

**SUPPLY CHAIN MANAGEMENT PRACTICES AS A MEDIATOR VARIABLE FOR THE IMPACT OF THE PRODUCT DEVELOPMENT STAGES ON OPERATIONS MANAGEMENT DECISIONS**

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**SUPPLY CHAIN MANAGEMENT PRACTICES AS A MEDIATOR VARIABLE FOR THE IMPACT OF THE PRODUCT DEVELOPMENT STAGES ON OPERATIONS MANAGEMENT DECISIONS****Abdullah Abbas AL-khrabsheh**

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**Keywords:** supply chain management, product development stage, operation management.**Abstract:** In this study, the researchers have attempted to determine the common Supply Chain Management (SCM) activities that were used as a mediator variable and influenced the effect of the product development stages on the implementation of operation management decisions in the companies belong to the Al-Manaseer Group in Jordan. For this purpose, they used a quantitative method, wherein they distributed questionnaires to the employees and management of the Al-Manaseer Company groups (such as the Director, Department Director, Head of the Section, Workers' Monitor). This helped them understand the relationship between the product development stage and the operational management decisions. They noted that the SCM activities were a significant variable that mediated the effect of the product development stage on the operational management decisions. Based on the findings of the study, the researchers recommended that The Group needs to show a higher interest in the site costs as the selection indicator and for determining the preliminary estimates while considering the information sharing.**1 Introduction**

In the past few decades, massive globalisation has converted the whole world into a small village, which has increased competition amongst the different companies and markets, worldwide. The customer always strives to acquire products and services from the right place and values quality and price competition. If the companies wish to achieve this and cater to a large variety of customers, they need to fulfil their demands of speedy delivery, high quality, cost-effectiveness, creativity, and flexibility.

[1] Supply Chain Management (SCM) refers to a hard and fast of procedures utilized in enterprise that variety from suppliers, manufacturers, warehouses, distributors, and outlets to customers (very last customers). [2] demonstrating that optimizing logistics solutions, it has been proved that focusing on "best practices" enables for long-term supply chain development, greater market share, the formation of trust links, and the promotion of a strong brand identity.

The companies can derive all the above advantages by studying the Supply Chain Management (SCM) activities, which offer integrated and diverse services that suit the customers, decrease the costs and improve their profitability. The supply chain practices help in material flow, information flow, financial flow and also help in the sustainability of the organisation's relationships with its customers that is based on the Internet and information

technology. These practices help in sharing the resources and information with other companies, which facilitates them to fulfil their objectives [3].

The organisations can also develop products using SCM practices. In one study, [4] highlighted the significance of developing novel products that are not available in the market, for ensuring that the companies enjoy longer business success. Many researchers have noted that the supply chain practices contribute to the company's growth, improve their profit performance, and play a vital role in business planning. The development of new products allows the companies they employ skilled people, increase their economic growth, achieve technological progress and improve the standard of living. Hence, the companies need to develop novel products and use better processes for their development.

The product development stages also affect the operational management decisions. [5] mentioned that operations are an important component of any organisation that helps them produce new products and services.

**2 Methodology**

H1: A significant relationship exists between the various product development stages (such as preliminary estimates, development and testing, economic analysis, final planning, and a broad production release) and the operation management decisions.

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H2: The product development stages (such as preliminary estimate, development and testing, economic analysis, final planning, and a broad production release)

significantly affect the operational management decisions, mediated by the SCM practices.

