Article

Determinants of Product Innovation Performance in Aviation Industry in Saudi Arabia

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Abstract: Innovative technology significantly transforms numerous activities and operations in the logistics sector across various industries, including the aviation sphere. This primary quantitative research aimed to explore the evolution of logistics and supply chain management in the digital age for aviation companies in Saudi Arabia. The research involved conducting a survey among 104 supply chain and technology personnel from Saudi Cargo and its affiliate firms in Saudi Arabia. Partial least squares (PLS–SEM) was used for data analysis to determine the relationships between three independent variables: market intelligence quality (MIQ), manufacturing–marketing coordination (MMC), and supply chain intelligence quality (SCIQ), with product innovation performance (PIP) as the dependent variable. The results indicated that SCIQ and MIQ have a positive and significant statistical relationship with PIP. Nonetheless, the findings disproved that the MMC gives insights into consumer needs directly affecting PIP. From this study, it can be concluded that aviation companies should improve their supply chain systems, marketing domain, and manufacturing marketing coordination to realize the improved performance of their product innovations in the contemporary digital era.

Keywords: market intelligence quality (MIQ); manufacturing–marketing coordination (MMC); supply chain intelligence quality (SCIQ)

1. Introduction

New products and services are being developed by companies to meet the needs of emerging markets. According to Chen et al. (2018), the underlying power is because of increasing competition alongside accelerating industry growth. Internal and external business coordination is becoming central to acquiring knowledge from the unique environment, exploiting and transforming the knowledge for innovation purposes. Marketing is a critical concept in business new product development because its coordination with the firm's internal functions, such as the integration of manufacturing functions, clouts the ideal knowledge and skills in pursuing the related innovation targets and goals. However, it is influenced by technological developments in the external business environment (Venesz et al. 2022). According to Pereira et al. (2022), technology has brought automation into the global business domain, which has had a significant impact on the reduction of the aviation industry's operational costs. Airlines' import-to-export paperwork was reduced by nearly 75 percent, thus giving the industry a new service delivery approach that guarantees customer experience and satisfaction. Aviation companies have integrated techniques that the government regulates to ensure they are relevant in the contemporary market, resulting in the enhanced roles of government agencies in the overall international trade growth.

Furthermore, the supply chain sphere is increasingly gaining attention and empowering the nation's international trade and recognition. According to Sombultawee and

Boon-itt (2018), coordination between manufacturing and marketing business activities denotes the volitional process of establishing a mutual agreement between the two departments towards attaining a single goal. However, the process requires the further inclusion of extra coordination from supply chain functions, which helps to improvise and understand the products' quality, increase competitive values, and reduce the costs of executing operations. Similarly, the supply chain influences product innovation performance; the distribution of products from the manufacturing stage to the marketing phase determines their consumption rate. These concepts provide specific insights about the product innovation performance concept whose impact on business is worthy and highly established through the development of products (Puriwat and Hoonsopon 2022). The benefits of PIP are well linked to the coordination existing between manufacturing, marketing, and the supply chain (Buciuni and Pisano 2021). The coordination of marketing and manufacturing enhances market knowledge development and empowers the business in managing tacit and complex consumer preferences while still improving the company's manufacturing capacity, and Sombultawee and Boon-itt (2018) stated that the firm's manufacturing and supply chain coordination enhances product design insights, thus accelerating product development.

Coordination is widely known for facilitating an on-time product launch, which effectively provides new services and products while ensuring product specification compliance (Li et al. 2022). It is easier to establish that SCIQ and QMI have the power to complement the manufacturing–supply chain relationship, which has an exemplary impact on improving PIP. According to Liu and Atuahene-Gima (2018), product innovation performance can be described as stating the degree to which innovations meet customer satisfaction expectations, company sales, and market share. The concept of product innovation performance elaborates on modifications and derivations of the product lines toward realizing new formats and functions that meet the targeted consumer expectations, market share, and sales. Additionally, Rajapathirana and Hui (2018) asserted that product innovation performance improves the business market share by facilitating new products and unique services to reach consumers and solving explicit problems or needs. Similarly, product innovation performance enhances firms' overall function of meeting consumer expectations based on their level of satisfaction.

PIP depends on MMC and SCIQ; according to Maskey et al. (2020), supply chain management is crucial for a business to acquire market trends and thus, develop products that meet market expectations. The pressure and competition in the market have forced enterprises to adopt available and suitable business management models to ensure the delivery of new products that meet the market needs. Yam and Chan (2015) further independently described the marketing intelligence quality, which illustrates their relationship and influence on the product development process. MIQ describes the marketing role of identifying, engaging, and satisfying consumer needs. It calls for the proper coordination between production or manufacturing and marketing in order to provide more efforts and facts towards realizing innovation- related subsystems. MIQ includes information about market activities and business rivals, enabling business management to establish suitable methods of approaching the market. For this reason, marketing intelligence quality influences the introduction of new products to the consumer base, allowing the business to improve its product performance (Kumar and Bagga 2020). SCIQ describes the relationship between the supplier and the consumer. This association requires further coordination between manufacturing and supply chain spheres, which is imposed to support innovation performance. The coordination of the business functions of the supply chain, marketing, and product production or manufacturing has a significant impact on attaining product innovation goals. The coordination between goods manufacturing and supply chain intelligence has been fostered by the concepts of MIQ alongside supply chain intelligence quality. Supply chain management digitalization is a strategy that enhances risk management (Peñalba-Aguirrezabalaga et al. 2022).

According to GACA (General Authority of Civil Aviation of Saudi Arabia) (2021) the reliability and predictability of the whole clearance process have improved in airports; nearly half of the customs declared are cleared within a day. The experience shows how air transport is becoming a critical airline logistics infrastructure. The digitalizing of the declaration processing is evidenced by the reduction in the manual inspection of imports and exports, hence reducing the associated risk management while increasing the integration and collaboration amongst the involved governmental institutions in the entire import-and-export process. Part of the technological influence experienced in the supply chain is enhanced security capabilities and controls (Ghadge et al. 2020). As of the moment, most supply-chain-related operations have been digitalized, providing room to enjoy the linked benefits among other attributes or segments (Seyedghorban et al. 2020).

