

Examining the Direct and Indirect Impacts of E-Supply Chain Implementation on Performance: A Collaborative Approach

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Abstract— The paper examines both the direct and indirect impact of implementing E-Supply Chain Management (E-SC) practices on performance of Omani manufacturing firms. A Structural Equation Modelling analysis was conducted based on a large scale survey applied to 108 manufacturing firms. Results of the research revealed that E-SC practices had a direct positive effect on both business and operational performance, where their direct effects on operational performance was stronger than their effect on business performance. The results also showed that while the indirect effect of E-SC on operational performance was partially supported, a full indirect effect between E-SC and business performance was found. Our findings imply that although a substitutive implementation of various types of E-SC can lead to marginal positive performance outcomes, achieving substantial performance outcomes might require more collaborative and highly coordinated approach of implementing these practices. Several other theoretical and practical insights are provided by the findings of this paper on understanding the potential benefits of the direct and indirect implementation of E-SC practices.

Keywords: E- Supply Chain Management, Performance, Direct and Indirect Effects.

1. Introduction

In the dynamic and interconnected world of contemporary business, maintaining a competitive edge hinges on effective and efficient supply chain management (SCM). Indeed, the landscape of business is characterized by constant evolution and fierce competition. Organizations must continuously adapt and innovate to stay ahead of the curve. This necessitates a robust supply chain capable of responding swiftly and collaboratively to changing market demands and emerging opportunities. Recognizing this, organizations

have increasingly embraced E-Supply Chain Management (E-SC), the utilization of electronic technologies to automate and streamline their supply chain operations. E-SC encompass a range of technologies, applications, practices, tools and initiatives, including electronic data interchange (EDI), supplier portals, e-commerce platforms, and collaborative forecasting and planning (CFPR), customer relationship management (CRM) systems, supplier management systems, and e-procurement platforms. Most of these practices are either customer focused E-SC, such as those related to information sharing and joint planning with customers, or supplier focused E-SC practices such as innovation and responsiveness E-SC practices which are known to significantly influence performance. The adoption of these practices stems from the wide spectrum of potential benefits E-SC offers, encompassing improved operational efficiency, reduced costs, heightened visibility, and enhanced collaboration throughout the supply chain network. E-SC, with its ability to automate manual processes, facilitate real-time information sharing, and foster collaboration, presents itself as a powerful tool for achieving these objectives. However, the mechanisms through which these practices exert their influence remain less explored and understood by the empirical research. The correlation between E-SC and supply chain management is worth exploring, especially considering the frequent failures of Internet projects and the growing integration of e-business models into commercial value networks [1]. Additional research is necessary to determine the potential impact of contingent factors on the effective adoption of E-SC practices [2].

Prior research has established the positive impact of E-SC on various performance metrics. Studies have documented its effectiveness in

reducing costs through automation and electronic transactions [3], enhancing inventory management through improved visibility and demand forecasting [4], and increasing customer satisfaction through faster order fulfillment and real-time tracking. However, these investigations primarily focus on direct effects, leaving the broader impact of different types of E-SC practices on various dimensions of organizational performance unexplored fully. More investigation into new trends and best practices in this dynamic field of E-Supply Chains is necessary as firms continue to navigate this ever-changing landscape [5]. To address this gap, this research gives more focus into the multifaceted relationship between E-SC implementation and organizational performance, paying particular attention to the indirect and collaborative nature of its adoption. The purpose of a collaborative and a cooperative supply chain is to reduce the number of supply chain partners, enhance customer satisfaction and establish a durable strategic collaboration that secures suppliers, provide quicker response to market changes and prevents competition [6].

This study seeks to expand the existing understanding of the relationship between E-SC practices and performance by exploring both direct and indirect effects, considering the mediating role of key types of E-SC practices which are 1) Customer focused E-SC, and 2) Supplier focused E-SC. By investigating these indirect relationships, we can gain a deeper understanding of how E-SC implementation contributes to organizational performance beyond its direct effects. Such indirect effect testing is critical in order to understand how prioritizing the implementation of specific types of E-SC lead to better performance by allowing firm to adapt to the changes, learn from experience of implementing some types of basic practices to adopt other advanced types, and minimize potential risks associated with the implementation of interrelated types of E-SC practices.

