Adapt or die: A competitive digital supply chain quality management strategy

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Abstract:

Purpose – The evolution of modern digitalization technologies necessitates the development of a competitive digital supply chain quality management (SCQM) strategy by manufacturers. Using the new institutions and institutional theory (IIT), our research first aims to identify the most important SCQM practices that can influence competitive performance (CP). Second, we intend to investigate the role of digital strategy alignment (DSA) in moderating the relationship between the multidimensionality of SCQM practices and CP among manufacturers.

Design/methodology/approach – We employ the Partial Least Squares-Structural Equation Modelling (PLS-SEM) technique to examine 225 valid samples from Malaysian manufacturers who use SCQM practices.

Findings – Our findings indicate that five of the twelve hypotheses developed were accepted. This suggests that supplier focus, strategic collaboration, information sharing, and customer focus are positively and significantly correlated with CP. Unexpectedly, DSA moderates the relationship between leadership and CP.

Originality/value – Our study extended the new IIT by empirically testing the six SCQM practices for CP in a DSA context, which can serve as a model for future research in the SCQM, CP, and DS fields.

Keywords Supply chain management; Quality management; Digital strategy; Competitive performance; Manufacturing; Digitalization

Paper type Research paper

1. Introduction

Almost every business has been on a roller coaster ride in recent years, exacerbated by the COVID-19 pandemic and digital transformation. Due to changes in current norms, and practices and the evolution of modern digitalization technologies, today's business marketplace is becoming more competitive, complex, and dynamic (Alnuaimi et al., 2022). Similarly, in Malaysia, there is an increased and urgent demand for digitalization businesses, prompting these businesses, particularly those in the manufacturing sector (Ignatius, 2022a), to develop a resilient management strategy that incorporates the digital realm. Modern digitalization technologies such as collaborative robots, artificial intelligence, machine learning, blockchain, big data, and the internet of things are evolving to support smart manufacturing for Industry 4.0 (Tay et al., 2021). Malaysia is one of the most important manufacturing hubs in the world; thus, Malaysian manufacturers must be resilient in dealing with changes in digitalization and supply chain (SC) and manufacturing processes to reduce rising logistics costs and SC disruptions (Ignatius, 2022b). Furthermore, consideration of digital strategy alignment (DSA) in the Supply Chain Management (SCM) system is required to improve the storage of vital data relating to customers, suppliers, and markets, thereby expanding the organization's development (Gupta et al., 2020). Despite this, many manufacturers continue to lag behind these developments. The Federation of Manufactures of Malaysia (FMM) (2022) reported that most manufacturers are aware of the Industry 4.0 initiative, but the proportion of manufacturers adopting modern technologies for smarter manufacturing has yet to meet expectations. Moreover, 69% of Malaysian businesses, including the manufacturing sector, have experienced business disruption because of failure to adapt to environmental changes and the introduction of new digital market norms (Ernst and Young, 2020). Therefore, practitioners and academics should propose strategies that focus on the growth and improvement of the Malaysian manufacturing sector, as this sector is critical to the revitalization of the Malaysian economy (contributing approximately 22.9% of GDP and 60% of total employment in 2020) (Department of Statistics Malaysia, 2021).

To accelerate the industry 4.0 process, the Malaysian government intends to allocate a total of RM45 million in technological transformation incentives for smarter business and manufacturing when preparing the budget for 2022 (MyGovernment, 2022). However, all this effort may not result in the success of digital transformation in the manufacturing industry if a well-grounded, effective management strategy that considers DSA is overlooked. As indicated by Alnuaimi et al. (2022), the solution to the strategy-execution gap is to return to the formation of the basic management strategy. Therefore, to adapt and embrace digitalization in manufacturing, Malaysian manufacturers should develop a robust digital supply chain quality management (SCQM) strategy to enhance their competitive advantage. With a resilient and hybrid SCQM strategy, they can produce digitalization-compatible, high-quality products that satisfy customer needs. This has been emphasized by Hennelly et al. (2019) the need rethink SCM strategies in the digital age. Nevertheless, there has been little research into the dimensions of SCQM that consider competitive performance (CP) among Malaysian manufacturers. Furthermore, there is a scarcity of research on the application of SCQM in response to DSA.

Li et al. (2006) stressed the importance of effective SCM in enabling American manufacturers to gain a competitive advantage, also, Ferdousi et al. (2018) recognized the importance of TQM in facilitating competitive advantage in Bangladesh garment organizations. On the other hand, previous research has demonstrated the significance of SCQM practices for organizational performance, such as innovation capability (Hong et al., 2019), product innovation (Lee et al., 2021), quality performance (Soares et al., 2017), sustainability performance (Lim et al., 2021), and organizational sustainability improvement (Bastas and Liyanage, 2019). However, the relationship between the hybrid SCQM strategy and CP has not been investigated in the aforementioned studies. Furthermore, the conceptual study conducted by Bastas and Liyanage (2019) that disregarded empirical evidence might not adequately explain the actual outcomes of the company’s performance. In other words, there has been a lack of studies drawing attention to SCQM practices on CP, which provides long-term benefits to manufacturers. This lays the groundwork for our study to further examine the impact of integrating SCM and TQM (SCQM) on CP among Malaysian manufacturers.

Given the pressure on manufacturers to adopt digitalization, DSA is regarded as the key moderating variable (Alnuaimi et al., 2022) in SCQM practices, particularly when a new perspective of institutions and institutional theory (IIT) is used to explain its relationship to CP. Alnuaimi et al. (2022) used the new institutional theory to explain the relationship between internal factors such as organizational agility and leadership on digital transformation, which is influenced by DSA; however, their study did not take into account the significant potential impact of SCQM practices. Meanwhile, Dubey et al. (2017) use IIT to explain the role of top management commitment in TQM diffusion, disregarding the external impacts of supplier and customer focus, as well as DS. Glover et al. (2014) and Kauppi (2013), on the other hand, proposed IIT as the most appropriate theory to use for SCM research; however, their study did not include a new and important perspective on the external factor of DSA. As a result, to fill the research gaps, we proposed two research questions (RQ) to be addressed:

RQ1. Do SCQM practices have a significant impact on CP?

RQ2. Does DSA moderate the effect of SCQM on CP significantly and positively?