Furthermore, manufacturing–marketing coordination provides links between the manufacturer and the market, providing the needed information on how to boost and sustain the relationship. These attributes have caused the manufacturing–marketing coordination to improve PIP. Nonetheless, the applicability of the aspects in the aviation industry is intense because the sector facilitates other industries' operations. Notably, high levels of manufacturing–marketing coordination increase the performance of product innovation. Additionally, customer satisfaction depends on the coordination between the supply chain and manufacturing because the relationship influences product quality and service delivery. Therefore, these relationships provide a way of understanding and documenting the best models that can be designed to offer a knowledge base on the development of supply chain management in the digital era for the aviation industry.

Technology in logistics and supply chain domains has undergone significant improvement by introducing lean systems, enterprise resources, and mobile telephony in the logistics and supply chain field. According to Cooper (2019) technology significantly influences product development from the perspective of consumer feedback and preferences within the market. However, the influence of product innovation performance on the aviation industry has received less attention in the research domain, especially regarding how product innovation performance is impacted by changes in MMC, MIQ, and SCIQ. Business product innovation is associated with the benefits of facilitating a company's effort to achieve its target sales, market share, competitive advantage, and customer satisfaction. The intelligence quality is a vital attribute for executing the relative models and ideologies towards attaining a positive product innovation performance. The identified gap in the background indicates a limitation in illustrating the significance of the requirements that may influence the realization of PIP. As noted, customer satisfaction is associated with understanding the customers' behavior changes while developing a positive attitude towards establishing a strong relationship. In addition, the introduction of relatively new features and values to the market is likely to enhance the business' competitive advantage in the target market. PIP depends on the execution of MIQ, MMC, and SCIQ. The three concepts are related to the variable of PIP, as illustrated. Better systems, processes, and models can be developed by linking the customer and their needs, the manufacturer and the market, and the supplier with the consumer. Product innovation performance depends on marketing strategies using MIQ, the coordination between manufacturing and marketing, and supply chain management. Understanding the history and evolution of technology in the industry would benefit innovators and technology providers who would identify the best possible technology to adopt in the industry as general supply chain technology evolves. The current research will help understand the challenges and problems encountered while adopting new aviation supply chain management technologies. Such an understanding is of significance in mitigating the risks associated with adopting new logistics and supply chain technology. Furthermore, the research will establish approaches appropriate for investigating the link between SCIQ, MMC, MIQ and PIP based on the case of Saudi Air Cargo.

2. Literature Review

2.1. Product Innovation Performance

Product innovation simplifies a process that enhances management alongside commercial-related activities associated with the newly developed product. According to Bodas Freitas and Fontana (2018), product innovation can be described as the process that encapsulates the technical design, research, and development of new products, which should be designed to fit within the competitive marketplaces. Song et al. (2020) asserted that PIP is simply a structure of varying the dimensions of the initiated innovation's effectiveness; thus, the aspect points to how the innovation or product would influence the consumer toward meeting their expectations and requirements. At the same time, the concept defines the overall commitment of the organizations toward innovation from its effects to target consumers' points of view. Therefore, product innovation can be denoted as the latest method applied in industrial engineering and other sectors to examine the industry results and aid in the businesses' future evolution (Bodas Freitas and Fontana 2018). PIP provides the conclusion that more positive outcomes are likely to be experienced in the future. The concept is beneficial in boosting the level of understanding of the business environment.

It is not enough to consistently rely on a single method during the production of products when organizations aim to enhance their business growth and development in the present competitive world. According to Bodas Freitas and Fontana (2018), introducing new production environments alongside understanding the nature of the product in consumers' minds provides a way of easily developing new methods that have the ability to enhance the organization's growth. For this reason, product innovation can be denoted as the approach of doing away with the traditional methods of working on competition within the market by improving consumer desires. Song et al. (2020) observed that the actual requirement of business survival throughout its growth stage, characterized by intense competition in the marketplace, is adopting the latest or new methods of product innovation. Product innovation is ranked among the significant approaches that determine the consumers' requirements, given that their needs and desires are dynamic because they always change over time. Therefore, product innovation has remained the new technique in the current global business domain. The process involves introducing new ideas and mechanisms that introduce unique novel products into the market to realize the changing consumer needs. Munoz-Pascual and Galende (2020) illustrated that working in a sound innovation management plan is not enough to offer positive results for the institution. It is essential to translate the plan into some viable products that will directly impact the consumers' needs by meeting their expectations. The Munoz-Pascual and Galende (2020) analysis i indicated that PIP is a concept that points to expanding the market with the introduction of new products, which emerge as a result of new ideas. The ideas can be generated from the analysis of consumer needs and expectations. While researching consumer needs, desires, and expectations within the market, the appropriate approach to conducting the evaluation is to create viable products that will positively influence consumer needs and wants. PIP is a broad concept and may require significant investments for companies to realize its influence on business performance in competitive industries.

The impact of PIP on an organization requires effective governance and measurement. According to Salisu and Bakar (2018), product innovation is a form of investment that should be monitored and evaluated within a defined period to determine the overall impact. The analysis indicates that the development of a new product is a process that requires strategic organization and road mapping from the start to the end (Salisu and Bakar 2018). The integration of the approach confirms the effective translation of the idea into the execution of innovation. Munoz-Pascual and Galende (2020) stated that providing an accolade business product innovation solution aids an institution in structuring, automating, and measuring the established product innovation. The practice of measuring product development is important to ensure that the new product is designed and produced using cost-effective and ethical or acceptable approaches in the manufacturing sphere. PIP is an exclusive determinant factor of an organization based on the introduction of unique

novel products in the target market. The description of PIP induces two essential factors: introducing new ideas and making them applicable for the business' success. The product innovation concept involves aspects beyond the introduction of the new product.

The development of incremental and exploitative product innovation depends on existing knowledge alongside the ideal products and services for the existing consumers. For this reason, PIP has been beneficial to businesses by enabling them to exploit market opportunities while eliminating potential threats. The success experienced in introducing a new product is contingently influenced by the established external factors of environmental threats and market opportunities (Liu and Atuahene-Gima 2018). According to Liu and Atuahene-Gima (2018), contingency theory posits that institutions must be strategic in the decision-making process depending on the explicit environmental conditions. These conditions are easily linked to consumers, suppliers, and the potential substitutes and competitors of the present market. To experience a favorable environment, organizations should be ambidextrous in order to build some capacity to develop both radical and incremental forms of innovation in various organizational sections or units.

