# Sales and product innovation: The mediating role of distributors’ supply chain collaboration via technological and organizational environments

# ABSTRACT

This study examines the influence of information communication technologies (ICT) and business and technological environments on collaboration between 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. The 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, emphasizing 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 both 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-driven 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 in 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 both directly and indirectly to customers, cutting the distributor’s profit (Huang et al., 2018). The combined direct and indirect approach increases the supplier’s access to customer information and changing demand (Vinhas & Anderson, 2005). In contrast, the distributor’s 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 studies, 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 focused 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 investigated how this capability can help firms navigate supplier intrusion and enhance organizational performance. They surveyed the semiconductor industry and 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) and business and technological environments for distributor–customer 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 ICT and business and technological environments influence the collaboration with customers, with the distributor serving as a mediator? This question seeks to understand the effects of elements such as ICT and business and technological environments 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 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 ICT and business and technological environments. Additionally, the study investigates the role of distributors as multiple moderators, influencing both 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 has a broader scope, surveying a diverse range of industries. It encompasses 14 industry types within 9 European countries with 372 responses, hence increasing the generalizability of the findings and contributing to fulfilling the call for future research suggested by Ghauri et al. (2016) and Wang et al. (2021).

The primary contribution of this research lies in the empirical examination of the impact of ICT and business and technological environments 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 and business and technological environments 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 in upstream and downstream performance (Cheshmberah et al., 2011; Chopra, 2003; Park & Keh, 2003), the direct connection between suppliers and customers (Huang et al., 2018), and 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 ICT and the business and technological landscapes. The investigation illustrates that while ICT and the business and technological environments possess the capacity to engender value within 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 the wealth 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 and the business and technological environments in propelling marketing strategies forward, specifically regarding sales amplification and product innovation.

The final contribution is by underlining four critical managerial insights. The study stresses the crucial role of distributor partnerships, alongside ICT and business and technological environments, in driving innovation. In addition, it emphasizes the value of ICT in aiding distributors to understand market trends and foster customer-centric strategies. Third, 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 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 results obtained. The final sections of the paper 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 between 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, a 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 dynamic capability theory (Mikalef & Pateli, 2017; Mikalef et al., 2016).

ICT enables companies to collect and process data in areas such as operations, production, or logistics (Hu et al., 2015) in real-time and more efficiently to make informed and complex decisions quickly (Stadtler, 2015; Vafaei-Zadeh et al., 2020) in a dynamic changing environment (Mikalef & Pateli, 2017; Mikalef et al., 2016). It enables integration with suppliers to facilitate better communication and information sharing in logistics processes (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. However, they did not find the impact of ICT on information sharing and quality to be significant. The research methodology was a survey with 121 completed questionnaires.

Various technologies are part of the ICT domain. For example, linked data (Bechhofer et al., 2013), mobile technologies (Levi-Bliech et al., 2020; Partridge, 2011), web-based technologies (Kashyap et al., 2022), the internet of things (IoT), big data (Gupta et al., 2020; Zhang et al., 2022), and industry 4.0 (Silva et al., 2022; Zhu et al., 2022) all facilitate real-time availability and ubiquity (Ikumapayi et al., 2022). For instance, Zhu et al. (2022) explored how ICT, such as industry 4.0, affect supply chain performance via supply chain integration as a mediator. The authors identified significant positive effects between ICT and supply chain integration (SCI) and between SCI and SCM. As a result of the implementation of ICT, 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 a 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 growth in environmental dynamism should be related to innovation that defines strategy-making activity. Garcia and Calantone (2002) reported that product innovation requires two factors to develop: a new marketplace and science or technology.

# Business environment

The business environment is the set of all external aspects that have an impact on an organization and is formed of two dimensions: the macro environment and the business sector (Pereira, 2018). Albright (2004) argued that the business environment is useful for identifying competition in an industry and understanding the role of the competitors, customers, and suppliers in the market. Understanding and scanning the external environment is required for the organization’s success and future opportunities. Leng et al. (2015) asserted that market orientation is considered essential 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) asserted that dynamic and unmunificent environments have a negative effect on new product innovation outcomes.

