

The Impact of Supply Chain Digitalization on Competitive Advantage at Maersk company in Saudi Arabia

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Abstract: This study examines the impact of supply chain digitalization on competitive advantage at Maersk in Saudi Arabia. Digitalization is operationalized through internal functional integration supported by enterprise resource planning (ERP) systems and interorganizational information sharing supported by Internet of Things (IoT) connectivity. A descriptive-analytical approach was adopted, using a structured questionnaire with a five-point Likert scale. Responses from 66 employees were suitable for analysis. Cronbach's alpha for the 20-item instrument was 0.933, indicating high internal consistency. Both digitalization dimensions were rated very highly: ERP-supported integration had a mean of 4.38 and an average item standard deviation of 0.67, while IoT-supported information sharing had a mean of 4.26 and an average item standard deviation of 0.77. Competitive advantage had an overall mean of 4.24. Indicators of internal operational capabilities, including continuous improvement and responsiveness, ranked above ultimate outcomes such as market share and entry into new markets. Response dispersion showed a systematic pattern: internal integration items exhibited less variation than items concerning information exchange with external partners, suggesting more consistent willingness to cooperate than execution of cooperation. Simple linear regression identified a strong, positive, statistically significant relationship between digitalization and competitive advantage ($R = 0.757$; $R^2 = 0.574$; $F(1,64) = 86.128$; reported $p < 0.001$). Digitalization thus explained approximately 57.4% of the variance in competitive advantage. Drawing on the resource-based view and dynamic capabilities perspective, the study argues that returns on digital investment depend on organizational routines built around technology. Recommendations address system integration, partner segmentation by digital maturity, data governance, and workforce development. Measurement and research-design limitations constrain generalizability and causal interpretation.

Keywords: Supply chain digitalization, competitive advantage, enterprise resource planning, Internet of Things, logistics sector.

1. Introduction

1.1 Study Background and Research Problem

Supply chains are no longer understood simply as sequences of operational activities. They have become information systems whose efficiency helps determine a firm's competitive position. The ability to establish a shipment's location and condition in real time, and to translate that information into a timely operational decision, increasingly distinguishes firms that respond to market needs from those that lag behind (Christopher, 2016).

The growing adoption of digital technologies has substantially reshaped these systems. Enterprise resource planning (ERP) systems provide an information backbone that integrates organizational data and eliminates conflicting versions of the same information (Thomas H. Davenport, 1998). At the same time, the Internet of Things (IoT) and the connectivity it enables allow information to flow beyond organizational boundaries to supply chain partners, improving transparency and interorganizational coordination (Ben-Daya et al., 2019). However, the relationship between digital investment and competitive performance is not automatic. Information systems research identified the “productivity paradox” early on: the absence of a clear relationship between technology expenditure and measured productivity growth (Brynjolfsson, 1993; Melville et al., 2003). Explaining this paradox requires a distinction between possessing technology and having the organizational capacity to use it effectively. Despite increasing investment in digital supply chain solutions, many firms lack a quantitative estimate of the competitive returns associated with that investment. The indicators they use are often aggregate, lagging financial measures that cannot isolate the contribution of digitalization from other influences. This difficulty is compounded in the Arab context, where the available literature tends to treat digitalization as a single overarching variable rather than as distinct dimensions that can be measured independently, limiting the practical applicability of its findings. This issue is particularly relevant to the shipping and logistics sector in Saudi Arabia, given national efforts to establish the Kingdom as a regional logistics hub. Accordingly, the study addresses the following main research question: What impact does supply chain digitalization have on competitive advantage at Maersk in Saudi Arabia?

Two subsidiary questions follow: To what extent are the two dimensions of supply chain digitalization implemented in the company? How much of the variation in competitive advantage can be explained by supply chain digitalization?

1.2 Literature Review

1.2.1 Supply Chain Digitalization and Its Levels

The literature distinguishes three successive levels that are often conflated in Arabic-language research. Digitization involves converting information from an analog to a digital format without changing the underlying procedure. Digitalization involves using technology to modify existing processes and improve their efficiency. Digital transformation goes further, reshaping business models and the mechanisms through which value is created (Bharadwaj et al., 2013; Vial, 2019). This distinction has practical implications. Many projects presented as digital transformation remain at the first level and therefore fail to deliver their anticipated returns. The present study focuses on the second level, examining the extent to which technology is used to modify information flows within the firm and between the firm and its partners. Supply chain digitalization is operationally defined here as the extent to which a firm uses digital systems and technologies to integrate its internal functions and exchange information with supply chain partners.

1.2.2 Internal Functional Integration Supported by ERP Systems

ERP systems are integrated software packages that connect organizational functions, including finance, purchasing, inventory, operations, and human resources, through a shared database. Information is entered once and made available to users according to their access rights (Thomas H. Davenport, 1998). Their defining feature is not automation itself, but a common authoritative data source that eliminates conflicting versions of the same information. Their contribution to logistics operates through four mechanisms. First, they eliminate inconsistencies in information across departments, improving decision accuracy. Second, they automate workflows by linking service orders, operational orders, and accounting entries in a single sequence that avoids duplicate data entry. Third, they support requirements planning by converting forecasts into time-phased orders. Fourth, they provide a basis for performance measurement, since indicators are difficult to calculate accurately without a system that records events and their timestamps (Gunasekaran et al., 2004). Nevertheless, the literature identifies substantial transition costs. Hitt, (2002) found that adopting firms achieved productivity improvements over the medium term, alongside a temporary decline in performance during implementation. (Zhu & Kraemer, 2005) further showed that differences in realized value reflect the depth of use after adoption rather than the adoption decision itself.