Our research expands IIT and SCQM practices in fields related to SCM and QM. First, we use IIT to better explain the hybrid SCQM strategy, which includes upstream, internal, and downstream SCQM practices implementation in the manufacturing industry. Given that IIT is frequently used to explain the implementation of SCM and TQM on organizational performance, the use of IIT in examining a growing SCQM strategy is scarce. Second, our research contributes to a better understanding of how SCQM practices can achieve CP, particularly when manufacturers push the need to implement an effective

SCQM strategy to sustain in increasingly complex and dynamic environments. Seeing SCM (Li et al., 2006) and TQM (Ferdousi et al., 2018) implementation improve competitive advantage and the company's capability to thrive in a turbulent marketplace. Furthermore, we close the research gap by utilizing the new IIT to better explain the new perspective of SCQM strategy, particularly when CP and DSA are incorporated into the conceptual framework of the study. As proposed by Sarkis et al. (2021), it is crucial to use IIT to explain the application of digital technology for optimal green SCM outcomes under varying internal and external pressures. Also, Alnuaimi et al. (2022) introduce a new viewpoint of IIT by employing DSA as the moderator to influence the implementation of business strategy. Given that IIT is widely used to explain the cultivation of organizational cultures and the implementation of organizational changes in formal structure (Dubey et al., 2017) or organizational agility (Alnuaimi et al., 2022). However, there is a paucity in the application of IIT to explain the adoption of SCQM practices on CP and the significance of DSA use in influencing their correlation.

2. Theoretical background literature reviews

2.1 Institutions and institutional theory (IIT)

IIT is crucial for the implementation of modern SCQM practices, considering Sarkis et al. (2021)'s assertion that this theory is essential for the development of SCM strategies. Organizations transform because of external and internal pressures at the organizational and SC levels (Dubey et al., 2019; Sarkis et al., 2021), indicating that implementing SCQM practices that are aligned to DS to respond to external and internal forces, such as digitalization, supplier and customer focus, and internal development, is extremely important. Therefore, IIT is essential to explain the understanding of organizational changes, shared expectations, and positive culture through the adoption of SCQM practices and DSA to succeed in the face of challenges and competition. IIT is interpreted as manufacturers sharing and responding to acceptable norms, understanding, and expectations (Alnuaimi et al., 2022) by leveraging the legitimacy and support gained from SC stakeholders in shaping organizational actions (Lim et al., 2019). Three pillars of fundamental forces, including coercive, normative, and mimetic isomorphic forces (DiMaggio and Powell, 1983), explain the application of IIT to the management strategy formation of an organization. The first coercive force arises from government and authority-related agencies, key suppliers and customers, and current market demands; the second normative force is a result of social thought and action, with manufacturers playing a social role in adapting to contemporary business norms; and the third mimetic isomorphic force depends on a leader's decision to imitate the behavior and direction of other institutions (Meyer and Rowan, 1977). Manufacturers seek to reconfigure institutional disciplines in response to technological and competitive forces (Dubey et al., 2019). An evolving institution and institutional perspective can thereby assist manufacturers in adapting to changing norms, policies, and practices by implementing effective SCQM practices that are digitally viable.

2.2 Supply Chain Quality Management (SCQM) practices

SCQM is a hybrid strategy that combines SCM and QM in collaborating with internal and external (upstream and downstream) stakeholders to improve product quality and customer satisfaction (Hong et al., 2019). According to Robinson et al. (2005), SCQM is a management strategy that coordinates business processes involving all SC partners to measure, analyze, and continuously improve products and processes for customer value creation and satisfaction. With an emphasis on coordination and streamlining throughout the entire SC, including all inter- and intra- management functions (Parast, 2019), the SCQM strategy is believed to increase a company's competitive advantage. Likewise, Zhong et al. (2016) indicated that SCQM can enhance SC quality and has the potential to boost CP. Our study identifies six practices deemed critical for SCQM strategy that aligns with digital strategy, including supplier focus (SF) (Soares et al., 2017), leadership (LD) (Gunasekaran et al., 2016), operation improvement (OP) (Lee et al., 2018), strategic collaboration (ST) (Mehdikhani and Valmohammadi, 2019), information sharing (IS) (Lim et al., 2021), customer focus (CI) (Kumar et al., 2020). Prior research has acknowledged the impact of these SCM and QM practices on a variety of business outcomes, but few studies have examined the impact of these six practices on CP. Furthermore, some previous studies attempted to relate these management practices to a digitalization perspective; however, research into the multidimensionality of SCQM that aligns with the digital strategy on CP is limited. Our research, hence, aims to explore which of these six SCQM practices are the most effective practices concerning the digitalization perspective on CP.

SF is the company's effort to collaborate and integrate with its key suppliers in the upstream supply channel to enhance the operation process, which is regarded as one of the essential SCQM practices (Soares et al., 2017). The quality and capacity of supplies are highly dependent on the effectiveness of communication and interaction skills between manufacturers and their suppliers (Lim et al., 2021). Suppliers play a crucial role in SC quality and should collaborate closely for continuous improvement. Therefore, Malaysian manufacturers should adopt SF as a crucial component of their upstream SCQM strategy.

LD refers to the behavior and actions of a leader that influence the organization's followers to achieve organizational goals (Gunasekaran et al., 2016; Liang et al., 2007). Appropriate and effective leadership styles that emphasize commitment, support, and motivation to influence SC members can spur superior SCQM performance among manufacturers (Jia et al., 2019; Lim et al., 2021). Leaders are the key individuals responsible for steering the organization's course by developing appropriate strategies to shape organizational behavior and are thus regarded as a critical component of SCQM.

OP is described as activities that involve resilient manufacturing systems and internal logistical flows to improve a company's ability to respond to market changes more quickly (Lee et al., 2018). OP is an essential element of internal SCQM practices. Given that, the improvement of internal departments including finance, engineering, research and development, and marketing is important for SCM performance in manufacturing firms (Lee et al., 2018).

ST is defined as the strategic planning and collaborative efforts of all SC partners to accomplish common objectives in the long run (Kim and Lee, 2010). ST focuses on facilitating manufacturers' connectivity and adaptability within the SC system (Mehdikhani and Valmohammadi, 2019). This includes the effort of SC members participating in strategic planning, knowledge development, and mutual support for continuous improvement. ST, therefore, should be categorized as one of the essential SCQM practices.

The sharing of crucial and confidential information with SC members is referred to as IS (Li et al., 2006). IS encourages open communication, which in turn improves mutual learning and understanding and strengthens relationships among manufacturing SC members (Lim et al., 2021). Hence, the SCQM strategy implementation should stress IS.

The key determiner of quality and the source of sustained business value is the customer. Capable of satisfying customers can gain repeat customers, and ensure continued operation, and business success in the manufacturing sector (Kumar et al., 2020). According to Soares et al. (2017), CI is defined as a prompt response, proactive collaboration, and interaction with customers to comprehend their demands and needs. Therefore, CI should be adopted as the key component of SCQM.

