# Sales and product innovation: The mediating role of distributor's supply chain collaboration via technological and organizational environment

# ABSTRACT

This study examines the influence of Information Communication Technologies (ICT), business, and technological environments on collaboration among distributors (as mediators) and customers, focusing on the impact on sales performance and product innovation. The analysis, executed using Smart PLS 4 software, encompasses 372 European survey responses. Findings underscore distributors' transformative role in facilitating customer engagement, revealing that while ICT and the business and technological environments can independently generate value within distributor-customer interactions, active distributor participation considerably enhances this process, leading to notable improvements in sales and product innovation. This research fills a current knowledge gap concerning the multidimensional value generation by distributors beyond traditional roles, emphasising their crucial contribution to driving product and sales innovation across varied market types. Therefore, it highlights the essential role of distributors in creating additional organizational value, providing significant insights for academia and industry.

# Keywords

Information Communication Technologies; Business Environments; Technological Environments; Distributors; Customer; Sales Innovation; Product Innovation.

# Introduction

The role of distributors in supply chains has traditionally been considered in a limited context, with little regard for their influence beyond distribution functions (Cheshmberah et al., 2011; Dolgui & Ould-Louly, 2002; Hernández-Espallardo et al., 2011; Sun et al., 2020; Takata, 2019). However, emerging literature has begun challenging this narrative, proposing that distributors can leverage a customer-driving marketing strategy to significantly impact their markets (Ghauri et al., 2016). This strategy is anchored in the ability of distributors to anticipate and respond proactively to changing customer demand and requirements by innovating their product and service offerings (Wang et al., 2021). Moreover, by fostering collaborations with customers, distributors can gain insights into customer expectations, carve new market niches, and enhance customer satisfaction and value creation (Blocker et al., 2011; Monczka et al., 2020; Van Weele, 2018). This adaptive approach falls within the theoretical framework of dynamic capabilities (Blocker et al., 2011; Gupta et al., 2020; Wang et al., 2021).

Distributors play a significant intermediary role, influenced by product characteristics, target market, and competitive environment (Park & Keh, 2003). These distributors act as intermediaries, purchasing bulk from manufacturers and selling smaller quantities to retailers (Takata, 2019). As independent entities in the manufacturer's distribution chain, they can notably impact several aspects of their collaboration with the organization, including knowledge enhancement, collaborative importance innovation strategies, and organizational performance (Hernández-Espallardo et al., 2011).

Nevertheless, suppliers prefer to distribute products directly and indirectly to customers, cutting the distributor’s profit (Huang et al., 2018). The combination of direct and indirect approach increase access to customer information and changing demand (Vinhas & Anderson, 2005). In contrast, the distributors' market decreases since customers can now order products and services directly from the supplier, reducing distributor performance (Homburg et al., 2014). Despite keen interest in supplier-distributor relationships within supplier intrusion, multichannel management research has mainly emphasized channel design and pricing strategies from a supplier's perspective (Fürst et al., 2017; Li et al., 2015).

Wang et al. (2021) investigated the collaboration between distributors and customers to bridge the existing gap. They focus on the concept of customer-driving capability, which refers to a distributor's ability to influence customer behavior and drive demand in the market. They examined the relationship between distributors' customer-driving capability and firm performance. The research investigates how this capability can help firms navigate supplier intrusion and enhance organizational performance. They surveyed the semiconductors industry. They identified three antecedents that systematically interact with supplier intrusion in developing the distributor's customer-driving capability. Nevertheless, this study did not investigate the impact of Information Communication Technologies (ICT), business, and technological environment on distributor-customers collaboration on organizational performance, and they surveyed specific industries.

Despite these insights, empirical research on how distributors can utilize dynamic capabilities to enhance their performance remains scarce (Wang et al., 2021). This knowledge gap signifies a critical opportunity for research. The present research aims to explore two research questions. (1) How do Information Communication Technologies (ICT), business, and technological environments influence the collaboration of customers, with the distributor serving as a mediator? This question seeks to understand the effects of elements such as ICT, business, and technological environment on the relationship between customers and distributors, emphasizing the distributor's role as a facilitator or mediator. (2) What is the quantifiable impact of collaborative interactions between distributors (as mediators) and customers on sales performance and the innovation of products? This question seeks to quantify the effects of distributor-customer collaborations on two key metrics - sales performance and product innovation while emphasizing the distributor's role as a mediator in these collaborations.

The present study employs the dynamic capability theory as its theoretical framework, intending to construct a novel research model that addresses the existing gap in distributor-customer supply chain collaboration (Wang et al., 2021) and Shaping market dynamics (Ghauri et al., 2016). The investigated model enhances collaboration by utilizing Information and Communication Technology (ICT), business, and technological environment. Additionally, the study investigates the role of distributors as multiple moderators, influencing both the customers and the overall organizational business performance in terms of sales and product innovation.

In contrast to the previous research conducted by Wang et al. (2021), the current study expands the scope by surveying a diverse range of industries, encompassing fourteen industry types within nine European countries with 372 responses, hence, broadening the generalizability of the findings and contributes to fulfilling the call for future research suggested by Ghauri et al. (2016); Wang et al. (2021).

The primary contribution of this research lies in the empirical examination of the impact of Information and Communication Technology (ICT), business, and the technological environment on marketing strategies, specifically in terms of sales and product innovation. This investigation focuses on the collaboration between distributors and customers within the supply chain, thereby augmenting the limited existing knowledge on the influence of ICT, business, and the technological environment on marketing strategies (Ghauri et al., 2016) and the collaboration between distributors and customers (Wang et al., 2021). While previous studies have predominantly focused on the traditional role of distributors with upstream and downstream performance (Cheshmberah et al., 2011; Chopra, 2003; Park & Keh, 2003), the direct connection between suppliers and customers (Huang et al., 2018), as well as channel design and pricing strategies from the supplier's perspective (Fürst et al., 2017; Li et al., 2015), this research specifically examines the collaboration between distributors and customers within the supply chain and its impact on marketing strategies, including sales and product innovation.

The research contributes significantly by presenting empirical findings regarding the diverse mediating role of distributors' collaborative capabilities in facilitating advancements in marketing strategies facilitated by utilizing Information and Communication Technology (ICT), business, and the technological landscape. The investigation illustrates that while ICT, business, and the technological environment possess the capacity to engender value within the distributor-customer dynamics directly, the active involvement of distributors plays a pivotal role in augmenting the value generation process, leading to noteworthy enhancements in sales and product innovation, against lake of research about how distributors generate value besides their traditional role (Ghauri et al., 2016; Wang et al., 2021). By furnishing empirical evidence substantiating the various mediation effects, this study establishes the pivotal role of ICT, business, and the technological environment in propelling marketing strategies forward, specifically regarding sales amplification and product innovation.