# Technological environment

Albright (2004) claimed that new technologies could impact an organization’s business efficiency and change its production technologies. Technological environment integrated with firm profitability, growth, and research and development (R&D) opportunity influences firm innovation (Bhattacharya & Bloch, 2004). Firms with market and technology orientations have superior product performance (Leng et al., 2015). Vega-Jurado et al. (2008) pointed out that firms’ technological capabilities, based on the firms’ 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 upstream flow of raw materials, products, and services from the supplier to the end customer and the downstream flow of information and transaction 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 between 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 distribution, and (3) hybrid distribution. When an organization chooses a distribution channel, it 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, who use the indirect strategy to reach the end customer (Chen & Chang, 2010; Takata, 2019). Distributors link manufacturers, wholesalers, and 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 an organization: (1) improve organizational knowledge, (2) strengthen the importance of collaborations, (3) reduce the organization’s inclination to prioritize one innovation strategy over another, and (4) positively affect organizational performance (Hernández-Espallardo et al., 2011).

# Customers

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 address 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 increase consumer demand dynamics and shorten the lead times to deliver products or services, leading to increased 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 information about 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

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

Kahn (2018) reported the importance of understanding that innovation outcomes include several types: product innovation, sales innovation, supply chain innovation, organizational innovation, and other kinds of innovation. Manual (2018) recommended collecting data on innovation outcomes, such as the sales share and 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[to] 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) found that the development of product innovation needs two factors: marketplaces and science or technology. Li and Vermeulen (2021) tested the outcomes of new product development on firm performance, measured in the pharmaceutical market in China. They argued that new product development is risky and correlates with lowering firm performance while increasing its variance. López-Cabarcos et al. (2020) reported that organizations can achieve higher profitability both directly and through product innovation. Product innovation in manufacturing firms considers external and internal factors, and cooperation with industrial agents (customers, suppliers, competitors) can be a decisive factor in the development of new products in traditional industries (Vega-Jurado et al., 2008). Silva et al. (2019) found a relationship between environmental uncertainty and importer involvement in innovation activities. They argued that effective communication between the export firm and the importer remains critical to successful product innovation. Some studies report on the connection between product innovation and the supply chain. Haus-Reve et al. (2019) reported that the supply chain can improve the chances of firm product innovation, new-to-market product innovation, and share of turnover from new products. The study also found that supply chain and scientific collaboration have only incremental effects on firm innovation. Gholizadeh and Fazlollahtabar (2021) found new product development strategies based on both external source supply chain supplies and non-supply chain resources (Gault, 2018).

Other research has explored the relationship between the supply chain and product innovation. Arlbjørn et al. (2011) claimed that SCM can produce competitive rewards by creating new products and services or entry into new markets. Graham and Hardaker (2000) examined the connection between supply chain design and management and the new competitive challenges due the growth of the internet. The findings showed that the internet has become a central part of a commercial drive toward innovation and has created new directions for marketplaces.

#  Sales innovation

Sales growth is related to knowledge and innovation and mainly refers to process and product innovation (Uhlaner et al., 2013). Colder (2000) explored innovation in international markets and found it as one of the most determinant factors. He claimed that business grading assisted in defining the market share goals of firms by creating new products. Technological innovation has been found in several studies to be an influencing factor in international markets’ innovation. New innovations create sales in new markets; they start in a weak form and then increase significantly (Agarwal and Bayus, 2002). Katsikeas et al. (2020) pointed out that the entry of a firm into foreign markets can be facilitated using digital technologies, and these can affect the firm’s implementation of an international marketing strategy. The internet was found to be a new and effective path to internationalization and to export marketing in two main ways: as a physical presence and as a sales channel (Sinkovics et al., 2013). Several pieces of research investigated the relationship between the supply chain and sales innovation. Lii and Kuo (2016) investigated the joint effect of an innovation orientation and SCI. They found that innovation orientation positively affected the supply chain and firms’ combined competitive and performance abilities. Cohen et al. (2000) found that after-sales service is made up of efficient SCM and satisfied customers.