Although previous studies have recognized the importance of SF, LD, OP, ST, IS, and CI in the manufacturing sector, little research has been conducted on how these multidimensional SCQM practices interact with CP and the impact of DSA as a moderator among manufacturers. Soares et al. (2017), for instance, examined the impact of SCQM on quality performance among manufacturers but did not account for the significance of DSA as the moderator effect. Furthermore, OP, ST, and IS were not considered essential components of SCQM, meanwhile IS instruments were classified as CI in their questionnaire design. While Gunasekaran et al. (2016) acknowledge that top management commitment and IS were important practices for big data predictive analytics models to improve SC performance in a variety of industries, including manufacturing, However, their study did not consider the impact of the other four SCQM practices (SF, OP, ST, and CI) on CP. Similarly, Lim et al. (2021) ignored OP and ST as important SCQM practices for manufacturers, and the moderating role of DSA in gaining a competitive advantage is overlooked.

2.3 Competitive Performance (CP)

CP is the extent to which a company is capable of achieving its goals in response to its external environment (Rai and Tang, 2010). Previous studies have poorly conceptualized competitiveness due to a lack of a concise instrument to represent the concept of CP (Sigalas and Economou, 2013). Therefore, a call for a concrete idea of competitiveness is encouraged (Lee et al., 2016) for the manufacturing sector.. The CP concept derived from Mikalef et al. (2020) was applied in this study with a broader consideration of strengthening capabilities and capacity for long-term CP. By considering sales growth, market share growth, rapid response to market demand, increasing customer satisfaction, profitability, return on investment, and ability to reduce operating costs as orchestrating items in measuring CP. However, Mikalef et al. (2020) demonstrate a lack of concern for institutions and institutional disciplines in response to internal and external pressures at the SC level in the manufacturing sector. To respond to internal development, technological, and competitive forces and achieve excellent CP, IIT must be employed by manufacturers. Given that, IIT explains how manufacturers can exploit and leverage the legitimacy and support gained from SC members to shape their actions for long-term competitive strategy. Furthermore, the study intends to broaden the scope of SCM and TQM studies by utilizing the new IIT to investigate the relationship between SCQM, CP, and DSA. Observing SCQM practices implementation via strategic organizational changes and reconfiguring resources in alignment with DS as complements to CP.

2.4 Digital Strategy Alignment (DSA)

DSA entails a shared vision and action plan that integrates digital technology and business strategies within an organization (Li et al., 2021). The proliferation of digital technologies shall result in the digitization of operations and supply chains, necessitating the development of a digital-related strategy (Alnuaimi et al., 2022; Chi et al., 2020; Dubey et al., 2020; Dwivedi et al., 2022a; Kapoor et al., 2021; Kshetri, 2021; Mathivathanan et al., 2021). Those manufacturing companies that have successfully transitioned from traditional operations and SC to modern and digitalization operations and SC systems have opportunities to gain a competitive advantage (Holmström et al., 2019). Therefore, it is imperative to embrace this transition by establishing a robust SCQM strategy that incorporates digital alignment. Traditional beliefs and practices should be replaced with new norms and practices for long-term competitive strategy, particularly in the context of institutional change (Herold et al., 2021). Internal and external forces compel institutional changes for a successful transition, with three phases highlighted by Suddaby and Seidl (2013) to be followed by manufacturers: new practices, praxis roadmap, and practitioner engagement. Indicating first in the implementation of strategy tools and trials influences employees' routinized responses to new practices. Second, guided by established practices, praxis in concrete and unfolding action and activity. Third, in engaging in strategy work, recognize the uniqueness and diverse backgrounds of the actors. All of this is important in interpreting the importance of deploying SCQM practices in the digital realm as new and defined practices with concrete and unfolding action in achieving CP. Also, manufacturers' uniqueness in involving strategic decisions must be recognized.

3. Hypotheses and model development

Figure 1 depicts all the constructs and hypotheses investigated in this study.

3.1 SF and CP

According to Lim et al. (2021), intense focus and collaboration with suppliers can increase SC efficiency and manufacturer competitiveness, resulting in sustainable performance. Analogously, strategic supplier involvement in operational and SC chain processes should have a significant impact on quality performance among UK manufacturers (Soares et al., 2017). In the age of Industry 4.0, the digitalization of the SC process strongly encourages manufacturers to collaborate in inter-organizational technological activities (Yang et al., 2021). This includes promoting supplier IT integration (Pereira and Frazzon, 2020) and supply visibility for smart manufacturing transitions between the manufacturer and its main suppliers. Supply-side digitalization, for example, improves transparency and real-time transactions, IS, and visibility with suppliers by implementing interconnected digital assets. With effective supplier collaborative practices that emphasize inter-organizational collaboration with a "hand in hand" strategy to synchronize operation and SC process, manufacturers' competitive advantage can be strengthened. Correspondingly, IIT explains that external forces necessitate close collaboration with suppliers to facilitate manufacturers' interconnectivity, interoperability, and compatibility, thereby improving their CP. Hence, we develop our first hypothesis:

H1. Intensely focusing on SF would positively influence CP.

3.2 LD and CP

Leaders who are accountable for identifying new opportunities, developing strategy, articulating the vision, and inspiring followers to work toward common goals (Lim et al., 2022). According to Ojha et al. (2018), transformational leadership motivates followers to implement new norms and employ innovative problem-solving techniques by stretching followers' efforts to increase manufacturers' competitiveness. IIT explains the significance of developing effective leadership skills for institutional change management

(Alnuaimi et al., 2022). In the smart manufacturing and SC processes, leadership abilities such as charisma in envisioning and enabling, instrumental in structuring and controlling, and institutional in maintaining the defined change implementation are all required. Likewise, in a specific aspect of implementing the SCQM strategy for the transition to smart manufacturing, leadership contributes to a greater CP. Consequently, our next hypothesis is formed:

H2. Intensely focusing on LD would positively influence CP.

3.3 OP and CP

Internal OP is another essential element of the value of SCQM. Prajogo et al. (2015) demonstrated that efforts to improve internal operations, such as process control and inventory management, can increase the competitiveness of 232 Australian manufacturing firms. Particularly when manufacturers can effectively improve their internal operations' integration with external forces, such as suppliers, into the overall value-chain processes. Consequently, the quality and reliability of internal operations that pursue continuous improvement must be present. For instance, an internal digitalization and advancement system can streamline and reconfigure the use of external information technology. Given manufacturers have reported dealing with SC disruptions due to a deficient internal operating system for gathering external information (Gu et al., 2020). Increasing competition necessitates continuous improvement in internal operations that are responsive to acceptable norms and practices, as exemplified by IIT. All of this adds value by reflecting and syncing the most current technological processes and information. Consequently, we postulate the following:

H3. Intensely focusing on OP would positively influence CP.

