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Integration of Supply Chains and Operational Performance: The Moderating Effects of Knowledge Management

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Abstract: Supply chain integration (SCI) is a strategic process management technique that may be used to boost an organization's performance and thereby gain a competitive edge. The purpose of this paper is to demonstrate both the direct effect of (SCI) on manufacturing firms' operational performance and the moderating effect of knowledge management (KM) on the relationship between supplier integration (SI), customer integration (CI), internal integration (II), and operational performance (OP). The study analyzed survey data from 277 Jordanian manufacturing and industrial businesses using the PLS–Structural Equation method. According to the data, (CI), (II), and (SI) are all positively and significantly associated with operational success. (CI), (II), and (SI) all have a strong and beneficial moderate relationship with (OP). There is, however, no connection between (KM) and (OP). Furthermore, further research may be conducted to assess the applicability of the findings from this study to other populations of varied sizes in other countries. A long-term study that tracks the growth of different measures might provide further insight on the relationship between SCI and OP.

Keywords: Supply Chain Integration, Operational Performance, Knowledge Management

1. Introduction

Integration is a well-studied area in operations and supply chain management study. Since the mid-1990s, several research papers have been published that address this strategic component of supply chain management and analyze the empirical relationships between various characteristics of (SCI) and various performance metrics [1, 2]. (SCI) may be seen both internally in a business and outside with customers and suppliers. Numerous studies have stressed the critical nature of integrating upstream and downstream suppliers and consumers [3-5]. Despite the critical nature of (SCI), previous research has considered and studied the underlying components from a variety of angles. Furthermore, it has been shown that both (II) operations inside a corporation and external integration activities across companies throughout the supply chain have varying degrees of effect on key performance measures [1]. Many academics throughout the globe are doing research to discover effective techniques for enhancing (OP) [6-9]. The role of technology has been important in overcoming this obstacle, and it is expected to continue to play a significant role in the future [6, 7, 10-14]. The term supply chain (SC) has gained currency as competition swings away from businesses and toward supplier networks. SC approaches are seen as a cornerstone for OP advancement [15]. The literature has devoted close attention to the relationship between SC practices and OP [16]. However, the findings are not entirely consistent [17] Supply chain management has evolved into a critical component of competitive advantage for organizations. Supply chain management research focuses on ways to maximize a business's total value by maximizing resource use and deployment across the organization [18]. Moderating factors may have an effect on the relationship between SC, operational capacity, and business competitiveness. These moderating factors must be included in the study to determine their impact [7]. The study proposes that (KM) may act as a moderator in the relationship between (SCI) and (OP). SC integration, on the basis of the above argument, may aid in achieving the advantages of an interaction connection between the SC and the operational

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OP. To successfully integrate corporate and SC capabilities, a firm's focus on SC integration is necessary.

In summary, there are several research gaps and inconsistent results that diminish the usefulness of prior research findings. Furthermore, the authors are unaware of any empirical work exploring this relationship in Jordan. Additionally, no research on the indirect impact of SCI on OP through KM has been undertaken. As a result, this research intends to fill these information gaps by examining the influence of SCI and KM on the (OP)of industrial firms in Jordan. This research paper addresses the following major questions in order to attain this goal: How does SCI (SI), (CI), and (II) affect (OP)in Jordan's industrial sector?

And What influence does (KM) have as a moderator variable on (SI), (CI), (II), and (OP)in the Jordanian industrial sector?