2.2. Manufacturing Marketing Coordination (MMC)

MMC is a concept that provides the foundation for linking the product producer or manufacturer with the targeted market. This ideology provides the necessary information from both ends to the opposite side, thus creating a sustainable relationship. According to (Mostaghel et al. 2019), MMC comprises attributes that evaluate the market trends that would influence the production of the products, hence influencing business activities. The author indicated how the MMC concept is capable of eliminating the possible barriers that would limit the flow of information between the market and the producer (Mostaghel et al. 2019). The market trends highly depend on the presentation of the product and therefore remain essential to providing an appropriate way of linking the market and the producer. The manufacturer is likely to evaluate the market requirements and thus, develop better processes and procedures to maintain dominance within the market (Patel and Feng 2021). While associating the concept of manufacturing marketing coordination with the linkage of market environment and production, it is notable that the phenomenon is essential to enhancing consumer satisfaction.

Consumer satisfaction and retention are the overall observable effects of MMC. Ahmadi and Letter (2021) provided that the coordination between manufacturing and marketing results in increased customer satisfaction through efficient services and product delivery, as expected by the potential consumers in the target market. The coordination was further observed to be an essential link between the suppliers and product manufacturers in the organizations' supply chain, guided by market behavior. The intelligence of the supply chain is good at alerting the manufacturer to the market trends and thus enabling the regular supply of products as demanded by the market. Consumer demand defines the market behavior, and upon studying the market trend, it is easier for the manufacturer to boost the supply chain and subsequently guarantee customer satisfaction (Mostaghel et al. 2019). Satisfaction can be achieved through maintaining product and service quality, timely delivery, and availability, among other attributes. According to Patel and Feng (2021), the automation of the manufacturing process, which can adopt the just-in-time approach, indicates how a business can gain dominance while guaranteeing service delivery in the current digital era. The market shortage may result in limited coordination or a missing link between the market and the manufacturer.

Bendoly et al. (2012) used the complementarity theory to explore the critical mediating role of intelligence obtained through augmenting the coordination efforts that are significant in accessing and aligning cross-functional expertise through complementarity investments in the information systems. The authors used instrument variable regression analysis to test theoretical predictions and found that the impacts of the coordination efforts on the manufacturing marketing coordination are moderated by the company's information system capability (Bendoly et al. 2012). In another study, Mostaghel et al. (2019) observed

that increasing MMC results in increased PIP. Furthermore, Yam and Chan (2015) argued that product innovation plays the role of executing ideas that will bring about processes that evaluate and understand the market before sharing the information with the manufacturer. Moreover, the literature review conducted did not reveal any contrasting concept on the ineffectiveness of the manufacturing marketing coordination on the PIP. Prior studies have shown consistent results between MMC and PIP. However, none of the studies reviewed explored the influence of MMC on PIP in the aviation sector. Therefore, there is a need to conduct the current study to fill the existing literature gap. As a first hypothesis, we therefore propose the following:

H1. *Manufacturing marketing coordination affects product innovation performance.*

2.3. Market Intelligence Quality (MIQ)

MIQ influences the best methods of meeting consumer needs. According to Hole et al. (2018), MIQ defines the role played by the practice of marketing a product. The concept points to the various events that are good at determining the best way to understand consumer needs and accomplish them. Among the roles played by marketing personnel, based on the author's analysis, are the identification, participation, and satisfaction of the consumer wants and needs (Hole et al. 2018). The concept was further described by Al-Zyadat and Al-Zyadat and Al-Zyadat (2018) as an aspect that brings about the needed coordination between the establishment of the product and the practice of product marketing. The process involves the provision of further information and facts about the consumer through their analysis towards realizing innovation subsystems. The concept comprises innovation aspects, which are the primary attributes of development and growth for businesses from the technology perspective. Based on Al-Weshah (2017), MIQ describes the process of gaining access to information about various operations within the market and business rivals. The information provided is applied in facilitating the business management process towards formulating appropriate methods that are essential in meeting the business' expectations within the competitive marketplace. It is not easy for an organization to plan and induce the relevant changes that would boost activities that are appropriate to influence the market trends. This influence is good at boosting competitive advantage and product acceptability in the market. The concept of marketing intelligence quality uses hidden facts that boost the research process.

MIQ is a process that facilitates the development of new products. According to Maria et al. (2020), the performance of a product within the market highly depends on the effectiveness of the marketing approaches adopted. This concept points to intellectual trends that businesses can apply to their projects' market trends and thus, aid in developing new products that will easily attract the market's attention (Maria et al. 2020). Al-Weshah (2017) demonstrated that MIQ is an initial attribute to initiate whenever a new product is intended to be introduced into the market. Based on the appropriate marketing intelligence observations, recommendations can be formulated to ensure that the product introduced into the market offers the expected solution to the target consumer base in the market. The study findings indicated that marketing intelligence quality provides an evaluation of the products within the market against the consumer needs and expectations, thereby enabling the business to initiate an appropriate mechanism of sustaining dominance and acceptance of the products within the market (Al-Weshah 2017). Market trends are easily identified with the initiation of marketing intelligence quality in a business based on its attributes and dimensions of improving innovations that have direct impacts on the business performance.

MIQ discusses the ability of the market to identify consumer needs (Falahat et al. 2020). Zhang et al. (2009) conducted research to examine the interplay of product development strategy, the utilization of knowledge, and PIP, and found that knowledge utilization is significant with PIP. In another study, De Luca and Atuahene-Gima (2007) demonstrated that MIQ has a significant role in mediating the link between MMC and PIP. However, the formulated hypothesis of the current study in the manufacturing marketing coordination

section is that manufacturing marketing coordination affects product innovation acceptability and implementation. Therefore, MIQ can differentiate businesses' offerings compared to their competitors when performed through an increasing manufacturing marketing coordination (Bendoly et al. 2012). For this reason, it is justifiable that increasing MIQ results in increased PIP (Mostaghel et al. 2019). Consumer needs are ever-changing, and satisfying them requires introducing new processes, products, and procedures, which can be initiated by product innovation performance. Similarly, businesses can understand the requirement of achieving consumer needs within the market through the act of integrating PIP concepts. According to Al-Weshah (2017), MIQ introduces new ideas that would be used to satisfy consumer expectations. The recommendations of marketing intelligence quality about the market as far as the consumer needs are concerned can enable the development of new products or improve the existing systems.