3.4 ST and CP

Increased competition can result from manufacturers and their SC partners collaborating on a strategic plan. Mehdikhani and Valmohammadi (2019) examine companies including the manufacturing sector where ST improves external and internal knowledge sharing, which provides avenues for competitive position enhancement. ST between SC partners demonstrates an unwavering dedication to success, resulting in an SC system that is responsive and competitive (Kim and Lee, 2010). IIT explains the shared expectations and strategic directions to enable SC partners to gain a competitive advantage through mutual understanding and support. This includes the exchange of insightful and exhaustive information, skills, and knowledge that facilitates the process of informed interfirm decision-making and reduces role ambiguities, especially in a rapidly changing technological climate. Therefore, the following hypothesis is proposed:

H4. Intensely focusing on ST would positively influence CP.

3.5 IS and CP

The results of a survey of 61 manufacturers in Greece demonstrate that IS among SC partners improves their overall performance (Marinagi et al., 2015). IS promotes open and transparent interaction and communication, which simultaneously discourages opportunistic behavior and information asymmetry in SC systems (Lee et al., 2018), which can heighten competition. Lim et al. (2021) empirical findings revealed that IS is one of the most important practices for improving 177 manufacturers' sustainability performance, which is largely contingent on their competitiveness capability. From the perspective of IIT, the rapid evolution of technology and the competitive marketplace manufacturers are under pressure to share vital and recent information with SC partners. Manufacturers can improve their competitiveness by leveraging the support they gain from SC stakeholders through information exchange and mutual learning. Consequently, we offer the following hypothesis:

H5. Intensely focusing on IS would positively influence CP.

3.6 CI and CP

Customers are viewed as the primary driver of manufacturing industry competitiveness. Chau et al. (2021) analyzed 132 Chinese manufacturers and found that CI is one of the most important success factors for developing SCQM. Greater emphasis on downstream customer relations improves the SC strategy's alignment with customers' needs, thereby enhancing the manufacturer's competitive position. CI motivates positive changes beyond financial performance (Kumar et al., 2020) and quality improvement (Soares et al., 2017) to gain a long-term competitive advantage. Market and customer needs are perceived as external institutional pressures that compel manufacturers to implement the changes. This is explained in the new IIT perspective as a requirement for adopting technology to facilitate SCQM implementation and enhance competitive capabilities. Hence, we suggest the following:

H6. Intensely focusing on CI would positively influence CP.

3.7 Moderating role of DSA

Manufacturers have encountered institutions and institutional pressures to improve the formulation of their management strategy (Sarkis et al., 2021) for CP. Consequently, re-evaluation and redesign of manufacturing and SC strategy, practices, and functions are required to ensure a more seamless transition to smart manufacturing. DSA is believed to be a significant influencer in their successful transition motive (Alnuaimi et al., 2022). A strategic alignment of emergent digital technologies in establishing a manufacturing management strategy can develop SC capability and prevent management disruptions (Rodríguez-espíndola et al., 2022). Meanwhile, emergent digital technologies interface with production-control systems must be considered for a successful digitalization transformation in operations and SCM (Herold et al., 2021; Holmström et al., 2019), particularly when designing effective SCQM practices. Digital alignment facilitates real-time information access and exchange, the identification of bottlenecks and process discrepancies, and the cost-effective reconfiguration of manufacturing processes and assets (Holmström et al., 2019). Therefore, effective digital alignment influences the implementation of SCQM practices. For instance, developing a leadership capable of propelling the transition to smarter design to enhance the competitive capability, DSA will undoubtedly have a significant bearing on this connection. Also, as revealed by Fallahpour et al. (2021), the convergence of emerging digital technologies can influence supplier integration for SC sustainability and competitive advantages. Therefore, we propose:

H7a-f. DSA positively moderates the relationship between SCQM practices (i.e., SF, LD, OP, ST, IS, and CI) and CP, where the relationship is stronger when DSA is high.

4. Methodology

The target respondents for the present study were the employees of the manufacturing firms listed in the Federation of Malaysian Manufacturers (FMM) directory. The manufacturing sector was selected given its significant contribution to the Gross domestic product (GDP) and overall economic performance of Malaysia (Department of Statistics Malaysia, 2020). The data collection was conducted with the assistance of professional enumerators through an online survey that was distributed to the respondents via email from June to August 2022. A purposive sampling method was used for the data collection process from 250 respondents. To obtain justifiable and reliable responses, three criteria were imposed by the researchers to determine the eligibility of the respondents. The criteria were: (1) the respondent must be a Malaysian, (2) he or she is over 18 years of age, and (3) he or she must have worked with the surveyed firm for at least six months. Individuals who fulfilled all these requirements were considered qualified respondents for this study. However, following the data cleaning process (i.e., subjected to the missing values, outliers, and normality assessment) of the returned questionnaire, only 225 cases were deemed usable for further analysis. Table I demonstrated the demographics of the sampled respondents. Middle management had the highest proportion in the study (67.11%), followed by senior management (28.89%), and junior management (4%) was deemed acceptable. As middle management was identified as the "traffic cop" for the successful implementation of management practices (e.g., TQM implementation (Ooi et al., 2012)), they have given the authority to direct information regarding SC and QM in the relevant divisions of the Malaysian manufacturing company.

On the other hand, both procedural and statistical remedies were used to control common method bias (CMB). First, for procedural remedy, there was no right or wrong response to the questions, and respondent anonymity was guaranteed (Tan and Ooi, 2018). Second, the measured latent marker variable, attitude toward the color blue (see Appendix Table A1), was used as a statistical remedy (Miller and Simmering, 2022). This study confirmed that CMB was not a problem because the difference in R^2 for CP, comparing measured and unmeasured latent marker variables, was less than 10%.