By examining the direct and indirect effects of E-SC implementation within the framework of a collaboration approach, this research aims to offer valuable insights for both practitioners and researchers. For practitioners, the findings will provide guidance on how to effectively implement E-SC solutions and maximize their benefits for improved performance. For researchers, the study will contribute to the development of a more comprehensive understanding of the complex dynamics between E-SC and organizational success in the contemporary business environment in the context of Omani manufacturing firms that has rarely been studied by previous empirical operations and supply chain management research. Additionally, unlike most of the existing E-SC studies, this study uses structural equation

modeling (SEM) as the primary data analysis technique in order to have a simultaneous testing of the direct and indirect relationships between various E-SC practices and various metrics of organizational performance which are used this study.

Thus, this study aims to address the above mentioned gap by investigating the following research questions:

- 1- How do customer versus supplier focused E-SC practices influence business and operational performance of the manufacturing firms?
- 2- To what extent customer and supplier focused E-SC practices can be considered as critical mediators on the relationship between implementation and performance of specific types of E-SC practices?

To achieve its objective of contributing to a deeper understanding of E-SC's potential to enhance organizational success in today's competitive business landscape, the remaining sections of this paper will cover the literature review and hypotheses development in the following section. Then, research methodology and data analysis will be covered in details. After discussion the results of the data analysis, the research implications, conclusions and limitation will be discussed.

2. Literature review and hypotheses development:

A thorough review of relevant literature on E-SC and performance reveals several key theoretical perspectives to explain this relationship. For example, resource-based theory suggests that E-SC can serve as valuable resources that enhance organizational capabilities and competitive advantage [7]. Information sharing theory emphasises how E-SC facilitates the exchange of critical information, leading to better decision-making and improved performance [8]. The available literature provides evidence for positive impact of various types of E-SC practices on organizational performance. We argue, however, that these E-SC practices, through their ability to facilitate information exchange, collaboration, and coordination, emerge as potential facilitators in the effects of these practise on various performance metrics but no empirical work has been conducted as of yet to validate this argument. Reviewing the literature provide evidence that further research is needed to fully understand the complex interplay between various types of E-SC practices and organizational performance. This research aims to contribute to the growing body of knowledge by

investigating both the direct and indirect role of two major types of E-SC practices in the relationship between implementation of specific types of E-SC practices and organizational performance in the context of Omani manufacturing firms. Based on these theoretical perspectives and based on the research objectives, we propose the following research models (Figure 1 & 2). Further discussion on the current literature on the relationship between practice and performance of E-SC is provided in the following sub-sections.

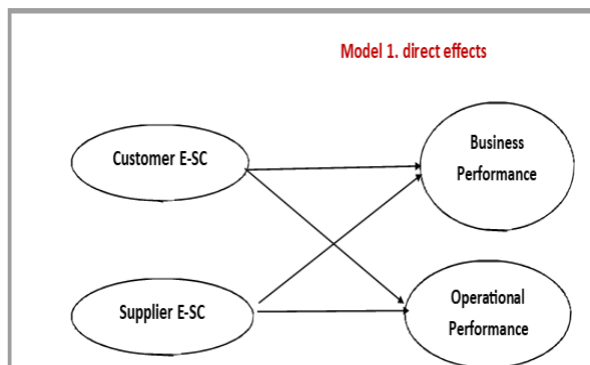


Figure 1. The direct effect model

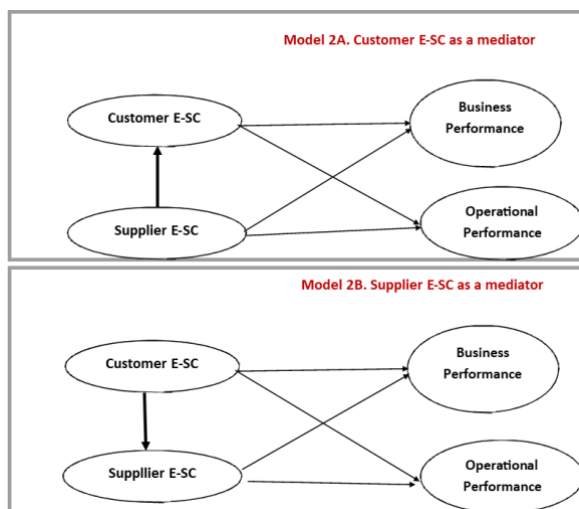


Figure 2. The indirect effect models.

