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The Effect of Supply Chain Management on Total Quality Management: An Application of Just-in-Time (JIT) Practices*

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Abstract

The study attempted to answer the questions related to the expected effects of supply chain management variables which include: Partnership with Suppliers (PS), Relationships with Customers (RC), Quality of Information Exchange (QIE), and Postponement (P), as independent variables, total quality management (TQM) as a dependents variable, and just in time (JIT) as a mediator variable. The study relies on the descriptive approach by conducting an empirical study on commercial companies in Riyadh Governorate in the Kingdom of Saudi Arabia. Through the methods of descriptive and analytical statistics represented in exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and structural equation modeling (SEM), using the AMOS and SPSS programs, the results of the applied study indicated that: There is an effect of supply chain management variables (quality of information exchange, Postponement) on just in time (JIT), there is no effect of the supply chain variables (relationship with customers, partnership with suppliers) on just in time (JIT), there is an indirect effect of the quality of information exchange, Postponement, partnership with suppliers, the relationship with customers on total quality management (TQM), relationship with customers affect on total quality management (TQM) indirectly, just in time (JIT) does not affect total quality management (TQM)

Keywords: Supply Chain Management, Just in Time, Total Quality Management

JEL Classification Code: M40, M41, M42

1. Introduction

The supply chain management practices (SCMP) Board of Directors is known for planning and managing all

activities related to sourcing, acquisition, transformation, coordination, and cooperation with strong partners of suppliers, brokers, services, and third-party service providers that achieve sustainable competitive advantage. Production lines directly or indirectly related to the production of a specific product can only be made through a group of activities, and a supply chain is a group of interrelated companies involved in the production, from the introduction of raw materials to refined and transferred materials to the end of the final products required for customers (Al-Hashimi & Al-Ardawe, 2020).

A limited number of studies presented the relationship between SCM, total quality management (TQM), and just-in-time (JIT), the most important of which is the study by Kannan and Tan (2005). Chen (2015) discussed the relationship between (JIT) and (TQM) in Chinese manufacturing companies, and the study found a complementary relationship between JIT and TQM and a positive impact of JIT on TQM.

The main study objective is to identify the impact of supply chain management on total quality management

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through just in time. The researchers in this study have several questions that have not been answered by previous research, namely: Does supply chain manufacturing have an impact on timely production? Do just-in-time production as a part of overall quality management affect the supply chain? Does timely production have an impact on total quality control? By gathering information from both primary and secondary sources, the researchers employed the descriptive analytical approach to provide answers to these issues.

2. Literature Review

2.1. SCM

Özlen and Hadžiahmetović (2013) focused on examining the implementation of supply chain management (SCM) and identifying the relationship between it and customers in small and medium companies in Bosnia through a questionnaire collected from stakeholders in small and medium companies. The findings showed that the level of implementation of SCM was good despite the weakness in the use of information technology; there is also a relationship between customer relationship management and SCM. Eriksson (2015) provided an intellectual framework on supply chain integration, adapting it to the project-based context; project-based supply chain integration is a multidimensional construct that includes four dimensions: strength, scope, duration, and depth of integration. The results of a case study of four engineering projects indicated that these four dimensions are important when conceiving and implementing partnerships in engineering projects. The results showed that there is a strong relationship between the four dimensions, which indicates the need to manage them simultaneously and regularly. Mishra and Sharma (2015) aimed to analyze the effect of SCM practice on the organization's performance through competitive priorities in Iran. The variables represented in the supply chain practices: are a partnership with suppliers, customer relations, the level of information exchange, and the quality of information exchange. As for the competitive advantage variables, they were represented by: cost/price, quality, design (reliability), and flexibility. As for organizational performance, variables were defined by: market performance, financial performance, and customer attitudes. The study results showed that applying SCM practices achieves the competitive advantage of a company, Iranian pumps, makes them more influential, and stressed the need to activate SCM strategies in Iranian companies and organizations. Bo et al. (2013) discussed some of the SCM practices: reducing transaction costs, sharing information, integrating with suppliers, and controlling the supply chain to fulfill the social responsibility of the facility.