5. Statistical analysis and results

5.1 Statistical analysis

Web Power online tool was adopted to check Mardia’s multivariate skewness and kurtosis. Given that both Mardia’s multivariate skewness (β=22.277) and kurtosis (β=121.841) have p-value less than 0.001, respectively, this confirmed non-normality in this set of data (Tew et al., 2022). Therefore, SmartPLS 3 (a variance-based Structural Equation Modelling) software was ideal for this study. Seeing as smartPLS, a variance-based SEM method tool, was best suited for non-parametric approaches (Hair et al., 2021). Furthermore, smartPLS was important for theory development and prediction in this study, rather than theory confirmation using the covariance-based SEM method (AMOS), which was consistent with the objective of this study (Hair et al., 2021). The study was carried out with a sample of 225 respondents. The number is higher than the minimum sample size of 131, considering the power level of 0.80, 13 predictors, alpha value of 0.05, and effect size of 0.15, using the software G*Power (Faul et al., 2009).

5.2 Assessing the Outer Measurement Model

Composite reliability (CR) and Dijkstra and Henseler's rho (pA) were employed to check for reliability (Wang et al., 2022). As all the values in Table II were larger than the recommended 0.70 cut-offs, the measurement model's internal consistency was good (Wong et al., 2022). OP8 was dropped due to poor outer loading, which was below 0.40. The validity test was based on convergent and discriminant validity. Convergent validity (CV) was guaranteed by having item loadings larger than 0.70 on their respective constructs and average variance extracted (AVE) surpassing 0.50 as shown in Table II (Lo et al., 2022; Wong et al., 2015; Chong et al., 2012) . In ascertaining the discriminant validity (DV) of constructs, the Hereto-Trait-Mono-Trait (HTMT) ratio was adopted. As all the values in Table III were below 0.85 and thus confirming that DV has been established.

5.3 Inspecting the Inner Structural Model

The study performed a bootstrapping procedure with replacement using 5000 sub-samples to check for the statistical significance of the parameter estimates (Loh et al., 2020). Before the analysis, inner variance inflation factor (VIF) values were performed to check for collinearity. As all VIF values were below 3, the result concluded that collinearity is not a critical issue in this study (Yuan et al., 2021). Additionally, the Standardized Root Mean Square Residual (SRMR) values for both the estimated and saturated model are 0.053 respectively, and as the value is below 0.08, this shows that the model fit was good (Tan and Ooi, 2018). Among the 6 hypotheses proposed in this paper, the results in Table IV and Figure 2 passed the statistical significance test except for the relationship between LD and CP ($\beta = 0.075$, $p > 0.05$) and OP and CP ($\beta = 0.006$, $p > 0.05$), which were not supported. The study adopted the orthogonalizing approach for interaction terms on the moderating effect. Table IV and Figure 2 indicate that DSA only moderated the relationship between LD and CP.

5.4 The Predictive Relevance and Effect Size

The coefficient of determination (R^2 values) of CP is 76.6, which can be described as substantial (Hair et al., 2021). Effect size (f^2) of 0.02, 0.15, and 0.35 suggested small, medium, and large impacts, according to Cohen (1992). Tan and Ooi (2018) indicated that values between 0.02 show no effect. As all the f^2 sizes in Table V ranged from 0.000 to 0.821, this means that the study has no large effects. A blindfolding procedure was performed with an omission distance of 7 to estimate Stone-Geisser's Q^2 values. All the results in Table VI were greater than zero, indicating that the model has predictive relevance (Loh et al., 2020).

6. Discussion and research implications

From a new IIT perspective, the two main research questions have been addressed through empirical testing among manufacturing firms. We investigated the impact of SF, LD, OP, ST, IS, and CI as multidimensionality practices on CP using DSA as a moderator.

6.1 Overview of the results

To answer RQ1 using IIT, our study suggested partial support for the hypothesized relationship. Our findings indicated that intense concentration on SF, ST, CI, and IS had a significant and positive effect on CP. However, it was discovered that LD and OP did not affect CP. Our findings agreed with Lim et al. (2021) and Soares et al. (2017) that SF emphasizes an inter-organizational collaboration strategy, resulting not only in improved quality and sustainability performance but also, as proposed in this study, a higher CP. Moreover, a significant and positive relationship was identified between ST and CP. This finding is consistent with Mehdikhani and Valmohammadi (2019)'s result that ST and alignment can enhance the responsiveness of the SC system, contributing to a greater degree of competitiveness. On the other hand, IS has a significant and positive effect on CP. This is in line with the findings of Lee et al. (2018) and Lim et al. (2021) that sharing recent and relevant information can improve innovation and sustainability performance, thereby shaping better competitive capabilities among manufacturers. Meanwhile, CI has a significant and positive effect on CP. Effective communication can garner valuable customer feedback, which is essential for implementing changes that align with the needs of the customer and market, thereby enhancing competitiveness. As concurred by Chau et al. (2021), CI remains the most important factor when establishing the SCQM model. Surprisingly, no significant correlations were found between LD and OP on CP, contradicting the findings of Ojha et al. (2018) and Prajogo et al. (2015). This is likely the result of Malaysia's rigid hierarchical system and bureaucratic culture, which have constrained manufacturers' adaptability and willingness (Qureshi et al., 2021) to collaborate for CP. The rigidity of the hierarchical culture structure in these manufacturing companies that are averse to change by enforcing strict rules in traditional management strategy has diminished their leaders' and employees' adaptability.

The final set of hypotheses relationships (H7a-f) investigated the moderator effect of DSA to address RQ2. Interestingly, DSA was found to moderate the connection between LD and CP significantly and positively. LD has a significant and positive impact on the competitive capabilities of manufacturers if digital strategy alignment is adopted effectively. Likewise, creating competitive value requires sufficient LD to propel business development by establishing holistic SCQM practices that align with DS. Nonetheless, DSA was discovered to not moderate the relationship between SF, ST, OP, SI, and CI on CP despite the support of IIT. This is likely because manufacturers are still in the learning and training phase (Tay et al., 2021) and lack an effective integration system for emergent technologies. Consequently, they do not comprehend the full advantages of adopting a DS when implementing SF, ST, OP, SI, and CI practices as essential components of a competitive SCQM strategy. In addition, the Malaysian government's haste in implementing DS by pressuring businesses, including the manufacturing sector (Ignatius, 2022a), may not achieve the desired results if the effort to cultivate skills and competencies in the workforce is impeded. It may also require some time to train leaders and employees on digitalization and to understand these new concepts in today's competitive environment. As suggested by Ignatius (2022b), it is crucial to upskill 30,000 Malaysians in automation and digitally driven SC systems for the manufacturing sector.

Regardless of the unsupported findings, a holistic SCQM strategy that includes efforts to develop internal, upstream, and downstream practices as well as alignment with DS is critical for increasing CP.

