

The Effect of Supply Chain Collaboration Efforts on Environmental Performance in the Manufacturing Industry

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Abstract

Manufacturing firms compete to better adapt to market fluctuations in the highly competitive market economy of today. Given the interdependence between supply chain participants, collaboration is therefore a significant necessity for integrating activities in order to meet the mutual goals of all parties. This study aims to examine the effect of supply chain collaboration dimensions on environmental performance as well as the extent to which manufacturing firms have adopted dimensions of supply chain collaboration. The study used a quantitative research approach. A structured questionnaire was used to collect data from 45 respondents who work in various management roles at manufacturing companies in Jordan. Descriptive and regression analysis was conducted using SPSS version 24 software to test the proposed hypotheses in the conceptual model. The regression model included six supply chain collaboration dimensions as independent variables and environmental performance as a dependent variable. The implementation of six supply chain collaboration dimensions was evaluated using a five-point Likert scale, with the following results: information sharing (4.42), collaborative communication (3.91), joint knowledge (3.78), decision synchronization (3.54), resource sharing (2.46), and goal congruence (2.27). Moreover, the findings showed that four supply chain collaboration dimensions, namely information sharing, resource sharing, collaborative communication, and joint knowledge, are all having positive and significant effect on environmental performance of manufacturing firms in Jordan with a p-value less than 0.05. The study presents policy implications from both theoretical and practical perspectives for managers, researchers, and academics. Managers can use the definition and performance measures of supply chain collaboration as a potential tool to build productive working relationships. By addressing these important dimensions of supply chain collaboration, businesses can reduce the likelihood of a failed collaboration. Managers in the manufacturing sector in Jordan should concentrate their efforts on enhancing resource sharing and goal alignment with supply chain partners. Moreover, using new technology should

enhance collaborative communication, joint knowledge, and decision synchronization aspects of collaboration. Additionally, information sharing is the most significant factor influencing supply chain collaboration and environmental performance. Finally, the government should enact new regulations and laws to enhance the environmental performance Jordan's manufacturing sector.

Keywords: Supply chain management; environmental performance; supply chain collaboration; supply chain performance; manufacturing firms.

1. Introduction

Manufacturing companies are constantly under pressure to deliver high-quality goods at the lowest possible price in the shortest amount of time, even in the most uncertain economic times (Ramanathan, & Gunasekaran, 2014). Due to competitive dynamics like cost reduction and improved customer service, businesses are constantly looking for new ways to establish sustainable competitive advantage (Alkalha et al., 2022). Collaboration in the supply chain is one such approach (Makkonen & Vuori, 2014; Teng et al., 2022).

One of the key changing developments for future supply chains has been highlighted as supply chain collaboration (Teng et al., 2022). The need for collaboration among businesses within the supply chain is driven by establishing global reach, ensuring a company's strategic position in the supply chain, focusing on developing a winning team, and enhancing financial performance (Heirati et al., 2016). Few companies may have all of the resources and capabilities needed to compete on a global scale, and the competitiveness of a supply chain will be determined by inclusion of talents and resources through collaboration (Teng et al., 2022). Scholars believe on the benefits of collaboration as they may accomplish considerable gains through coordinated supply chain operations (Baah et al. 2021).

Various empirical studies have been conducted to understand the links between enablers of collaboration and effective cooperation, as well as the effects on companies' operational performance. As a result, the empirical findings from Jordanian manufacturing firms contribute to scholars' and practitioners' knowledge of the connection of supply chain collaboration on environmental performance (Salam, 2017; Baah et al. 2021; Teng et al., 2022). Therefore, the study attempts to assess the impact of supply chain collaboration on environmental performance by identifying the supply chain enablers of collaboration. The specific objectives are a) to identify the supply chain collaboration dimensions for manufacturing firms b) to assess the effect of supply chain collaboration on environmental performance.

