linkage between the culture and communication of the organization's staff and the ability to improve the innovation of the organization.

References

[1] Queiroz, M.M., Wamba, S.F., Machado, M.C. and Telles, R. (2020), "Smart production systems drivers for business process management improvement", Business Process Management Journal.

[2] D. Bonnet, P. Ferraris, G. Westerman and A. McAfee, "Talking 'bout a revolution," Digital Transformation Review, 2012.

[3] Backhaus, S.K.H. and Nadarajah, D. (2019), "Investigating the relationship between industry 4.0 and productivity: a conceptual framework for Malaysian manufacturing firms", Procedia Computer Science, Vol. 161 No. 2019, pp. 696-706.

[4] Leonhardt, D., Haffke, I., Kranz, J. and Benlian, A. (2017), "Reinventing the IT function: the role of IT agility and IT ambidexterity in supporting digital business transformation. Reinventing the IT -function: the role of IT agility and IT ambidexterity in supporting digital business transformation", Proceedings of the 25th European Conference on Information Systems (ECIS), Guimar~aes, pp. 968-984.

[5] Oslo Manual, OECD (2005), Guidelines for Collecting and Interpreting Innovation Data, 3rd ed.,available at: http://www.oecd.org/ (accessed 18 April 2020).

[6] Kaya, B., Abubakar, A.M., Behravesh, E., Yildiz, H. and Mert, I.S. (2020), "Antecedents of innovative performance: findings from PLS-SEM and fuzzy sets (fsQCA)", Journal of Business Research,Vol. 114, pp. 278-289.

[7] Camis_on, C. and Villar-L_opez, A. (2014), "Organizational innovation as an enabler of technological.innovation capabilities and firm performance", Journal of Business Research, Vol. 67 No. 1,pp. 2891-2902.

[8] Blumentritt, T. and Danis, W.M. (2006), "Business strategy types and innovative practices", Journal of Managerial Issues, Vol. 18 No. 2, pp. 274-291.

[9] Jutla, D., Bodorik, P. and Dhaliwal, J. (2002), January, "Government support for the e-readiness of small and medium sized enterprises", Proceedings of the 35th Annual Hawaii International Conference on System Sciences, IEEE, p. 11.

[10] H. Elsaid, C. Zaki and M. Elsaid, "Small and Medium Enterprises Landscape in Egypt: New Facts from a New Dataset," Journal of Business and Economics, 2014.

[11] Camila Silva de Mattos and Giustina Pellegrini "Systematic literature review on technological transformation in SMEs" *Management Review Quarterly*, 2023.

[12] Paoloni P, Modafari G, Paoloni N, Ricci F (2022) The strategic role of intellectual capital components in agri-food frms. Br Food J 124: 1430–1452.

[13] Priyono A, Moin A, Putri VNAO (2020) Identifying digital transformation paths in the business model of SMEs during the covid-19 pandemic. J Open Innov Technol Market Complex 6(4): 1–22.

[14] Lee H, Choi B (2003) Knowledge management enablers, processes, and organizational performance: an integrative view and empirical examination. J Manag Inf Syst 20(1): 179–228.

[15] Roberts J (2000) From know-how to show-how? Questioning the role of information and communication technologies in knowledge transfer. Technol Anal Strateg Manag 12(4): 429–443.

[16] Gold AH, Malhotra A, Segars AH (2001) Knowledge management: an organizational capabilities perspective. J Manag Inf Syst 18(1): 185–214.

[17] Medina-Molina C, Rey-Moreno M, Felício JA, Romano Paguillo I (2019) Participation in crowdfunding among users of collaborative platforms. RMS 13(3): 529–543.

[18] T. Hes, C. B. A. MAtt and F. Wiesböck, "Options for formlating a digital transformation strategy," *MIS executive quarterly*, 2017.

[19] Kraus, S., Palmer, C., Kailer, N., Kallinger, F.L. and Spitzer, J. (2019a), "Digital entrepreneurship: a research agenda on new business models for the twenty-first century", International Journal of Entrepreneurial Behavior and Research, Vol. 25 No. 2, pp. 353-375.

[20] Watson, G.F., IV, Weaven, S., Perkins, H., Sardana, D. and Palmatier, R.W. (2018), "International market entry strategies: relational, digital, and hybrid approaches", Journal of International Marketing, Vol. 26 No. 1, pp. 30-60.