6.2 Theoretical and practical implications

Our study expanded IIT by empirically testing the six SCQM practices for CP in a DSA context, which can serve as a foundation research model for future SCM, QM, CP, and DS-related fields of research. Commonly used theories in this field include dynamic capability theory, knowledge-based view theory, and resource-based view theory (Lee et al., 2021; Lim et al., 2022; Sarkis et al., 2021); however, adopting new IIT to explain the hybrid SCQM strategy on CP is understudied, particularly when digitization initiatives are aligned with the formation of a holistic strategy. As suggested by Alnuaimi et al. (2022), Dubey et al. (2019), and Sarkis et al. (2021), a rapidly changing technology environment causes the direct and indirect external and internal pressure to compel businesses to adopt new theories (such as new IIT) when establishing an emerging strategy. Hence, digitalization allows revisiting the existing theory and development of the new theory, as proposed in our study of the new IIT, to enrich the field of SCQM. Second, our research contributes to the body of knowledge for existing literature by investigating the multidimensionality practices of SCQM on CP. Among the highlighted practices, SF, ST, SI, and CI were found to have a significant and positive influence on CP, providing insight into future studies to adopt these significant practices when considering shaping organizational changes for CP. Similarly, by leveraging external and internal institutional pressures, IIT can explain how implementing sufficient SF, appropriate ST, proactive IS, and adequate CI can improve CP. Furthermore, empirical studies investigating DSA as a moderator to influence the relationship between the multidimensionality of SCQM practices and CP are scarce. Our research, hence, adds value to the existing literature by encapsulating DSA as the moderating role of the influence of LD on CP. This further emphasizes the importance of aligning DS into the SCQM strategy for CP, especially when LD practice is concentrated.

Manufacturers must establish an SCQM strategy that prioritizes SF, ST, SI, and CI practices to increase competition. Concentrating intensely on these enablers improves manufacturing's competitiveness. However, there is a paucity of literature examining these significant predictors that can improve the CP of Malaysian manufacturers. Manufacturers should judiciously re-evaluate the strategies for implementing these practices (SF, ST, SI, and CI) that can improve competitiveness, particularly when the manufacturer is under institutional pressure to change. This strategy includes promoting SF, coordinating ST, emphasizing a proactive IS system, and adequately focusing on customer demands. Our study, on the other hand, provides useful practical insight to manufacturers by demonstrating that DSA is a positive moderator in influencing the connection between LD and CP. This compels manufacturers to rethink their business models to adapt to internal and external pressures caused by changing environmental conditions by implementing a competitive digital SCQM strategy.

7. Limitations and future direction

Even though we have developed a sound theoretical model and established a reliability and validity test on the collected data, several limitations can be addressed in future research. First, we were unable to gather data from manifold industries; instead, all our data was gathered from Malaysian manufacturing companies that adopt SCQM. Consequently, we cannot make broad generalizations based on our findings. Hence, interesting future research that examines the various industries using the same theoretical model is encouraging, which may lead to different outcomes. Second, our study was purely a quantitative approach; future research could incorporate qualitative methods, such as conducting interviews with the respondents. This will broaden the research model to investigate additional potential research questions. Third, our theoretical model that examines the relationship between the multidimensionality of SCQM practices and CP, with the moderating effect of DSA, is heavily influenced by a new IIT. From the standpoint of learning and knowledge sharing, SC members advocate for active sharing and learning capacity to adapt to changes in digitalization. Furthermore, future research into the metaverse (Dwivedi et al., 2022b) as a potential variable in the SCM and QM fields is encouraged.