A thorough literature review did not yield any previously published study with contrasting findings on the role of MIQ on PIP. Nonetheless, the current study will address the literature gap on the link between MIQ and PIP in the aviation industry despite the significant results obtained from the existing literature. As a second hypothesis, we therefore propose the following:

H2. *MIQ gives insights into consumer needs that directly affects PIP.*

2.4. Supply Chain Intelligence Quality (SCIQ)

SCIQ describes the link existing between the business' consumer and supplier. According to the description of the concept by Min et al. (2019), the consumer is highly dependent on the transit of products from the manufacturer to the market for accessibility. It was demonstrated that the consumer will gain interest in a readily available product on the market (Min et al. 2019). However, product availability depends on the effectiveness of the supply chain system. SCIQ is appropriate for checking the efficiency of consumer access to the product regardless of the prevailing market conditions. This attribute is defined by the variables of projecting product acceptance, demand and use within the market. Gautam et al. (2018) described supply intelligence quality as the process of acquiring, integrating, and presenting the information of the business supply chain to the relevant authority or section in order to enable the development of collaborative planning, measuring, monitoring, analyzing, and managing the established supply network. The illustration captures the activities of ensuring that the business develops some procedures that will allow effective supply chain management (Min et al. 2019). A supply chain network is significant to any business that wishes to gain a competitive advantage and at the same time realize tremendous growth. The concept is beneficial to businesses because it impacts their overall growth and existence within the market.

SCIQ is a concept that has gained prominence in the last decade as an approach to achieving competitive advantage and maintaining performance and sustenance. According to Kurien et al. (2011), in the present era of globalization, digitalization, and snowballing business concerns, supply chain management has emerged as the focal point for most businesses. SCIQ aims to achieve a desired customer service level while targeting the market segment and optimizing the investment in the distribution of materials and products. Furthermore, it is not easy to establish an effectively error-free SCIQ because the process requires the elimination of unneeded activities to attain optimal service efficiency (Gautam et al. 2018). Nonetheless, supply chain intelligence has enabled businesses to integrate various applications for the effective execution of operations. This concept has further enabled organizations to promote their product transition process by monitoring and tracking the flow, improving efficiency in product traceability and service delivery to different customer categories. The aspect is good at securing the product transmittal process.

Supply chain intelligence provides the fastest transmittal channel, which must have a fast and smooth system that guarantees products' easier and free movement. Kurien et al. (2011) showed how the supply chain management systems require the intensive integration of other supplemental applications to boost their deliverability. These applications are

good at being determined by the supply chain intelligence quality. The experienced changes in technology and business challenges have been linked to the adopted supply intelligence quality. The evolution of supply chain management depends on emerging changes in business operations and business approaches. Additionally, supply chain intelligence has enabled businesses to effectively adapt these operations and approaches toward gaining a competitive advantage. Since the integration of technology in supply chain management, various benefits have been realized in the global business domain. Therefore, SCIQ contributes part of the influence on the benefits of competitive advantage, product traceability promotion, and the provision of ideas for new product development.

Notably, supply chain management technologies have boosted traceability. According to Asiri and Odularu (2020), the history of technological integration in logistics and supply chain management can be traced to the security and control capacity of business operations. Currently, institutions can track their shipment process on a real-time basis, and they are able to learn about the status and overall progress of the shipments (Asiri and Odularu 2020). For instance, the automation of processes has enabled custom brokers to receive updates on the state of the items or products in transit. The item status may include the time for shipping. Through the operations, declarations about the shipping are made available online. Asiri and Odularu (2020) further illustrated that the business acquisition of an operational system has guaranteed security, reliability, and efficiency in exchanging data. The growth will be induced by the materialization of the increase in international trade, easing governmental regulation, and increasing domestic consumer consumption. It was indicated that traceability has emerged as the most embracing technological capacity to offer change. It has nearly solved the challenge of misplacing and losing goods or misappropriation. However, since technology has its associated issues, the emerging challenges must be dealt with accordingly. Technological advancements provide the best way of boosting supply chain management security for the realization of traceability. Counterfeiting has been pointed to as an issue that supply chain traceability has managed to control. Automations aid in detecting faults and counterfeits, thus offering the best line of retaining product quality from production to consumption.

Bodas Freitas and Fontana (2018) found that collaboration with suppliers is strategic in improving the company's innovation performance and that the benefits are greater when industry-level knowledge is absent than when it is present. Similarly, the data obtained in another earlier study indicated that increasing SCIQ has a positive association with PIP (Mostaghel et al. 2019). The concept provides intellectual facts about the transmission of products from the manufacturer to the consumer, as demonstrated by Min et al. (2019) in an analysis of SCIQ with marketing and production. Elsewhere, Köhler et al. (2012) conducted an empirical study on the same topic and revealed that SCIQ is impactful on PIP only if the innovation is not in the consumer base, and not if the innovation is in the form of an imitated product. These findings from previously published studies form a significant part of the current research in formulating the hypotheses and forming a string of background information that provides significant insights into the already established concepts in the knowledge base. For instance, it is evident that using the provided facts requires the initiation of processes and ideas whose execution creates a unique environment. PIP demonstrates how to attain the goals of empowering the supply chain by developing intelligence-based systems that will foster the monitoring and linking of the market with the consumer and manufacturer. According to Bendoly et al. (2012), the impact of coordination of supply chain intelligence on new product development performance is contingent on the impacts being attenuated during stable market conditions. As a third hypothesis, we therefore propose the following:

H3. *SCIQ has a positive impact on PIP.*

3. Research Framework

PIP depends on manufacturing market coordination, quality of intelligence, and supply intelligence. These components feed the product innovation performance with

relevant insights that result in developing new ideas that enhance business operations and activities. This research proposes that MMC, MIQ, and SCIQ are associated with increased levels of PIP, as presented in Figure 1. The relationship between the concepts is reflected in the flow of information alongside the influence experienced, for instance, competitive advantage, consumer satisfaction, and market sustenance. As highlighted above, it illustrates the theoretical evaluation of the concepts by pointing at their respective importance to businesses. The relationship provides a clear hypothesis that can be evaluated in the subsequent segments of the reports.
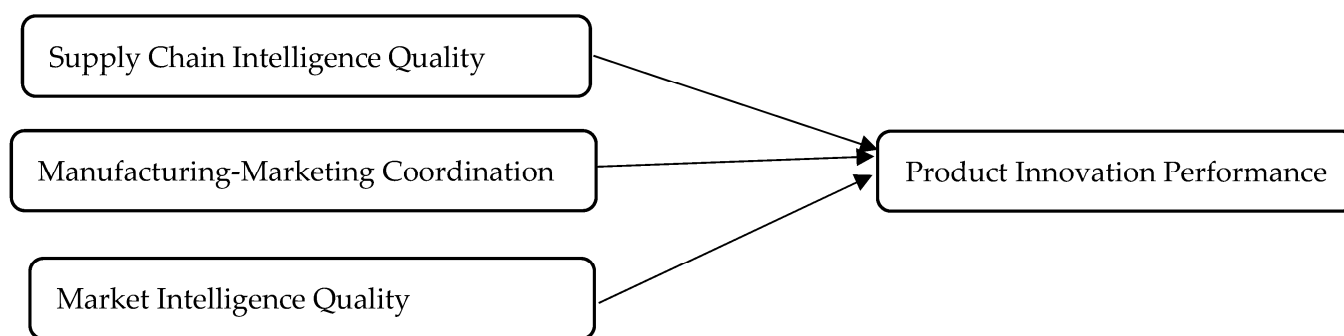

Figure 1. Research Framework.

