

# Uncertain Supply Chain Management

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## Determinants influencing the supply chain performance in Saudi Arabia

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### CHRONICLE

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### ABSTRACT

Supply chain management is essential for enhancing an organisation's position among its competitors by improving its efficiency and effectiveness. The fundamental goal of this study is to recognize the effect of the supply chain responsiveness, flexibility, and its adaptation within the Saudi Arabian business industry. The data in this study were collected from a sample of 390 participants in senior business positions, and then analysed using the multiple regression technique. The results indicated that both the measurements and model have satisfactory fit indices and showed that the three hypotheses raised in this study could be accepted. Additionally, the results demonstrated that both the responsiveness and adaptation of the supply chain exert a positive effect on how the supply chain performs. So, the faster the organisation responds and adapts to the supply chain activities, the higher performance they tend to get.

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## 1. Introduction

Supply chains have become an important phenomenon since they are used by organisations to reach their goals. The supply chain is the link between resources and operations that includes raw materials, the delivery of finished products to the final customers, merchants and industrial facilities, and those in charge of supply systems, internal distribution centres, distributors and any other entities that pave the way to reach the ultimate customer satisfaction (Chan et al., 2017). Supply chain management is defined as the management of information, materials, money and services in business activities to maximize the effectiveness of operations in an organisation. It also involves introducing new tools and changing or modifying known methods that are efficient and effective. In relation to supply chain management, efficiency is characterized as the right things to be accomplished; meanwhile, effectiveness is the achievement of the right things (Dubey et al., 2018). Successful supply chain management will reduce the costs for both suppliers and customers, manage risk, add value to supply chain activities, and improve the profit margin. Consequently, companies that are effective in supply chain management are more successful among their competitors (Brusset & Teller, 2017). Supply chain management demonstrates the complementarity of the functions and processes performed by the various parties and organisations and ultimately helps improve the competitiveness of these parties, whether within the domestic or global market.

## 2. Literature review

### 2.1 Supply Chain Management

Supply Chain Management involves planning, managing, and identifying the sources an organisation purchases and transfers goods to and from. It also includes the coordination and cooperation of channel partners such as suppliers, intermediaries, and customers (Shi & Yu, 2013). In other words, supply chain management is a critical component of

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organisations that helps connecting partners together and facilitating communication across the other parties (Tran et al., 2020). Supply Chain Management is also important for organisations to reach globalization and achieve a competitive advantage on an international scale. Since competition has moved from competition between organisations to another more powerful form which is competition among organisations' supply chains, it has become more vital for organisations to respond quickly and alter their supply chains to align with the constant changes in the business environment (Shibin et al., 2016). Success in managing the supply chain is one of the strategic challenges facing business organisations. Successfully managing supply chains is challenging because supply chains, in their nature, are about integrating diverse and different parties of the chain that includes diverse suppliers, manufacturers and customers. The integration of these parties helps organisations reach their long term growth and financial goals (Liu et al., 2019).

## *2.2 Supply Chain Objectives and Operations*

There are many goals for the supply chain within an organisation, provided next is a summary of these goals: to improve the organisation's competitive position by controlling supply activities that contribute to the goals and strategy of the organisation; to ensure the uninterrupted flow of materials, components, and services to and from the organisation; to maintain a safe and minimal stock to reduce losses resulting from maintaining stock and prevent supply interruptions; to maintain and improve the quality of the goods and services provided by an organisation; to find and develop potential suppliers to work with to obtain the best results in the long run; to standardize purchased components and production processes, which lead to lower risks in the business environment and reduce prices through large-scale purchases. Also, to help organisations buy parts and goods at the lowest possible price to reduce costs. Organisations should take into consideration that goods and services bought at lower prices usually result in lower quality, which is something that doesn't align with all organisations' goals. Finally, supply chains create harmonious internal production relationships between the supply group and other members involved within the other organisational departments and functions (Altay et al., 2018).