2. Review of the literature and formulation of hypotheses:

2.1 Operational Performance and Supply Chain Integration

SCI has produced a wide range of results, both in actual practice and in previous study. To better understand the relationship between external integration and manufacturing businesses' overall performance (OP),[2] looked at how (SCI) impacts operations directly and the mediating role of (II) (OP). Inter-organizational capabilities (SI) and (II) were considered intra-organizational capabilities. A PLS model was used to investigate the relationship between the operational performance of manufacturers and the direct effects of (II). A positive and substantial association between (CI) and (II) and (OP) was found, however (II) only mediates the relationship between (CI) and (OP) and (SI) and (OP) respectively (OP). Similar study was done by [19], who looked at the impact of (SCM) on operational and financial outcomes. The study found that the level of product and market complexity affects how much supply chain information integration enhances a company's success. Specifically, supply chain information integration allows greater performance gains, regardless of whether a supply chain serves simpler commodities or operates in a highly complex market setting. Another research, by [20], looked at the relationship between supply chain flexibility, integration of internal and external information, and (OP). Hierarchical regressions were used to test the assumptions by analyzing the annual reports of 84 Chinese manufacturing enterprises that had been listed for three years. Reactive and proactive flexibility are both enhanced by incorporating external data, according to the results. Even though the study did not evaluate the mediating influence of SCF, internal information integration enhanced both reactive and proactive flexibility. According to the findings, supply chain flexibility has an effect on the integration of supply chain information in the manufacturing industry. Using three types of intermediate enterprises, [5] studied the impact of SCI on company financial performance. A review of 170 studies found that the degree of SCI did, in fact, increase monetary success. Contrary to popular belief, the (OP)associated with a lower cost positional advantage has a bigger mediating impact than types of intermediate performance connected with a higher customer value positioning advantage. SCI and commercial success have a strong correlation because of time, great relationships, and a collectivist national culture, among other factors. We compare our findings to those of past meta-analyses and explain the practical implications of what we've learned about how to effectively use SCI. Small and medium-sized businesses (SMEs) in Korea were studied in Lee's to see how supply chain management (SCM) affected their operational performance (OP). empirical research was conducted on the usage of SCM approaches by 300 Korean manufacturers. The variables were analyzed using structural equation modeling. SCM methodologies and organizational competencies have a significant influence on total business performance, according to the conclusions of this study. SMEs' organizational capacities are also significantly impacted by SCM strategies [21]. SCM strategy's impact on whole business performance was also investigated, as well as the role of organizational skills. SCM strategy's impact on operational success was shown to be mitigated by organizational competence, but not on financial performance. There is a pattern of interaction between SC operational competency and the corporate competitive capacity for performance improvement, as identified by [22]. Research is also focused on an evaluation of the effect that SC integration has on inter-organizational interactions. A questionnaire based on previous research was used to collect the data. It has been shown in previous studies on SCM and manufacturing strategy that these selections must be strategically linked to the company's business strategy. SCM and company strategy are intertwined, but previous research has not yielded consistent conclusions concerning the nature of this interplay. This study offers a wide range of implications for academics and theory creators. Several SCI activities from a poor country setting are included in this research, which expands previous frameworks of supply chain practices that centered on developed nation situations. Ecocentricity and supply chain traceability, two notably sustainable supply chain techniques, were examined by [23] in a comparable study, which examined the influence of these two approaches on a company's environmental and operational costs. Using moderated hierarchical regression, the researchers obtained data from 248 UK manufacturing firms and evaluated it. Supply chain management solutions have been linked to enhanced environmental and cost-effectiveness performance, according to the study. In addition, supply chain traceability and increased ecocentricity are associated with stronger SCM practices and cost performance correlations. It was shown that traceability of the supply chain had a negative impact on environmental performance, contrary to what was expected. Eight supply chain management (SCM) components were examined by [24] to see how they affected economic, environmental, and social performance, the three pillars of a sustainable firm.

procurement, manufacturing, distribution, packaging and marketing, environmental education and management of the internal environment and investment recovery were all addressed in the study. SCM features and sustainability performance were examined by conducting a plant-level survey. The results emphasized the importance of SCM in improving sustainability performance. The following research hypotheses might be established in light of the preceding discussion:

H1: there is a significant relationship between SI, CI, II & OP.

2.2 Knowledge management as a supply chain integration and operational performance moderator:

There is an urgent need to comprehend knowledge management (KM) as companies transition from heavy data processing to information-based operations and then to knowledge-based enterprises [7, 25]. This call becomes more comprehensible in light of the SC. Effective knowledge management entails or is dependent on knowledge management strategies. They need the transformation of personal knowledge into corporate knowledge that can be communicated widely and effectively. Organizations may successfully compete and maintain market share in competitive marketplaces by incorporating knowledge management approaches into regular business operations [26]. Knowledge management is crucial for resolving disputes between suppliers and customers [3] Numerous academics have underlined the importance of knowledge in supply chain management (e.g., [3, 27-29]. noticed that a crucial facilitator of the SCM process is the collecting of pertinent information. Similarly, [30] said that information exchange is a significant factor in determining the adoption of knowledge management in a SC. The key findings revealed that knowledge management may be utilized as a lever for: I supply chain integration; (ii) increasing intra- and inter-supply chain linkages; (iii) harmonizing supply chain plans; and (iv) enhancing knowledge transfer throughout the product development process. As a result, the researchers hypothesize that (KM) might act as a link between (SCI) and (OP) in this study.

H2: KM moderates the relationship between SI, CI, II & OP.