[21] Abdul-Hadi G "Open innovation management: challenges and prospects",2012.

[22] McLaughlin, L., & McLaughlin, J. (2024). Moving beyond the innovation mindset. In: Making employee-driven innovation achievable (pp. 53–71). Routledge.

[23] Kuczmarski, T. D. (1996). Fostering an innovation mindset. Journal of Consumer Marketing, 13(6), 7–13.

[24] Harsono, A. A., & Fitri, S. (2020). Innovation mindset: SMES vs startups. International Journal of Business and Economy, 2(2), 54–61.

[25] Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the Work Environment for Creativity. Academy of Management Journal, 39(5), 1154–1184.

[26] Tojeiro-Rivero, D., & Moreno, R. (2019). Technological cooperation, R&D outsourcing, and innovation performance at the frm level: The role of the regional context. Research Policy, 48(7), 1798–1808.

[27] Yuen, Y. Y., & Ng, X. P. (2021). Enhancing innovation performance of small and medium enterprises in Malaysia. Management Science Letters, 11(3), 887–894.

[28] Mohamed Nowfal, S. &., and S. Manoj. "The Role of Information Technology in the Business Sector." Shanlax International Journal of Management, vol. 6, no. S1, 2018, pp. 126–130.

[29] Bae, J. and Lee, J.M. (2021), "How technological overlap between spinouts and parent firms affects corporate venture capital

investments in spinouts: the role of competitive tension", Academy of Management Journal, Vol. 64 No. 2, pp. 643-678.

[30] Freixanet, J., Rialp, A. and Churakova, I. (2020), "How do innovation, internationalization, and organizational learning interact and co-evolve in small firms? A complex systems approach",Journal of Small Business Management, Vol. 58 No. 5, pp. 1030-1063.

[31] Bahl, M., Lahiri, S. and Mukherjee, D. (2021), "Managing internationalization and innovation tradeoffs in entrepreneurial firms: evidence from transition economies", Journal of World Business,Vol. 56 No. 1, 101150.

[32] Almunawar, M.N. and Anshari, M. (2021), "Digital enabler and value integration: revealing the expansion engine of digital marketplace", Technology Analysis and Strategic Management,Advance Online Publications, pp. 1-11.

[33] Cenamor, J., Parida, V. and Wincent, J. (2019), "How entrepreneurial SMEs compete through digital platforms: the roles of digital platform capability, network capability and ambidexterity",Journal of Business Research, Vol. 100, pp. 196-206.

[34] Helfat, C.E. and Raubitschek, R.S. (2018), "Dynamic and integrative capabilities for profiting from innovation in digital platform-based ecosystems", Research Policy, Vol. 47 No. 8,pp. 1391-1399.

[35] Blaschke, M., Haki, K., Aier, S. and Winter, R. (2018), Capabilities for Digital Platform Survival: Insights from a Business-To-Business Digital Platform, Association for Information Systems, San Francisco.

[36] Jun, W., Nasir, M.H., Yousaf, Z., Khattak, A., Yasir, M., Javed, A. and Shirazi, S.H. (2021), "Innovation performance in digital economy: does digital platform capability, improvisation capability and organizational readiness really matter?", European Journal of Innovation Management, Advance Online Publications.

[37] Ferreira, J.J., Fernandes, C.I. and Ferreira, F.A. (2019), "To be or not to be digital, that is the question:firm innovation and performance", Journal of Business Research, Vol. 101, pp. 583-590.

[38] Cui, T., Ye, H.J., Teo, H.H. and Li, J. (2015), "Information technology and open innovation: a strategic alignment perspective", Information and Management, Vol. 52 No. 3, pp. 348-358.

[39] Parida, V., Westerberg, M. and Frishammar, J. (2012), "Inbound open innovation activities in high-tech SMEs: the impact on innovation performance", Journal of Small Business Management, Vol. 50 o. 2, pp. 283-309.

[40] Rangus, K. and Slavec, A. (2017), "The interplay of decentralization, employee involvement and absorptive capacity on firms' innovation and business performance", Technological Forecasting and Social Change, Vol. 120 No. 2017, pp. 195-203.