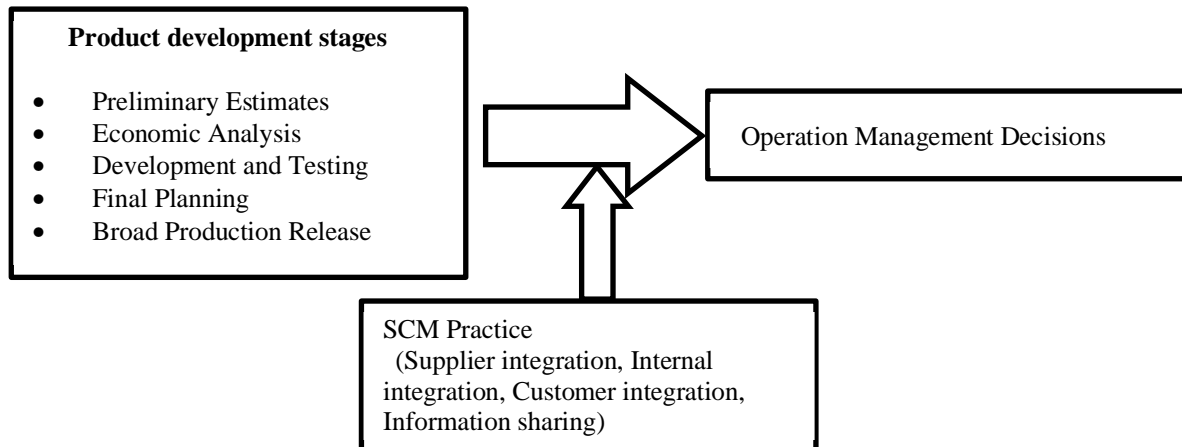


Figure 1 Research model

**3 Literature review**

Many researchers have noted that the supply chain practices were a significant step as they help the company decrease its costs and also ensure that the companies benefit from various external opportunities as these practices improve the relationships between the customer and companies, and also between the supplier and the company. SCM practices help in managing the information flow and control the number of resources and services offered by the company such that it increases its operations [6].

Furthermore, the SCM practices play a vital role in the modern economy and assist many companies to improve their finances, thereby improving the economic condition of the country. Many researchers attempted to integrate the different supply chain factors into the customer-driven management system [7]. The SCM practices allow the organisations to show their competitive advantage in business. These activities highlight the value of the organisations as all sections in the organisation can use and disseminate resources in a very effective manner [8].

The concept of SCM is very novel and modern. A few researchers stated that the SCM activities play an effective and vital role as they ensure that the companies can easily face their competitors. These activities allow all organisational members to control the complete product development process, right from their access to raw materials to the product marketing stage and finally to its delivery to the customer [9].

A supply chain consists of a group of 3 or more organisations that are directly connected through steps like Downstream and Upstream Suppliers, information flow, financial flow and exchange of products and services [10]. It can be also described as a group of close and interrelated activities, such as manufacturing, designing and delivery

of products and services through distribution channels [11].

[12] stated that a supply chain creates a loop around a customer, as it starts and ends with the final customer. All the finished materials and products pass through the loop. The supply chain refers to a mobile network of all facilities that help organisations to fulfil their objectives. The SCM practices have the following characteristics:

- Cooperative relationships: The logistics of an organisation are dependent on the information technology processes since these processes improve the cooperative relationships. Cooperative relationships are vital as they improve the organisation’s strengths that further improve and enhance their competitive advantage [13].
- Process Integration: This step is characterised by shared technology, trust, partnership, and better collaboration [14].
- Integration of information: This refers to the process of accurately accessing the information provided to the organisations and firms, at a reasonable cost and proper time. This step ensures that the cost of deriving information decreases over a period [15].

In their study,[16] presented 3 major objectives of the SCM activities. Objective 1 includes the overall framework and directions needed for fulfilling their needs and implementing the material management activities efficiently. Objective 2 includes a proper technique for managing the information input from outside the company. [17] described many SCM objectives, such as – 1) Decreasing costs and improving efficiency, 2) On-time delivery, 3) Improving the logistic services that are offered to the customers and company partners, 4) Decreasing the inventory levels, increasing the efficiency of the resource investments, and enhancing the value-added chain, and 5) Ensuring the flexibility of all the above steps.

[18] demonstrates that using SCM techniques increases corporate performance and is linked to competences such

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as R&D, technology commercialization, production capability, and marketing capabilities. As a result, a combination of SCM methods and organizational competences can result in long-term overall sustainability. Small- and medium-sized businesses (SMEs) perform well.

[19] stated that the major objective of the SCM activities was to encourage the companies, institutes, people and employees in a specific sector to shift to a new system that improved the mutual trust amongst all these parties, by developing a novel communication and participatory system. Thus, it could improve the integration and consistency between the new procedures and work system.

[20] described many components that could be included in the SCM structure, such as control and planning, work structure, product flow structure, overall organisation's structure, information flow structure, management techniques, leadership and power structure, risk-reward structure, culture and attitude. The organisational structure of the supply chain included the following steps: Measure, Resource Management, Main data management, Production and processes, System management and Distribution [21].