The essential benefits of successful supply chain management is reflected on both the customers and suppliers of an organization. One of the most important aspects of business is achieving customer interaction and acquisition, and supply chain management helps the organisations achieve this. An efficient supply chain can reduce costs, increase market share and sales, and achieve strong customer relationships. All of this leads to savings and an increase in the facility's cash flows, which in turn also increases the market value of stocks. Moreover, optimizing a supply chain can positively influence the factors that further lead to an increase in the market value of stocks. Since optimal supply chains move products quickly, organisations benefit from this speed and efficiency, as it contributes to higher sales, cost reduction, and an efficient use of fixed assets. Altogether, these factors also increase the market value of the stocks. In an optimal supply chain, capital costs such as operating costs for factories and warehouses are at a minimum. For instance, if orders are more than the sales forecasts, which are the basis for production and manufacturing, production will be more than the customers' demand. Thus, when the inventory is at a minimum stock, there will be a reduction in the number of stores needed. In addition to lowering costs, effective supply chain management will maximize the company's working capital. This is because the stock will be instantly converted into receivables, and from a financial point of view, this transformation of the stock into cash will have a positive impact on the market value of the facility (Khorasani, 2018).

According to Sutducan et al. (2019) supply chain activities work collectively and can increase revenue, achieve better cost control, offer better use of assets and with successful implementation will convincingly achieve greater consumer satisfaction and profitability growth.

The criterion used to measure the supply chain performance include customer relationship and service management, manufacturing and demand management, product development, return management, order fulfilment, and commercialization (Dissanayake & Cross, 2018).

To improve the efficiency of the performance of the supply chain, organisations are required to learn to better forecast, flexibly manage inventory and effectively plan and schedule all operational activities of all resources. Thus, a shift in the efficiency of the supply chain also means the reduction of costs and maximization of profitability; however, this will only be accomplished by assimilating all the value-adding activities performed by the organisation (Kumar et al., 2017).

All activities in the operation process are directly responsible for producing and providing organisation's goods and/or services. The outputs from the operation process of organisations are different, as some organisation's outputs are purely products (such as oil production) and others are purely services (such as education sectors), whereas some organisations produce a mix of products and services at the same time (such as restaurants) (Slack and Brandon-Jones, 2018). Thus, this study focuses on all three type of operations and outputs, the pure goods, services, and the mixture of products and services.

## *2.3 Measuring Supply Chain Performance*

Successful supply chain management provides the capability to reduce the costs for both customers and suppliers and also manage risk, and maintain or improve the added-value and profit margin. Consequently, companies that are effective in supply chains are more successful in business (Brusset & Teller, 2017). In order to be a successful business and achieve its ultimate goals, organisations must measure the degree of success (Neely et al., 2005) in optimizing the utilization of productive resources and meet their customer needs (Hallgren & Olhager, 2009).

Neely et al. (2005) defines performance measurement as the practice of computing the effectiveness and efficiency of an activity performed in an organisation. In other words, performance measurements can also be used to quantify the efficiency of the end results. According to Chan and Qi (2003) there are six core processes in supply chain which can be used as composite performance measures these include outbound logistics, sales, and satisfactions of end customers. This study focusses on sales, order fulfillment, just-in-time deliveries, customers' satisfactions, and lead time as supply chain management performance.

The advantage of implementing supply chain management in organisations would increase the sales and market share as result of a comprehensive arrangement that span from raw material sourcing to end customer purchase (Ferguson, 2000). Supply chain management and activities have positive impact on company sales. Study by Tunc et al. (2017) found there are associations between supply chain characteristics and company sales. For example, if the company seeks customers' need and identify goals that can meet those needs through supply chain activities then the total sales will grow as result of this efficiency in supply chain (Mensah et al., 2014). The order fulfillment strategies assist organisations in responding to the high levels of demand (MacCarthy and Brabazon, 2020). Also, it is about designing a process that meets customer requests and minimises the costs of generating, filling, delivering and servicing customer orders (Croxtton, 2003). Therefore, order fulfilment can affect the financial performance as well as other parties the exist within the supply chain network. Just-in-time (JiT) deliveries are critical for many organisations. Basically, JiT deliveries help organisations to speed up order fulfillment and reduce stocks so that the production of products starts only when the order is placed and thus stocks will be delivered when needed (Hubl et al., 2015). JiT deliveries release orders at the scheduled time and place, from the right source, with the right price, to the scheduled place, since they obtain all the right information directly from the parties within the supply chain (De Toni and Nassimbeni, 2000). By utilizing those attributes organisations will improve their competitive position and keep their inventory investment at the lowest possible operation costs. Customer satisfaction has been linked to organisation performance, and there are a number of studies that investigated the relationship among customer satisfaction and performance (Yu et al., 2013, Heskett et al., 1997). The relationship between customer satisfaction and performance has been found significantly correlated (Dotson and Allenby, 2010, Narayanan et al., 2011, Lambert et al., 1998). Therefore, satisfaction of the end customers has been added in this study to measure the supply chain performance.