The last contribution is by underlining four critical managerial insights. The study stresses the crucial role of distributor partnerships, alongside ICT, business, and technological environments, in driving innovation. In addition, it emphasizes the value of ICT for distributors to understand market trends and foster customer-centric strategies. The current research advocates for a proactive approach and innovation culture, strategically integrating sustainability and digital media to navigate dynamic business environments. Lastly, the research encourages technological investment to enhance relationships with distributors and customers, improve supply chain processes, and stimulate product development. In essence, these insights promote operational efficiency, improved relationships, product innovation, and business growth.

 The subsequent section provides an in-depth analysis of the subjects pertaining to Information and Communication Technology (ICT), organizational environment, and supply chain management. This is followed by a comprehensive elucidation of the research model employed in the study and the subsequent presentation of the obtained results. The final sections of the article engage in a detailed discussion encompassing the key findings, contributions, and limitations of the study.

# Literature review

# ICT

Information and communication technologies (ICT) play an important role in supply chain management (SCM) (Apiyo & Kiarie, 2018; Daneshvar Kakhki & Gargeya, 2019) by facilitating efficient and effective communication and information sharing among suppliers and customers to improve business process performance (Han et al., 2017; Wen et al., 2019; Zhang et al., 2022). In addition, ICT capabilities enable supply chain flexibility when there are market changes, dynamic environment and disruptions by facilitating and adjusting the supply chain without compromising overall performance (Ngai et al., 2011; Zhou et al., 2017). The ability of organizations to adapt to a changing business environment (Priem & Butler, 2001) through ICT to improve business performance is supported by the dynamic capability theory (Mikalef & Pateli, 2017; Mikalef et al., 2016)

ICT enables companies to collect and process data such as operational, production, or logistics (Hu et al., 2015) in real-time more efficiently to make informed and complex decisions quickly (Stadtler, 2015; Vafaei-Zadeh et al., 2020) in dynamic changing environment (Mikalef & Pateli, 2017; Mikalef et al., 2016). ICT enables integration with the supplier to facilitate better communication and information sharing for the logistics process (Lazarova & Sapundzhi, 2023; Pham et al., 2019) and production (Chopra & Meindl, 2014). Kumar et al. (2020) explored ICT's positive effect on logistics integration and supplier relations. Nevertheless, results about the relationship between ICT on information sharing and quality were insignificant. The research methodology was a survey with 121 complete questionnaires.

Various technologies are part of the ICT domain. For instance, linked data (Bechhofer et al., 2013), mobile technologies (Levi-Bliech et al., 2020; Partridge, 2011), web-based technologies (Kashyap et al., 2022), IoT, big data (Gupta et al., 2020; Zhang et al., 2022) and industry 4.0 (Silva et al., 2022; Zhu et al., 2022) facilitate real-time availability and ubiquity (Ikumapayi et al., 2022). For instance, Zhu et al. (2022) explored how ICT, such as industry 4.0, affects supply chain performance via supply chain integration as a mediator. The authors identified a significant positive effect between ICT and supply chain integration (SCI) and a significant positive effect between SCI and SCM. As a result of ICT implementation, organizations may improve efficiency, and flexibility, re-engineer processes, decrease overhead, and increase customer service (Fettermann et al., 2018). likewise, with the data gathered from ICT, companies can decide how to allocate resources, manage inventory, and improve customer satisfaction and service in dynamic environment.

# Organizational environments

Business environments play a crucial role in shaping the strategy of product innovation, which in turn significantly influences business performance. According to research conducted by Prajogo (2016), the impact of product innovation on business performance becomes particularly meaningful when the business environments are more dynamic. Khan and Mir (2019) found that environmental dynamism effect on new product innovation outcomes. Miller and Friesen (1983) argued that growths in environmental dynamism, should be related to innovation which defined strategy-making activity. Garcia and Calantone (2002) reported that product innovation requires two factors to develop: new marketplace and science or technology.

# Business Environments

Business environment is the set of all external aspects which have an impact on a the organization, and is formed by two dimensions: The Macro environment and the business sector (Pereira, 2018). Albright (2004) argued that the business environment is useful for identifying the competition in the industry and understanding the role of the competitors, the customers, and the suppliers in the market. Understanding and scanning the external environment is required for the organization’s success and future opportunities. Leng et al. (2015) assert that market orientation are considered top-notch for new product quality. In Addition, Miller and Friesen (1983) found that increased environmental dynamism creates more opportunities for innovation. In contrast to Miller and Friesen (1983), Khan and Mir (2019) assert that dynamic and unmunificent environments have a negative effect on new product innovation outcomes.

# Technological environment

Albright (2004) claimed that new technologies could impact organizations’ business efficiencies and changes their production technologies. Technological environment integrated with firm profitability, growth, and R&D opportunity influences firm innovation (Bhattacharya & Bloch, 2004). Firms with market and technology orientations improve their new product performance (Leng et al., 2015). Vega-Jurado et al. (2008) pointed out that firms’ technological capabilities, based on the firm's R&D, are the main factor for product innovation. They claimed that innovation factors depend on the industrial sector and the degree of uniqueness of the product developed. Souitaris (2002) found that the main factor that influenced innovation was the intensity of R&D.

# Supply Chain Management: From Distributor to Customer

# Supply chain management (SCM) refers to the flow of upstream raw materials, products, and services from the point of the supplier to the end customer and the downstream flow of information and transaction of data and payments (Min, 2019; Takahashi, 2017).

# SCM encompasses several key elements that contribute to its effectiveness. These include the coordination and integration of data, the seamless flow of information, enhanced visibility (Min, 2019), and fostering collaboration among various partners within the supply chain (Hyun, 1994; Takahashi, 2017). By incorporating these crucial components, SCM can optimize the overall performance and efficiency of the supply chain network. The supply chain contains various local and international networks (Min, 2019). SCM's primary goal is maximizing efficiency and minimizing costs while meeting customer needs and satisfaction (Adam et al., 2020).

# Distributors

Distribution refers to moving products and services from the manufacturer to the end customer (Cheshmberah et al., 2011). Distribution is measured by lead time (Sun et al., 2020), delivery performance (Dolgui & Ould-Louly, 2002), customer satisfaction (Hameed et al., 2018), and cost (Cheshmberah et al., 2011; Chopra, 2003). There are three channels in distribution (1) direct distribution, (2) indirect, and (3) hybrid distribution. When an organization chooses a distribution channel, one should consider product characteristics, target market, and competitive Environment (Park & Keh, 2003). For the purpose of our study, we focus on the indirect distribution channel where distributors have the most influence as intermediaries.

Distributors are the organization's intermediaries that use the indirect strategy to reach the end customer (Chen & Chang, 2010; Takata, 2019). Distributors link manufacturers, wholesalers, or retailers (Park & Keh, 2003). They purchase products from manufacturers in large quantities and then sell products to retailers in smaller amounts. According to Hernández-Espallardo et al. (2011), distributors are independent companies involved in the manufacturer's distribution channel, consisting of local agents, wholesalers, and retailers. Distributors may impact five aspects when collaborating with the organization (1) improve organizational knowledge, (2) strengthens the importance of collaborations, (3) reduces organization's inclination to prioritize one innovation strategy over another, and (4) positively affect organizational performance (Hernández-Espallardo et al., 2011).