An overview of E-SC in the manufacturing industry: definitions and practices

In theory, the connections between electronic marketplaces and logistics management are recognized to be troublesome [9]. A manufacturing company employs diverse strategies to enhance its performance [10], including the adoption of E-SC practices, technologies and tools. The extent of computer and internet utilization have enhanced manufacturing companies' efficiency through the creation of a web-based application for supply chain management [11].

The supply chain has been extensively influenced and enhanced by digital technology, encompassing procurement, manufacturing, distribution, and customer/supplier interactions [12]. The process of adopting and depending on digital technologies to carry out corporate tasks is commonly known as "digital transformation" or "digitalization" [13] or what is also known to be "E-supply chain". Digital transformation refers to the incorporation of digital technology throughout all aspects of an organization in order to develop new or modify existing business processes, culture, stakeholder and customer experiences [14]. This results in a fundamental shift in how companies operate, implement their supply chain activities, function and provide value to their consumers. The digital transformation of the supply chain refers to the utilization of digital technology to establish connections, integrate operations, and enhance business activities, including interactions with suppliers and customers [15], which indicates that these digital supply chain initiatives can be generally classified to those related to customers and/or those related to their suppliers.

E-SC has been defined differently in the literature to focus generally on those methods, tools, technologies and practices where organizations utilize internet and information technologies and systems to connect different supply chain partners, such as suppliers, manufacturers, retailers, and customers, with the goal of enhancing service level and supply chain performance [16]. Converting the SCM system into a feasible E-SC strategies and models is crucial for future success [17].

The analysis of the previous researches led to the proposal of several E-SC evolution frameworks, which were then used to demonstrate their implications for analyzing and identifying the specific requirements for future advancements and for better performance [18]. Such analysis also indicates the presence of distinct E-SC strategies among manufacturing enterprises that use Web-based solutions to integrate and streamline their supply chains [19]. This was done through the discussion of various examples and best practices of E-SC [20].

Impact of E-SC on performance: a collaborative perspective

E-SC is critical component that enable the firm to achieve better performance. E-SC can play a crucial role in preventing excessive inventory and missed sales by adapting manufacturing and delivery capacities based on changes in demand, supply fluctuations, and unforeseen threats and dangers [21]. However, in the present era, in order to enhance and augment customer satisfaction and guarantee the quality of products and services,

firms must engage in close collaboration with all elements of their supply chain system [22].

Collaboration in E-SC is crucial for enhancing the agility of the supply chain [23]. This crucial function of E-SC arises from the capacity to utilize cooperative information technology to effectively anticipate dangers and opportunities, and to outpace competitors in meeting market demand, while promptly adapting to market changes, risks, and emerging trends [24]. Such collaboration can improve the capacity to promptly detect emerging consumers' demands and requirements, hence lowering the time used for product creation and enabling speedier market entry compared to competitors [25].

Collaboration in E-SC has a substantial effect on the production of value [26] and plays a crucial role in helping participants survive during times of extreme crisis [27]. By aligning their dynamic capabilities and boosting response times and supply chain efficiency, collaborative E-SC provides numerous essential advantages for all partners [28]. These collaborative digital platforms facilitate the participation of customers in the process of producing new products and services for firms [29]. In addition, they offer partners a lucrative and commanding market position. E-supply chain collaboration plays a significant role in value co-creation, allowing partners to fulfill their social duties towards customers and society [30].

Customer versus supplier focused E-SC and organizational performance: The direct effect:

Customer focus E-SC are those practices that are strategically and operationally oriented towards understanding and meeting customer needs and expectations. These practices have been recognized as a key driver of organizational performance. Such practices including customer portals, online ordering systems, and CRM software, can enhance customer services, improve communication and foster closer collaboration between businesses and their customers [31]. Superior customer experiences and stronger customer relationships fostered by a customer-focused E-SC contribute to a competitive advantage. This advantage manifests in increased market share, customer acquisition, and brand differentiation, leading to improved financial performance and market position [32]. Several studies have explored the positive impact of customer-focused E-SC on various performance metrics, including customer satisfaction, revenue growth and market share [33][34]. These positive outcomes can be attributed to improved demand forecasting, better inventory management, and faster responsiveness to customer needs [31].