4. Research Methodology

The selected methodology utilized to attain the research objectives included an evaluation of the previously published studies in the existing literature about the evolution of logistics and supply chain management in the contemporary digital age, an analysis of how personnel consult technology to complete supply chain and logistics tasks, the distribution of online questionnaires, data collection, and data analysis. The current research covered individuals taking responsibility for managing supply chain and information technology tasks. An online questionnaire was designed based on the literature review, and the target population was individuals working with Saudi Cargo in the company's headquarters, Jeddah, Saudi Arabia. The current study targeted supply chain managers and information technology professionals who had direct experience working in the aviation industry in Saudi Arabia. A fraction of the 925 employees working with Saudi Cargo in Jeddah (as of 30 January 2022) was considered for the present study because of the company's efforts in adopting innovative technology, a vast global network, and overall international standards and quality in its operations in the supply chain and logistics domains. Thus, recruiting research respondents from this international aviation company was strategic in obtaining accurate information to answer the current study's research question. Given that the accurate population size of the supply chain managers and information technology professionals working with Saudi Cargo and its associates and their population proportions are unknown, the sample size selection was determined in the current study to avoid instances of unguided generalization using the Raosoft calculator available on the Raosoft website, (Sample Size Calculator by Raosoft, Inc., Seattle, WA, USA). The population proportion was assumed to be 50% in a population size of 925 people, as recommended by the online sample size calculator platform used. Using the confidence level of 95% with a margin of error of 5%, based on convenience sampling which contained a requested to fill out the survey and explanation of its purpose. To select a random group of 300 supply chain managers using systematic random sampling, the questionnaires were then created online using the Google Drive website and a link was distributed to the managers in the aviation industry via email and WhatsApp. The researcher received 104 responses.

4.1. Measurement of Variables

Conducting a survey is among the ways researchers collect data from participants to achieve study goals. For the current research, the constructs were measured using items

developed in past research. PIP consisted of nine items based on ([Bendoly et al. 2012](#)) and ([Talke and O'Connor 2011](#)); SCIQ consisted of nine items based on ([Maltz and Kohli 1996](#)); MMC consisted of six items based on ([Bendoly et al. 2012](#)); MIQ consisted of six items based on ([Maltz and Kohli 1996](#)). The specific contents of the measurement items are shown in Appendix A. All the measurement items of the variables were framed into survey prompts and listed in the questionnaire using precise language to avoid jeopardizing the target information from the respondents.

4.2. Data Collection and Techniques for Data Analysis

The target population for the current research comprised supply chain managers and information technology professionals who were working with Saudi Cargo and its associates at the time of research. Given that the target sample size was 272 experts, on-line mechanisms were adopted to reduce the overall research cost, especially travelling expenses and survey administration costs. Therefore, Google Drive was used to create and distribute the closed-ended questionnaires to the recruited personnel. After creating the online questionnaire, the link was distributed among the selected supply chain managers and information technology professionals through either e-mail, WhatsApp, or Facebook platforms. Participants were allowed to respond to the survey questions within ten days, after which the Google Drive link was closed for all the participants. Nonetheless, respondents had the opportunity of withdrawing from taking part in the current research without issuing any notice or explanation. After collecting data, we used SmartPLS 4 for data analysis.

5. Findings

5.1. Demographic Profile of Respondent

Descriptive statistics were used to present the demographic data of the research participants whose questionnaires were included in the data analysis of the current study. The demographic variables considered in this case included gender, age, highest education attainment, income in Saudi Riyale (SR), level of management, job experience, and type of work contract. A total of 104 questionnaires were successfully included in the data analysis section, having adhered to all the requirements, including zero instances of missing information, such as unanswered questions (see Table 1).

Among the 104 participants whose questionnaires were included in the current data analysis, 54.8 were male and 45.2 were female. From the age perspective, 34.6% of the participants belonged to the 18–30-year-old cluster, while 52.9% of the participants were in the 31–45-year-old group, and the remaining 12.5% of the sample population involved in the present research belonged to the 45–65-year-old age bracket. Table 1 provides the frequency distribution presenting the highest education attainment of the participants from three options: bachelor's degree, master's degree, and others. Among the 104 participants, 57.7% confirmed to have a bachelor's degree as their highest academic attainment at the time of the current study. Additionally, 32.7% of participants had a master's degree qualification, and the remaining 9.6% participants opted for "others" as their highest education qualification. In this case, the term "others" could mean either a lower academic qualification than a bachelor's degree or a higher qualification than a master's degree.

Furthermore, 80.8% of the participants confirmed to be receiving below 11,000 SR per month from their jobs, whereas 13.5% of the individuals earned between 11,000 SR and 20,000 SR. Only 5.7% of the participants involved in the current study had a monthly income of more than 20,000 SR. In addition, participants were recruited from varying levels of management in their respective workplaces. The low-management category was represented by 43 individuals, while 50 participants stated to be associated with the middle-management level, and only 11 out of 100 participants engaged in high-management duties in their companies (see Table 1). From the job experience perspective, at least 45 individuals who took part in the current study had less than ten years' job experience, 43 people confirmed having 10–15 years' job experience, and 16 participants stated having between

15 and 20 years' experience at work. Lastly, all participants who were included in this study were full-time employees.

Table 1. Summary of Demographic Profile.