# Customer

In the contemporary technological era, consumer requirements have evolved to prioritize short lead time, customized product or service delivery, flexibility, and reduced costs (Adam et al., 2020; Nimeh et al., 2018). Abdallah et al. (2021) stated that supply chain companies must incorporate their customers and suppliers within their supply chain operations to achieve a competitive advantage and answer customers' demands. Such integration elevates the efficiency and effectiveness of their supply chain, thereby augmenting their overall business performance within both local and global markets (Abdallah et al., 2021).

Digital media increases consumer changing demand and shorten the lead time to deliver products or services to increase customer satisfaction and loyalty (Adam et al., 2020). Social media platforms such as Facebook, LinkedIn, TikTok, and mobile apps amplify the exposure of purchased goods or services since customers post them online. Studies showed that satisfied customers are likely to return after a good experience via mobile or electronic commerce (Ali et al., 2021; Ramanathan et al., 2017) and thus enhance the company's competitive advantage. Therefore, companies should use social network marketing strategies to improve customer satisfaction and loyalty (Lim & Winkenbach, 2019; Nimeh et al., 2018). Sidharta and Suzanto (2015) state that companies should strengthen their branding approaches by leveraging social media platforms and online brand communities facilitated by online co-creation marketing techniques (Ali et al., 2021).

# Innovation outcomes

Innovations include three main types: product innovation, process innovation and organizational innovation. These types have similarities and differences between them that related to the type of innovation developed or adopted (Boer & During, 2001).

Kahn (2018) report the importance in understanding that innovation outcomes include several types as product innovation, sales innovation, supply chain innovation organizational innovation and other kind of innovation. Manual (2018) recommended to collect data on the innovation outcomes as the sales share and the product innovations in a new and improved product.

# Product Innovation

Gault (2018) defines product innovation as a product that is new or significantly improved and has to be ‘introduced on the market’. Product innovation is the most popular innovation type, investment in R&D create outputs in terms of patents or new products Edwards-Schachter (2018). Garcia and Calantone (2002) performed that the developing of product innovation need two factors marketplaces and science or technology. Li and Vermeulen (2021) tested the outcomes of new product development on firm performance was measured in the pharmaceutical market in China. They argued that new product development is risky and corollate with lowering the firm’s performance while increasing its variance. López-Cabarcos et al. (2020) reported that organizations get higher profitability from both directly or through product innovation. Product innovation in manufacturing firms considers external and internal factors and a cooperation with industrial agents (customers, suppliers, competitors) has a decisive factor for the development of new products in traditional industries, Vega-Jurado et al. (2008). Silva et al. (2019) found relationship between environmental uncertainty and importer involvement in innovation activities. They argue that effective communication within the export firm and the importer remains critical to successful product innovation. Some studies reports about the connection between product innovation and supply-chain. Haus-Reve et al. (2019) report that supply-chain improve the chances to the firm product innovation, new-to-market product innovation, and share of turnover from new products. The study found also that Supply-chain and scientific collaboration have only additive effects on firm innovation. Gholizadeh and Fazlollahtabar (2021) discover that new product development strategies based on the external source supply chain supplies and on the non-supply chain resources (Gault, 2018).

Other researches explore the relationship between the supply-chain and the product innovation. Arlbjørn et al. (2011) claimed that supply chain management can produce competitive rewards by creating new products and services, or entry into new markets. Graham and Hardaker (2000) examine the connection between the supply-chain design and management and the new competitive challenges due the growth of the Internet. The findings showed that the Internet become a central part of a commercial drive towards innovation and create new directions for marketplace.

#  Sales Innovation

Sales growth related to knowledge and innovation and mainly refereed to process and product innovation (Uhlaner et al., 2013). Colder (2000) explored innovation in international markets and found it as most determinant factors. He claimed that business grading assist to form the market share goals of firms by creating new products. Technological innovation has been found in several studies as an influencing factor on international markets innovation. New innovations creates sales in new markets start in a weakened form and then increase significantly, Agarwal and Bayus (2002). Katsikeas et al. (2020) point out that the entry of firm into foreign markets can be facilitated using digital technologies and effect the firm implementing international marketing strategy. The internet was found as a new and effective path to internationalization and to export marketing in two main uses: a physical presence and the as a sales channel (Sinkovics et al., 2013). Several researches investigated the relationship between the supply chain and sales innovation. Lii and Kuo (2016) investigated the joint effect of an innovation orientation and supply chain integration. They found that innovation orientation was positively affect the supply chain and combinative firm competitive and performance abilities. Cohen et al. (2000) found that efficient supply-chain management and satisfied customers form after-sales service.

# Research Model and Hypotheses Development

The conceptual model evolved in this chapter elaborates on the correlations among Information Communication Technologies (ICT), Technological Eviroment, and Business Environment on Distributors, Retailers, and Consumers on Sales Innovation and Product Innovation (Figure 1). The ICT construct encompassed mobile applications, semantic web/linked data, cloud computing, social networks, electronic markets, and knowledge management systems. Other technologies do not control each measurement item and have their versatility. These technologies are used via portable or on-premises devices that depend on the internet Wi-Fi (Storgards, Tuunainen, & Oorni, 2009). Workers and customers may access them outside the organization (Leclercq-Vandelannoitte, Isaac, & Kalika, 2014). Customers commonly use mobile applications for purchasing commodities ambiguously.

Figure 1: Research Model



Note: Cust – Customer; Dis – Distribution; Buis Env – business environment; Tech Env – Technological environment ; Prod Inn – Product innovation; Sal Inn – Sales Innovation; Geo Reach – Geographical Reach; Mang Level – Management Level

ICT enhances SCM performances via information sharing, communication, integration, and collaboration (Levi-Bliech et al., 2018; Zhu et al., 2022) as well as automation (Huang & Javed, 2008) and improved customer service (Danese & Romano, 2011; Stevenson & Spring, 2009). SCM is facilitated when integrating the entire supply chain systems into subnational business processes (Lambert et al., 1998; Shahzad et al., 2020). SCM facilitate collaboration and cooperation among suppliers, organization, distributors, wholesalers, retailers, and customers (Monczka et al., 2020; Van Weele, 2018) that is achieved via information sharing and integration (Shahzad et al., 2020).