[41] Zotoo, I.K., Lu, Z. and Liu, G. (2020), "Big data management capabilities and librarians' innovative performance: the role of value perception using the theory of knowledge-based dynamic capability", The Journal of Academic Librarianship, available at: https://www.sciencedirect.com/science/article/abs/pii/S0099133320301634 (accessed 18 April 2020).

[42] Kaya, B., Abubakar, A.M., Behravesh, E., Yildiz, H. and Mert, I.S. (2020), "Antecedents of innovative performance: findings from PLS-SEM and fuzzy sets (fsQCA)", Journal of Business Research,Vol. 114, pp. 278-289.

[43] Kafouros, M., Love, J.H., Ganotakis, P. and Konara, P. (2020), "Experience in R&D collaborations, innovative performance and the moderating effect of different dimensions of absorptive capacity", Technological Forecasting and Social Change, Vol. 150, p. 119757.

[44] Han, J., Wang, Y. and Naim, M. (2017), "Reconceptualization of information technology flexibility forsupply chain management: an empirical study", International Journal of Production Economics,Vol. 187 No. 2017, pp. 196-215.

[45] Li, B. (2015), "The effects of new technology flexibility on innovation performance in the postimplementationage", International Journal of Business and Social Science, Vol. 6 No. 5, pp. 22-27.

[46] Mikalef, P., Pateli, A. and van de Wetering, R. (2016), "IT flexibility and competitive performance: the mediating role of IT-enabled dynamic capabilities", Proceedings of the 24th European Conference on Information Systems (ECIS), AIS Electronic Library (AISeL), p. 176.

[47] Jorfi, S., Nor, K.M. and Najjar, L. (2017), "An empirical study of the role of IT flexibility and IT apability in IT-business strategic alignment", Journal of Systems and Information Technology, Vol. 19 Nos 1/2, pp. 2-21.

[48] Baskerville, R., Rowe, F. and Wolff, F.C. (2018), "Integration of information systems and cyber security countermeasures: an exposure to risk perspective", ACM SIGMIS - Data Base: The DATABASE for Advances in Information Systems, Vol. 49 No. 1, pp. 33-52.

[49] Mishra, S.K., Jena, M.C., Pradhan, S. and Sekhar, H. (2018), "Integration of information technology with supply chain management for a strategic change", International Research Journal of Engineering and Technology (IRJET), Vol. 5 No.11, pp. 1760-1764.ff.

[50] Vongkulluksn, V.W., Xie, K. and Bowman, M.A. (2018), "The role of value on teachers' internalization of external barriers and externalization of personal beliefs for classroom technology integration", Computers and Education, Vol. 118 No. 2018, pp. 70-81.

[51] Natsis, A., Papadopoulos, P. and Obwegeser, N. (2018), "Research integration in information systems education: students' perceptions on learning strategies, skill development, and performance", Journal of Information Technology Education: Research, Vol. 17 No. 1, pp. 345-363.classroom technology integration", Computers and Education, Vol. 118 No. 2018, pp. 70-81.

[52] Christensen, R., Eichhorn, K., Prestridge, S., Petko, D., Sligte, H., Baker, R. and Knezek, G. (2018),"Supporting learning leaders for the effective integration of technology into schools",Technology, Knowledge and Learning, Vol. 23 No. 3, pp. 457-472.

[53] Hoffmann, D., Ahlemann, F. and Reining, S. (2020), "Reconciling alignment, efficiency, and agility in IT project portfolio management: recommendations based on a revelatory case study",International Journal of Project Management, Vol. 38 No. 2, pp. 124-136.

[54] Kuusisto, M. (2017), "Organizational effects of digitalization: a literature review", International Journal of Organization Theory and Behaviour, Vol. 20 No. 03, pp. 341-362.

[55] Kranz, J.J., Hanelt, A. and Kolbe, L.M. (2016), "Understanding the influence of absorptive capacity and ambidexterity on the process of business model change–the case of on-premise and cloudcomputingsoftware", Information Systems Journal, Vol. 26 No. 5, pp. 477-517.

[56] Leonhardt, D., Haffke, I., Kranz, J. and Benlian, A. (2017), "Reinventing the IT function: the role of IT agility and IT ambidexterity in supporting digital business transformation. Reinventing the IT function: the role of IT agility and IT ambidexterity in supporting digital business transformation", Proceedings of the 25th European Conference on Information Systems (ECIS), Guimar~aes, pp. 968-984.