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Figure 1. Conceptual model

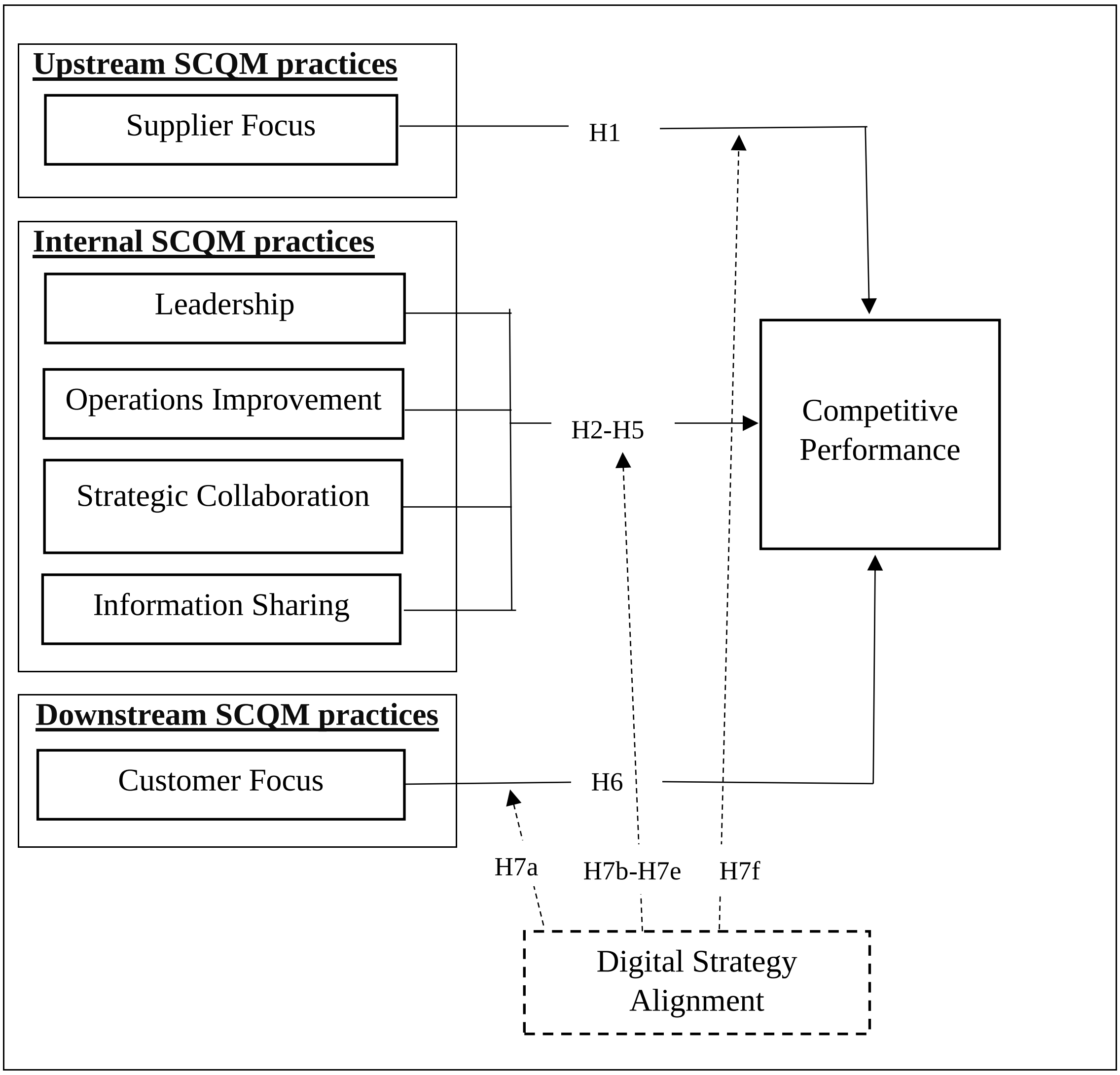

Figure 2. Results of Hypotheses Testing

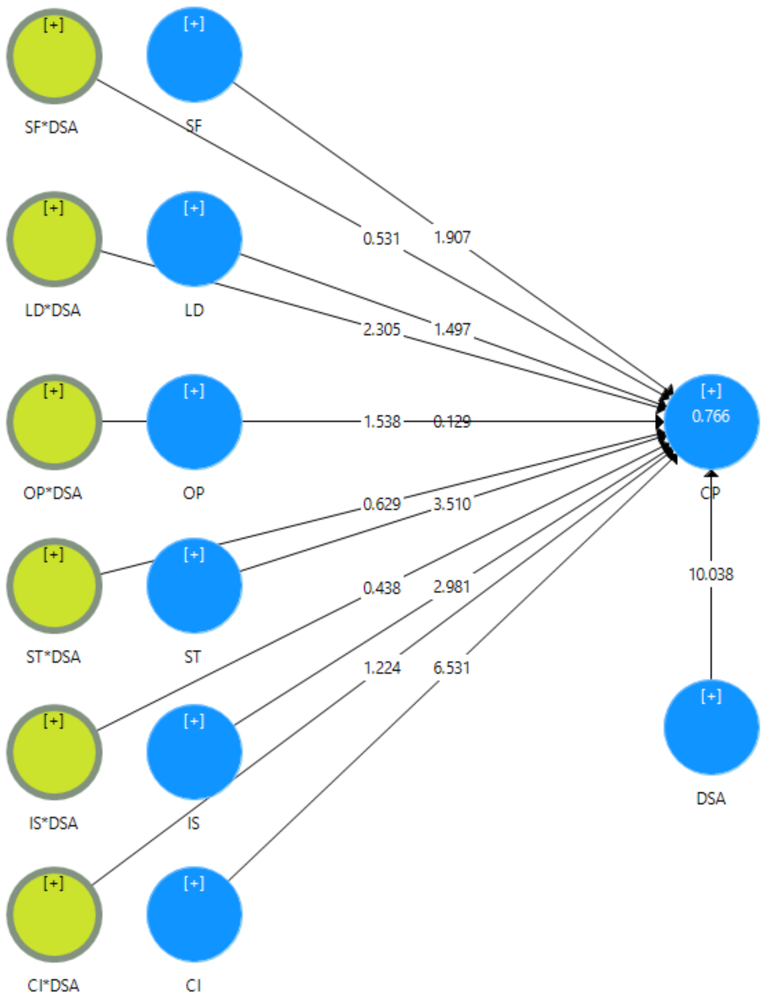

Table I. Demographics of the sampled respondents

Item	Category	Sample (N = 225)	Proportion (%)
Gender	Male	129	57.33
	Female	96	42.67
Job Position	Senior management	65	28.89
	Middle management	151	67.11
	Junior management	9	4.00
Status of firm	ISO 9001 certified	87	38.67
	Planning for ISO 9001 certified	116	51.56
	Non-ISO 9001 certified but with SCQM practices	22	9.78
Age of firm	More than 20 years	102	45.33

	Between 5 to 20 years	115	51.11
	Less than 5 years	8	3.56
Number of employees	More than 200	104	46.22
	Between 75 to 200	84	37.33
	Less than 75	37	16.44
Firm’s product category	Electrical and electronics products	69	30.67
	Computer, IT, and technological products	34	15.11
	Furniture, carpets, and wood related products	11	4.89
	Plastic products and resins	3	1.33
	Pharmaceutical products	3	1.33
	Iron, steel, and metal products	15	6.67
	Medical devices and/or equipment	8	3.56
	Food and beverage products	28	12.44
	Paper, packaging, labelling, and printing products	7	3.11
	Rubber products	9	4.00
	Household products and appliances	16	7.11
	Industrial and engineering products	13	5.78
	Textile, apparel, leather, and footwear	7	3.11
	Gifts, stationery, and office supplies	2	0.89

Table II. Loadings, Composite Reliability and Average Variance Extracted

Constructs	Items	Loadings	Dijkstra Henseler’s (rho pA)	Composite Reliability (CR)	Average Variance Extracted (AVE)
CI	CI1	0.820	0.903	0.921	0.701
	CI2	0.861			
	CI3	0.881			
	CI4	0.825			
	CI5	0.796			
CP	CP1	0.796	0.917	0.933	0.666
	CP2	0.894			
	CP3	0.777			
	CP4	0.777			
	CP5	0.869			
	CP6	0.816			
	CP7	0.774			
DSA	DSA1	0.892	0.911	0.936	0.786
	DSA2	0.906			
	DSA3	0.897			
	DSA4	0.851			
IS	IS1	0.839	0.934	0.945	0.743
	IS2	0.844			
	IS3	0.945			

	IS4	0.825			
	IS5	0.883			
	IS6	0.832			
LD	LD1	0.802	0.902	0.924	0.710
	LD2	0.833			
	LD3	0.867			
	LD4	0.869			
	LD5	0.839			
OP	OP1	0.814	0.901	0.914	0.602
	OP2	0.789			
	OP3	0.766			
	OP4	0.796			
	OP5	0.748			
	OP6	0.774			
	OP7	0.743			
ST	SC1	0.861	0.882	0.903	0.700
	SC2	0.885			
	SC3	0.787			
	SC4	0.810			
SF	SF1	0.744	0.923	0.934	0.640
	SF2	0.879			
	SF3	0.796			
	SF4	0.700			
	SF5	0.804			
	SF6	0.885			
	SF7	0.760			
	SF8	0.525			
	SF9	0.791			