ICT such as mobile applications (Rossi et al., 2007), linked data, and semantic web (Huang & Javed, 2008) enabled transparency, customer service, and streamlined data among supply chain entities (Bizer et al., 2008; Rossi et al., 2007). Hameed et al. (2018) claimed that ICT mediates the effect of E-payment, E-traceability, and Website design on customer satisfaction. The authors found a positive impact between ICT and customer satisfaction. Soosay et al. (2008) stated that organizations engaged in collaboration and information sharing are better equipped to adapt to market fluctuations, pricing pressures, and increasingly short product life cycles which consist with dynamic capabilities theory (Blocker et al., 2011; Gupta et al., 2020; Wang et al., 2021). ICT improve customer service (Rossi et al., 2007; Zhu et al., 2022) via information sharing of orders, inventory levels, and delivery status (Danese & Romano, 2011; Stevenson & Spring, 2009). Customer service is improved since the company collects accurate data in real-time on stock levels, sales information, and customer preferences (Rossi et al., 2007).

Hence, we propose the following two hypotheses for consideration:

H1a: ICT positively related to the distributor's SCM collaboration.

H1b: ICT positively related to customer SCM collaboration.

Open innovation partners as customers increased collaboration, enabling the firm to achieve concurrent economic and sustainability innovation goals and to intensify success (Rauter et al., 2019). The dynamic business environment challenges firms and businesses and requires them to deal with technological tools such as e-commerce to sell products to their customers (Savrul et al., 2014). Globalization generates novel ways to create orders and new contacts with distributers and customers in new business environment that exposed the firms to unique events and in theirs business environment (Muhammad et al., 2010).

Hence, we propose the following two hypotheses for consideration:

H2a: Business Environment positively related to the distributor's SCM collaboration.

H2b: Business Environment positively related to customer SCM collaboration.

Technological environments allow the firm to create interactions with its prospects and customers. Those interactions enable the organizations to provide customers’ exclusive needs and desires, develop technology to support the firms, and adapt to changing business environments (Hollebeek et al., 2019). Technological features impact the customers’ interactivity and tailor-made virtual experiences (Zhang et al., 2014). Technology transfer between firms in the worldwide competition enables new products and strengthens the firm's competitive advantage (Fava Neves et al., 2001).

Hence, we propose the following two hypotheses for consideration:

H3a: Technological Environment positively related to the distributor's SCM collaboration.

H3b: Technological Environment positively related to customer SCM collaboration.

Distributors have little influence on the supply chain, so their effect is often expressed through a marketing strategy that encourages customers to buy products and services. Hence the customer-driving marketing strategy (Ghauri et al., 2016) is more suitable for distributors. Customer driving can broadly be defined as the competency of the distributors to identify customers' new and upcoming expectations and proactively adjust or foster new products and services (Wang et al., 2021). Furthermore, distributors collaborating with customers (Monczka et al., 2020; Van Weele, 2018) can learn about their expectations and proactively create new markets, thus improving customer satisfaction and fostering customer value creation (Blocker et al., 2011). This ability is encompassed by the dynamic capability theory (Blocker et al., 2011; Gupta et al., 2020; Wang et al., 2021).

Hence, we propose the following hypothesis for consideration:

H4: Distributers positively related to customers SCM collaboration.

Distributors should add value to stay relevant to organizations and customers seeking to enhance competitiveness and growth. Organizations aim to increase market share, while customers seek improved products and services (Mudambi & Aggarwal, 2003). Distributors are often the first point of contact with customers, which gives them valuable insights into customer needs and preferences. Distributers have in-depth customer knowledge that is important building close, cooperative, and partnering relationships. By understanding customers' unique needs and challenges, distributers can provide tailored support and guidance, become a trusted partner, and achieve mutual success (Cocks, 1996; Daulay & Saputra, 2019).

Distributers contribute organization via understanding significant new trends, customers’ needs and behavior, and awareness of competitor strategies (Mudambi & Aggarwal, 2003). The relationships between the firm and the distributors influences the firms innovations and performance and include knowledge that gathered from the distributors about markets (Hernández-Espallardo et al., 2011). Zulfiu et al. (2015) found that the organizations have to reveal corporations with trading partners. They document that participation of the distributors in the innovation process allow to develop innovative ideas. Information Technology and innovation in the logistical actions may assist the retailer to use only the distributor by using the approach of direct-to-store shipments and get supply on real-time sales (Bello et al., 2004).

Hence, we propose the following two hypotheses for consideration:

H5a: Distributor's SCM collaboration positively related to product innovation.

H5b: Distributor's SCM collaboration positively related to sales innovation.

Customer orientation that moderated by business connections have a positive impact on innovation Wang and Chung (2013). Customers select products that create value for them and realize the evaluation of those product offers opportunities for innovation. Understanding the modifications in customer perceptions regarding functional, service and other features will be the base for logistics innovation Flint et al. (2005). Improving customer orientation has been known as one of the main trials in product and service innovation and provide competitive advantage for firms for the firm Pishgar et al. (2013)

Hence, we propose the following two hypotheses for consideration:

H6a: Customer SCM collaboration positively related to product innovation.

H6b: Customer SCM collaboration positively related to sales innovation.

# Methodology

# Instrument construction

This survey contains several groups of items that led to a questionnaire with approximately 44 items. The first group of items measured the ICT tools in the organization include 8 items was adopt from (Levi-Bliech et al., 2018). Two other groups tested the characteristics of the business environment include 8 items was adopt from (Levi-Bliech et al., 2018) and the characteristics of the technological environment include 4 items was strenuous from (Wang & Chung, 2013). Another two groups of items, aiming to measure the interface between the organization and between the distributors and the customers in the supply chain include 9 items was adapted from (Levi-Bliech et al., 2018). The last two groups of items, measuring the outcomes of innovation. The outcome of sales innovation include 4 items was adapted from (Manual, 2018) and the outcome of product innovation include 5 items was adapted from (Hsu et al., 2014). The questionnaire items used a seven-point Likert scales anchored mostly from “very low”.

# Data collection

The data was collected in August 2022 from the European Union by Cint ([www.cint.com](http://www.cint.com)), a company that operates as a hub with over 4600 survey panels worldwide. Cint specializes in creating digital questionnaires and adheres to ISO 20252 certification protocols and procedures to ensure high-quality samples. The company employs various tactics and follows established sampling theory and best practices to maintain accurate records of potential respondents, whose information is verified before use. Cint utilizes sampling algorithms based on established principles and best practices.

The survey questionnaire was distributed to nine European countries, with the number of participants from each country in parentheses: Denmark (31), Spain (40), Germany (41), Netherlands (38), Sweden (34), France (76), Italy (70), United Kingdom (40), and Israel (2). The participants were English speakers from various positions in the supply chain, including junior, middle, and senior management levels. During the screening process, incomplete questionnaires, those with ascending or descending answers, and constant answering were removed. The survey yielded a total of 372 full questionnaires.

# Data analysis

# Descriptive statistics

# Background data gathered from the participants indicated that about half of them (47%) were working in organizations whose markets were in the European union, about third (30%) working in organizations with global and the rest were working in organizations with local market. The respondents were from a variety of function in the organization the most popular role was IT and Technology (28%) and the functions of marketing and Customer service, research and development (R&D), procurement and operations and production were between 10%-20% and the rest were under 10%. Most (53%) of the participants were middle-level managers, about a third (34%) were senior managers and the rest (13%) were junior-level managers (Table 1).