Similar to customer focused E-SC, supplier focused E-SC emphasizes the importance of building and nurturing strong relationships with suppliers. Effective E-SC practices with suppliers, such as information sharing, joint planning and performance evaluation, can significantly enhance supply chain efficiency and resilience [35][36]. Additionally, supplier-focused E-SC, such as supplier portals, e-procurement platforms and collaborative forecasting and planning systems, can facilitate these practices by enabling seamless communication, data exchange, and transparency across the supplier network [37]. Strong collaboration with suppliers through a supplier-focused E-SC enables organizations to adapt to market changes and disruptions more effectively. This agility translates to reduced production delays, improved risk management, and ultimately, enhanced operational performance and financial stability [38]. Studies have shown that supplier-focused E-SC can lead to reduced lead times, improved product quality and lower procurement costs [39]. Thus, and based on the above discussion, the following hypotheses are proposed:

H1: Customer focused E-SC practices positively influence performance of the firm.

H1a: Customer focused E-SC practices positively influence business performance of the firm.

H1b: Customer focused E-SC practices positively influence operational performance of the firm.

H2: Supplier focused E-SC practices positively influence performance of the firm.

H1a: Supplier focused E-SC practices positively influence business performance of the firm.

H1b: Supplier focused E-SC practices positively influence operational performance of the firm.

The choice between customer- and supplier-focused E-SC strategies involves trade-offs. While a customer-focused approach might excel in customer-centric metrics like satisfaction and loyalty, it might neglect supplier needs and lead to higher costs. Conversely, a supplier-focused strategy might enhance operational efficiency and reduce costs but might overlook customer expectations and market opportunities. The optimal approach likely lies in a balanced and collaborative focus on both customer and supplier relationships, considering the specific context of implementing these practices. Such collaborative approach might suggest for the need to consider the indirect interrelationships between these practices and their impact on performance.

The indirect effects of Customer and supplier focused E-SC on organizational performance:

The dynamic environment of global business has undergone a paradigm shift with the introduction of electronic supply chain management, or e-supply chain management [15]. The increased responsiveness, efficiency, and openness of supply chain operations are clear benefits of using e-supply chain methods [40]. The immediate benefits—like shorter lead times, cheaper operating costs, and better order fulfillment accuracy—are often highlighted in research studies [41]. These immediate effects help firms become more adaptive and competitive, enabling them to deal with changing market conditions [25].

The indirect effects of E-SC are also critical, influencing how organizations approach E-SC strategy in general [42]. Previous research provides general support to our indirect effect argument, highlighting that the indirect consequences also include enhanced internal and external stakeholder participation, which promotes a more connected and cooperative business environment [43]. Implementing a collaborative E-SC also makes it easier to integrate trends, demand forecasts, and risk management [44][45]. As a result, the indirect effects of E-SC support companies' long-term viability and adaptability in a market that is changing quickly [47].

While the literature established a general positive impact of both customer and supplier focused E-SC practices on performance, the mechanism through which these practices translate into performance improvement remain less empirically explored and less understood. This were various E-SC practices emerge as potential mediator factors. Thus, and based on the above discussion, the following hypotheses are proposed:

H4: Customer focused E-SC mediates the relationship between supplier focused E-SC and performance of the firm.

H4: Supplier focused E-SC mediates the relationship between customer focused E-SC and performance of the firm.

3. Research Methods:

This section details how we have developed and administered our questionnaire, and assessed the various constructs utilized in the study, collected data, addressed potential biases, and ensured the reliability and validity of our measurements.

3.1 Instrument development, data collection and measuring constructs:

A questionnaire served as our main data collection tool, where all items used are based on existing

literature and expert feedback. With the aim of enhancing the clarity and context-specific relevance and after incorporating feedback from several experts on the quality of the questionnaire and its content, the final instrument was sent to the target respondents. As our unit of analysis was the individual firms in Oman, targeted firms consisted around 550 Omani manufacturing firms. 108 valid responses were obtained, representing 19.6% response rate. Managers of these firms were asked to evaluate their E-SC practices and the resulting impact on various aspects of operational and business performance. The questionnaire comprised three main sections; 1) respondent and company general information, 2) E-SC implementation indicators including 8 items of various customer and supplier focused E-SC practices, 3) Performance indicators, which measured the performance implications of E-SC on both business and operational performance (8 items). All items were measured using a 5-point Likert scale (1 = "not considering it" to 5 = "carrying it out fully", for E-SC implementation; 1 = "not at all" to 5 = "very significantly" for performance effects of E-SC) (see Table 1 for full list of items).