#### 4 Product development

The product development process includes different stages needed for developing a product from the idea or concept phase to market release and even beyond. Thus, this process consists of the product's complete journey, from identifying the market needs, conceptualising, or designing a product, constructing the product roadmap, developing a viable product, offering this minimal viable product to the users and iterating the product based on the user feedback (Product Plan 2018).

In their report, [22] stated that the Product Development process was a complete process that considered the product/ service from its conceptualisation to its market release. Rebranded or new products/services are developed for fulfilling the customer demands or exploiting an opportunity present in the market. Some of the steps included in the product development process include – drafting a concept related to the service or product, creating a product/service design, developing the product/service, and determining the marketing strategy.

This product development process is systematic and works in a stepwise manner to develop or modify new or existing products. This process ensures that the institutions and markets need to fulfil the customer demands, after considering the strengths and competitive advantage offered by the competing organisations [23].

[24] observed that a few institutions believe that people are reluctant to change and refuse to try new products or services. This could cause the failure of new products. Many factors contribute to the success of a new product, such as:

- Developing a better and novel product.

- The product needs to satisfy the customer or market demands.

- Product development requires a lot of work.
- The developer must define the properties of a product in the early development stage.

- Implementation quality.
- A proper institutional structure and good atmosphere.
- Making focused and better decisions during the product development process.

- Proper planning and collecting all resources before starting the product development.

- Senior management plays a vital role.

- Speedy development, without compromising on the product quality.

#### 5 Operations management

Operation management is regarded as a significant component of any organisation that wants to succeed as it helps in managing resources needed for the development and transfer of new products or services. [25] stated that the main aim of operation management was to assist the business practitioners to improve their understanding regarding the operation management tools concepts and techniques related to their environment. The operations management process includes 3 primary tasks, i.e., Creation of new knowledge, transferring this knowledge, and Communicating ideas from the research stage to the development of novel teaching materials.

[26] stated that the operational management process has many benefits like Profitability Management, Manufacturing Edge Regulatory Compliance and Competitive Advantage.

#### 6 Related literature

[27] investigated the supply chain disruptions faced by the 3rd-Party Logistics service providers (3PLs) and their subsequent effect on their clients in South Africa. For this purpose, they studied the disruptions that were faced by the organisations and the steps implemented for managing these issues. The researchers used a generic qualitative approach for collecting the data by conducting some semi-structured interviews of 22 respondents, comprising of 11 client organisations and 11 3PLs that were operational in South Africa. The researchers classified the disruptions noted in the study as intra-, inter-, and extra-organisational. They noted that the clients and 3PLs in South African faced a majority of inter- or intra-organisational disruptions. The primary focus of the 3PLs and clients shifted from the risk management process to disruption management. The researchers noted that the 3PLs and clients operating from South Africa preferred learning through disruptions rather than learning through the conventional risk management processes, for understanding ways for managing future disruptions.

In another study, [28] identified the different SCM practices that need to be adopted by the managers for

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improving their company performance. In their study, they analysed 88 global firms spread over 13 different sectors for determining the effect of 31 activities using 5 enterprise operational performance indicators. They used a quantitative approach, specifically a multivariate analysis process. In Step 1, they described every variable statistically. The researchers noted that the SCM practices positively affected the enterprise performance indicators. Furthermore, even collaboration and distribution activities were used for determining the performance of SCM practices regarding forecast accuracy and on-time delivery.

[29] proposed a novel model that incorporated various factors that positively affected the new product development process and business performance of different firms. They also determined the important parameters that negatively affected the implementation of a new product development process and its business performance. For this purpose, they analysed 180 Nigerian manufacturing companies. The researchers determined the population sample in their study using the convenience sampling technique. They distributed 2 copies of their questionnaire to each of the manufacturing industries included in the population sample. Then, they analysed the data from 360 questionnaires that were collected using statistical techniques like correlation analysis, factor analysis and reliability analysis. The reliability and validity analysis indicated that all the variables were reliable and valid. They also noted that strategy, culture and ability of all personnel affected the NPD business plans and the business performance.

In another study, [30] determined the effect of SCM practices on supply chain efficiency and its performance. They collected the data from 104 manufacturing industries in Jordan. Then, they carried out a hierarchical regression for testing the hypothesised relationships. They noted that 3 SCM practices, i.e., internal integration, information sharing, and postponement (excluding customer and supplier integration) positively affected the supply chain efficiency. The competitive intensity also moderated the relationship between the supplier, internal and customer integrations, and the supply chain efficiency performance.