This shifts the research question from whether a firm has adopted a system to how extensively it uses that system.

1.2.3 Interorganizational Information Sharing Supported by IoT Technologies

The IoT refers to a network of devices and sensors capable of collecting data from their physical surroundings and exchanging it over a network without direct human intervention (Atzori et al., 2010). In logistics, this infrastructure takes several practical forms, including geolocation devices on vehicles and containers, temperature and humidity sensors in refrigerated shipments, and radio-frequency identification tags on pallets and parcels. The central contribution of these technologies lies in addressing an information gap concerning asset status.” However sophisticated an information system may be, its knowledge of a physical asset is limited to what has been entered manually and when that entry occurred. Sensors, by contrast, allow assets to report their condition and location automatically and continuously (Ben-Daya et al., 2019; Verdouw et al., 2016). The most significant organizational implications extend beyond individual firms. When shipment status is available to all parties in real time, transparency increases, dependence on delayed reports diminishes, and coordination and trust between partners improve. Lee et al., (1997) identified information distortion and delay as the principal sources of amplified demand fluctuations upstream in the supply chain, a problem that shared visibility directly addresses. Drawing specifically on the resource-based view, (Barratt & Oke, 2007) showed that supply chain visibility becomes difficult to imitate when it arises from embedded organizational practices rather than technological connectivity alone. Prajogo & Olhager, (2012) found that supply chain integration supported by information technology and data sharing is positively associated with operational performance. Ivanov et al., (2019) likewise showed that digitally enabled real-time visibility reduces the time needed to detect disruptions and limits their propagation through the supply chain. On this basis, the study's second dimension measures the organizational manifestations of IoT-enabled connectivity: the accuracy and timeliness of information exchange, trust, and interorganizational cooperation. It does not directly measure the extent to which assets are equipped with sensors. The implications of this explicit operational definition are considered in the limitations section.

1.2.4 Competitive Advantage

Competitive advantage is defined as a firm's ability to deliver greater customer value than its competitors in ways that are difficult to imitate, enabling it to sustain a strong market position over time (Porter, 1985). In logistics, this advantage is reflected in interrelated indicators, particularly service quality, on-time delivery, responsiveness to customer requirements, cost efficiency, and innovation in service design (Christopher, 2016; Fugate et al., 2010). Previous management studies highlight several organizational factors that can contribute to performance and competitiveness. Al-Hosaini and Sofian (2015) found that corporate social responsibility positively influences customer perspective, emphasizing stakeholder responsiveness, organizational reputation, and customer-oriented management. Similarly, Al-Hosaini et al. (2025) found a positive influence of corporate social responsibility on financial performance, suggesting that effective managerial practices and strategic alignment of organizational resources can support stronger outcomes and a more sustainable competitive position. From a human-resource perspective, Al-Nabae et al. (2024) showed that training in communication, problem-solving, and teamwork significantly contributes to employee performance, underscoring the importance of developing human capabilities alongside technical resources. In addition, Al-Nabae and Sammani (2022) found that technological and organizational innovation can enhance project performance and support sustainable competitive advantage. Collectively, these findings provide a broader managerial foundation for the present study, which examines the impact of supply chain digitalization on competitive advantage at Maersk in Saudi Arabia.

1.2.5 Research Gap and Contribution of the Present Study

Büyüközkan & Göçer, (2018) provided an extensive review of the digital supply chain concept, identifying system interoperability and real-time data-sharing capability as the two conditions governing the realization of benefits. Hofmann & Rüsch, (2017) emphasized that effective integration of digital technologies with logistics processes contributes to cost reduction and competitiveness. Schniederjans et al., (2020) showed

that the capacity to absorb and disseminate knowledge within the firm is a critical mediator between technological investment and realized performance. In the Arab context, Albalwy, (2025) , studying a major Saudi industrial company, found that the digitalization of transportation, storage, and delivery operations collectively explained approximately 33.5% of the variation in supply chain performance. The present study differs from this work in three respects. It separates digitalization into two functionally distinct dimensions, internal integration and interorganizational sharing, rather than classifying it by logistics activity. It treats competitive advantage, rather than operational performance alone, as the dependent variable. It also examines shipping and logistics, a sector less represented in Arabic-language research than manufacturing.

1.3 Theoretical Foundations, Conceptual Model, and Hypothesis

The study draws on two complementary frameworks to explain how digital investment translates into competitive advantage. The resource-based view (Barney, 1991) proposes that sustained competitive advantage arises from valuable, rare, and difficult-to-imitate resources. Commercially available technology is not inherently rare: competitors can purchase the same system from the same vendor. Advantage therefore stems from a firm's distinctive combination of technology, processes, and employees' tacit knowledge. The dynamic capabilities perspective (Teece, 2007) explains how firms reconfigure their resource base through sensing, seizing, and transforming capabilities. IoT technologies support sensing, while ERP systems support seizing by translating signals into implemented decisions.