# Research model and hypotheses development

The conceptual model evolved in this chapter elaborates on the correlations between (1) ICT, technological eviroment, and business environment; (2) distributors, retailers, and consumers; and (3) sales innovation and product innovation (Figure 1). The ICT construct encompasses mobile applications, semantic web/linked data, cloud computing, social networks, electronic markets, and knowledge management systems; other technologies do not influence the measured items or have the versatility of those listed. These technologies are used via portable or on-premises devices that depend on the internet and wi-fi (Storgards, Tuunainen, & Oorni, 2009). Workers and customers may access them from outside the organization (Leclercq-Vandelannoitte, Isaac, & Kalika, 2014). Customers commonly use mobile applications for purchasing commodities anonymously.

Figure 1: Research model



Note: Cust – Customer; Dis – Distribution; Busi 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 performance 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 complete supply chain systems into subnational business processes (Lambert et al., 1998; Shahzad et al., 2020). SCM facilitates collaboration and cooperation between suppliers, the organization, distributors, wholesalers, retailers, and customers (Monczka et al., 2020; Van Weele, 2018). This is achieved via information sharing and integration (Shahzad et al., 2020).

ICT, such as mobile applications (Rossi et al., 2007), linked data, and the semantic web (Huang & Javed, 2008) enable transparency, customer service, and streamlined data flow between 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 is consistent with dynamic capabilities theory (Blocker et al., 2011; Gupta et al., 2020; Wang et al., 2021). ICT improves 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 is positively related to the distributor’s SCM collaboration.

H1b: ICT is positively related to customer SCM collaboration.

Open innovation partners such as customers increase collaboration, enabling the firm to achieve concurrent economic and sustainability innovation goals and to increase their performance (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 offers novel ways to create orders and new contacts with distributers and customers in a new business environment that exposes the firms to unique events and in their own business environment (Muhammad et al., 2010).

Hence, we propose the following further two hypotheses for consideration:

H2a: Business environment is positively related to the distributor’s SCM collaboration.

H2b: Business environment is positively related to customer SCM collaboration.

Technological environments allow a firm to create interactions with its prospects and customers. Those interactions enable the organization to fulfill customers’ individual needs and desires, develop technology to support the firm, and adapt to a changing business environment (Hollebeek et al., 2019). Technological features impact customers’ interactivity and personalized virtual experiences (Zhang et al., 2014). Technology transfer between firms in worldwide competition stimulates 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 is positively related to distributor SCM collaboration.

H3b: Technological environment is 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 a distributor to identify customers’ new and upcoming expectations and proactively adjust existing products or foster new products and services to meet them (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 dynamic capability theory (Blocker et al., 2011; Gupta et al., 2020; Wang et al., 2021).

Hence, we propose the following hypothesis for consideration:

H4: The use of distributors is positively related to customer 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. Distributors have in-depth customer knowledge that is important in building close, cooperative, and partnering relationships. By understanding customers’ unique needs and challenges, distributors can provide tailored support and guidance, become a trusted partner, and achieve mutual success (Cocks, 1996; Daulay & Saputra, 2019).

Distributors contribute to an organization via understanding significant new trends and customers’ needs and behaviors, and having an awareness of competitor strategies (Mudambi & Aggarwal, 2003). The relationships between a firm and its distributors influence the firm’s innovations and performance and include knowledge gathered from the distributors about markets (Hernández-Espallardo et al., 2011). Zulfiu et al. (2015) found that organizations are obliged to reveal corporations with trading partners. They found that participation of the distributors in the innovation process stimulates the development of innovative ideas. Information Technology and innovation in logistical actions may encourage the retailer to use only a particular distributor by the use of direct-to-store shipments and fulfillment of real-time sales (Bello et al., 2004).

Hence, we propose the following two hypotheses for consideration:

H5a: Distributors’ SCM collaboration is positively related to product innovation.

H5b: Distributors’ SCM collaboration is positively related to sales innovation.

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

Hence, we propose the following two hypotheses for consideration:

H6a: Customer SCM collaboration is positively related to product innovation.

H6b: Customer SCM collaboration is positively related to sales innovation.