*Table 1: Description of the participants according to demographic characteristics*

| Characteristic (n=372) | Frequency | Percent |
| --- | --- | --- |
| Organization's countryDenmarkFranceGermanyIsraelItalyNetherlandsSpainSwedenUK | 31764127038403440 | 8%20%11%1%19%10%11%9%11% |
| Organization's geographical reach Global market European union Local market | 11117785 | 30%47%23% |
| Organization industryBanking/financeBusiness servicesCommunicationsDefenseDistribution/retailEducationGovernment/MunicipalitiesHealth servicesInsuranceLogisticsManufacturingReal estateTechnological developmentTransportationUtilitiesOther  | 262115627372532152735103127830 | 7%6%4%2%7%10%7%9%4%7%9%3%8%7%2%8% |
| Number of employees in the organizationBelow 2020–100101–500501–10001001–5000 Over 5000 | 5578107564234 | 15%21%29%15%11%9% |
| Function in the organization Marketing/Sales/Customer serviceResearch and development (R&D), ProcurementIT, TechnologyHR, Well-Being/WelfareOperations, ProductionOutbound logisticsOther | 53374510326611532 | 14%10%12%28%7%16%4%9% |
| Management levelJuniorMiddle Senior | 47197128 | 13%53%34% |
| Time in managerial position Less than a year 1–5 yearsMore than 5 years | 38189145 | 10%51%39% |

# Common Method Bias

The term "common method bias" denotes the scenario where the variance in data is related to the measurement technique utilized rather than the actual constructs being measured (Podsakoff, 2003). Based on Podsakoff (2003) research, different treatments should be used for formative and reflective constructs. When “formative-indicator constructs are an integral part of a study, researchers must be even more careful than normal in designing their research because procedural controls are likely to be the most effective way to control common measurement biases” (Podsakoff, 2003, p. 900). For reflective construct, statistical controls, such as VIF below 3.3 (Kock, 2015) and Harman’s one-factor test below 0.5 (Bhatia & Kumar Srivastava, 2019; Xiao et al., 2022), serve as an indication that common method bias is not a threat in the data.

This study followed the remedies for CMB for ICT formative construct according to Podsakoff et al.'s (2012) guidance. The questions for each construct were taken from validated questionnaires. Then, the clarity of the questionnaires was examined by two experts from the field of SCM and innovation. In addition, a cover page was supplemented with relevant information to help the respondent understand the purpose of the survey, including the instruction on how to fill out the questionnaire. After constructing the questionnaires, a pilot was conducted, to pinpoint possible issues and test the questionnaires and protocols. Finally, the reflective constructs were statistically tested for CMB following Kock (2015); Podsakoff and Organ (1986); Spralls et al. (2011) statistical procedures. The results of the statistical procedures are as follows: VIF was below 3.3 threshold and Harman’s one-factor test was below 50%, suggesting no concerns for CMB.

# Measurement model

To assess the measurement model, it is important to determine whether the construct is formative or reflective. Therefore, we followed the procedure suggested by Hair et al. (2016) based on the research work of Chin (1998); Diamantopoulos and Winklhofer (2001); Fornell and Bookstein (1982); Jarvis et al. (2003) to determine if the construct is formative or reflective. A fundamental literature review provided well-grounded theoretical reasoning (Diamantopoulos & Winklhofer, 2001; Jarvis et al., 2003) to conclude that ICT is a formative construct (Gäre & Melin, 2011; Khaola et al., 2022; Levi-Bliech et al., 2018). In addition the ICT's measurement items identifies a specific aspect of the construct area (Chin, 1998; Hair et al., 2016). Since the indicators of ICT represents autonomies and independent systems they caused the construct and are non-replaceable (Hair et al., 2016; Jarvis et al., 2003).

To test the research hypotheses, we used A second-generation structural equation modeling (SEM)– partial least squares (PLS) software. The analysis via Smart PLS 4 is better than other programs such as AMOS and LISREL when there is one or more formative constructs, complexity of the structural model, in an exploratory research for theory development, and small sample size (Hair et al., 2016; Hair et al., 2019).

The measurement items of the formative construct in this study are in accordance to the work of Levi-Bliech et al. (2018) that carry out construct validity for similar construct. The Variance Inflation Factor (VIF) of ICT items were below three (Hair et al., 2016; Petter et al., 2007) suggesting no collinearity across formative measurement items (Table 2). The next step is to test the statistically significant of the outer weight. We used 5,000 bootstrap samples for the final results (Hair et al., 2016; Hair et al., 2012). The outer weights were statistically significant except for ICT8 (Table 1). Yet we decided to retain ICT 6 in the formative construct despite the outer weight is not significant because of content validity (Hair et al., 2016).

Table 2: Outer weights

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|   | VIF | Weights | Mean | Standard dev. | T -statistics |
| ICT1 | 1.596 | 0.363 | 0.363 | 0.072 | 5.011\*\*\* |
| ICT2 | 1.663 | 0.271 | 0.268 | 0.074 | 3.662\*\*\* |
| ICT3 | 1.599 | 0.189 | 0.189 | 0.064 | 2.970\*\* |
| ICT5 | 1.615 | 0.181 | 0.179 | 0.081 | 2.223\* |
| ICT6 | 1.778 | 0.142 | 0.146 | 0.08 | 1.787 |
| ICT8 | 1.614 | 0.196 | 0.193 | 0.068 | 2.884\*\* |

Note: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001.

To evaluate the reflective constructs in the measurement model we first need to evaluate the composite reliability (CR) and validity (of each reflective construct. The CR results were grater than 0.8 therefore establish "internal consistency and individual indicators reliability" (Hair et al.,P 100, 2016). Internal consistency was also supported with Cronbach's alpha higher than 0.7 thresh hold (Hair et al., 2016). To estimate convergent validity, we need to calculate the Average Variance Extracted (AVE). In Table 3 all AVE indicators are above 0.5 thresh hold with outer loading higher than 0.7 and statistically significant. Therefore, we also established convergent validity (Hair et al., 2014). There are two tests for discriminant validity (1) The Fornell-Larcker criterion were all AVE squared root on the diagonal (in grey, Table 3) should be higher than the inner correlation matrix between the constructs (Fornell & Larcker, 1981; Hair et al., 2016), (2) The outer loadings should load to the relevant construct with minimum 0.7 and greater than the cross-loadings on the other constructs (Hair et al., 2016). Discriminant validity was supported (Table 3 and Table 4, in grey). After establishing the measurement model with formative and reflective constructs we can now analyze the structural model and hypotheses.