2. Literature review

2.1 Supply chain collaboration and environmental performance

The importance of supply chain collaboration in today's fiercely competitive business environment cannot be underestimated. In reality, businesses must increasingly work with supply chain members to preserve the competitiveness of their supply networks (Baah and Jin, 2019; Jum'a, 2020). Supply chain collaboration, defined as two or more independent enterprises collaborating to design and conduct supply chain operations, can provide significant benefits and present advantages to supply chain partners (Panahifar et al., 2018).

Firms benefit from collaborative relationships primarily for risk sharing and easy access to resources and capabilities, which boosts economic performance and gives them a competitive advantage. Although the notion of collaborative supply chains has been thoroughly researched, many supply chain stakeholders fail to perform their roles to guarantee mutual advantages (Teng et al., 2022). The resource-based view (RBV) is a managerial framework for determining the strategic resources that a company can use to gain a sustainable competitive advantage. The RBV prompts managerial attention to the firm's internal resources in order to identify assets, capabilities, and competencies that have the potential to deliver better competitive advantages (Barney, 1991). The RBV states that a firm's capabilities serve as the foundation for further developing and strengthening its competences via continuous, collaborative learning (Wernerfelt, 2013). As a result, supply chain collaboration can serve as a foundation for improving the company's environmental performance and promoting its competitive advantage. A supply chain collaboration is a firm's long-term collaboration approach in which supply chain partners with common aims collaborate closely to produce mutual benefits better than the businesses could achieve separately. Information sharing, goal congruence, decision synchronization, resource sharing, collaborative communication, and shared knowledge exchange are all interconnected aspects of supply chain collaboration (Cao et al., 2010). Managers' knowledge of the company environment and their capacity to receive information can both benefit from information exchange. Inter-organizational dynamics and shared learning should be influenced positively by a greater grasp of a common context and improved transparency (Baghizadeh et al., 2021; Jum'a et al., 2022).

The amount to which a company exchanges a range of relevant, precise, comprehensive, and private information with its supply chain partners in a timely way is referred to as information sharing (Rawewan & Ferrell, 2018). External information acquired through interactive collaboration is critical for collaboration performance in this context (Jimenez-Jimenez et al., 2019). Goal congruence is "agreement by all members of a group on a common set of objectives" while behavioral congruence is "alignment of individual behavior with the best interests of the organization regardless of the individual's own goals" (Lanen, Anderson, & Maher, 2011, p. 446). Moreover, when supply chain partners arrange collaborative decisions targeted at supply chain optimization through their planning and

operational strategy, this is referred to as decision synchronization (Im et al., 2019). Supply chain collaboration also focuses on the practice of utilizing capabilities and assets while also investing in knowledge and assets with supply chain partners is referred to as resource sharing. Physical resources, such as industrial equipment, facilities, and technology, are examples of resources (Gong et al. 2015). In addition, the process of interaction and message transmission among supply chain partners in terms of frequency, direction, channel, and impact strategy is referred to as collaborative communication which is an important part of supply chain collaboration (Hudnurkar et al. 2014). Finally, the extent to which supply chain partners collaborate to obtain a greater understanding of and respond to the competition and changing environments is referred to as joint knowledge creation (Kahn et al., 2006). According to the literature, companies that grow their engagement in supply chain collaboration over time tend to improve their knowledge networks and eventually the performance (Jum'a, 2020; Teng et al., 2022).

Environmental performance in relation to supply chain can be defined as a holistic view of all environmental aspects including green supply chain practices (Jimenez-Jimenez et al., 2019; Jum'a et al., 2021). Previous studies have found a link between continuous improvement in business processes, Just in Time (JIT) delivery systems, and green supply chain practices, as well as their combined effect on environmental performance and green supply chain activities like green product design and development are linked to enhanced environmental performance (Feng et al., 2018; Green et al., 2019). Environmental performance practices include improvement of a company's environmental situation, reduced water and/or solid waste waste, reduced air pollution, reduce the use of hazardous/harmful/toxic materials and reduce the number of environmental accidents (Jum'a et al., 2021).

However, very few studies have been done to assess the effect of supply chain collaboration on environmental performance (Panahifar et al., 2018; Jimenez-Jimenez et al., 2019; Jum'a et al. 2021; Teng et al., 2022). This research bridges the gap by incorporating these two essential constructs within the conceptual framework.