[31] investigated the effect of the relationship between the SCM strategy and SCM practices on supply chain performance. All data was collected using questionnaires that were distributed to 200 managers (based on their Job title). The respondents were categorised on their job functions into corporate executives, SCM, manufacturing production, purchasing, material, transportation, and operations, in the Malaysian manufacturing industry. They analysed the data using statistical tools like Mean, Standard Deviation (SD) and Correlation between the dependent and independent variables. They also used a few statistical tools like validity and reliability tests and multiple regression. They noted that the SCM practices were positively and statistically related to the firm performance.

[31] introduced the concepts related to the Supply chain and the SCM. They defined the supply chain and the SCM

activities and presented a practical, theoretical and measurement analysis. For this purpose, they methodically analysed many randomly selected references articles from the literature. Their findings indicated that different researchers had differing perceptions regarding these topics. They also noted that the implementation of a theoretical view could significantly contribute while defining the scope of the supply chains. The literature review that was included in this study proposed many vital topics that were generally used in academic dissertations. All these concepts are helpful to the organisations and academicians involved in the SCM businesses.

[32] proposed a framework that included important success factors, tools, techniques and metrics for the implementation of a novel product development process. For fulfilling these objectives, the researchers conducted a literature review that investigated many studies related to the success of the new product development process. All studies were analysed for determining the common factors that were used by the firms that successfully launched new products in the market. The researchers also noted that the use of different research directions offered additional information to the firms that investigated Critical Success Factors (CSF), those measuring the success of a product development process and the academicians working on this topic. They further recommended that some metrics must be used for measuring the CSF responsible for the new product development process. They also proposed some tools and techniques for using these metrics.

[33] conceptualised and developed 5 dimensions of the SCM practices (i.e., customer relationship, strategic supplier partnership, information sharing level, quality of information that was shared, and postponement). They also tested the relationship between the SCM practices, competitive advantage and organisational performance. The researchers collected the data from 196 organisations and proposed all relationships using a Structural Equation Modelling framework. They noted that a higher SCM activity improved the competitive advantage and subsequently the firm performance. Also, competitive advantage showed a direct and positive effect on the firm performance.

## 7 Research methodology

In this study, the researchers have used a quantitative and inductive approach for theoretically analysing the data collected in the study. They also used an analytical and descriptive approach for understanding the SCM practices that mediated the relationship between the product development stages and operations management decisions.

The researchers used primary and secondary data sources, which could be derived using a self-completion questionnaire.

This study was based on 2 data types, i.e., primary and secondary data. The primary data includes the data derived using the questionnaires. However, the secondary data includes all the data that was derived from the field and

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theoretical studies published in the literature, in addition to books and research articles related to the topic under discussion. This data was used for developing a theoretical framework and defining the dimensions that could be measured. Here, the SCM practices were regarded as a mediator variable that mediated the effect of the product development stages on the operations management decisions. The primary data was collected using the questionnaire and used for measuring the variables and dimensions and determining the study objectives.

The population sample included in the study comprised of different employees and management staff (such as Director, Head of Section, Department Director, Workers' Monitor), working in the in Al-Manseer Company groups, Jordan, totalling 938 employees. The researchers distributed 95 questionnaires to the respondents and collected 88 questionnaires. Out of the 88 questionnaires, 3 were rejected due to incomplete answers. Hence, 85 final questionnaires were found suitable for further testing. Table 1 presents the demographic characteristics of the respondents selected in the study.

Table 1 Demographic characteristics of the respondents

AGE (Years)	Frequency	Percent (%)
Less Than 30	27	31.8
30-40	32	37.6
41-50	22	25.9
More Than 50	4	4.7
Total	85	100.0
Gender	Frequency	Percent (%)
Male	45	52.9
Female	40	47.1
Total	85	100.0
Education	Frequency	Percent (%)
Diploma	7	8.2
Bachelors	61	71.8
Higher Education	17	20.0
Total	85	100.0
Experience (Years)	Frequency	Percent (%)
Less Than 5 Years	47	55.3
5-10 Years	20	23.5
11-15 Years	10	11.8
More Than 15 Years	8	9.4
Total	85	100.0

As shown in Table (1), 31.8% of the respondents were aged <30 years; while 37.6% of the respondents were aged between 30-40 years; 25.9% of the respondents were aged between 41-50 years; while 4.7% were >50 years. The results indicated that 52.9% of the respondents were male, while the rest were female. 71.8% of the respondents had a Bachelor's degree; whereas 20% of the participants had a higher education degree.