# Methodology

# Instrument construction

This survey contains several groups of items, which led to a questionnaire with approximately 44 items in total. The first group of items measures the ICT tools in the organization, includes eight items, and was adapted from Levi-Bliech et al. (2018). Two other groups test the characteristics of the business environment and the technological environment; these include eight items adapted from (Levi-Bliech et al., 2018) and four items adapted from Wang & Chung (2013), respectively. Another two groups of items, aiming to measure the interface between the organization and the distributors and customers in the supply chain, include nine items adapted from Levi-Bliech et al. (2018). The last two groups of items measure the outcomes of innovation. The outcome of sales innovation includes four items adapted from Manual (2018); the outcome of product innovation includes four items adapted from Hsu et al. (2014). The questionnaire items use seven-point Likert scales anchored mostly from “very low.”

# Data collection

The data were 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), the Netherlands (38), Sweden (34), France (76), Italy (70), the 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 and those with ascending or descending answers or constant answering were removed. The survey yielded a total of 372 complete 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 one third (30%) were working in organizations with global reach, and the rest were working in organizations with national (domestic) markets. The respondents were from a variety of organizational functions; the most prevalent role was IT or technology (28%); the functions of marketing and customer service, R&D, procurement and operations, and production accounted for 10–20% each; and other functions 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 | Percentage |
| --- | --- | --- |
| Organization’s countryDenmarkFranceGermanyIsraelItalyNetherlandsSpainSwedenUK | 31764127038403440 | 8%20%11%1%19%10%11%9%11% |
| Organization’s geographical reach GlobalEuropean Union Local | 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” (CMB) 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’s (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 constructs, statistical controls, such as variance inflation factor (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 CMB is not a threat in the data.

This study followed the remedies for CMB for the 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 instructions 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 statistical procedures of Kock (2015), Podsakoff and Organ (1986), and Spralls et al. (2011). The results of the statistical procedures are as follows: VIF was below the 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), and Jarvis et al. (2003) to determine if a 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 measurement items used identify a specific aspect of the construct area (Chin, 1998; Hair et al., 2016). Since the indicators of ICT represent autonomous 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 second-generation structural equation modeling (SEM) – partial least squares (PLS) software. Analysis via Smart PLS 4 is superior to other programs, such as AMOS and LISREL, when there are one or more formative constructs, a complex structural model, an exploratory research context, 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 with the work of Levi-Bliech et al. (2018), who carried out construct validity for similar constructs. The VIFs of the ICT items were below 3 (Hair et al., 2016; Petter et al., 2007), suggesting no collinearity across formative measurement items (Table 2). The next step is to test the statistical significance of the outer weight. We used 5000 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 not being 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 needed to evaluate the composite reliability (CR) and validity (of each reflective construct). The CR results were greater than 0.8, therefore establishing “internal consistency and individual indicator reliability” (Hair et al., 2016, p. 100). Internal consistency was also supported with Cronbach’s alpha higher than a 0.7 threshold (Hair et al., 2016). To estimate convergent validity, we calculated the average variance extracted (AVE). In Table 3, all AVE indicators are above a 0.5 threshold, 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, where all AVE square roots on the diagonal (in gray, 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 be greater than the cross-loadings on the other constructs (Hair et al., 2016). Discriminant validity was supported (Table 3 and Table 4, in gray). After establishing the measurement model with formative and reflective constructs, we next analyzed 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; Busi 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 in assessing the structural model is to identify collinearity issues in the inner model (Hair et al., 2016; Ringle et al., 2012). All VIF were below 3, suggesting that there are no indications of collinearity issues in the inner model. measurement model assuring there are no collinearity problems (Ringle et al., 2012). In the second step, the significance of the path coefficient was analyzed. A bootstrapping procedure with 5000 samples for significant levels indicated that all hypotheses are significant (Table 5). The adjusted $R^{2}$ are between 0.548 and 0.637, which is acceptable in marketing and innovation research (Hair et al., 2011; Henseler et al., 2009). According to Cohen (1988) and Hair et al. (2016), an $f^{2}$effect size results threshold of 0.02 is regarded as a small effect size; results up to 0.15 are regarded as medium effect size, and results above 0.32 are regarded 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 and 0.209, respectively). The effect size of technological environment on distribution is medium (0.134). All other effects are low. The last step in evaluating the structural model is to assess the predictive relevance. Stone–Geisser’s $Q^{2}$ was used, which measures the model’s ability to predict the relevance of the analysis (Geisser, 1974; Stone & Choice, 1974). All $Q^{2}$ are above 0.5, indicating 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 2a and 2b show, respectively, the innovation outcomes by management level by market type, with plots of the inter-group differences in the DVs and their confidence intervals (one standard error in each direction). Figure 2a shows that the two innovation outcomes do not differ due to management level. These results support the findings in Table 5; they show no significant evidence that management level impacts product or sales innovation. Figure 2b shows that the two innovation outcomes do not differ due to market type. 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 type