Table 3: Standardized correlation matrices

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | Cronbach's alpha | CR | AVE | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (1) ICT | F | F | F | F |   |   |   |   |   |   |
| (2) Cust | 0.810 | 0.875 | 0.637 | 0.682 | 0.798 |   |   |   |   |   |
| (3) Dist | 0.843 | 0.889 | 0.615 | 0.713 | 0.724 | 0.784 |   |   |   |   |
| (4) Busi Env | 0.798 | 0.868 | 0.622 | 0.727 | 0.683 | 0.712 | 0.789 |   |   |   |
| (5) Tech Env | 0.766 | 0.865 | 0.681 | 0.641 | 0.638 | 0.692 | 0.652 | 0.825 |   |   |
| (6) Prod\_Inn | 0.831 | 0.881 | 0.598 | 0.708 | 0.719 | 0.749 | 0.713 | 0.702 | 0.773 |   |
| (7) Sal\_Inn | 0.812 | 0.877 | 0.640 | 0.656 | 0.666 | 0.696 | 0.665 | 0.650 | 0.786 | 0.800 |

Note: Pearson correlation coefficients are presented with the square roots of AVE on the diagonal; Cust – Customer; Dis – Distributers; Buis Env – Business environment; Tech Env– Technological Environment; Prod Inn – Product innovation; Sal Inn – Sales Innovation; CR – composite reliability; AVE - Average variance extracted; F – Formative construct

Table 4: Outer loadings

|   | Cust | Dist | Env\_M | Env\_T | Prod\_Inn | Sal\_Inn |
| --- | --- | --- | --- | --- | --- | --- |
| Cust\_1 | 0.791 | 0.556 | 0.578 | 0.489 | 0.589 | 0.582 |
| Cust\_2 | 0.777 | 0.571 | 0.526 | 0.489 | 0.555 | 0.512 |
| Cust\_3 | 0.796 | 0.568 | 0.510 | 0.502 | 0.559 | 0.466 |
| Cust\_4 | 0.827 | 0.615 | 0.562 | 0.556 | 0.59 | 0.559 |
| Dist\_1 | 0.586 | 0.759 | 0.622 | 0.514 | 0.583 | 0.543 |
| Dist\_2 | 0.596 | 0.761 | 0.556 | 0.487 | 0.583 | 0.495 |
| Dist\_3 | 0.608 | 0.836 | 0.588 | 0.586 | 0.639 | 0.568 |
| Dist\_4 | 0.517 | 0.777 | 0.507 | 0.562 | 0.540 | 0.550 |
| Dist\_5 | 0.530 | 0.787 | 0.516 | 0.564 | 0.587 | 0.573 |
| Busi Env1 | 0.580 | 0.603 | 0.787 | 0.530 | 0.569 | 0.567 |
| Busi Env2 | 0.568 | 0.566 | 0.821 | 0.516 | 0.576 | 0.494 |
| Busi Env3 | 0.549 | 0.568 | 0.780 | 0.523 | 0.601 | 0.559 |
| Busi Env4 | 0.441 | 0.499 | 0.765 | 0.486 | 0.492 | 0.470 |
| Tech Env 1 | 0.494 | 0.566 | 0.570 | 0.818 | 0.538 | 0.515 |
| Tech Env 3 | 0.515 | 0.546 | 0.529 | 0.810 | 0.580 | 0.519 |
| Tech Env 4 | 0.568 | 0.600 | 0.519 | 0.848 | 0.617 | 0.572 |
| Prod\_Inn1 | 0.617 | 0.617 | 0.603 | 0.560 | 0.742 | 0.625 |
| Prod\_Inn2 | 0.555 | 0.584 | 0.548 | 0.571 | 0.822 | 0.628 |
| Prod\_Inn3 | 0.518 | 0.561 | 0.572 | 0.526 | 0.784 | 0.587 |
| Prod\_Inn4 | 0.527 | 0.584 | 0.515 | 0.596 | 0.792 | 0.591 |
| Prod\_Inn5 | 0.552 | 0.541 | 0.508 | 0.452 | 0.723 | 0.600 |
| Sal\_Inn1 | 0.578 | 0.543 | 0.576 | 0.503 | 0.587 | 0.766 |
| Sal\_Inn2 | 0.518 | 0.549 | 0.534 | 0.567 | 0.633 | 0.799 |
| Sal\_Inn3 | 0.496 | 0.515 | 0.453 | 0.536 | 0.657 | 0.817 |
| Sal\_Inn4 | 0.535 | 0.613 | 0.556 | 0.477 | 0.637 | 0.816 |

# Structural Model

The first step is to assess the structural model is to identify collinearity issues in the inner model (Hair et al., 2016; Ringle et al., 2012). All VIF were below three concluding that there are no indications for collinearity cases in the inner model. measurement model assuring there are no collinearity problems (Ringle et al., 2012). In the second step the significant of the path coefficient was analyzed. A bootstrapping procedure with 5000 samples for significant levels indicate that all hypotheses are significant (Table 5). The adjusted $R^{2}$ are between 0.548 to 0.637 which is acceptable in marketing and innovation research (Hair et al., 2011; Henseler et al., 2009). According to Cohen (1988); Hair et al. (2016), the $f^{2}$effect size results threshold of 0.02 referred as small effect size. Results arrowed 0.15 referred as medium effect size and results above 0.32 referred as large effect size. The effect size of the customer on product innovation is medium (0.176). The effect size of distribution on product innovation and sales innovation is medium (0.310, 0.209 correspondingly). The effect size of technological environment on distribution is medium (0.134). All other effects are low. The last step to evaluate the structural model is to assess the predictive relevance Stone-Geisser's $Q^{2}$ which measures the model ability to predict the relevance of the analysis (Geisser, 1974; Stone & Choice, 1974). All $Q^{2}$ are above 0.5 indicates that all exogenous constructs have high predictive relevance (Hair et al., 2016).

Table 5: Results of structural model

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Hypotheses | Path | Beta | Standard dev. | T-Statistics  |
| H1a | ICT 🡪 Dist | 0.306 | 0.062 | 4.97\*\*\* |
| H1b | ICT 🡪 Cust | 0.204 | 0.06 | 3.4\*\*\* |
| H2a | Busi Env 🡪 Dist | 0.289 | 0.063 | 4.589\*\*\* |
| H2b | Busi Env 🡪 Cust | 0.202 | 0.068 | 2.97\*\* |
| H3a | Tech Env 🡪 Dist | 0.307 | 0.048 | 6.369\*\*\* |
| H3b | Tech Env 🡪 Cust | 0.143 | 0.062 | 2.319\* |
| H4 | Dist 🡪 Cust | 0.335 | 0.096 | 3.477\*\*\* |
| H5a | Dist 🡪 Sal\_Inn | 0.449 | 0.076 | 5.922\*\*\* |
| H5b | Dist🡪Prod\_Inn | 0.479 | 0.076 | 6.273\*\*\* |
| H6a | Cust 🡪 Sal\_Inn | 0.341 | 0.077 | 4.408\*\*\* |
| H6b | Cust 🡪 Prod\_Inn | 0.373 | 0.076 | 4.877\*\*\* |
| Control | Geo Reach Global 🡪 Prod\_Inn | 0.049 | 0.073 | 0.667 |
| Control | Geo Reach Global 🡪 Sal\_Inn | 0.200 | 0.078 | 2.556\* |
| Control | Geo Reach Local 🡪 Prod\_Inn | 0.060 | 0.081 | 0.733 |
| Control | Geo Reach Local 🡪 Sal\_Inn | 0.040 | 0.098 | 0.678 |
| Control | Manag Level Middle 🡪 Prod\_Inn | -0.120 | 0.099 | 1.208 |
| Control | Manag Level Middle 🡪 Sal\_Inn | 0.081 | 0.105 | 0.767 |
| Control | Manag Level Senior 🡪 Prod\_Inn | -0.174 | 0.111 | 1.573 |
| Control | Manag Level Senior 🡪 Sal\_Inn | 0.052 | 0.115 | 0.455 |