	Frequency	**Percentage**
Gender		
Male	57	54.8
Female	47	45.2
Age		
18–30 years	36	34.6
31–45 years	55	52.9
45–65 years	13	12.5
Education		
Bachelor's degree	60	57.7
Master's degree	34	32.7
Others	10	9.6
Monthly Income		
Below 5000 SR	44	42.3
5000–10,000 SR	40	38.5
11,000–20,000 SR	14	13.5
Above 20,000 SR	6	5.7
Management Level		
Low management	43	41.34
Middle management	50	48.07
High management	11	10.59
Service Years in the Organization		
5–10 years	45	43.27
10–15 years	43	41.35
15–20 years	16	15.38

5.2. Measurement Model

A two-stage model approach was applied in this study that included measurement and structural models using SmartPLS 4 as recommended by (Henseler and Chin 2010). The measurement model indicated in Figure 2 was used to find the link between MIQ, MMC, and SCIQ, as the independent variables, and PIP, as the dependent variable. Then, we examined the path coefficients between the variables using the structural model based on the literature (Hair et al. 2014; Henseler and Fassott 2010). The evaluation of the measurement model was based on three parameters: "composite reliability, convergent validity, and discriminant validity". In order to assess internal consistency reliability, we used composite reliability (CR) and average variance extracted (AVE). An acceptable level of CR for exploratory research is 0.60 to 0.70 (Hair et al. 2014). As seen in Table 2, the composite reliability for all study constructs ranged from 0.850 to 0.913, demonstrating the reliability of the measurement model. As part of assessing convergent validity, we examined the value of AVE to see how one measure of a construct related to the other. It was proposed by Henseler et al. (2009) that the AVE should be greater than 0.5 in order to show that the latent variable explains a greater proportion of variance. A convergent validity was achieved in all constructs, with AVE varying from 0.588 to 0.773 as indicated in Table 2. Additionally, Table 2 and Figure 2 exhibit the outer loading (factor loadings) of the measurement model.
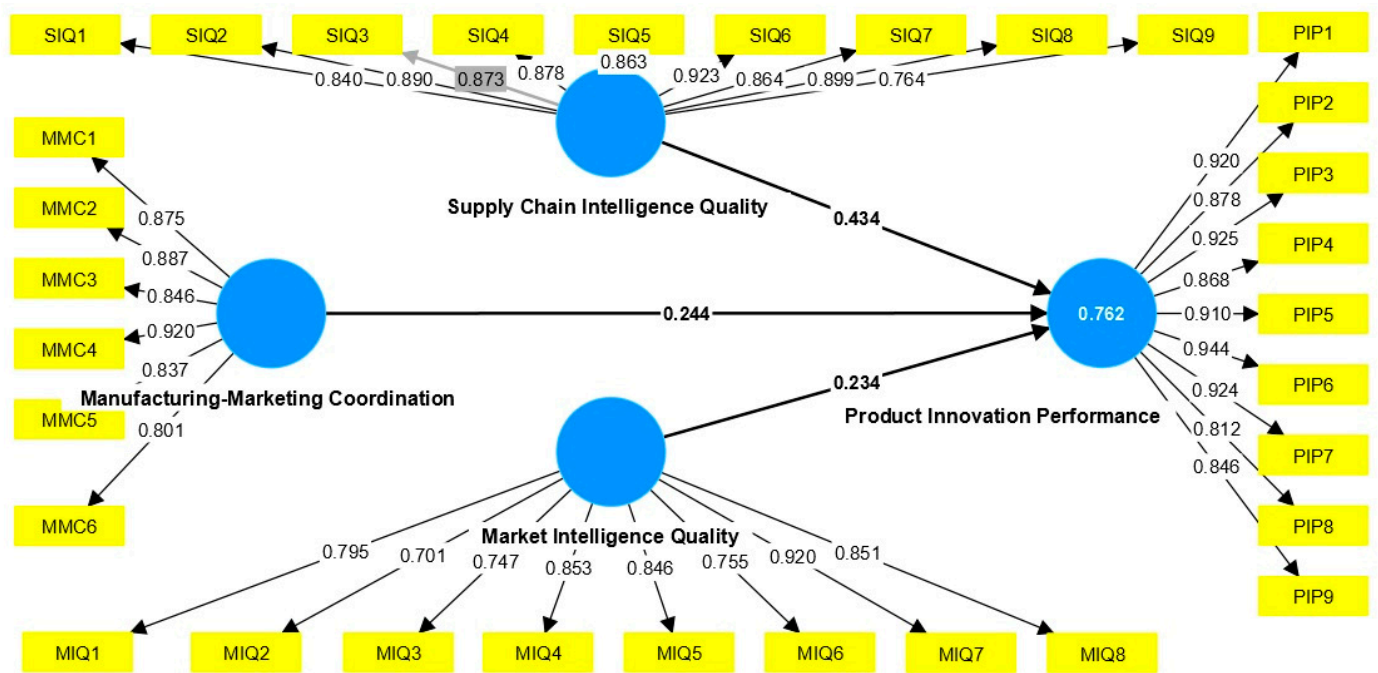
Figure 2. Measurement Model.

Table 2. Item Loadings, CR, AVE, and CA.

Constructs	Items	Loadings	AVE	CR	CA
Market Intelligence Quality	MIQ1	0.795	0.658	0.939	0.924
	MIQ2	0.701			
	MIQ3	0.747			
	MIQ4	0.853			
	MIQ5	0.846			
	MIQ6	0.755			
	MIQ7	0.920			
	MIQ8	0.851			
Manufacturing–Marketing Coordination	MMC1	0.875	0.743	0.945	0.930
	MMC2	0.887			
	MMC3	0.846			
	MMC4	0.92			
	MMC5	0.837			
	MMC6	0.801			
Product Innovation Performance	PIP1	0.920	0.797	0.972	0.968
	PIP2	0.878			
	PIP3	0.925			
	PIP4	0.868			
	PIP5	0.910			
	PIP6	0.944			
	PIP7	0.924			
	PIP8	0.812			
	PIP9	0.846			
Supply Chain Intelligence Quality	SCIQ1	0.840	0.752	0.964	0.958
	SCIQ2	0.890			
	SCIQ3	0.873			
	SCIQ4	0.878			
	SCIQ5	0.863			
	SCIQ6	0.923			
	SCIQ7	0.864			
	SCIQ8	0.899			
	SCIQ9	0.764			

Fornell and Larcker (1981) proposed that it is necessary to have a square root greater than the correlation of the latent constructs to achieve adequate discriminant validity.

Therefore, discriminant validity was confirmed, as all values were below 0.90, as indicated in Table 3.

Table 3. The discriminant validity assessment (HTMT).