These arguments underpin the conceptual model presented in Figure 1.

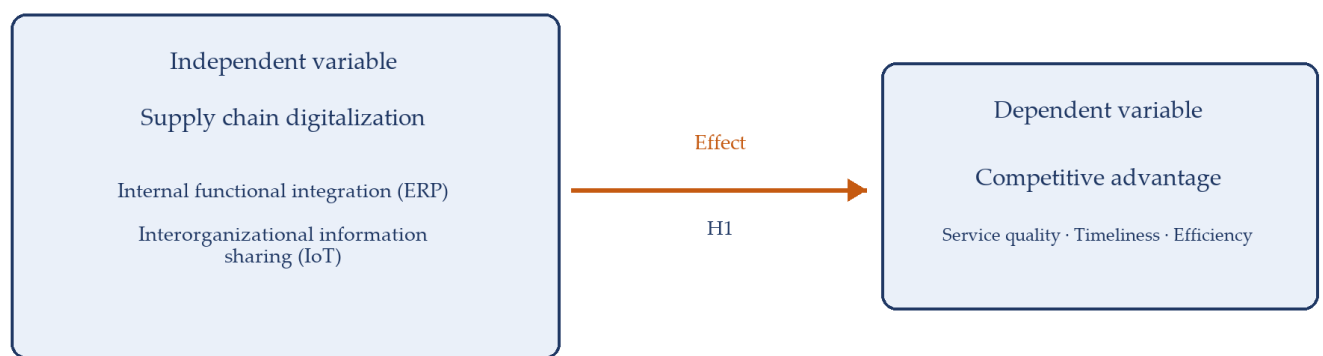


Figure 1. Conceptual model of the study

The following hypotheses were formulated from this model and tested at a significance level of $\alpha \leq 0.05$:

Null hypothesis (H0): Supply chain digitalization has no statistically significant effect on competitive advantage at Maersk in Saudi Arabia. Alternative hypothesis (H1): Supply chain digitalization has a statistically significant effect on competitive advantage at Maersk in Saudi Arabia. Methodological note: The study addresses a single inferential hypothesis, while the extent of implementation of the two digitalization dimensions is treated as a descriptive research question. Measuring the extent to which a practice is implemented and comparing its mean with a verbal threshold on a Likert scale is a descriptive procedure, not an inferential test, and should not be presented as a hypothesis to be accepted or rejected.

1.4 Study Objectives and Significance

The study aims to assess the extent to which the two dimensions of supply chain digitalization are implemented in the company, determine the direction and strength of the relationship between digitalization and competitive advantage, estimate the proportion of variance explained, and develop practical recommendations grounded in the findings. Theoretically, the study addresses a gap in Arabic-language research arising from the treatment of digitalization as an undifferentiated construct. Distinguishing two functionally different dimensions makes it possible to examine each pathway separately. In practical terms, the study provides a quantitative estimate of the competitive returns associated with digitalization in a leading logistics firm. This estimate can inform senior management decisions on the justification and prioritization of digital investment.

2. Methodology

2.1 Research Design, Population, and Sample

A descriptive-analytical approach was adopted as appropriate to the research problem and objectives. It permits a detailed description of the phenomenon as observed and a quantitative analysis of relationships between variables to test the hypothesis. The approach comprised a descriptive component assessing implementation of the two digitalization dimensions and an analytical component examining their effect on competitive advantage. The study population comprised employees of Maersk in Saudi Arabia. A random sample yielded 66 responses suitable for analysis. This exceeds the commonly cited minimum of approximately 50 observations for regression analysis with one independent variable (Green, 1991). Figure 2 presents the demographic characteristics of the sample.

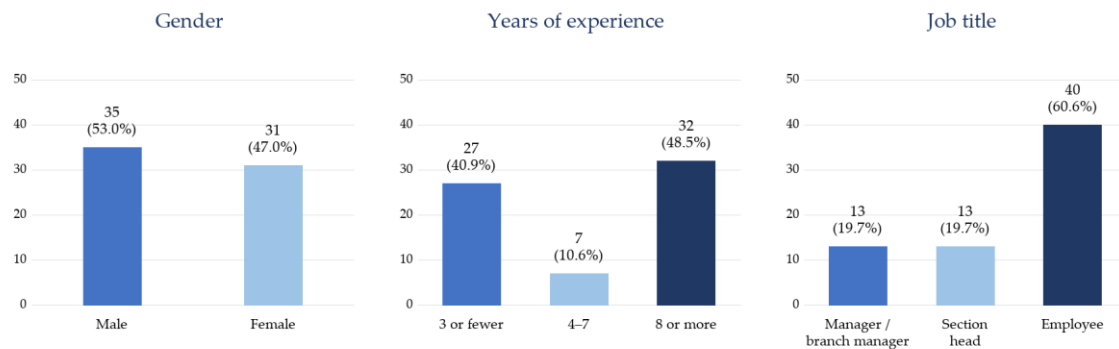


Figure 2. Sample demographic characteristics (n = 66)

The sample was relatively balanced by gender, with men accounting for 53.03% and women for 46.97%, a distribution that supports sample representativeness. Years of experience followed a bimodal pattern: responses were concentrated at the two ends of the range, with 48.48% reporting eight or more years and 40.91% reporting three years or fewer; the intermediate category accounted for only 10.61%. This pattern likely reflects a staffing structure combining an established core of experienced employees with recent recruits, as is common in firms that have expanded operations in recent years. By job title, nonmanagerial employees predominated at 60.60%, compared with 39.40% in supervisory and managerial roles combined.