 Note: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001 Cust – Customer; Dis – Distributers; Buis Env – Business environment; Tech Env– Technological Environment; Prod Inn – Product innovation; Sal Inn – Sales Innovation; Geo Reach – Geographical Reach; Mang Level – Management Level

Figures 2.a and 2.b show, respectively, the innovation outcomes by management level by market sort, with plots of the inter-group differences in the DVs and their confidence intervals (one standard error in each direction). Figure 2.a shows that the two innovation outcomes do not differ due to management level. These results support the findings in Table 5, the show no significant evidence that management level impacts product or sales innovation. Figure 2.b shows that the two innovation outcomes do not differ due to market sort. These results support the findings in Table 5 that only the path of Geographical Reach to sales innovation has a significant Beta.

Figure 2.a: Innovation outcomes by management level



Figure 2.b: Innovation outcomes by market sort

 

# Multiple Mediation analysis

Statistical mediation analysis is a valuable tool for identifying the mediating effect of an independent variable on a dependent variable through a mediator (Hayes, 2017; Preacher & Hayes, 2008). This technique can be used to explore complex relationships involving multiple variables or independent variables. (Gunzler et al., 2013; Hayes, 2017). Structural equation modeling (SEM) is a powerful approach for conducting mediation analyses with multiple mediators or independent variables (Mackinnon, 2012). SEM is a preferred framework for making inferences in mediation and other causal analyses (Gunzler et al., 2013). Gunzler et al. (2013) stated that SEM simplifies testing mediation hypotheses by allowing complex mediation models to be tested in a single simultaneous analysis. According to Hayes (2017), the results obtained from a simultaneous analysis via SEM are equivalent to those obtained from the PROCESS tool. Additionally, Smart PLS 4 can easily extract mediation analysis's indirect, direct, and total effects (Ringle et al., 2015).

To analyze the multiple mediation effects of ICT, Business environment, and technological environment on customer satisfaction through the supplier as a mediator, we utilized SEM with bootstrapping procedures and 5000 iterations according to Preacher and Hayes (2004, 2008) and analyzed the results according to the procedure outlined by Baron and Kenny (1986); Hayes (2017). The multiple mediation analysis included three independent variables: ICT, business environment, and technological environment, representing the first indirect effect path (a). The second indirect effect path (b) was between the distributor and the customer. The combined indirect effect path was computed as the multiplication of (a\*b). In addition, the analysis also computed the direct effect path (c), as presented in Table 6. All effects pathswere found to be statistically significant and positive. Among the three indirect paths analyzed, the business environment exhibited the highest ratio between indirect and direct effects at 66%. Following closely was the technological environment with a ratio of 57%, while the ICT showed the lowest ratio at 33%. These findings indicate that the influence of business environment indirect path has the most substantial impact, followed by the technological environment, and finally, the ICT. Our findings revealed three partial complementary mediations that shed light on the mechanisms of the independent variables and their mediation effects. These insights can help enhance customer collaboration measurements, which in turn may impact sales and product innovation, as shown in the research model presented in Figure 3*.*

Table 6: Results of Multiple Mediation Analysis via smartpls4

|  |
| --- |
| Multiple Mediation Analysis |
| First Indirect Effects  | Second Indirect Effects  | Combined Indirect Effects | Direct Effects | Total Effects | Effect Size |
|  |
| a | b | a\*b | c | a\*b+c | a\*b/Total Effect |  |
| ICT à Dist | Dist à Customer | ICT à Distà Customer | ICT àCustomer | ICT à Customer |   |  |
| 0.295\*\*\* | 0.346\*\*\* | 0.102\*\*\* | 0.207\*\*\* | 0.309\*\*\* | 33% |  |
| Busi Envà Dist | Dist à Customer | Busi Env àDist àCustomer | Busi Env à Customer | Busi Env à Customer |   |  |
| 0.301\*\*\* | 0.346\*\*\* | 0.104\* | 0.206\*\* | 310\*\*\* | 66% |  |
| Tech Env à Dist | Dist à Customer | Tech Env à Dist à Customer | Tech Env àCustomer | Tech Env à Customer |   |  |
| 0.307\*\* | 0.346\*\*\* | 0.106\*\* | 0.144\* | 0.250\*\*\* | 57% |  |

# Note: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001; Cust – Customer; Dis – Distributers; Busi Env – Business environment; Tech Env– Technological Environment; Prod Inn – Product innovation; Sal Inn – Sales Innovation.

Figure 3: structural model



Note: \* p < 0.05; \*\* p < 0.01; \*\*\* p < 0.001; Cust – Customer; Dis – Distributers; Busi Env – Business environment; Tech Env– Technological Environment ; Prod Inn – Product innovation; Sal Inn – Sales Innovation; Geo Reach – Geographical Reach; Mang Level – Management Level

# Discussion

# Key findings

This study presents five key findings. The initial two findings pertain to technological aspects. The utilization of ICT has expanded and facilitated organizations' access to novel marketing strategies and the evolving needs of their existing customers, particularly in a rapidly changing world, for instance, during the COVID-19 pandemic. Implementing ICT during disruptive global events significantly influences the innovative process of creating new products and exploring fresh customer marketing avenues (H1b, H6a,b). For instance, organizations that swiftly adopted ICT platforms could quickly adapt their marketing approaches to cater to customers' shifting demands and preferences who increasingly relied on digital channels for their purchasing decisions. By embracing technology-driven solutions, organizations can proactively identify emerging trends and develop innovative products or services that meet the evolving demands of their customers.

However, to fully leverage its potential and enhance its value, the organization must prioritize promoting seamless communication, integration, and collaboration between the distributor and the customer through technological system innovation, business opportunity development, and marketing innovation (H1a, H4). The distributor collaboration been found to have a partially mediating and complementary effect on the impact of ICT on customer's SCM collaboration. This, in turn, is observed to positively influence sales and product innovation. For example, some distributors leveraged ICT tools and data analytics to identify new customer segments and tailor their marketing strategies, accordingly, increasing customer satisfaction and business growth. Another example is a leading e-commerce platform that successfully implemented an ICT system that allowed customers to provide instant feedback on products, leading to improved product development and enhanced customer engagement.