Factors	MMC	MIQ	PIP	SIQ
MMC				
MIQ	0.982			
PIP	0.885	0.848		
SCIQ	0.939	0.864	0.867	

5.3. Structural Model

To evaluate the path coefficients, we used a structural model examination to illustrate the link between exogenous and endogenous variables. This study used SmartPLS 4 and the bootstrapping procedure with 5000 subsamples, and 104 cases to test the path coefficient significance (Hair et al. 2014). The findings are shown in Figure 3 and Table 4.
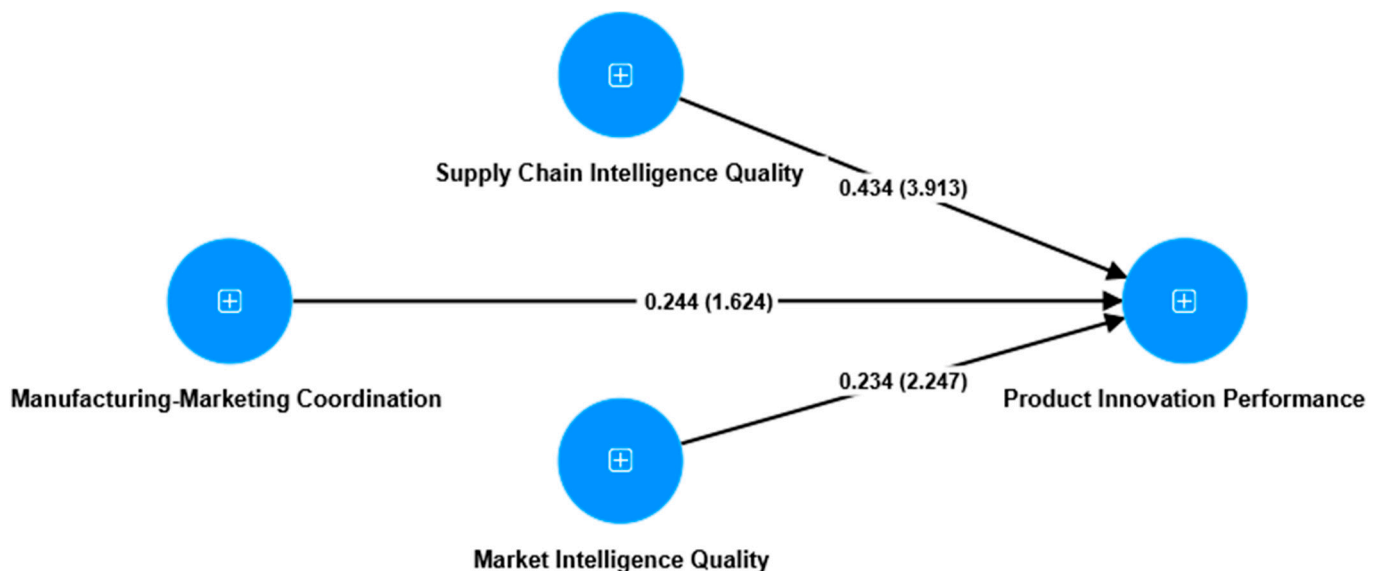

Figure 3. Structural Model.

Table 4. Structural Model.

HyP	Paths	Beta	SE	T-Value	*p*-Value	Findings
H1	MMC -> PIP	0.244	0.150	1.624	0.104	Rejected
H2	MIQ -> PIP	0.234	0.104	2.247	0.025	Accepted
H3	SCIQ -> PIP	0.434	0.111	3.913	0.000	Accepted

Table 4 indicates that H1 was found to have a low-significance link between MMC and PIP, as shown in Table 4 (β = 0.244, t = 1.624, p < 0.104), meaning that H1 was rejected. Regarding H2, the link between MIQ and PIP was found to be positive and significant (β = 0.234, t = 2.247, p < 0.025), meaning that H2 was accepted. H3 was found to have a positive and significant link between SCIQ and PIP (β = 0.434, t = 3.913, p < 0.000), meaning that H3 was accepted.

6. Discussion

Firstly, the results obtained in the present research disproved the first hypothesis that MMC gives insights into consumer needs that directly affect PIP. The findings confirmed the second hypothesis of the current study that MIQ affects product innovation acceptability

and implementation. Thirdly, the findings confirmed the third hypothesis that SCIQ has a positive impact on PIP. The results obtained in this study indicated that the evolution of logistics and supply chain management in the digital age of the aviation companies in Saudi Arabia involves the strict adherence of the aviation companies to the supply chain intelligence and manufacturing marketing coordination factors more than the marketing intelligence components. This assertion is based on the observations obtained from the data analysis and hypothesis testing that showed the first hypothesis was not supported. This finding indicated that MMC has an insignificant impact on PIP because there is no coordination between manufacturing, marketing, and invention. Manufacturing is the process by which goods are created by combining materials to create new products, and marketing is the process of selling manufactured products to earn revenue. In addition to creating physical items, companies have been able to conceptualize new products and ideas through invention. Without coordination among these three processes, a business will have a hard time succeeding in its operations and increasing its performance. It is very difficult to achieve product innovation performance without proper coordination between the partners (Hou et al. 2017; Katiyar et al. 2018). Additionally, MIQ and SCIQ have significant impacts on the PIP of aviation companies, and MIQ has insignificant impacts on PIP. These results complement the findings of earlier studies in the existing literature, in which the MIQ and SCIQ factors were found to have significant effects on PIP. A greater MIQ increases PIP; this finding is consistent with past studies (Falahat et al. 2020; Katsikea et al. 2019; Mostaghel et al. 2019). SCIQ had a significant link with PIP, which shows that a high level of SCIQ is emerging as a competitive advantage in innovation performance. This finding is consistent with previous studies (Bendoly et al. 2012; Toorajipour et al. 2021). These findings complement the Zhang and Duan (2010) results that the direct path dominates the total effect of the responsive market orientation on new product success, whereas proactive market orientation influences product innovation performance through innovativeness. In contrast, Mostaghel et al. (2019) observed that increasing manufacturing–marketing coordination results in increased product innovation performance. The supply chain intelligence quality variables were observed to critically influence the achieving sales target variable more than any other PIP variable. Increasing supply chain intelligence quality positively affects product innovation performance (Mostaghel et al. 2019).

Additionally, MIQ was found to have a statistical significance in predicting the outcome of PIP. The current study obtained findings that were in agreement with some of the results recorded in the previously published studies. For instance, Al-Weshah (2017) found that the marketing intelligence quality introduces new ideas that are used to satisfy consumer expectations; thus, it poses a significant influence on a company's product innovation performance. According to Falahat et al. (2020), market intelligence involves understanding competitors, consumers, and other business stakeholders, enabling companies to gain a competitive advantage by exploiting market opportunities. This assertion means that marketing intelligence is capable of enhancing a business' competence in identifying and exploiting external opportunities rather than internal opportunities forming the basis of product innovation performance.