The results also showed that 55.3% of the respondents had <5 years of work experience, while 23.5% of the respondents had 5-10 years of work experience. It was also seen that 11.8% of the respondents had 11-15 years of work experience and 9.4% of the participants had >15 years of work experience.

**8 Descriptive statistics**

Table 2 presents the values of the Arithmetic Mean and SD calculated in the study for the Dependent and Independent variables included in the product development stages. Here, they identified the patient-based mean and SD. Table (2) presents the detailed results.

Table 2 Values of Arithmetic Mean and SD for the Product development stages

Statement	Mean	SD	Chi-Square	SIG
Preliminary estimates	3.582	0.88	19.98 <sup>a</sup>	0.000
Economic Analysis	3.871	0.89	31.18 <sup>a</sup>	0.000
Devilment and Testing	4.029	0.92	15.94 <sup>a</sup>	0.001
Final Planning	4.341	0.97	61.41 <sup>b</sup>	0.000
<b>3.96</b>	<b>0.92</b>			

Table 3 presented the attitude of the respondents to the questionnaire statements included in the Product development stages. The average mean was seen to be 3.96 while the average SD was 0.92. The average mean value indicated that there was a higher degree of estimating the variables included in the Product Development Stages. The researchers carried out a Chi-Square test for determining the statistical significance (0.05), thus, indicating a consensus amongst the respondents for the Operation Management Decisions.

Table 3 highlighted the attitude of the respondents to the questionnaire statements related to Operations Management Decisions, where the average mean was 3.88 and SD was 0.95. The value of the average mean showed a higher degree of estimation for the variables related to the Operations Management Decisions. The researchers conducted a Chi-Square test for determining the statistical significance of the values (0.05) and noted a consensus amongst the respondents.

The researchers also determined the Arithmetic Mean and SD for the values related to the SCM Practices. Table 4 presents these results.

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Table 3 Mean and SD values for the Operations Management Decisions

Statement	No.	Mean	SD	Chi-Square
The company continuously develops its products	3.8	0.881	20 <sup>a</sup>	0.000
Employees are trained in accordance with technological requirements	3.9	0.894	31.2 <sup>a</sup>	0.000
Demand is constantly estimated	3.8	0.921	16 <sup>a</sup>	0.001
The company plans to produce what can be sold	4	0.970	61.4 <sup>b</sup>	0.000
Products are presented according to schedules	3.9	1.036	51.3 <sup>b</sup>	0.000
Company needs are scheduled out of stock	3.8	0.995	51.3 <sup>b</sup>	0.000
Lost time is minimised	4	0.859	24.7 <sup>a</sup>	0.000
There are plans for maintenance	4	1.007	34 <sup>b</sup>	0.000
The Company shall maintain preventive maintenance	3.9	1.065	32.5 <sup>b</sup>	0.000
The company seeks to have a location close to the markets	3.9	0.921	22.6 <sup>a</sup>	0.000
The Group is interested in site costs as a selection indicator	3.6	0.901	27.800 <sup>a</sup>	0.000
<b>Average</b>	<b>3.9</b>	<b>0.95</b>		

Table 4 presents the attitude of the respondents towards the questionnaire statements related to SCM practices, where the average mean was 3.76 and SD was 0.85. The value of the average mean showed a higher degree of estimation for the variables related to the SCM Practices. The researchers conducted a Chi-Square test for determining the statistical significance of the values (0.05) and noted a consensus amongst the respondents.

Table 4 Arithmetic Mean and SD for the SCM Practices

Variables	Mean	SD	Chi-Square	SIG
The Company considers Supplier integration	3.865	0.851	27.800 <sup>a</sup>	0.000
The Company considers Internal integration	4.306	0.868	25.353 <sup>a</sup>	0.000
The Company considers Customer integration	3.788	0.940	71.882 <sup>b</sup>	0.000
The Company considers Information sharing	3.065	0.731	76.118 <sup>b</sup>	0.000
<b>Average</b>	<b>3.76</b>	<b>0.85</b>		

### 9 Research hypotheses

The researchers proposed the following hypotheses in this study: H1: A significant relationship exists between the various product development stages (such as preliminary estimate, development and testing, economic analysis, final planning, and a broad production release) and the operation management decisions. The researchers carried out a regression analysis for H1 and results are shown in Table 5.