2.2 Research Instrument, Validity, and Reliability

Data were collected using a questionnaire with two sections. The first collected demographic information. The second comprised 20 items covering three constructs: internal functional integration supported by ERP systems (five items), interorganizational information sharing supported by IoT technologies (five items), and competitive advantage (ten items). Responses were recorded on a five-point Likert scale. Mean scores were interpreted using the criteria in Table 1.

Table 1. Criteria for interpreting mean scores

Mean score range	Score	Response category
1.00 to <1.80	1	Strongly disagree
1.80 to <2.60	2	Disagree
2.60 to <3.40	3	Neutral
3.40 to <4.20	4	Agree
4.20 to 5.00	5	Strongly agree

Face validity was assessed by a panel of subject specialists, whose recommendations informed revisions to the wording of several items. Content validity was addressed by ensuring that the instrument covered the relevant aspects of the phenomenon. Reliability was assessed using Cronbach's alpha. The overall coefficient

for the 20-item instrument was 0.933, well above the conventional threshold of 0.70 and indicative of very high reliability (Hair, 2019; Jum C. Nunnally & Ira H. Bernstein, 1994) .

Table 2. Cronbach's alpha for the research instrument and interpretation criteria

Coefficient range	Interpretation
Below 0.60	Unacceptable
0.60 to <0.70	Acceptable reliability
0.70 to <0.80	Good reliability
0.80 or above	High reliability
Overall instrument (20 items)	0.933 — High reliability

2.3 Statistical Methods and Analytical Model

Data were analyzed using the Statistical Package for the Social Sciences (SPSS). Frequencies and percentages described the sample; means and standard deviations assessed the levels of the study constructs; Cronbach's alpha assessed reliability; Pearson's correlation coefficient measured the direction and strength of the relationship; and simple linear regression tested the hypothesis. The analysis did not include diagnostic tests of regression assumptions, such as residual normality and independence. This omission is addressed among the study limitations. The regression model was specified as follows:

$$Y = \beta_0 + \beta_1 X + \varepsilon$$

Here, Y denotes competitive advantage, the dependent variable; X denotes supply chain digitalization, the independent variable; β_0 is the intercept; β_1 is the regression coefficient; and ε is the random error term.

2.4 Scope of the Study

The study examines the two specified dimensions of supply chain digitalization as the independent variable and competitive advantage as the dependent variable. Other technologies, including cloud computing, blockchain, and artificial intelligence, are outside its scope. Geographically and sectorally, it is confined to Maersk in Saudi Arabia, a company operating in shipping and logistics rather than manufacturing. Its findings should therefore be interpreted within the context of this company and sector and should not be generalized to industrial firms. Participants were employees at different organizational levels, and data were collected in November 2025.

3. Results and Discussion

3.1 Implementation of the Two Dimensions of Supply Chain Digitalization

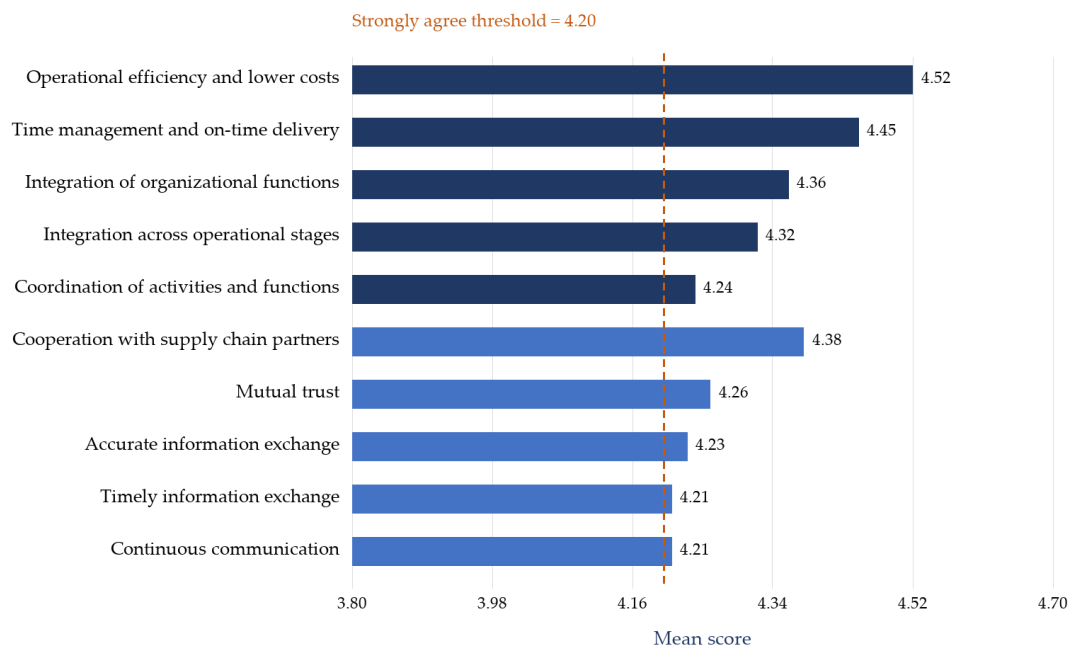
Table 3. Means and standard deviations for ERP-supported functional integration items