The study concluded that SCM practices enable organizations to understand customer and market demands fully. That participation between members of the chain and integration with suppliers improves and strengthens the supply chain's competitiveness, sensitivity to market risks, meeting customer needs effectively, and achieving sustainable development for facilities in the long term. Hamister (2012) studied the impact of supply chain management practices and represented five practices: strategic partnership with suppliers, relationships with customers, the level of information exchange within the chain, the quality of the information exchanged on the competitive advantage, and the organizational performance of business establishments. The study concluded that the effective use of appropriate and timely information by all partners in the supply chain is a competitive factor. Good relationships and partnerships with supply chain members, customers, and management are essential to the chain's success and competitive advantage.

With the practices of SCM, the establishments achieve a competitive advantage and improve their organizational performance. Li et al. (2006) discussed measuring the effectiveness of SCM practices in achieving competitive advantage and improving organizational performance. The study concluded that controlling SCM contributes to competitive advantage and improves organizational performance. Hasan (2013) discussed SCM and its impact on major companies' environmental and operational performance in Australia. The study concludes that sustainable SCM has a significant positive impact on operational and environmental performance.

The study relied on a comprehensive procedure to develop a multifaceted measure of supply chain resilience through a series of pilot tests. This study has reached the most noticeable results: that the flexibility of the SCM can be activated as a second-order factor model consisting of four dimensions, namely: sources of flexibility, flexibility as an operating system, flexibility of distribution, and system flexibility that the measure provided a clearer picture of the supply chain's resilience. This good measure can validate other variables as a standard for further research in SCM (Garzón et al., 2013).

Kim and Song (2019) provided a framework for understanding supply chain integration and the impact of supply chain information practices on manufacturing industries. It concluded that supply chain information practices play an important role in the exchange of information between members of the Supreme Committee's network.

Lee and Ha (2020) showed that the good relationship and cooperation between the company and the buyers and sellers have a good impact on the performance of the supply chain.

2.2. TQM

This study dealt with information technology as an independent variable due to the importance of its role in providing information technology excellent and necessary information for the decision-making process in the organization regard to the extent of information technology and its important and influential role in quality management comprehensive and responsive to the needs of critical success factors for managing information systems in abundance. The study focused on achieving a number of goals, the most important of which were: identifying the extent of awareness of systems information management to achieve the interaction between information technology and TQM, which helps to reduce production costs, improve profitability and productivity, and improve customer satisfaction, as well as quality assurance. As the purpose of this study is to test the relationship between TQM (strategic planning, human resources, quality assurance of outputs, quality results, leadership, information, and analysis) and JIT, the study was also tested on a sample of the public sector in Malaysia, represented by (110) quality managers who are employees and affiliates of the administrative universities.

The study relied on questionnaires, conducting interviews, and referendums to collect the supported data. Its accuracy and the answers (43%) were naturally compatible with the study. The study concluded that information technology has a more direct role in implementing the quality management strategy (Ang et al., 2001). Hence, companies must design academic programs that focus primarily on customer satisfaction and meet their needs. The proliferation of quality functions converts expectations and requirements into service benefits, thus they are two analytical tools that aid in the development of educational programs in the service and production domains. This study aimed to demonstrate the purpose of using quality and benchmarking methods when analyzing other creative quality tools to deal with new customers and solve problems. This research concludes that theoretical methods to develop works are based on listening to the client's needs and giving him freedom (Gonzalez et al., 2008).

Anggadini et al. (2021) showed that TQM directly impacts performance in Bali coffee exporting institutions. Through customer focus, continuous improvement, and employee engagement factors.

Trang and Rang (2020) identified the most important TQM standards, which are administrative commitment, training and learning, continuous improvement, quality procedures, quality of data and reports, communication for quality improvement, and customer satisfaction.