The competition on the time of manufacturing lead to organisations lowering their overall cycle time and providing faster services, which also impacted the supply chain performance (Harrison et al., 2014). When organisations deal with time directly by shortening their cycle manufacturing times and making faster inventory turns faster, they lower costs and improve customers' satisfaction. According to Karmarkar (1993) lead times could be affected by capacity, loading, batching, and scheduling, which will also affect costs and control.

#### *2.4 Supply Chain Performance and Supply Chain Responsiveness*

Several studies have shown that there exists a relationship between how the supply chain responds and performs. In one study, Hallavo (2015) found that there is an immediate relationship between how the supply chain responds and performs. Similarly, Danese et al. (2013) confirmed a positive relationship between the practices followed by organisations in its supply chain and its responsiveness. The results of the Hallavo (2015) study demonstrated the influence of the supply chain response and the manufacturing response on the company's performance (supply chain objectives), and the results showed that rapid responsiveness lead to distinct organisational performance, especially in the moderated role of operation uncertainty that exists in the supply chain response. Danese et al. (2013) further researched the influence of internal and external supply chain integration and the modified role of the international supply network, in positive outcomes. The study sample included 266 factories in several countries of the world. The results showed that internal and external assimilation procedures strengthened in the response and that there is a modified effect of the international supply network on the relationship between external assimilation and response. Effective organisations responsiveness can also contribute to improving the supply chain objectives and performance, as they are able to responding to the various and diverse demands, low manufacturing, supplier, and delivery performance, and how fast organisations are responding to new markets, goods, and services. Supply chain performance includes the organisation sales, order fulfillment, JiT deliveries, and lead time can benefit from the organisation's openness of communication and quick response to supply chain issues as they provide for the various and changing demands, reduce machine breakdown or poor services, condense any low performance from their suppliers, process orders on time, deliver orders quickly, and meet due dates.

From the previous paragraphs, the following hypothesis needs to be tested:

*H1: Supply chain performance is positively related to responsiveness performance.*

#### *2.5 Supply Chain Flexibility and Adaptation*

Koh et al. (2007) explained that the major purpose of optimal supply chain management is being able to differentiate a business entity in the eyes of its consumers from its competitors by operating at lower costs and by achieving greater profits. Production time, forecasting, resource planning, cost reduction, stock level reduction, all can be accomplished through the flexibility of the supply chain flexibility and its strength to adopt all the necessary changes quickly.

Supply chain management processes enhance the company's resilience. An organisations' resilience is defined as the company's capability to adopt to changes occurring in its business environment. Building long-term relationships with

partners, suppliers and customers helps to improve supply chain flexibility through mutual understanding among members and outsourcing as a practice. Supply chain management provides internal flexibility for core activities within the company which also contributes to an increase in responsiveness by reducing delivery time, on-time delivery (Chang et al., 2005). Successful organisations must be able to adapt change and respond to the market needs in order to achieve their strategic objectives (Yusuf et al., 1999).

This can be achieved by the organisation's flexibility and capability to introduce new goods or services in the market regularly, and their ability to increase production and alter the production volumes when needed. Along with that, their ability to deliver the required products or services to the right customer. Also, the ability of their employees to change tasks. This leads to the following hypotheses:

*H2: Supply chain performance is positively related to its flexibility and adaptation.*

*H3: Supply chain flexibility and adaptation are positively related to supply chain responsiveness*

### **3. Methodology**

#### *3.1 Questionnaire Design*

With regard to this study, quantitative analyses have been adapted to illustrate how the context can be seen, measured, and understood. The deductive approach can be used to establish facts, and test hypotheses; therefore, the survey research method was selected for this research.