Table 5 Regression Analysis for H1

Model	Sum of Squares	df	Mean Square	R Square	F	SIG
Regression	74.530	3	24.8	0.78	96.8	0.0
Residual	20.791	81	0.2			
<b>Total</b>	<b>95.321</b>	<b>84</b>				

Table 5 presented the correlation coefficient value between the dependent and independent variables, i.e., 0.884. Furthermore, the coefficient of determination value ( $R^2$ ) was 0.782, thereby indicating that the independent variables could explain 78.2% of the changes occurring in the dependent variables, while the remaining were attributed to other factors. The Examined value (F) was seen to be 96.788, with a significance of 0.00, which was  $<0.05$ . This highlighted a significant relationship between the product development stages and the operations management decisions.

Table 6 presents the standardised and unstandardised coefficients included in H1.

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Table 6 Coefficients

Model	Unstandardised Coefficients		Standardised Coefficients	t	SIG
	B	Std. Error	Beta		
Preliminary	0.2	0.1	0.21	1.9	0.05
Estimates	0.2	0.0	0.15	2.0	0.04
Economic Analysis	0.5	0.1	0.59	6.2	0.00
Development and Testing	0.3	0.1	0.26	2.2	0.03
Final Planning	0.4	0.1	0.38	4.6	0.00
Broad Production Release	0.8	0.1	0.80	7.6	0.00

a. Dependent Variable: Personal Mastery

Table 7 Regression Analysis for H2

Model	Sum of Squares	df	Mean Square	R Square	F	SIG
Regression	268.8	6	44.8	0.872	87.5	0.0
Residual	39.4	77	0.51			
<b>Total</b>	<b>308.2</b>	<b>83</b>				

Table 7 presents the value of the correlation coefficient between the dependent and independent.

The F value was 87.552, while the significance was 0.00, which was <0.05, indicating the significant effect of the product development stages (such as preliminary estimate, development and testing, economic analysis, final planning, and a broad production release) on the operational management decisions, mediated by the SCM practices.

As shown in Table 6, a significant relationship existed between the product development stages and operations management decisions. The researchers noted that the T-test values were higher compared to the tabular value of 1.984, while the significance was <0.05.

The preliminary stages in the product development stage showed no significant relationship with the operations management decisions, since the T-value was lesser compared to the tabular value of 1.984, and even the significance level was higher than 0.05.

H2: The product development stages (such as preliminary estimate, development and testing, economic analysis, final planning, and a broad production release) significantly affect the operational management decisions, mediated by the SCM practices. The researchers tested the hypothesis by conducting a multi-Regression Weighted analysis for the SCM practices and results are presented in Tabvariables, i.e., 0.934, while the coefficient of determination value (R2) was 0.872. This indicated that the independent variables could explain 78.2% of the changes

occurring in the dependent variables, while the remaining were attributed to another factor

**10 Conclusions and recommendations**

Based on the above results, the researchers concluded that the AL-Manaseer Company Group, Jordan displayed efficient Product Development Stages, made efficient Operations Management Decisions, and followed efficient SCM Practices. A significant relation was noted between the product development stages and the operational management decisions. The researchers further stated that the SCM practices are a very important variable that mediates the effect of the product development stages on the operations management decisions. In a similar study, [34] observed that the SCM practices positively affected the firm performance variables. [35] noted that 3 major SCM practices, i.e., internal integration, information sharing, and postponement (except the supplier integration and customer integration) positively and significantly affected the supply chain efficiency. [36] also showed that the SCM practices were statistically related to the supply chain performance. The above results indicated that the AL-Manaseer Group is primarily interested in the site costs as the selection indicator and considers the preliminary estimates and data sharing amongst the peers.

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**SUPPLY CHAIN MANAGEMENT PRACTICES AS A MEDIATOR VARIABLE FOR THE IMPACT OF THE PRODUCT DEVELOPMENT STAGES ON OPERATIONS MANAGEMENT DECISIONS**

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