2.3. SCM & TQM

Dubey and Chakrabarty (2011) conducted an empirical study on the possibility of integrating innovative practices in the supply chain and TQM. They discussed the effect of supply chain innovation and TQM on the performance of cement firms in India. The results showed that the cement industry in India is still in the early stages of adopting innovative chain management supply. They used some variables in the creativity of the supply chain and some variables in quality management. The overall correlation is very weak, which indicates that the cement industry, particularly in India, has not efficiently increased these operations' performance.

2.4. TQM & JIT

Adeyemi (2010) examined the extent to which industrial companies in Nigeria apply the just-in-time production system and what are the technical obstacles to the application, and the study showed that despite the enormous benefits of the on-time production system, its adoption in the third world is still limited as large sectors are still operating based on those old production systems that included many activities that added a small value to the final production method.

Eker and Pala (2008) examined the effect of the JIT system and TQM on the use of multiple performance scales in companies, and the study was conducted on 122 industrial companies in Turkey. The results showed that there is an increasing linear relationship between the use of multiple performance scale systems and companies that use On-time production and TQM systems.

Marjan et al. (2022) showed that a strategic cost advantage can be obtained using Total Quality Management (TQM) techniques (continuous improvement, emphasis on quality, and customer focus).

2.5. TQM & SCM, JIT

Kannan and Tan (2005) studied the link between JIT, TQM, and SCM instead of looking at them as independent and distinct tools from each other. Using them as three dimensions of the integrated operations strategy, they examined how they affect performance improvement. The study results indicated a link between production, On-time purchasing TQM, and SCM at the strategic and operational levels of the companies studied. The results also indicated that commitment to quality and understanding supply chain dynamics significantly impact performance.

From the literature review, the researchers formulated the following hypotheses:

H1: *The supply chain management is an effect on JIT.*

H1-1: *The partnership with suppliers is an effect on JIT.*

H1-2: Relationships with customers are an effect JIT.

H1-3: The quality of information exchange effect on JIT.

H1-4: Postponement is an effect on JIT.

H2: Supply chain management is an effect on total quality through JIT.

H2-1: The partnership with suppliers is an effect on total quality through JIT.

H2-2: Relationships with customers is an effect on total quality through JIT.

H2-3: The quality of information exchange effect on total quality through JIT.

H2-4: Postponement is an effect on total quality through JIT.

H3: The JIT is an effect on total quality.

3. Theoretical Framework

3.1. Supply Chain

A group of researchers dealt with the concept of the supply chain from the perspective of its structure, as it was known. According to Booth (1997), a supply chain means that the facility is a ring. It starts with the supplier, facility, and customer, putting the facility in the middle between customers and suppliers.

Horngren et al. (2012) defined the supply chain as describing the flow of products and information from primary sources of materials to the final consumer regardless of whether these activities occur in the same organizations or other organizations.

Talib et al. (2011) defined improved competitive performance by integrating the facility's internal functions and linking them with the external operations of suppliers, customers, and other supply chain members. Hamister (2012) defined a supply chain as a set of procedures or administrative actions taken to improve the performance of the integrated supply chain. Ghatebi et al. (2013) described it as a series of activities to be undertaken to encourage the effective management of the organization's supply chain costs, and Li et al. (2006) defined a supply chain as a set of activities that a business organization performs and seeks to enhance supply chain management's efficiency and effectiveness.

Sim et al. (2004) explained that supply chain management is new items or services, the management of raw materials, their transformation into semi-finished and final products, and their delivery to the customer.

Koch (2005) indicated that supply chain management (SCM) represents a combination of science and art to improve the sourcing of raw materials, the method of production, the docking, and the docking of them. It also describes all the elements and processes involved in obtaining the right amount of product at the right place and time.

The supply chain aims to achieve a set of goals, the most important of which are as follows (Fayard et al., 2007; Piontkowski et al., 2012).