The second key finding is how distributors harness ICT to improve product and sales innovation. ICT affects supply chain distributors by leveraging data analysis and business intelligence tools to gather insights on customer behavior and market trends. ICT facilitates efficiency, transparency, information sharing, collaboration, and accessibility to data in real-time, enhancing close partnerships among suppliers, manufacturers, and customers (Anderson & Narus, 1984) and fostering innovation and understanding of customers' needs (H1a). As a result, the distributor serves as an innovative knowledge bridge between the customer and the organization in a dynamic environment (Hansen & Birkinshaw, 2006). In addition, the distributor has a business interest and motivation to contribute to the customer's ability to innovate by improving communication beyond information, integration of systems, and collaborations.

The third key finding refers to the distributors that affect both sales and product innovation. To improve sales innovation, distributors may leverage the ICT toolbox to reveal new market segments globally and locally and expand current segments through improved sales and product innovation to enhance customer experience and increase sales. In addition, ICT enables distributors to analyze sales data, track channel performance, and identify areas for improvement. The distributor serves as a generator in identifying customers' needs when it comes to the indirect supply chain (Serra & García, 2013). As a result, distributors can gain insights into customer buying behavior, identify cross-selling and upselling opportunities, and forecast future sales trends (H5a). To improve product innovation via the ICT toolbox, the distributors have unique knowledge about the current and future needs of the business environment. They can harness better communication to collaborate with supply chain entities which serve as a fertile ground for new ideas development, feedback, and suggestions for service and product innovation (H5b).

The fourth key finding refers to business environment. Dynamic business environment refers to the constant evolution of identifying challenges and opportunities for organizations in new markets and their needs to adapt marketing strategies. In addition, organizations navigate the fast-changing market demands regarding products, services, and logistics requirements. Distributors can achieve innovative sustainability through dynamic business environment by improving packaging and identifying new cost-effective ways to distribute products and services, such as utilizing innovative transportation methods like drones (H2a). The combination of dynamic business environment with customers' innovative requirements in digital media, along with an understanding of their innovative needs, such as customized product or service delivery, agility, ecological quality, and price reduction, opens new avenues for new business environments (H2b). By adapting new strategies to dynamic business environments, organizations can leverage distributor relationships to enhance customer innovation via partial complementary mediation (H4).

The fifth key finding refers to technological environment. Organizations should leverage the technological environment to enhance the supply chain especially with customers (H3a) and distributors (H3b). The more the organization invests in a dynamic technological environment with distributors, the greater the dynamic innovation ability concerning customers will increase (H4) via distribution mediation. A dynamic technological environment impacts the significance of the relationship between distributors and customers. Hollebeek et al. (2019) assert that relationships are strengthened through the organization's ability to respond quickly to customers' changing technological demands, exclusive needs, and desires (H4). A technological environment contributes to establishing dynamic communication between the organization and customers, thus providing an infrastructure for business opportunities and developing new products through initial and innovative technological breakthroughs. The technological environment facilitates innovation in both sales and production when it benefits from the collaboration among the organization, customers, and distributors.

# Science contribution

Little literature has addressed the importance of gathering knowledge about the market from the distributors as having direct knowledge of changes and transformations in the future market (Wang et al., 2021). In addition, the distributors are intermediaries between the organization and the customers. Consequently, they operate as channels for transferring information about the current and future needs of the business environment in general and the customers in particular. Due to the direct and indirect knowledge accumulated among the distributors, the organization will know the needs of the existing market, particularly the required developments of the products and services, and be exposed to new markets. The current study focuses on the distributors' contribution to creating added value for the organization through the nurture of product and sales innovation while examining different types of markets.

# Managerial contribution

From the key finding, the first contribution to managers refers to the multiple mediation analysis. Managers can glean that while ICT, business, and technological environments are essential drivers of innovation, the role of distributors as intermediaries is also significant. This insight underlines the importance of building strong, strategic partnerships with distributors. The insights also address the call of Wang et al. (2021). Managers should harness these relationships to understand better and meet customer preferences and demands. This approach leads to enhanced sales and product innovation and contributes to more efficient and effective market penetration. Furthermore, by involving distributors in the innovation process, organizations can leverage their unique market insights and logistical capabilities, potentially leading to improved product design and distribution strategies.

 The second contribution highlights that Managers should recognize the role of distributors in utilizing ICT for product and sales innovation. Distributors leverage data analysis and business intelligence tools to understand customer behavior and market trends. ICT enables efficient information sharing, collaboration, and real-time data accessibility, strengthening partnerships. Distributors serve as knowledge bridges, fostering innovation and understanding customer needs. Managers should involve and empower distributors, providing them with ICT tools to drive innovation and customer-centric strategies.

The third contribution indicates that managers should adopt a proactive approach to navigate the dynamic business environment. The adoption requires fostering an organizational culture of innovation, strategically incorporating sustainability, leveraging digital media, and enhancing service delivery in line with customer needs. Also, building and nurturing strong distributor relationships is crucial to boost customer innovation and enhance overall performance. Ultimately, this blend of strategic flexibility and a customer-centric approach can result in cost efficiencies, quality improvement, higher customer satisfaction, and competitive advantages.

The last contribution is that managers should invest in technology to drive innovation and enhance relationships with distributors and customers, according to these findings. Investment in the technological environment could enhance supply chain processes, facilitate dynamic communication, respond effectively to changing customer needs, and stimulate product development. Further, the technological environment provides the necessary infrastructure for recognizing and capitalizing on business opportunities. Hence, integrating technology into strategic management can lead to operational efficiencies, improved relationships, product innovation, and business growth.

# Research Limitations

The study's limitations can be categorized into three distinct areas. Firstly, it is important to acknowledge that this study employed a correlative methodology, thereby restricting the ability to establish causal relationships between the identified variables. Secondly, while the present study included participants from diverse countries and industries, it is crucial to recognize the substantial variances in ICT utilization and innovation perceptions across different industries and countries. Thus, it becomes imperative to conduct comparative studies in the future that directly examine these variations to gain a more comprehensive understanding of the subject matter. Finally, it is worth noting that the current study relied on self-reported data provided by the research participants rather than empirical data derived from organizational information systems. Consequently, future research endeavors should strive to incorporate data obtained from organizational information systems to augment the reliability and validity of the findings.

# Summary

The existing literature focuses on innovation processes in the supply chain and the distributor component in particular, but does not examine the contribution of the distributors, as an mediator between the organization and the customers, to the knowledge required for the development of organizational innovation. The current study explore uniquely the distributors as a direct and indirect path of knowledge about the needs of the market and the customers that form the basis for the development of product innovation and sales innovation. By using a SEM model the research examine the effects of ICT and the business and technological environment on the supply chain and the impacts of the distributors and the customers on various innovation applications that can increase the value of the organization. The research findings point to a significate influence of the distributors directly and indirectly on the development of innovation in the organization.

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