Item	Statement	Mean	SD	Rank	Response
4	Improving operational efficiency and reducing some operating costs	4.52	0.56	1	Strongly agree
5	Managing time and delivering to customers on schedule	4.45	0.66	2	Strongly agree
1	All organizational functions work together in an integrated manner	4.36	0.72	3	Strongly agree
2	Achieving integration and interaction at every operational stage	4.32	0.71	4	Strongly agree
3	Achieving coordination and interaction between internal activities and functions	4.24	0.72	5	Strongly agree
—	Overall dimension mean	4.38	0.673	—	Strongly agree

Table 4. Means and standard deviations for IoT-supported information-sharing items

Item	Statement	Mean	SD	Rank	Response
5	Cooperation between the firm and supply chain partners is high	4.38	0.60	1	Strongly agree
3	Mutual trust between the firm and supply chain partners is high	4.26	0.71	2	Strongly agree
1	Accurate information is exchanged between the firm and supply chain partners	4.23	0.89	3	Strongly agree
2	Information is exchanged with supply chain partners in a timely manner	4.21	0.83	4	Strongly agree
4	Ongoing communication between the firm and supply chain partners is high	4.21	0.83	4	Strongly agree
—	Overall dimension mean	4.26	0.773	—	Strongly agree

Note. The overall mean for each dimension is the arithmetic average of its item means. The accompanying standard deviation is the arithmetic average of the item standard deviations, not the standard deviation of the composite score.

**Figure 3.** Mean scores for the two dimensions of supply chain digitalization

As shown in Figure 3 and Tables 3 and 4, the means for all items in both dimensions fell within the “strongly agree” category. They ranged from 4.24 to 4.52 for the first dimension and from 4.21 to 4.38 for the second. The overall mean was 4.38 for internal integration and 4.26 for interorganizational sharing. Although small, this difference is consistent with theoretical expectations: firms exercise full control over the integration of their internal functions, whereas information sharing depends on partners' technological readiness and willingness to share data. Büyüközkan & Göçer, (2018), similarly identified interoperability as a critical bottleneck in realizing digital supply chain benefits. Within the first dimension, the two highest-ranked items concerned cost reduction (4.52) and on-time delivery (4.45), the two central elements of value in logistics services. Horizontal coordination between internal activities and functions ranked last (4.24). This

pattern suggests that visible, directly observable system contributions, such as faster completion and delivery reliability, are more readily perceived than contributions to cross-functional coordination, a dispersed organizational outcome that individual employees may find difficult to observe from their own positions. This is consistent with Hitt, (2002) , who found that deeper organizational gains emerge later than visible operational gains. Horizontal coordination is among the most difficult organizational outcomes to achieve in integration projects; it requires process redesign and the redistribution of roles, rather than a system alone (Thomas H. Davenport, 1998).

3.2 Response Dispersion and Its Implications

A complete interpretation of the descriptive results requires more than mean scores. The distribution of standard deviations provides additional information, as Figure 4 illustrates.