[57] Panda, S. and Rath, S.K. (2017), "The effect of human IT capability on organizational agility: an empirical analysis", Management Research Review, Vol. 40 No. 7, pp. 800.

[58] Zulfikar, R., Kartini, D., Suryana, Y. and Mulyana, A. (2017), "The impact of capability innovation to marketing performance through value creation at the center of small and medium knitting industry in bandung", International Journal of Scientific and Research Publications, Vol. 7 No. 5, pp. 530-541.

[59] Yeh, C.C. and Ku, E.C. (2019), "Process innovation capability and subsequent collaborative team performance in travel planning: a knowledge exchange platform perspective", Current Issues in Tourism, Vol. 22 No. 1, p. 107-126.

[60] Chang, H.H., Wong, K.H. and Chiu, W.S. (2019), "The effects of business systems leveraging on supply chain performance: process innovation and uncertainty as moderators", Information and Management, Vol. 56 No. 6, pp. 103140-103157.

[61] AlNuaimi, B.K. and Khan, M. (2019), "Public-sector green procurement in the United Arab Emirates: innovation capability and commitment to change", Journal of Cleaner Production, Vol. 233,pp. 482-489.

[62] Al-kalouti, J., Kumar, V., Kumar, N., Garza-Reyes, J.A., Upadhyay, A. and Zwiegelaar, J.B. (2020), "Investigating innovation capability and organizational performance in service firms", Strategic Change, Vol. 29 No. 1, pp. 103-113.

[63] Saunila, M. (2014), "Innovation capability for SME success: perspectives of financial and operational performance", Journal of Advances in Management Research, Vol. 11 No. 2, pp. 163-175.

[64] Najafi-Tavani, S., Najafi-Tavani, Z., Naud_e, P., Oghazi, P. and Zeynaloo, E. (2018), "How collaborative innovation networks

affect new product performance: product innovation capability, process innovation capability, and absorptive capacity", Industrial Marketing Management, Vol. 73 No. 2018, pp. 193-205.

[65] Camis_on, C. and Villar-L_opez, A. (2014), "Organizational innovation as an enabler of technological innovation capabilities and firm performance", Journal of Business Research, Vol. 67 No. 1, pp. 2891-2902.

[66] Saunders, m., lewis, p., & thornhill, a. (2023). research methods for business students (7th ed.). pearson.

[67] Bryman, a., & bell, e. (2011). business research methods (3rd ed.). oxford university press.

[68] Saunders, m., lewis, p., & thornhill, a. (2019). research methods for business students (7th ed.). pearson.

[69] Collis, j., & hussey, r. (2009). business research methods: a guide to management research (3rd ed.). palgrave macmillan.

[70] Gray, d. e. (2014). doing research in the real world (4th ed.). sage publications.

[71] Sekaran, u., & bougie, r. (2016). research methods for business: a skill-building approach (6th ed.). john wiley & sons.

[72] Hair, J., C.Black, W., J.Babin, B., & E.Anderson, R. (2019). 'Multivariate Data Analysis' (8th ed.). England: Pearson Prentice.

[73] Byrne, b. m. (2016). structural equation modeling with amos: basic concepts, applications, and programming (3rd ed.). routledge.

[74] Fornell, c. and larcker, d. (1981), "evaluating structural equation models with unobservable variables and measurement error", journal of marketing research, vol. 18 no. 1, pp. 39-50.

[75] O'Cass, a., & ngo, h. (2007). a study of the measurement properties of brand trust in the context of e-commerce. european journal of marketing, 41(1/2), 19-35.

[76] Tabachnick, B.G., Fidell, L.S. (2018), Using Multivariate Statistics. 7th ed. New Jersey: Pearson Education Inc.

[77] Hair, J., Ringle, C. and Sarstedt, M. (2011) PLS-SEM: Indeed a Silver Bullet. Journal of Marketing Theory and Practice, 19, 139-151.

[78] Thakkar, j. (2020). model fit assessment in structural equation modeling: a review of fit indices. international journal of psychological research, 13(1), 1-10.

[79] Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology, 51, 1173-1182.