The type of information needed from participants can be knowledge, attitudes and opinion, behaviour, and attributes (Taylor and Marshall, 1996). In construction of the questionnaire, this study considered the five major process for designing a survey. According to Frazer and Lawley (2001) the five process are first to determine the information and data which is required to fulfil the research objectives. Second, administer the process of the questionnaire. Third, prepare a first draft of the questionnaire. Fourth, pre-test the questionnaire and revise it on order to avoid mistakes, inappropriate wording, or unclear questions. Finally, assess the reliability and the internal validity of the research's questionnaire.

The types of questions, and the administration processes were considered during the designing of the questionnaire, and the questions were carefully designed to fulfil the research objectives. The final version of the questionnaire contained five major sections of grouped questions.

Section One - Demographic questions, which are attribute question. This section includes the participant's position, number of employees in the organisation, the age of the organisation in business, and the annual turnover in Saudi Riyal.

Section Two – The type of the organisation. These are also attribute question. In this section, participants were asked to state the type of the operations and outputs that are produced in their organisation, whether pure goods, pure services, or a mix of products and services together.

Section Three – Supply chain responsiveness, which are belief and opinionated questions. This section required the participants to state their opinions and judgements on the supply chain responsiveness of their organisation. Their responses were measured using a 5-point Likert scale, anchored at one end by 1 highly disagree and at the other by 5 highly agree.

Section Four - Supply chain flexibility and adaptation, which are also belief-related and opinionated questions. This section required the participants to state their opinions and judgements on the supply chain flexibility of their organisation and its ability to adapt changes. Their responses were measured using a 5-point Likert scale, anchored at one end by 1 highly disagree and at the other by 5 highly agree.

Section Five – Supply chain performance, which are attitude-related and opinionated questions. It measures the output performance of the organisation's supply chain activities which covered sales, order fulfilment rate, JiT deliveries, customer satisfaction, and manufacturing lead time. Their responses were measured using a 5-point Likert scale, anchored at one end by 1 very bad and at the other by 5 very good.

#### *3.2 Content Validity*

Formal interviews were conducted with supply chain and operation experts in different industries to verify all the empirical indicators identified from the literature review. Using experts' opinions and perspectives will reduce bias and increase the validity the research constructs (Nunnally, 1970). Also, García-Valderrama and Mulero-Mendigorry (2005) suggest that an adequate result could be obtained with expert opinions and could strengthen the findings of the research.

Therefore, a pilot study was conducted by using seven participants from the related industry and academia in order to confirm the content validity and remove mistakes and/or problems. As a result of the pilot study, the questionnaire was modified by rewording and deleting some ambiguous questions.

Table 1 shows the description of variables used in this research and reports the means and standard deviations.

**Table 1**  
Descriptive of variables

Variables	Variables description	Mean	SD	Min	Max
<b>Dep. variable</b>					
<i>Supply Chain Performance</i>					
E1: Increase sales	Company sales	3.57	.91	1	5
E2: Order fulfilment	Company order fill rate	3.51	.77	1	5
E3: Just-in-time deliveries	On time deliveries	3.45	.89	1	5
E4: Customer satisfaction	Satisfaction of end customers	3.48	.91	1	5
E5: Manufacturing lead time	Competition on manufacturing lead time	3.37	.82	1	5
<b>Indep. variable</b>					
<i>Supply Chain Flexibility and Adaptation</i>					
D1: New products or services	Flexibility to introduce new products or new services in the market	3.29	1.21	1	5
D2: Production level	Ability to change the level of production volumes	3.38	1.01	1	5
D3: Right customer	Flexibility to deliver the required product or services to the right customer	3.55	1.08	1	5
D4: Flexibility to change tasks	Flexibility of employees to change tasks	33.45	1.08	1	5
<i>Supply Chain Responsiveness</i>					
C1: Demand variations	Capability to react and sustain the various demands of the market	3.46	1.19	1	5
C2: Poor manufacturing performance	Capability to react and sustain the periods of low manufacturing	3.25	.93	1	5
C3: Poor supplier performance	Capability to react and sustain the periods of low supplier	3.48	.96	1	5
C4: Poor delivery performance	Capability to react and sustain the periods of low delivery	3.42	.93	1	5
C5: Responding to new markets	Capability to react and sustain new products, new markets, new services	3.32	1.04	1	5
<b>Control variable</b>					
Firm Type	The respondents asked to identify what type of their organisation (1- Pure Service 2- Pure Goods 3- Mix)	1.48	.75	1	3