2.2 Influence of supply chain collaboration on environmental performance

Supply chain collaboration allows chain members to become more sensitive to changes in market. By working together closely, supply chain members may increase their capacity to meet consumer demands through flexible options and resources sharing (Teng et al., 2022). According to Jimenez-Jimenez et al. (2019), supply chain collaborations have a high potential for boosting organization and supply chain performance, suggesting that more research into the topic is required. The different multidimensional viewpoints of supply chain collaborations suggest that more needs to be learned about supply chain collaborations. It is also worth emphasizing that current trends need environmental agreements in supply chains; hence, the purpose of this study is to evaluate how supply chain collaboration impacts environmental performance (Jimenez-Jimenez et al., 2019; Jum'a et al. 2021). Therefore, based on the above discussion, the following hypotheses are proposed.

Hypothesis H1. Supply chain information sharing positively influences environmental performance.

Hypothesis H2. Supply chain goal congruence positively influences environmental performance.

Hypothesis H3. Supply chain decision synchronization positively influences environmental performance.

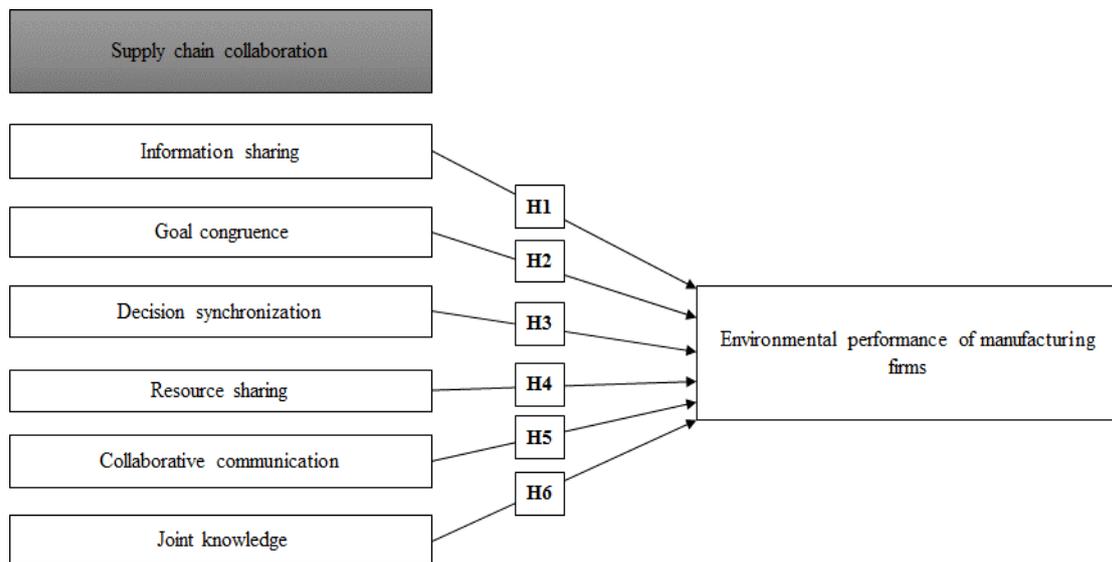
Hypothesis H4. Supply chain resource sharing positively influences environmental performance.

Hypothesis H5. Supply chain collaborative communication positively influences environmental performance.

Hypothesis H6. Supply chain shared knowledge positively influences environmental performance.

The conceptual model which is utilized in this study is presented in Figure 1.

Figure 1: Conceptual model of the study



Source: Developed by the author

3. Methodology

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3.1 Sampling and data collection

The participants in this study were employees in various managerial roles in the Jordanian manufacturing organizations. The sample participants provided primary data using a structured questionnaire, and the samples were selected using a convenience sampling approach. Convenience sampling is a form of non-probability sampling approach that may be used to determine population characteristics (Malhotra, 2010). Participants in the study provided a total of 45 responses. To evaluate the data and test the hypotheses, proper statistical data analysis techniques were used.