7. Implications of the Study

It is clear from the research hypothesis that the current study encourages management teams and supply chain personnel in the aviation companies to improve the quality of their marketing intelligence, supply chain intelligence, and marketing coordination process to improve their product innovation performance. Aviation companies should consider increasing their focus and investment in creating product innovations that create strong attitude and behavior changes in customers when consuming services in the aviation industry. Furthermore, aviation companies should introduce completely new features to the market and target improving customer satisfaction to gain a competitive advantage in the current evolving logistics and supply chain domain in the digital age. These theoretical study findings provide business managers with essential and critical information on empowering

innovation within the sector. Technology enhances the efficiency of business processes. This research provides relevant details about improving and integrating the latest technologies within the sector for efficiency and increasing productivity. The information provided by this study will be critical for companies in terms of making decisions on how to enhance the supply chain and logistics segments, among others. This study provides some clear evidence that indicates the technologies adopted in the various industries or sectors.

The current study's findings have important implications for understanding the evolution of logistics and supply chain management in the digital age of aviation companies. This study confirmed the positive significant relationship of supply chain quality, marketing intelligence quality, and marketing coordination quality with product innovation performance. Therefore, future researchers can rely on the findings of the current study as a source of grey literature when accounting for these relationships in future studies.

8. Conclusions

The current study aimed to analyze and assess the impact of MIQ, MMC, and SCIQ on product innovation performance. The practical evaluation of the study involved substantiating how the supply chain had emerged as critical in any process of a company, with the influence of its automation on product performance. Businesses are likely to boost and sustain a strong supplier and consumer relationship when they invest in appropriate technology in the modern business environment. Additionally, the present study focused on exploring the development of supply chain management in the digital era.

The results acquired from the study were perceived to have both theoretical and practical implications. Given that the theory's principle is about the constructs that keep the supply chain strong and functional, the current study was strategic in providing an intensive review and demonstration of using information to enhance the operations of logistics in the aviation industry. The results obtained offer material proof for academicians and researchers interested in gaining more information and facts about supply chain management and logistics evolution in the aviation industry in the digital era. It also forms equivalent groundwork for more research on the topic. The insights of this study remain beneficial to researchers. Using these designations, this study will aid in identifying the determinants in logistics and supply chain dimensions that influence the general organizational performance of an industry.

Subsequently, the acquisition of the knowledge of the evolution of logistics and supply chain management in the digital era in various industries will help the company's top management in decision making within the sector to focus on embracing relevant technologies. For instance, the technologies that foster item and passenger tracking are supportive in the case of an emergency. The system maintains the current state of the products or items in transit and passengers. Similarly, it monitors the state of security and thus enables the responsible team to respond accordingly. The study remains vital for enabling logistics companies to easily evaluate the benefits of embracing technology while understanding their challenges.

Limitations and Opportunities for Further Research

The current study was conducted on the aviation industry in Saudi Arabia; the sample for our study was deemed representative of Saudi Cargo. However, future studies across other industries such as the energy sector, tourism, hospitality, SMEs, and logistic supply could help to generalize the current findings. A broader range of constructs could also be used by future researchers. The current study only examined MIQ, MMC, and SCIQ on PIP; it may be possible to add new factors that will add value to future research to increase novelty, for example, the knowledge management dimension (Mardani et al. 2018) and green service (Chang 2018). Future research could also explore the multidimensionality of PIP (Löfsten 2014).

Appendix A. Measurement of the Constructs

Factors	Items	Resource
(MIQ)	Our marketing/sale contacts successfully facilitated following market intelligence activities because it provided valid estimates of the market.	(Maltz and Kohli 1996)
	Our marketing/sale contacts successfully facilitated following market intelligence activities because it provided accurate information.	
	Communicated important details about customer needs because it provided the data necessary to estimate the size of the market for our product.	
	Communicated important details about customer needs because it presented their ideas clearly.	
	Communicated important details about customer needs because it presented their ideas in a timely manner.	
	Communicated important details about customer needs because it provided real-time updates of changes in the market.	
	Communicated important details about customer needs because it provided novel information with regard to the customers and the market.	
	Communicated important details about customer needs because it gave information that was new and interesting to the customer and the market.	
MMC	We had processes to ensure that our manufacturing plans/solutions were marketing-aligned.	(Bendoly et al. 2012).
	We had processes to ensure that marketing input was used in developing manufacturing plans and solutions.	
	We had processes to ensure that our marketing plans/solutions were manufacturing-aligned.	
	We had processes to ensure that manufacturing input was used in developing manufacturing plans and solutions.	
	Employees engaged in marketing understood the importance of manufacturing to our business.	
	Employees engaged in manufacturing understood the importance of manufacturing to our firm.	
SIQ	Our supply chain partners successfully facilitate following intelligence activities provided valid estimates of the market.	(Maltz and Kohli 1996)
	Our supply chain partners successfully facilitate following intelligence activities provided accurate information.	
	Our supply chain partners successfully facilitate following intelligence activities communicated important details about customer needs.	
	Our supply chain partners successfully facilitate following intelligence activities provided the data necessary to estimate the size of the market for our product.	
	Our supply chain partners successfully facilitate following intelligence activities presented their ideas clearly.	
	Our supply chain partners successfully facilitate following intelligence activities presented their ideas in a timely manner.	
	Our supply chain partners successfully facilitate following intelligence activities provided real-time updates of changes in the market.	
	Our supply chain partners successfully facilitate following intelligence activities provided novel information with regard to the customers and the market.	
	Our supply chain partners successfully facilitate following intelligence activities gave information that was new and interesting with regard to the customer and the market.	
PIP	Our latest innovative product release was successful in achieving the sales target.	(Bendoly et al. 2012; Talke and O'Connor 2011)
	Our latest innovative product release was successful in achieving market share target.	
	Our latest innovative product release was successful in achieving competitive advantage target.	
	Our latest innovative product release was successful in achieving customer satisfaction target.	
	Our latest innovative product addresses a wholly new customer benefit.	
	Our latest innovative product requires strong attitude and behavior changes of customers.	
	Our latest innovative product offers customers unique advantages over competitor products.	
	Our latest innovative product requires strong learning effort on the part of customers.	
	Our latest innovative product introduces completely new features to the market.	

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