3. Methods of Study

3.1 Method of Data Analysis:

To find out how the latent variables relate to one another, this research was conducted. The survey approach was used for this study because it has been shown in prior studies to be an effective way to uncover new research topics. To choose the sample from a given population, basic random sampling is used: Jordanian businesses engaged in manufacturing. 47.1 percent of the participants in the present research responded to the survey, compared to a minimum of 30 percent in the previous study. For the analysis of the data, the research used SEM-PLS, one of the most modern and rigorous data analysis techniques in the social sciences, particularly for structural concerns. A questionnaire based on previous research is used to collect all the data.

3.2 Operational Variables and their Measurements

In this study, the primary data collection method was a survey questionnaire, which necessitated the development of simplified questionnaire items that represented the dimensions of the construct's measurements in the research model. Notably, the questionnaire items were generated using conceptual explanations from the literature, as justified by [31]. The questionnaire items were thus adapted from previous similar research, and the items measuring demographic data, as well as the calculation of the three IV and one DV, were included in their respective parts of the questionnaire and used one moderator variable. This study is a formal investigation into the impact of SCI on (OP) (Supplier integration, (CI), (II) & (OP). The instrument was developed by adopting or adapting related literature, In the following table, as shown.

Table 1: Scale Items for Variables

No.	Scale Items for Variables:
Operational Performance:	
1	We are capable of rapidly introducing new items to the market.
2	We can swiftly change items to match the specifications of our largest customers.
3	We are capable of expediting the execution of our customers' urgent requests.
4	We are able to react swiftly to changes in market demand.
5	The lead time required to fulfill client orders is minimal.
Sources: Adapted from [1-3].	
SCI:	
Supplier integration	
1	With our key suppliers, we build rapid ordering procedures.
2	We assess the extent to which our key suppliers are strategic partners.
3	Our key suppliers are aware of our manufacturing plans.
4	The degree to which supply forecasts and inventory levels are shared.
5	The extent to which the supplier collaborates on product development and process improvement.
6	The extent to which a supplier collaborates with you to build supply forecasts.
Sources: Adapted from [4, 5]	
Customer integration:	
1	We routinely communicate with consumers to establish our standards for dependability, responsiveness, and other characteristics.
2	Customer satisfaction is regularly measured and evaluated.
3	We routinely forecast client expectations for the future.
4	The extent to which consumers are involved in product development and process improvement.

5	The extent to which consumers are involved in developing production schedules.
6	The degree to which inventory is optimized collaboratively.
Sources: Adapted from Adapted from [4, 5]	
Internal integration	
1	We enhance processes via the utilization of cross-functional teams.
2	We The extent to which internal operations use enterprise application integration.
3	Utilization of a computer system to track and manage the movement of material inside a company.
4	The extent to which employees use ERP for data storage, processing, broadcasting, and access to information.
5	Internal functions make use of occasional interdepartmental meetings.
6	The utilization of cross-functional teams in the creation of new products.
7	The degree to which departments collaborate in developing sales predictions, supply strategies, and manufacturing schedules.
8	The level of dedication and coordination amongst departments in resolving order fulfillment issues.
Sources: Adapted from[1].	
Moderating variable of Knowledge management	
1	We have established procedures for gathering information about new items in our business.
2	We have devised procedures for synthesizing existing knowledge.
3	We have created procedures for combining information from disparate sources and kinds.
4	We've devised methods for applying knowledge to new issues.
Sources: Adapted from [6]	

3.3 Conceptual Framework:

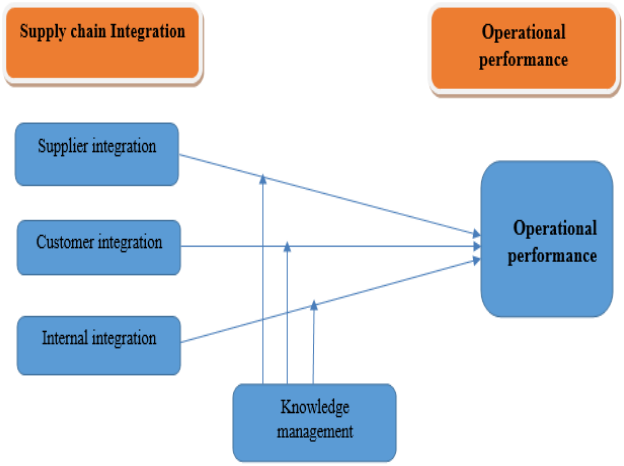

Figure 1: Research framework

4. Interpretation and Discussion

The PLS structural equation has two components: the measurement model and the structural model. The conceptual model's reliability and validity are explained by the measurement model, whilst the path coefficients between and among the latent variables are explained by the structural model. At the moment, we're at these two stages of the research. Figure 1 depicts the measuring model used in this study.