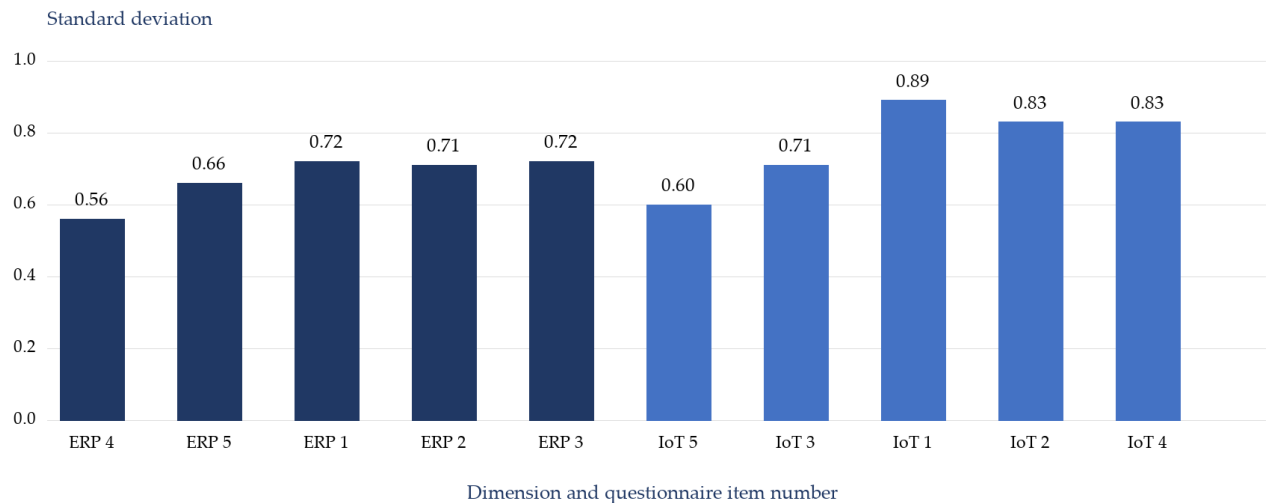


Figure 4. Response dispersion across the two digitalization dimensions

The figure reveals a systematic rather than random pattern. Standard deviations for the first dimension occupied a narrow range of 0.56–0.72, whereas those for the second ranged from 0.60 to 0.89. More important than the wider range is where the dispersion occurs. The item on cooperation with partners had both the highest mean (4.38) and the lowest standard deviation (0.60) within the second dimension. In contrast, items concerning the actual execution of information exchange—its accuracy (0.89), timeliness (0.83), and continuity of communication (0.83)—had the lowest means and greatest dispersion. This pattern may have practical managerial implications. Employees perceive the willingness to cooperate with partners relatively consistently, but not the regularity of the mechanisms through which cooperation occurs. The variation concerns execution rather than willingness. This is consistent with the dependence of interorganizational sharing on partners' readiness as well as the firm's own capabilities. A company may work with partners at different levels of digital maturity, receiving regular data from some and intermittent data from others. Such differences can produce variation in responses among employees who work with different groups of partners. The dispersion results provide additional insight beyond the mean scores, has direct practical relevance and informs a specific recommendation in Section 4.

3.3 Level of Competitive Advantage

Table 5. Means and standard deviations for competitive advantage items

Item	Statement	Mean	SD	Rank	Response
6	Focusing on continuous improvement efforts	4.30	0.841	1	Strongly agree
8	Responding rapidly and flexibly to customer requirements and reaching markets quickly	4.30	0.701	1	Strongly agree
10	Considering environmental factors when offering products in local, regional, or global markets	4.29	0.696	3	Strongly agree

3	Increasing employee productivity and improving quality	4.26	0.810	4	Strongly agree
7	Achieving efficient and optimal resource utilization	4.26	0.730	4	Strongly agree
4	Possessing advanced production technologies	4.24	0.681	6	Strongly agree
5	Offering new products to retain existing customers and attract new ones	4.23	0.760	7	Strongly agree
1	Increasing the firm's market share	4.18	0.783	8	Agree
9	Entering new competitive markets that competitors find difficult to access	4.18	0.742	8	Agree
2	Reducing operating costs while preserving sustainable resources	4.17	0.736	10	Agree
—	Overall construct mean	4.24	0.748	—	Strongly agree

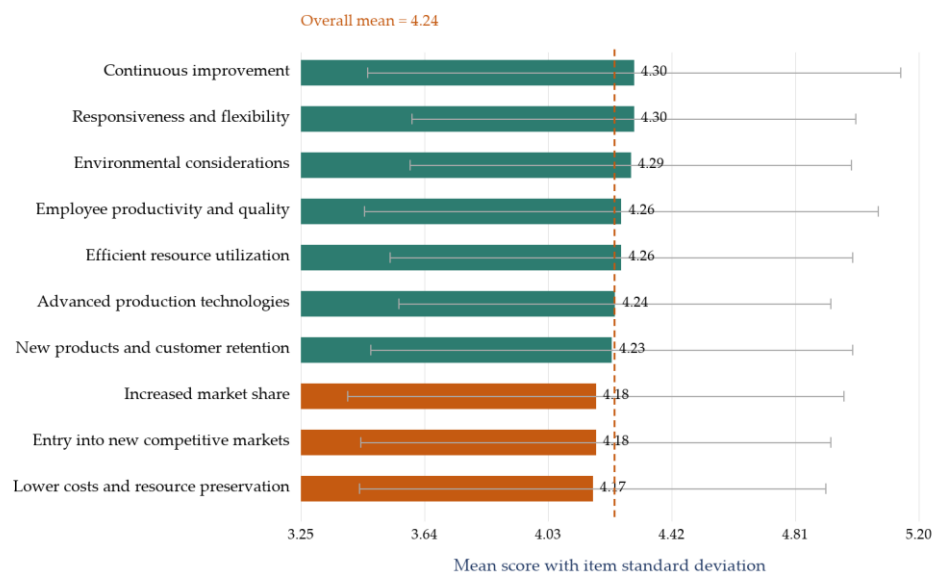


Figure 5. Mean scores for competitive advantage items with standard deviations

Table 5 and Figure 5 show that seven competitive advantage items fell within the “strongly agree” category and three within “agree,” with means ranging from 4.17 to 4.30. The overall mean was 4.24, with a reported standard deviation of 0.748. This indicates a very high level, although below that of both dimensions of the independent variable. Such an ordering is plausible because competitive advantage is an ultimate outcome shaped by multiple factors beyond digitalization alone. A notable finding is the ordering of items within the construct. The items are systematically divided into two types of indicators. Those describing organizational capabilities and practices ranked highest: continuous improvement (4.30), responsiveness and flexibility (4.30), environmental considerations (4.29), employee productivity and quality (4.26), and efficient resource utilization (4.26). The bottom three positions, the only items below the “strongly agree” threshold, described ultimate outcomes: lower operating costs (4.17), increased market share (4.18), and entry into new competitive markets (4.18). This division is consistent with the patterns observed in the two digitalization dimensions. The perceived effects of digitalization appear first in capabilities and practices and only later, and indirectly, in ultimate outcomes. Market share, entry into new markets, and operating costs are influenced by factors beyond the firm's control, including competitive structure, entry barriers, and fuel-price fluctuations. Continuous improvement and flexibility, by contrast, respond more directly to improved information flows. This interpretation accords with the dynamic capabilities' perspective (Teece, 2007), which positions organizational capability as a mediator between technological resources and market outcomes while distinguishing the two. Nevertheless, the interpretation remains inferential: the instrument was not originally designed to distinguish these indicator types, and verification would require independent measurement of each. The continuous improvement item combined the highest mean (4.30) with the largest