3.2 Measurement scale

The conceptual model included six supply chain collaboration dimensions including information sharing, collaborative communication, joint knowledge, decision synchronization, resource sharing, and goal congruence as independent variables and environmental performance as a dependent variable. Scale items used in this study were adopted from previous studies. Items related to supply chain collaboration were adopted from Jimenez-Jimenez et al. (2019) and Cao et al. (2010). Items related to environmental performance were adopted from Jum'a et al. (2021) and Baah et al. (2021). The questionnaire was divided into two sections, the first of which included questions about the demographic characteristics of the respondents. In the second section, on a 5-point Likert scale, respondents were asked to show their level of agreement and disagreement on questions linked to the study constructs ranging from 1 = strongly disagree to 5= strongly agree.

4. Results

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4.1 Descriptive analysis

Descriptive and regression analysis was conducted using SPSS version 24 software to test the proposed hypotheses in the conceptual model. The descriptive statistics included mean, standard deviation. Moreover, the implementation of six supply chain collaboration dimensions was evaluated using a five-point Likert scale. Linear regression analysis was used to measure the effect of six supply chain collaboration dimensions as independent variables on company's environmental performance as a dependent variable.

The results showed that the variable named “information sharing” as a part of supply chain collaboration generated the highest mean score ($M = 4.42$). On the other hand, “goal congruence” generated the lowest mean score ($M = 2.27$) as shown in Table 1.

Table 1: Descriptive statistics ($N = 45$)

Latent variables	Mean	Std. Deviation
Information sharing	4.42	.82
Goal congruence	2.27	.74
Decision synchronization	3.54	.82
Resource sharing	2.46	.94
Collaborative communication	3.91	.84
Joint knowledge	3.78	.64
Environmental performance	3.95	.86

Source: Developed by the author

4.2 Regression Analysis

All variables in the linear regression analysis ought to be multivariate normal. A histogram, a Q-Q-Plot, and a goodness of fit test are the best methods for evaluating this assumption. The Kolmogorov-Smirnov Test and the Shapiro-Wilk Test are two well-known normality tests. The Shapiro-Wilk Test is better appropriate for small sample sizes equal or less than 50 samples responses (Pallant, 2013). The Shapiro-Wilk Test Sig. value for the sample is greater than 0.05, indicating that the data is normal. The predictive effect of supply chain collaboration dimensions on manufacturing company environmental performance is investigated using a linear regression analysis. Because there are many types of regression analysis, each of which can be used for a specific situation (Pallant, 2013), this test was carried out using the enter method, which involves simultaneously entering all independent variables of supply chain collaboration dimensions into the equation; this is the most commonly used regression analysis (Hair et al., 2014). Table 2 shows the model summary, which includes the correlation coefficient, R, R-squared, adjusted R-squared, and standard error of the estimate scores, all of which are used to measure the overall fit of the regression model with the data.

Table 2: Regression model summary for supply chain collaboration on predicting environmental performance

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error
1	.785a	.616	.611	.32158

a. Predictors: (Constant), IS, GC, DS, RS, CC, JK

Source: developed by author

The R-value for the multiple correlation coefficient was 0.785. The impact of supply chain collaboration on the environmental performance is predicted to be high. The R-squared score, which measures the amount of variance in manufacturing environmental performance that can be explained by supply chain collaboration, is included in the coefficient of determination. The R-squared score for this study was 0.616, indicating that supply chain collaboration account for 61.6% of the variability in environmental performance.

Moreover, Table 2 shows the adjusted R-squared value as a better approximation of the real population of manufacturing firms when R-squared is influenced by sample size. The corrected R-squared value was 61.1 percent in this case, confirming the R-squared finding.

Table 3 shows the coefficients that indicate how effectively each of the supply chain collaboration dimensions are connected to the environmental performance.