### 3.3 Data Collection and Analysis

After conducting the pilot study, the questionnaire was refined into an online questionnaire using Google Forms. Furthermore, the link of the structured questionnaire was distributed through e-channels such as email and related WhatsApp contacts in Saudi Arabia as the targeted segment for this study. This research ended up including a sample of 390 participants in senior organizational positions. A variety of statically analysis methods were applied in this research to examine the research hypotheses such as the use of descriptive and inferential statistics. For this purpose, the data were analysed using a multiple regression technique, which is a convenient and applicable method to indicate and predict the previously hypothesized correlations among a set of substantively meaningful variables.

### 3.4 Reliability

Reliability tests were performed for each construct to assess the internal consistency of the items. The results, shown in Table 2, the Cronbach  $\alpha$  coefficient used to denote the supply chain performance was 0.82, the supply chain flexibility and adaptation were 0.82, and the responsiveness of the supply chain was given a 0.80. According to Hair et al. (2010) all of these numbers are significantly higher than the acceptable level of 0.6. Therefore, the instrument appears to have adequate reliability.

**Table 2**  
Rotated factor loading (pattern matrix)

Variable	Item	SCP	SCFA	SCR	Uniqueness
<b>Supply Chain Performance</b>					
	E1	.81			.35
	E2	.82			.33
	E3	.80			.36
	E4	.68			.54
	E5	.73			.47
<b>Supply Chain Flexibility and Adaptation</b>					
	D1		.76		.42
	D2		.82		.32
	D3		.79		.37
	D4		.86		.26
<b>Supply Chain Responsiveness</b>					
	C1			.77	.41
	C2			.79	.37
	C3			.75	.43
	C4			.77	.40
	C5			.64	.59
<b>KMO</b>		.77	.73	.82	$\geq .5$
<b>Bartlett test</b>		732.860	594.673	553.483	***
<b>Cronback's <math>\alpha</math></b>		.82	.82	.80	$\geq .7$

#### 4. Results

To contrast the hypotheses and to verify the influential relationships of the capabilities and the role of the mediating variables on supply chain performance, we used the multiple regression technique. The purpose of regression analysis as a statistical technique is to use the independent variables to predict selected criterion variable (Hair et al., 1998). Table 1 provides the means, standard deviations and pairwise correlation coefficients for study variables, and Table 4 provides the results of the logistic regression models. Correlations of Table 3 showed some variables to be highly correlated. Thus, we also conducted a diagnostic test of multicollinearity [examining the variance inflation factors (VIFs) of all variables in the analyses], and according to Hair et al. (1998) the recommended level for the tolerance index is greater than 0.10 and for the VIF a number lower than 10.0. These criteria enabled us to determine that there is no collinearity in any of the models. The values for each criterion are greater than 0.10 and less than 1.45, respectively. Therefore, we found that it was not likely to be a problem in this data set.

**Table 3**  
Colleration Matrix

Variable	Obs	1	2	3	4	VIF
Supply Chain Performance	390	1.000				
Supply Chain Flexibility and Adaptation	390	.36***	1.000			1.42
Supply Chain Responsiveness	390	.37***	.54***	1.000		1.44
Firm Type	390	-.09*	-.05	-.02	1.000	1.06