standard deviation in the construct (0.841). Employees therefore did not perceive these efforts uniformly: some regarded them as well established, while others were less convinced. This variation may reflect differences in the reach of improvement initiatives across operational units. The item rankings also reveal an apparent discrepancy between constructs. The ERP item on operational efficiency and cost reduction received the highest mean (4.52), whereas the competitive advantage item on reducing operating costs received the lowest (4.17). Two considerations may explain this. First, the former measures the system's contribution to internal operational efficiency, while the latter concerns the firm's competitive cost position, which is influenced by external factors such as fuel-price fluctuations and price competition. Second, the latter is double-barreled, combining cost reduction and the preservation of sustainable resources in one statement; respondents may rate it according to whichever component they assess less favorably.

3.4 Hypothesis Testing

Table 6. Simple linear regression results for the effect of supply chain digitalization on competitive advantage

Statistic	Value
Correlation coefficient (R)	0.757
Coefficient of determination (R^2)	0.574
Adjusted R^2	0.567
F statistic	86.128
Degrees of freedom (df)	1, 64
Significance (Sig.)	0.001
Standardized regression coefficient (Beta)	0.757
t statistic	9.28

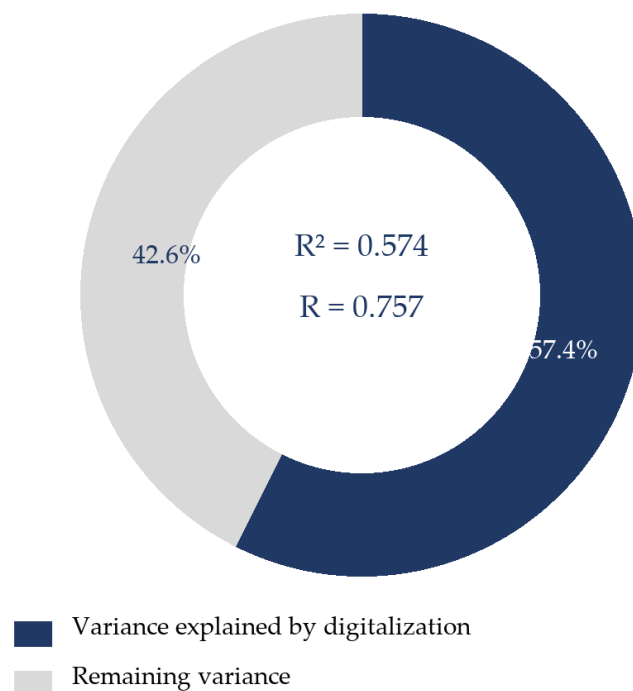


Figure 6. Explained variance in competitive advantage

The correlation between supply chain digitalization and competitive advantage was 0.757, indicating a strong positive relationship. The coefficient of determination was 0.574. As illustrated in Figure 6, supply chain digitalization therefore explained 57.4% of the variance in competitive advantage, while the remaining 42.6% was attributed to factors outside the model, such as the quality of human resources, market

competition, geographical location, and service innovation capabilities. Adjusted R^2 was 0.567, very close to the unadjusted value, suggesting a stable model whose explanatory power was not substantially inflated by sample size. The F statistic was 86.128, with 1 and 64 degrees of freedom and a reported significance level of 0.001. This is below the adopted threshold of $\alpha \leq 0.05$, indicating that the overall model was statistically significant and suitable for explaining the relationship between the variables. Adjusted R^2 was calculated from R^2 and the sample size using the standard formula. The t statistic was calculated as the square root of F, a valid relationship in simple regression with one independent variable. The intercept and unstandardized regression coefficient were not extracted, as noted in the limitations section. Hypothesis decision: The null hypothesis is rejected in favor of the alternative hypothesis that supply chain digitalization has a statistically significant effect on competitive advantage at $\alpha \leq 0.05$.

3.5 Interpretation in Relation to Previous Research

The principal finding is consistent with the broader literature linking digitalization positively to competitive performance, although the magnitude of the observed effect warrants closer examination. Supply chain digitalization explained 57.4% of the variance in competitive advantage, substantially more than the 33.5% reported by Albalwy, (2025) in a Saudi industrial company. Three factors may explain this difference. First, information in logistics is part of the service itself, rather than merely supporting a product. Alongside transportation, shipping customers purchase the ability to know where their shipment is and when it will arrive. The competitive returns to digitalization may therefore be structurally greater in this sector. Second, the dependent variable here is competitive advantage, a broader construct than the operational performance measured in the comparison study. Third, a methodological explanation is possible: all variables were measured through the same instrument and from the same source, which may inflate the observed correlation (Podsakoff et al., 2003). Its implications are considered in the limitations section. The finding also accords with the resource-based view (Barney, 1991). The systems used by the company are commercially available to competitors; advantage therefore derives from their integration into operational routines rather than from their acquisition. The very high means for functional integration are consistent with this interpretation. It is further supported by Zhu & Kraemer, (2005), who identified depth of use rather than adoption itself as the explanation for differences in realized value, and by Schniederjans et al. (2020), who emphasized organizational knowledge absorption as a critical mediator between technological investment and performance.