- Developing performance to meet customers' needs and minimizing costs through an optimal exploitation of resources and sustainable competition.
- The right products and services at just in time and at the right price, fulfilling the customers' desires.
- Reduce the amount of inventory to the minimum possible and reduce the costs involved.
- Organizing and coordinating the flow of products or information between the supply chain partners, thus achieving and improving the efficiency of supply chain performance.
- Improving the competitive position of the supply chain to achieve competitive advantages that support it in the face of competitors.
- Fulfilling the customers' desires by linking the customers' needs and desires with the current activities of the supply chain members.

The supply chain comprises many facilities, and their efforts are coordinated through their activities and actions toward a common goal. Still, the number of supplier members varies from one chain to another depending on the products, the limits of use of strategies, the conditions of demand and competition, and the possibility of entering into partnership relationships based on trust and commitment to achieve the best competitive position for the members of the chain. The supply chain consists of suppliers, manufacturers, and customers as members Lockamy and Smith (2000) and Faria et al. (2013) noted that there are three types of supply chains:

- A proprietary supply chain: where only one facility occupies the central position and is directly related to the customer.
- The baronial supply chain. Two or more organizations are involved in replacing the leading role in the chain and have equal control over the parties, more minor than the control of the capital in the stock chain.
- The supply chain is of equal power. Ghatebi et al. (2013) and Hamister (2012) demonstrated a range of supply chain management practices:
- Partnerships and extracts with suppliers: The long-term relationship between the facility is supplied and designed to take advantage of the strategic and operational capabilities of individual origin participating in the framework to help them achieve Ongoing benefits.
- Relationships with clients: through a set of practices that are used to manage complaints.

- Customers and building long-term relationships with them to meet their demands and improve their satisfaction.
- The level of information sharing (exchange): The extent to which information is exchanged and transferred along the supply chain. The level of information exchange shows the facility’s ability to exchange knowledge and information with partners in the supply chain efficiently and effectively. Also, the quality of the information exchanged reflects the accuracy and credibility of the information shared between the partners and the exchange of accurate and counter-accurate information.
- Outsourcing: This represents assigning work previously performed within the facility to an external facility to perform such work, such as packaging, transportation, and storage.

3.2. Total Quality Management

Quality management is described as an organized method of ensuring that activities occur in a planned and orderly manner, a management system concerned with preventing problems by creating trends and controlling potential prevention (Crosby et al., 2008).

Some have indicated that TQM includes: customer focus, leadership, human resources management, strategic planning, operations management, process quality, and employee empowerment (Prajogo, 2005).

3.3. JIT

The “just in time” business system began in the 1960s at the Toyota plant in Japan. This system aims to remove or reduce stocks, process work, finished products, and goods in the beginning stages of its development. In addition, its focus was extended to the disposal of all types of business waste. Specifically, companies implement the JIT business system with a purpose (Drury & Tayles, 2005):

- Elimination of non-value-added activities,
- Zero stocks,
- Zero defects,
- Batch sizes,
- Zero crashes and
- 100% on-time delivery service.

4. Research Methods and Materials

The study included four independent variables to Supply Chain Management, namely: Partnership with Suppliers (PS), Relationships with Customers (RC), Quality of Information Exchange (QIE), Postponement (P), and one

mediator variable, namely: Just in Time (JIT) and one dependent variable namely: TQM.

The study sample included administrators, accountants, and distribution managers in Riyadh Governorate commercial companies. The researchers distributed (174) questionnaires, and (168) were collected. The researchers used SPSS and AMOS software, version 24, for the statistical procedures (Anderson & Gerbing,1998).

5. Results and Discussion

5.1. Exploratory Factor Analysis

(EFA) shows the latent variables loaded on the questionnaire statements. The researchers concluded that the questionnaire bore latent factors by more than 70% (Table 2), and the KMO test value is equal to 0.824 (Table 1). The measure is appropriate if the KMO is more significant than 0.60 (Hair et al., 1998) where the extracted value turns out to be greater than the specified value. Thus, the sample size is compatible with the study.