According to Holmes-Smith (2013) when the factor loading is significantly different from zero, the estimated coefficient does not need to be greater than 0.6 to achieve convergent validity. Therefore, factor loadings are statistically significant because they achieve the minimum requirement. Table 2 Shows the factors loading for all latent variables, which range from 0.64 to 0.86. The results of the regression analysis for each model are shown in detail in Table 4. A Pearson's correlation was also run to assess the relationship between the performance, adaption and flexibility of the supply chain. There was a moderate positive correlation among the supply chain adaptation and supply chain performance,  $r = .36, p < 0.001$ . This provides support to hypothesis number H1. Also, A Pearson's correlation was run to assess the relationship between supply chain performance and supply chain responsiveness. There was a moderate positive correlation between supply chain responsiveness and supply chain performance,  $r = .37, p < 0.001$ . This provides support to hypothesis number H2. Likewise, there was a strong positive correlation between supply chain responsiveness and supply chain flexibility and adaptation,  $r = .54, p < 0.001$ . This provides support to hypothesis number H3. In Table 4, model 1 presents the logistic regression results with only the control variables. Model 2 is the full model with only significant variables. A linear regression established that supply chain responsiveness could statistically and significantly predict supply chain performance,  $F(4, 385) = 25.31, p = .0001$  and the supply chain responsiveness accounted for 22% of the explained variability in supply chain performance. So, the faster the organisation respond the higher performance they tended to get.

Similarly, supply chain flexibility and adaptation could statistically significantly predict supply chain performance,  $F(4, 385) = 25.31, p = .0001$  and the supply chain flexibility and adaptation accounted for 21% of the explained variability in supply chain performance. So, the more the organisation adapts the higher performance they tended to get.

**Table 4**  
Logistic Regression

Variable	Model 1		Model 2 (Main model)	
	Coefficient	SE	Coefficient	SE
Supply Chain Flexibility and Adaptation			.22***	.05
Supply Chain Responsiveness			.21***	.05
<b>Control variable</b>				
Firm Type				
Pure goods	.44***	.13	.32**	.12
Mix	-.46***	.14	-.36***	.13
Number of obs.	390		390	
Model R2	.0645		.2082	
Adjusted R2	.0597		.2000	
Model F	13.34		25.31	

#### 5. Discussion and Conclusion

The main aim of this study was to determine empirically the degree to which the supply chain's responsiveness, flexibility and adaptation influence its performance within the Saudi Arabian business industry. The results indicated that both the measurements and model have satisfactory fit indices and showed that the three hypotheses could be accepted. The supply chain performance components, which includes sales, order fulfillment, on time deliveries, customer satisfactions, and lead time were adopted and modified from the scale by Chan and Qi (2003) and Tunc et al. (2017). By using exploratory factor analysis, the variables produced a good construct, validity, and internal consistency. Likewise, the variables of both supply chain responsiveness and supply chain flexibility and adaptation were high on validity and internal consistency.

The study results demonstrated that the supply chain responsiveness exerts a positive influence on performance in regards to reacting and sustaining the demand variations. Some demand variations included periods of low manufacturing, supplier, and delivery performance, and even periods of new goods, markets and services. This result is consistent with Nyaoga and Magutu (2016) who suggest that firms can improve their supply chain performance through better relationship between awareness of their management and performance.

Furthermore, the results confirmed that the firms' ability and flexibility to introduce new products or services in the market, change the level of production volumes, deliver the required product or services to the customer, and empower their employees to change tasks all have a positive and direct effect on supply chain performance. Some of these direct effects include increasing sales, improving order fulfillment, expanding Just-in-time deliveries, reducing inventory, improving customer satisfactions, and advancing manufacturing lead time.

To conclude, this study identified the positive relationships between supply chain responsiveness, performance, flexibility and adaptation. There was also a strong positive relationship between supply chain responsiveness and adaptation.

The study results permit conclusions about the fast and early response to demand variations, poor manufacturing, supplier, and delivery performance and a new competitive market in favour of a positive supply chain performance. The results also permit the acceptance of the hypotheses that firms' supply chain performance is positively related to how the supply chain responds and adapts. Finally, the research results also support the idea that proactivity towards early and rapid response to supply chain activities and maintaining efficient adaptation are associated with greater supply chain performance.

## 6. New Research Directions

A number of possible future research directions are offered in relation to the findings presented above. Firstly, while this study focused on supply chain practices in Saudi Arabia companies, there is an opportunity to replicate this study from the context of other developed or developing countries. Secondly, this study explored the relationship between supply chain practices variables and its association with supply chain performance. However, exploring the relationship between firm's strategy and supply chain performance would be needed in order find to what extend the strategy tactics are associated with supply chain performance.

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