Table 3: Regression coefficients of supply chain collaboration dimensions on environmental performance

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.*
	B	Std. Error	Beta		
(Constant)	.371	.239		1.549	.124
Information sharing (IS)	.489	.086	.508	5.707	.000*
Goal congruence (GC)	-.115	.091	-.122	-1.269	.207
Decision synchronization (DS)	.056	.096	.057	.581	.562
Resource sharing (RS)	.177	.084	.169	2.107	.037*
Collaborative communication (CC)	.278	.083	.298	3.364	.001*
Joint knowledge (JK)	.184	.082	.048	1.907	.041*

Source: Developed by the author

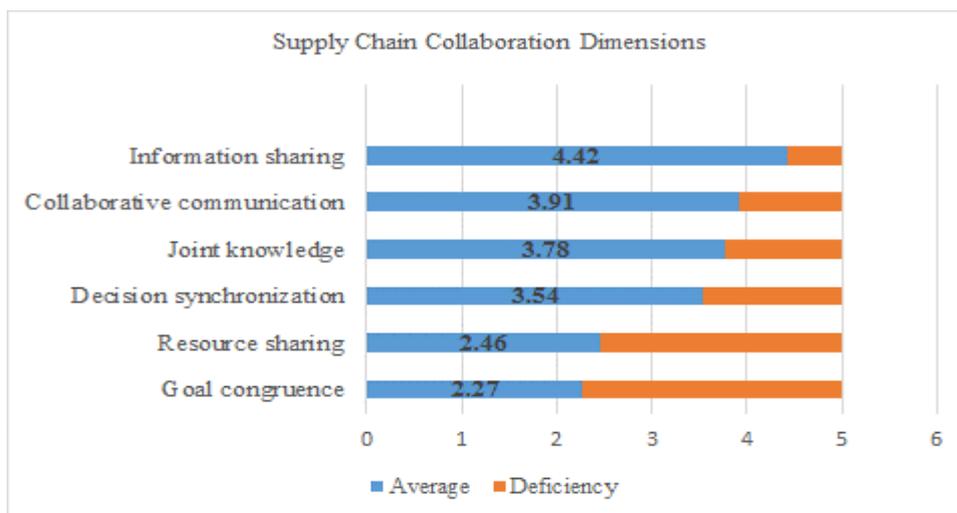
The significance values (column Sig.) reflect whether the supply chain collaboration make a statistically significant unique contribution; statistical significance is defined as values less than 0.05. As can be seen from Table 3, the supply chain collaboration dimension information sharing has the biggest impact on the environmental performance (B = .489, t-vale = 5.707). This result supports the hypothesis H1. The supply chain collaboration dimension resource sharing (B = .177, t-vale = 2.107) supported the hypothesis H4. Collaborative communication dimension (B = 0.278, t-vale = 3.364), supported the sub-hypothesis H5, and joint knowledge dimension (B = .184, t-vale = 1.907), supported the hypothesis H6. Thus, the general equation to predict the environmental performance through supply chain collaboration dimensions is $= (.489 \times IS) + (-.115 \times GC) + (.056 \times DS) + (.177 \times RS) + (.278 \times CS) + (.184 \times JK)$.

5. Conclusion

The influence of supply chain collaboration aspects on manufacturing firms' environmental performance in Jordan was examined. The suggested study model focused on six supply chain collaboration dimensions: information sharing, goal congruence, decision synchronization, resource sharing, collaborative communication, and joint knowledge.

It is proven that four elements of supply chain collaboration have a major impact on manufacturing enterprises' environmental performance. These findings will enable managers in Jordanian manufacturing firms to strengthen crucial supply chain collaboration aspects as shown in Figure 2.

Figure 2: Clustered bar char for supply chain collaboration dimensions



Source: developed by author

Figure 2 depicts how Jordanian manufacturing managers should focus their efforts on improving goal congruence and resource sharing with supply chain partners. Additionally, the use of new technology should improve decision synchronization, joint knowledge, and collaborative communication. Furthermore, information sharing is the most important aspect influencing supply chain collaboration and environmental performance. Finally, the government should implement additional policies and laws to improve the environmental performance of manufacturing companies in Jordan.

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