5.2. Confirmatory Factor Analysis

(CFA) ensures the plausibility of factor structure resulting from the EFA. Figure 1 confirmed 24 indices loaded on six latent variables (P.S., R.C., QIE, P, JIT, TQM) with greater than 0.80 and the CFA showed the Quality of the model with values close to those indicated (CFI = 0.981, RMSEA = 0.058) by Hair et al. (1998) and (Netemeyer et al., 2003; Hu et al., 1999), who suggested CFI \geq 0.90 and RMSEA 0.06 and Table 3 shows model fit measures.

5.3. Hypothesis Testing

Structural equation modeling (SEM) was used to test the hypotheses, specifically the (path analysis) method, which is one of the structural equation modeling methods, as shown in Figure 1 and Tables 4 and 5 where it was found that:

- There is an effect at the 0.01 significance level for Quality of Information Exchange (QIE) on the Just in Time (JIT) there is an effect at the 0.01 significance level for Postponement (P) on the Just in Time (JIT),

Table 1: KMO and Bartlett’s Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		828
Bartlett’s Test of Sphericity	Approx. Chi-Square	2213.003
	Df	276
	Sig.	0.000

Table 2: Rotated Component Matrix

Phrases	Components						
	Code	PS	RC	QIE	PM	JIT	TQM
The institution selects the optimal supplier in terms of Quality	PS1	0.897					
The institution chooses the optimal supplier in terms of cost	PS2	0.878					
The institution chooses the optimal supplier in terms of supply time	PS3	0.856					
The institution participates with suppliers in decision-making	PS4	0.825					
The institution offers products that meet the aspirations of customers	RC1		0.908				
The institution provides products to gain customer loyalty	RC2		0.883				
Enterprise participates with suppliers in product development	RC3		0.865				
The institution provides after-sales services to its customers	RC4		0.844				
The institution provides information about the customers it deals with	QIE1			0.883			
The institution provides information about the suppliers it deals with	QIE2			0.858			
The institution provides information on how to contract with suppliers	QIE3			0.857			
The institution provides sufficient information on each supplier separately	QIE4			0.834			
The institution postpones the process of searching for other suppliers to deal with qualified suppliers	P1				0.873		
The institution postpones the supply process because it has sufficient materials and equipment	P2				0.870		
The institution postpones the supply process because it has sufficient materials and equipment	P3				0.794		
The institution postpones the delivery process because it provides advantages to customers	P4				0.788		
The institution provides its customers with the required products on time	JIT1					0.828	
The institution provides its customers with products of the required quality on time	JIT2					0.811	
The institution delivers products on time to its customers	JIT3					0.808	
The institution is interested in reducing the products delivery time to its customers	JIT4					0.771	
The institution cares about the overall quality of all its operations	TQM1						0.764
The company is interested in the continuous improvement of its products	TQM2						0.665
The institution supports the participation of employees in their decisions	TQM3						0.626
The institution contributes to the continuous training of employees	TQM4						0.566

Table 3: Model Measure

Measure	CMIN	DF	CMIN/DF	CFI	RMSEA	PClose
Estimate	330.917	240.000	1.379	0.957	0.056	0.236
Threshold	–	–	Between 1 and 3	>0.95	<0.06	>0.05
Interpretation	–	–	Excellent	Excellent	Excellent	Excellent