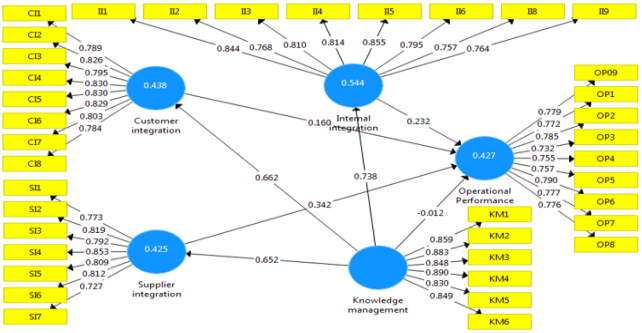

Figure 2: Model for Measuring

Table 1 illustrates the convergent validity of the existing model. The item's external loadings are all more than the threshold value of 0.70. [7].

Table 2. Outer Loading:

Source: Author's calculation

	(CI)	(II)	(KM)	(OP)	(SI)
CI 1	0.789				
CI 2	0.826				
CI 3	0.795				
CI 4	0.830				
CI 5	0.830				
CI 6	0.829				
CI 7	0.803				
CI 8	0.784				
II 1		0.844			
II 2		0.768			
II 3		0.810			
II 4		0.814			
II 5		0.855			
II 6		0.795			
II 8		0.757			
II 9		0.764			
KM 1			0.859		
KM 2			0.883		

KM 3			0.848		
KM 4			0.890		
KM 5			0.830		
KM 6			0.849		
OP09				0.779	
OP 1				0.772	
OP 2				0.785	
OP 3				0.732	
OP 4				0.755	
OP 5				0.757	
OP 6				0.790	
OP 7				0.777	
OP8				0.776	
SI 1					0.773
SI 2					0.819
SI 3					0.792
SI 4					0.853
SI 5					0.809
SI 6					0.812
SI 7					0.727

AVE, Cronbach's alpha, and composite dependability are all included in the table 2 below, as illustrated in this figure. It is clear from the findings that our study is reliable since all of the numbers in the above table are over the threshold levels.

Table 3: Reliability:

	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
(CI)	0.926	0.927	0.939	0.658
(II)	0.920	0.921	0.935	0.643
(KM)	0.929	0.930	0.945	0.740
(OP)	0.914	0.915	0.929	0.592
(SI)	0.905	0.906	0.925	0.638

In our investigation of the criteria's discriminant validity, we observed that every diagonal value is considerably greater than the threshold value and every diagonal value is higher than the lowest conceivable value [8].

Table 4. Discriminant Validity (Fornell-Larcker Criterion):

	(CI)	(II)	(KM)	(OP)	(SI)
(CI)	0.811				
(II)	0.675	0.802			
(KM)	0.662	0.738	0.860		
(OP)	0.515	0.603	0.488	0.769	
(SI)	0.602	0.796	0.652	0.615	0.799

After the study's reliability and validity have been assessed, the next step is to assess the path coefficient between variables that make up the sample under consideration for this investigation. Figure 3 depicts a depiction of the currents investigation's structural model.

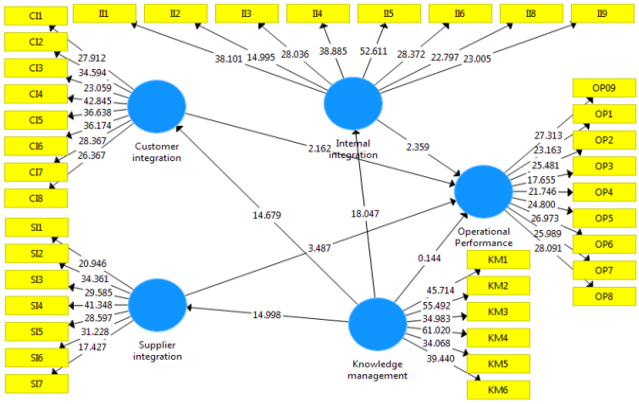

Figure 3 depicts a model for structural.

The bootstrapping approach is used to examine the direct and indirect correlations between and among the variables explored in this research.

There are direct correlations between SCM characteristics and corporate performance categories. We began by examining the direct relationships between SCM dimensions and other forms of business performance using our massive dataset, which was created with the goal of avoiding selection bias.