 

# 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). SEM is a powerful approach for conducting mediation analyses with multiple mediators or independent variables (Mackinnon, 2012); it 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 the testing of 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 the indirect, direct, and total effects of mediation analysis (Ringle et al., 2015).

To analyze the multiple mediation effects of ICT, the business environment, and the 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) and Hayes (2017). The multiple mediation analysis included three independent variables: ICT, the business environment, and the 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 effect 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 ICT showed the lowest ratio at 33%. These findings indicate that the influence of the business environment indirect path has the most substantial impact, followed by the technological environment, and finally 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 Smart PLS 4

|  |
| --- |
| 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 processes of creating new products and exploring fresh customer marketing avenues (H1b, H6a,b). For instance, during the pandemic, organizations that swiftly adopted ICT could quickly adapt their marketing approaches to cater to customers’ shifting demands and preferences as they 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 the potential of ICT and enhance their 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). Distributor collaboration has been found to have a partially mediating and complementary effect on the impact of ICT on customers’ SCM collaborations. 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 allowing 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 access to data in real-time, enhancing close partnerships between 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 the 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). 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 serves as fertile ground for the development of new ideas, feedback, and suggestions for service and product innovation (H5b).

The fourth key finding refers to the business environment. The dynamic business environment refers to the continuous process of identifying challenges and opportunities for organizations in new markets to adapt marketing strategies. In addition, organizations must navigate the fast-changing market demands regarding products, services, and logistics requirements. Distributors can achieve innovative sustainability through the 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 the 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 up 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 the 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) asserted 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 between the organization, its customers, and its distributors.

# Science contribution

Little literature has addressed the importance of gathering knowledge about the market from distributors, as having direct knowledge of changes and transformations in the future market (Wang et al., 2021). In addition, distributors are intermediaries between an organization and its customers. Consequently, they operate as channels for transferring information about the current and future needs of the business environment in general and customers in particular. Due to direct and indirect knowledge obtained from distributors, an organization can 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 distributors’ contribution to creating added value for an organization through the nurture of product and sales innovation while examining different types of markets.

# Managerial contribution

From the key findings, the first contribution to managers refers to the multiple mediation analysis. Managers can glean that while ICT and 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 better understand 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 navigating 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. Furthermore, building and nurturing strong distributor relationships is crucial to boosting customer innovation and enhancing 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, according to these findings, managers should invest in technology to drive innovation and enhance relationships with distributors and customers. Investment in the technological environment could enhance supply chain processes, facilitate dynamic communication, help them respond effectively to changing customer needs, and stimulate product development. In addition, 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. First, it is important to acknowledge that this study employed a correlative methodology, thereby restricting the ability to establish causal relationships between the identified variables. Second, 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 will be important 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 increase 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 it does not examine the contribution of distributors as mediators between an organization and its customers of the knowledge required for the development of organizational innovation. The current study uniquely explores distributors as direct and indirect sources of knowledge about the needs of the market and customers, which forms the basis for the development of product innovation and sales innovation. Using an SEM model, the research examines the effects of ICT and the business and technological environments on the supply chain and the impacts of distributors and customers on various innovation applications that can increase the value of an organization. The research findings point to a significant influence of distributors both directly and indirectly on the development of innovation in an organization.

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