4. Conclusion and Recommendations

4.1 Conclusions

The study yielded five principal findings. First, supply chain digitalization was very high in both dimensions, with internal functional integration (4.38) exceeding interorganizational information sharing (4.26). Second, response dispersion indicated a gap between a consistently perceived willingness to cooperate with partners and less consistent mechanisms for doing so. Third, competitive advantage was very high (4.24), with internal operational capability indicators ranking above ultimate outcome indicators. This suggests that digitalization is reflected in capabilities before it appears in market outcomes. Fourth, supply chain digitalization and competitive advantage were strongly and positively related ($R = 0.757$), with statistical significance. Fifth, digitalization explained 57.4% of the variance in competitive advantage, making it a major, though not exclusive, explanatory factor.

4.2 Recommendations

Maintain functional integration and deepen cross-functional coordination. Coordination between internal activities and functions ranked last within its dimension. This should be addressed by redesigning cross-departmental processes and clarifying responsibilities at handover points, rather than by adding further technology. Segment partners by digital maturity. Greater dispersion in information-exchange items suggests that the regularity of exchange varies between partners. Partners should be classified by readiness, with simplified connection channels offered to less digitally mature organizations instead of requiring full technological integration that may be beyond their capabilities. Consistent information flows across all

partners are more important than deep integration with only some. Establish explicit data governance. Define data ownership, quality standards, and life cycles, since the value of any digital system depends on the quality of its inputs. Invest in employees' analytical capabilities. Support the transition from operating systems to interpreting their outputs and using them in decisions. In many firms, the central gap concerns the ability to interpret data rather than its availability. Develop key performance indicators (KPIs) for digitalization returns. Measure them regularly and link digital investment to specific competitive indicators, including on-time delivery, shipment cost, and response time, to enable objective evaluation and corrective action.

4.3 Limitations and Future Research

Operational measurement of the second dimension. Its items measure the organizational manifestations of IoT-enabled connectivity, including the accuracy and timeliness of information exchange, trust, and cooperation. They do not directly measure sensor deployment or the maturity of IoT infrastructure. The study therefore establishes an association between interorganizational information sharing and competitive advantage, rather than a direct association between IoT technologies themselves and competitive advantage. Future studies should use direct measures of IoT maturity, including the proportion of sensor-equipped assets, the density of sensed data, and the extent to which those data feed automatically into management systems. Common method bias. All variables were measured using the same instrument, from the same respondents, at the same time, potentially inflating the observed relationship (Podsakoff et al., 2003). Future research should address this by collecting dependent-variable data from an independent source, such as actual company performance indicators or customer evaluations, or by conducting Harman's single-factor test to assess the extent of bias. Undocumented response rate. The original report did not document the size of the study population or the numbers of questionnaires distributed and returned. Consequently, the response rate and potential nonresponse bias could not be assessed. Documenting these details is a fundamental survey-research practice that should be followed in subsequent work.

Untested regression assumptions. Residual normality, using skewness and kurtosis, and independence, using the Durbin-Watson test, were not examined before interpreting the regression model. Although the sample size of 66 and the pronounced relationship may mitigate this concern, diagnostic testing remains recommended to strengthen confidence in the model and should be included in any extension of this study.

Incomplete regression equation. The report provided model-fit indicators (R , R^2 , and F) but not the intercept or unstandardized coefficient, preventing the specification of an explicit prediction equation. These values should be obtained from the coefficients table in the analytical output. Reliability not assessed separately for each construct. Cronbach's alpha was calculated for the full instrument (0.933), but not for the three constructs individually. Construct-specific estimates are recommended to establish whether the high overall reliability reflects internal consistency within each construct or simply the number of items. Cross-sectional design. Data were collected at a single point in time, limiting causal inference. The findings establish a strong, statistically significant association, not a confirmed causal direction (Rindfleisch et al., 2008). Longitudinal studies tracking outcomes before and after implementation are proposed. Sample size and generalizability. The study included 66 respondents from one firm. Although adequate for simple regression, this sample does not support generalization to the Saudi logistics sector or to industrial companies. Future research should include multiple firms of different sizes and test for differences between them. Unmeasured mediating and moderating variables. The model did not include factors that might explain how digitalization translates into competitive advantage, such as operational flexibility, innovation capability, data quality, and top management support. Including these factors in mediation and moderation models would be a natural extension. Untested interaction between the two dimensions. The resource-based view suggests that the combined effect of the two dimensions exceeds the sum of their individual effects. Testing this proposition would require an interaction term in a multiple regression model, providing a direct extension with theoretical value.

Declarations

Ethics statement. Participation was entirely voluntary. The questionnaire cover letter informed participants that their responses would be treated as strictly confidential and used exclusively for scientific research.

Conflicts of Interest.

The authors declare no conflicts of interest.

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Data availability.

The data supporting the findings are available from the corresponding author upon reasonable request.

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