Table 1 shows the mean correlations between the three dimensions of SCM and each kind of firm performance, as well as the number of estimates (i.e., the number of correlations detected for each connection) and sample sizes for each association (i.e., total sample size from all studies included in the relationship analysis). As indicated in Table 1, our detailed research reveals that (II) has a positive connection with (OP), with values ranging from 0.019 (p 0.01) for (OP) to 0.019 (p 0.01) for (OP), a finding comparable to [1]. According to [9], SCI has an effect on (OP). (SI) is also strongly connected with performance, beginning at 0.001 (p 0.01) for (OP), a result identical to [1]. Finally, (CI) is positively linked with (OP), 0.031 (p 0.03), a result that is consistent with [1]. To be thorough, the study also calculated the direct and moderator impacts of knowledge management. For instance, the research discovered a mean correlation between (KM) and (OP)of 0.000 (p 0.00) between T value=0.144 and P value0.886. Similarly, the mean correlations between (KM) in general and (II)are 0.000 (p 0.00). Similarly, the average correlation coefficients between total (KM) and (SI) are 0.000 (p 0.00). Thus, the overall SCM results offer the largest empirical

generalizations known on the relationship between SCM and many forms of (OP).

Table 5. Overview of relationships between SCI and OP.

	Original Sample (O)	Sample Mean	(STDEV)	T Statistics	P Values
(CI)-> (OP)	0.160	0.161	0.074	2.162	0.031
(II)-> (OP)	0.232	0.233	0.098	2.359	0.019
(KM) -> (CI)	0.662	0.664	0.045	14.679	0.000
(KM) -> (II)	0.738	0.738	0.041	18.047	0.000
(KM) -> (OP)	-0.012	-0.009	0.086	0.144	0.886
(KM) -> (SI)	0.652	0.654	0.043	14.998	0.000
(SI) -> (OP)	0.342	0.343	0.098	3.487	0.001

Knowledge management's moderating influence on the links between SCI aspects and (OP)

As hypothesized, (KM) acts as a moderator of the relationships between (SI) and (OP). As seen in Table 4, there was a substantial moderating impact, as indicated by a t value of 3.320 and a p value of 0.001. [4] stated that (KM) mediates the association between SCI and OP. On the other hand, the study's findings suggested that (KM) has a moderating influence on the relationship between (CI)and (OP). The T value is 2.124, whereas the P value is 0.034. Additionally, (KM) is claimed to have a moderating influence on the links between (II)and (OP), with a T value of 2.381 and a P value of 0.018.

Table 6. Overview of moderating effect between SCI and OP.

	Original Sample	Sample Mean	(STDEV)	T Statistics	P Values
(KM) -> (SI) -> (OP)	0.223	0.225	0.067	3.320	0.001
(KM) -> (CI)-> (OP)	0.106	0.107	0.050	2.124	0.034
(KM) -> (II)-> (OP)	0.171	0.171	0.072	2.381	0.018

5. Conclusions and Recommendations of the Study:

The goal of this study is to determine the impact of SCI on OP as well as the moderating effect of KM on OP in Jordanian manufacturing and industrial enterprises. The following conclusions were reached based on the test results for three regression models: Discussion and Implications of Results Manufacturing enterprises in Jordan displayed effective (SCI)in order to enhance their (OP)as a consequence of supply chain practice. The outcomes of this research reveal that (SCI) has a positive influence on (OP) in these organizations, which is supported by numerous conclusions reached by (SCI)experts [1, 9, 10]. The results support our premise that firms may increase their (OP) by sharing information and working with key customers and suppliers throughout the business process. Collaboration throughout the supply chain allows firms to understand their customers' needs and respond precisely to them. Similarly, partners that collaborate to generate demand estimates and production plans may minimize supply chain disruptions and respond quickly to changes in market demand. The results of this study add to the expanding body of knowledge on (SCI) by investigating the impact of SC interaction and (OP)in a Jordanian manufacturing situation and utilizing (KM) as a moderator. According to the research, Jordan's manufacturing sector should prioritize (SI) since it has the most influence on (OP), although customer and (II) are also important components of manufacturing sector management. As a consequence of this research, we created a model with relevant questions for each of the categories examined, which may be used to assess the influence of (II), (SI), and (CI) on Jordan's manufacturing industry (OP). The study's disadvantage is that data was collected across sectors in Jordan's manufacturing sector; however, processes occur over time, and therefore periodic data collection might be used to track changes over time. Furthermore, further research may be undertaken to evaluate the relevance of the results from this study to other populations of varying sizes in other nations. A long-term research tracking the progression of multiple metrics may provide further light on the link between SCI and OP.

Conflicts of Interest

The authors declare that they have no conflicts of interest to report regarding the present study.

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