Table 1. List of items and constructs used in this study

Construct / Sources	Items *	Factorial weight
	<i>Electronically conducting the following activities:</i>	
Customer focused / ([54]; [5]; [56])	Online after-sales service to customers (E-SC1)	0.854–
	Responding to customer enquires (E-SC2)	0.887***
	Order processing and fulfillment activities (E-SC3)	0.874***
	Assisting customers with their online ordering and solving their problems (E-SC4)	0.797***
Supplier focused E-SC / ([54]; [56])	Facilitating shipping and logistics activities (E-SC5)	0.803–
	Procurement activities of materials, products or services (E-SC6)	0.883***
	Online planning and coordination activities with suppliers (E-SC7)	0.912***
	Inventory control activities (E-SC8)	0.867***
Business Performance / ([54]; [56])	Increase customers' satisfaction (BusP1)	0.816–
	Increase sales volume (BusP2)	0.801***
	Increase overall earnings growth and business profitability (BusP3)	0.942***
	Enhance firm's reputation and public image (BusP4)	0.863***
Operational Performance / ([57]; [56]; [58])	Enhance delivery speed and logistics efficiency (OpsP1)	0.857–
	Enhance the level of flexibility and responsiveness to market changes (OpsP2)	0.844***
	Enhance productivity (OpsP3)	0.741***
	Enhance quality of products and service as perceived by customers (OpsP4)	0.792***

***p-value<.001, **p-value<.01, –Fixed parameter for scaling purposes

Several techniques were employed in this study to mitigate potential biases. Non-response bias: To measure the effects of the non-response bias on our data, we compared early and late responders on key variables using t-tests. The results showed no significant differences in means or variances, suggesting no significant non-response bias. Additionally, to check for common method bias, Harman's single-factor test was used. The results revealed different distinct factors, with the no single factor that explain majority of the variance,

indicating that common method bias was not a major concern.

3.2 Construct Reliability and Validity

To assess the reliability and validity of our constructs, we conducted Confirmatory Factor Analysis (CFA). The results are summarized in Table 1. To assess the reliability of our constructs Cronbach's alpha test was used. Cronbach's alpha values for the constructs ranged from 0.840 to 0.932, exceeding the recommended threshold of 0.70, demonstrating high internal consistency. Additionally, convergent validity was checked by ensuring that all estimated standard loadings for the items were significant ($p < 0.05$), indicating that the items within each construct shared a strong association with the underlying construct. Furthermore, we assessed the discriminant validity using Average Variance Extracted (AVE) and cross-correlations. Our results indicated that the square root of AVE for each construct exceeded 0.5 and was higher than its correlations with other constructs. This suggests that the items within each construct shared more variance with their respective construct than with other constructs, indicating satisfactory discriminant validity.

In conclusion, the methods outlined in this section demonstrate a robust and well-designed study, employing appropriate measures, controls, and validation procedures to enhance the reliability and validity of our findings.

4. Results of Data Analysis: Unveiling the Links Between E-SC Practices and Performance

This section presents the findings of our data analysis, focusing on the proposed indirect-mediating relationships between E-SC practices and performance. This was achieved by assessing: 1) The model fit of our models, and 2) significance and direction of the effects of E-SC practices on operational and business performance. Both the direct and indirect effects of E-SC practices on performance were assessed using three models: 1) The direct effect model, where the effects of both customer focused E-SC and supplier focused E-SC practices on performance was considered as a direct effect (Model 1), 2) the indirect effect models in which two mediation models were created. While in the first indirect model (Model 2A), the customer focused E-SC was considered as a mediator between supplier focused E-SC and performance, in the second indirect model (model 2B), the supplier focused E-SC was considered as a mediator between customer focused E-SC and performance.