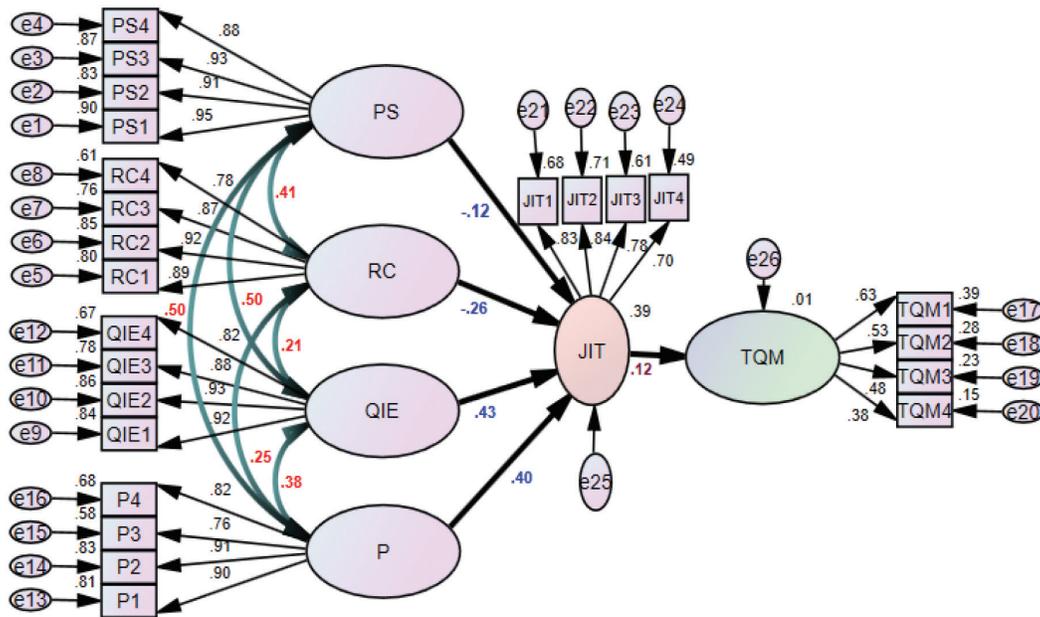


Figure 1: Structural Equation Modelling

Table 4: Standardized Direct Effects

Hypothesis	Standardized Estimates	C.R. t-value	p-value	Hypothesis Supported?
JIT ← PS	-0.084	-1.088	0.277	No
JIT ← RC	-0.275	-2.705	0.007	No
JIT ← QIE	0.304	4.128	***	Yes
JIT ← P	0.265	3.807	***	Yes
TQM ← JIT	0.080	0.907	0.364	No

p-value < 0.05; *p-value < 0.001. Significant at the 0.05 level.

Table 5: Standardized Indirect Effects

Hypothesis	p-value	Hypothesis Supported?
TQM ← JIT ← PS	***	Yes
TQM ← JIT ← RC	***	Yes
TQM ← JIT ← QIE	***	Yes
TQM ← JIT ← P	***	Yes

p-value < 0.05; *p-value < 0.001. Significant at the 0.05 level.

there is no effect at the 0.05 significance level for Partnership with Suppliers (PS) on the Just in Time (JIT), there is no effect at the 0.05 significance level for Relationships with Customers (RC) on the Just

in Time (JIT) in Riyadh Governorate commercial companies, which confirms the acceptance of (H1) partially.

- There is an indirect effect at the 0.01 significance level for Quality of (QIE) on the (TQM), there is an indirect effect at the 0.01 significance level for (P) on the Total Quality Management (TQM), there is an indirect effect at the 0.01 significance level for Partnership with Suppliers (PS) on the Total Quality Management (TQM), there is an indirect effect at the 0.01 significance level for Relationships with Customers (RC) on the Just in Time (JIT) in Riyadh Governorate commercial companies, which confirms the acceptance of (H2).
- There is no effect at the 0.05 significance level for the Just in Time (JIT) on the Total Quality

Management (TQM) in Riyadh Governorate commercial companies, which confirms the unacceptance of (H3).

6. Conclusion

It is clear from the effect of TQM principles and SCM using JIT as a mediator that it is appropriate to integrate the main TQM principles with supply chains to create cooperation between organizations, customers, and suppliers. Through this cooperation, Riyadh Governorate commercial companies achieve several advantages in the short term, such as lowering production or service costs, consistent with Diamandescu (2016). It turns out that companies' supply chain practices (P, QIE) affect JIT. In contrast, companies' SCM practices (P.S., R.C.) do not affect the JIT, and it also turns out that there is an indirect effect of SCM practices (P.S., R.C., P, QIE) on TQM by mediating production on time. The researchers recommend studying the reasons that prevented the impact of some SCM practices on JIT in Riyadh Governorate commercial companies, and studying the impact of SCM practices on JIT and TQM in industrial companies in Saudi Arabia.

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