Table III. Hetero-Trait-Mono-Trait Assessment

	CI	CP	DSA	IS	LD	OP	SF	ST
CI								
CP	0.471							
DSA	0.237	0.825						
IS	0.317	0.519	0.387					
LD	0.157	0.474	0.444	0.138				
OP	0.093	0.326	0.336	0.073	0.396			
SF	0.073	0.354	0.325	0.219	0.373	0.192		
ST	0.228	0.514	0.374	0.437	0.157	0.182	0.129	

Table IV. Outcome of the Structural Model Examination

PLS Path	**Original Sample (O)**	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**	**Bias Corrected Confidence Interval**	**Remarks**

CI -> CP***	0.234	0.219	0.036	6.531	0.000	0.179	0.322	Significant
IS -> CP**	0.142	0.142	0.048	2.981	0.003	0.058	0.242	Significant
LD -> CP^NS	0.075	0.069	0.050	1.497	0.135	-0.010	0.185	Not significant
OP -> CP^NS	0.006	0.010	0.049	0.129	0.897	-0.106	0.090	Not Significant
SF -> CP*	0.091	0.091	0.046	1.975	0.049	0.001	0.174	Significant
ST -> CP***	0.160	0.157	0.045	3.510	0.000	0.072	0.252	Significant
CI*DSA -> CP^NS	-0.098	-0.087	0.080	1.224	0.221	-0.187	0.143	Not significant
IS*DSA -> CP^NS	-0.033	0.026	0.074	0.438	0.661	-0.220	0.059	Not significant
LD*DSA -> CP*	-0.107	-0.104	0.046	2.305	0.021	-0.223	-0.026	Significant
OP*DSA -> CP^NS	-0.058	-0.054	0.038	1.538	0.124	-0.136	0.012	Not significant
SF*DSA -> CP^NS	-0.029	-0.044	0.054	0.531	0.595	-0.090	0.183	Not significant
ST*DSA -> CP^NS	-0.042	-0.030	0.067	0.629	0.529	-0.141	0.098	Not significant

Notes:
a.* Significant at p <0.05 level.
b.** Significant at p <0.01 level.
c.*** Significant at p <0.001 level.
d.^NS Not supported

Table V. Effect Size (f^2)

Predictor Constructs /Dependent Constructs	**CP**
CI	0.196
DSA	0.821
IS	0.063
LD	0.015
OP	0.000
SF	0.029
ST	0.083

Table VI. Predictive Relevance (Q^2) and R^2

Endogenous Construct	**SSO**	**SSE**	**Q^2 (=1-SSE/SSO)**	**Predictive Relevance**	**R^2**
CP	1575	799.281	0.493	$Q^2 > 0$	0.766

Appendix

Table A1. Measurement scales

Constructs and instruments
<u>**Upstream SCQM Practices**</u>
Supplier Focus (SF) (Soares et al., 2017)
Our company…
SF1: "Regularly conducts supplier quality audit"
SF2: "Has detailed information about supplier performance"
SF3: "Always gives feedback on the performance of suppliers' products"
SF4: "Has a formal programme for evaluating and recognising suppliers"
SF5: "Regards product quality as the most important factor for selecting suppliers"
SF6: "Always participates in supplier activities related to quality"
SF7: "Has very frequent face-to-face planning/communication with key suppliers"
SF8: "Can influence 1st tier/Main supplier's responsiveness to our requirements"
SF9: "Enters into special agreements with suppliers who have improved performance"
<u>**Internal SCQM Practices**</u>
Leadership (LD) (Gunasekaran et al., 2016)
Top management…
LD1: "Expresses how supply chain partnering will provide significant business benefits to the firm"
LD2: "Expresses how supply chain partnering will create a significant competitive arena"
LD3: "Articulates vision for supply chain collaboration"
LD4: "Formulates strategy for organizational information sharing"
LD5: "Establishes the metrics to monitor supply chain success through partnering"
Operation Improvement (OP) (Chong et al., 2011; Lee et al., 2018)
OP1: "The current production level is up-to-date"
OP2: "The current internal logistics flow for the main product is satisfactory"
OP3: "There are excessive automated processes to produce the core product"
OP4: "The production system is flexible to handle order pattern/variations"
OP5: "The innovation level of the main product is acceptable"
OP6: "There are continuous improvements made in the production"
OP7: "The senior management is aware of the effectiveness of the supply chain processes"
OP8: "The extent of modular production is reasonable"
Strategic Collaboration (ST) (Mehdikhani & Valmohammadi, 2019)
Our company…
ST1: Collaborates actively in forecasting and planning with supply chain partners
ST2: Collaborates with supply chain partners in demand forecasting and planning

ST3: Develops strategic plans in collaboration with supply chain partners

ST4: Shares projects and plans future demand collaboratively with supply chain partners

Information Sharing (IS) (Lim et al., 2021)

IS1: “We inform supply chain partners in advance of changing needs”

IS2: “Our supply chain partners share proprietary information with us”

IS3: “Our supply chain partners keep us fully informed about issues that affect our business”

IS4: “Our supply chain partners share business knowledge of core business processes with us”

IS5: “We and our supply chain partners exchange current information that helps establishment of business planning”

IS6: “We and our supply chain partners keep each other informed about events or changes that may affect the other partners”

<u>Downstream SCQM Practices</u>

Customer Focus (CI) (Kumar et al., 2020)

Our company…

CI1: Actively and regularly seek customer inputs to identify their needs and expectations

CI2: Always maintain a close relationship with our customers and provide them an easy channel for communicating with us

CI3: Have an effective process for resolving customers’ complaints

CI4: Systematically and regularly measure customer satisfaction

CI5: “customer needs and expectations are effectively disseminated and understood throughout the workforce”.

Competitive performance (CP) (Mikalef et al., 2020)

We believed that our firm outperformed our main competitors in each of the following criteria:

CP1: Sales growth

CP2: Growth in market share

CP3: Rapid response to market demand

CP4: Increasing customer satisfaction

CP5: Profitability

CP6: Return on investment (ROI)

CP7: In reducing operating costs

Digital Strategy Alignment (DSA) (Alnuaimi et al., 2022)

Our company…

DSA1: integrates digital technology and business strategy to attain strategic alignment.

DSA2: creates a shared vision of the role of digital technology in the business strategy.

DSA3: jointly plan how digital technology will enable the business strategy.

DSA4: confers with each other before making strategic decisions.

<u>Marker Variable (MV) - Attitude toward the color blue</u>

MV1: Blue is a beautiful color

MV2: Blue is a lovely color
MV3: Blue is a pleasant color
MV4: The color blue is wonderful
MV5: Blue is a nice color
MV6: I think blue is a pretty color
MV7: I like the color blue