When considering the model fit, our results show that all three models tested achieved a satisfactory level of fit. Notably, the fit indices for models 2A

and 2B were superior (Model 2A-Normed $\chi^2=2.077$, CFI=.923, IFI=.935, PCFI=0.780/ Model 2B- Normed $\chi^2=2.077$, CFI=.918, IFI=.926, PCFI=0.774) to those of the direct effects model (Model 1-Normed $\chi^2=2.261$, CFI=.910, IFI=.914, PCFI=0.765). This suggests that the indirect-mediating perspective is crucial for understanding the complex interplay between different types of E-SC practices and their combined impact on performance.

4.1 Results of the direct relationship:

Our direct effect assessment shows that both customer focused and supplier focused E-SC practices exhibited significant positive relationships with operational and business performance. Customer focused E-SC had a strong influence on both operational ($\beta = 0.418$, $p < 0.001$) and business performance ($\beta = 0.214$, $p < 0.01$). Similarly, supplier focused E-SC demonstrated a strong positive association with operational ($\beta = 0.546$, $p < 0.001$) and business performance ($\beta = 0.117$, $p < 0.05$). Thus, the direct effect of supplier focused E-SC on operational performance is stronger than the direct effect of customer focused E-SC. On the other hand, the direct effect of customer focused E-SC on business performance is stronger than the effect of supplier focused E-SC. Thus, both types of E-SC are needed to enhance the operational performance, but the implementation of the customer focused E-SC is required more in order to enhance business performance than the need to implement supplier focused E-SC. In general, these results provide support for our first hypothesis (H1).

4.2 Results of the indirect-mediated relationships:

[46] approach of testing the indirect-mediation effect was followed in assessing both the mediation effect of customer focused E-SC and the mediation effect of supplier focused E-SC. First, when adding the customer focused E-SC as a mediator between external E-SC and performance, our results show that the relationship between supplier focused and customer focused E-SC practices was significant ($\beta = 0.558$, $p < 0.001$), indicating that supplier focused E-SC positively influences the implementation of customer focused E-SC practices. The direct effect of supplier focused E-SC on operational performance remained significant but diminished in magnitude ($\beta = 0.420$, $p < 0.001$) when compared to its effect in model 1, suggesting a partial mediating effect of customer focused E-SC on Supplier focused E-SC \rightarrow operational performance relationship. At the same time, the effect of customer focused E-SC on business and operational performance were

significant ($\beta = 0.207$, $p < 0.01$, and $\beta = 0.391$, $p < 0.001$, respectively). Interestingly, the direct effect of supplier focused E-SC on business performance became non-significant ($\beta = 0.087$), suggesting a full mediating role of customer focused E-SC in this relationship. Second, when adding the supplier focused E-SC as a mediator between customer focused E-SC and performance, our results show that the relationship between customer focused and supplier focused E-SC practices was also significant ($\beta = 0.464$, $p < 0.001$), highlighting the influence of customer focused E-SC on supplier focused E-SC implementation. At the same time, the effect of supplier focused E-SC on operational performance was significant, its effect on business performance was non-significant ($\beta = 0.495$, $p < 0.001$, and $\beta = 0.054$, respectively). While the direct effects of customer focused E-SC on both operational ($\beta = 0.372$, $p < 0.001$) and business performance ($\beta = 0.181$, $p < 0.05$) remained significant, their magnitudes decreased, indicating partial mediation effects. Thus, in general these results provide support for H 2 & 3 respectively.

Based on the analysis of direct and mediated relationships, the following hypotheses were supported:

H1a: Customer focused E-SC strongly impacts business performance (strongly supported).

H1b: Customer focused E-SC strongly impacts operational performance (strongly supported).

H2a: Supplier focused E-SC positively impacts business performance (partially supported).

H2b: Supplier focused E-SC strongly impacts operational performance (strongly supported).

H3: Supplier focused E-SC \rightarrow Customer focused E-SC \rightarrow Performance (full mediation for business performance, partial mediation for operational performance).

H4: Customer focused E-SC \rightarrow Supplier focused E-SC \rightarrow Performance (no mediation for business performance and partial mediation for operational performance).

Overall, the results reveal the importance of considering both customer focused and supplier focused E-SC practices and their indirect-mediating effects on performance.

5. Discussion

Views from research publications highlight the complexity of the effects of E-SC [25],[47]. Academics stress that comprehending the ramifications of the E-SC requires a comprehensive

approach that takes into account both direct and indirect effects [48] [42]. Research highlights the significance of organizational preparedness and strategic planning from a managerial and operational perspectives in order to fully utilize E-SC technologies [25] [49]. The current research emphasises how E-SC affect organizational performance should be studied both directly and indirectly. The indirect effects assumed to have larger implications for business performance, while the direct benefits concentrate on operational efficiency and cost savings [53].

The results of this study offer valuable insights into the direct and indirect impacts of E-SC implementation on organizational performance, considering the collaborative nature of its adoption. As hypothesized, E-SC implementation demonstrates a significant positive influence on performance, directly contributing to improved efficiency, cost reduction, increased sales volume and enhanced firm reputation and customer satisfaction. In general, this finding aligns with prior research that emphasizes the potential of E-SC to streamline operations and unlock cost savings (e.g., [50] [51]).

The study also reveals the crucial role of E-SC supply chain collaboration in the implementation of the E-SC with customers and E-SC with suppliers' practices as mediating factors in the relationship between E-SC and performance. This finding supports the theoretical framework proposed by [52], suggesting that E-SC fosters a more innovative supply chain environment, ultimately leading to improved performance outcomes. Furthermore, the collaborative implementation of E-SC emerges as a significant mediator, amplifying the positive relationship between E-SC and performance. This finding suggests that organizations that adopt a staged approach to E-supply implementation, beginning with core functionalities and gradually progressing towards more advanced applications, are likely to achieve greater benefits compared to others that focus only on one specific type of E-SC.

Implications and conclusions:

As organizations continue to navigate the complexities of the globalized business environment, E-SC will undoubtedly play a critical role in ensuring their competitiveness and success. By embracing E-SC in a strategic and systematic manner, organizations can unlock the potential for improved efficiency, enhanced agility, and ultimately, superior performance. This research contributes to the existing body of knowledge by demonstrating the significant direct and indirect impacts of E-SC implementation on organizational performance, highlighting the mediating role of different types of E-SC, and emphasizing the

importance of a mediated implementation approach. These findings offer valuable insights for practitioners and researchers alike, paving the way for further research and advancements in the field of E-supply and supply chain management. For practitioners, our findings argued for the importance of focusing on comprehensive E-SC implementation. Organizations should strive to implement a broad range of E-SC technologies and applications, not just focusing on basic functionalities like e-procurement. This comprehensive approach can unlock the full potential of E-SC and maximize its impact on performance. It also cultivates a culture of collaboration and innovation, in which E-SC implementation should be accompanied by efforts to foster a culture that values collaboration among various E-SC efforts and innovation within and across the organization. This can involve investing in a more operationally focused E-SC such as employee training on E-SC, promoting cross-functional collaboration for E-SC, and encouraging experimentation with new E-SC technologies and processes. Additionally, organizations may need to pay more attention on enhancing their market focused E-SC with their customers which may include developing more advanced E-SC tools that predict customers' expectations with highest level of accuracy and provide customers with on time delivery of their products. Furthermore, our results highlight the importance of adopting a sequential implementation approach or E-SC practices. Implementing E-SC practices in a staged manner, starting with essential practices and then moving towards adopting more advanced applications, is expected to provide firms with better performance outcomes. This allows organizations to adapt to the changes, learn from experience, maximize utilization of its resources and maximize the benefits of E-SC implementation. Such approach also suggest that organizations should regularly monitor and evaluate the performance of their various E-SC initiatives while considering the most optimum approach to identify areas for improvement and ensure that they are achieving their desired objectives.

Limitations and future research directions:

Despite its contributions, this study suffers from several limitations that can be considered by future research. For example, the current study focuses on manufacturing companies and we didn't consider the effect of organizational characteristic on our main relationships. Further research is needed to explore how the findings translate to other industries and other company sizes and with different characteristics. Future research could also

explore how E-supply interacts with other organizational factors such as organizational culture, leadership style, and information technology infrastructure to influence performance. Also, the study's cross-sectional design limits its ability to capture the long-term impacts of E-SC implementation. Longitudinal research is needed to understand how the effects of E-SC evolve over time. Finally, this study contributes to the literature by developing a more comprehensive framework for assessing E-SC implementation and its performance impacts. Based on the findings of this study and future research, more contingent elements should be added to our models in order provide organizations with a roadmap for successfully implementing E-SC solutions and maximizing their benefits.

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