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EFFECT OF SUPPLY CHAIN LEARNING ON FLEXIBILITY PERFORMANCE: AN EMPIRICAL STUDY

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ABSTRACT

Today's intensely competitive business is undergoing significant shifts, which render it a challenging environment to compete in. Production processes are evolving as customer demands change, which leads to greater variability. Firms must respond to changing environmental conditions to remain sustainable. Companies today look for ways to overcome their problems not only on their own but also with their supply chains. Reduced cost and improved performance are two significant benefits of supply chain management. Because companies can work together in the face of challenging market conditions throughout their supply chains, it makes sense for them to collaborate. When companies work together, they can collaborate to produce better-designed products and more efficient manufacturing processes. Learning, supply chain integration, and flexibility throughout the supply chain are critical to successful supply chain management.

In this study, the effect of supply chain learning on supply chain integration and production flexibility has been investigated. The mediating role of supply chain integration on the impact of supply-chain learning on production flexibility has been tested. For this purpose, survey data was collected from the 144 companies selected out of Turkey's largest exporting companies. The data were analyzed via structural equation modeling and process macro methods. As a result of the structural equation model analysis, it was found that supply chain learning significantly affects the chain's integration and its production flexibility. As a result of the

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intermediation test, it was determined that the integration of the supply chain has a vital intermediary role regarding the effect of supply chain learning on the flexibility of production.

Keywords: Supply chain learning, supply chain integration, production flexibility

1. INTRODUCTION

In today's intensely dynamic market climate, firms must confront the complexity, volatility, and other risk factors owing to the reality that they are entirely accessible socio-technical structures (Yanine et al., 2016; Dahooie et al., 2020). For supply chain processes, as for all company activities, the minimization of these risks is critical. No question controlling the whole supply chain is very different, more complicated, and challenging than managing a particular business.

As an organization successfully controls the supply chain, it can also enhance its productivity because supply chain management is vital for minimizing costs and improving efficiency (Loke et al., 2012; Meidute-Kavaliauskiene & Ghorbani, 2021). Leading corporations use their supply chain partners' resources and skills to expand their markets by lowering their costs and optimizing their returns (Zhang et al.,2015). As firms can't gain a competitive advantage alone, they should strengthen collaboration along their supply chains through information sharing, integration, and joint learning activities.

Supply chain learning is a method to obtain, assimilate and leverage information and expertise from the focal organization via internal functions and its major suppliers and customers (Haq, 2020). It is also widely accepted that organizational learning is considered one of the most critical factors (Flint et al., 2008), and supply chain learning has a strategic role in gaining sustainable competitive advantage (Gibson et al., 2016).

It is essential to provide a philosophy that has the potential to define the corporation's priorities. Companies should focus on improving their supply chain efficiency by employing and promoting a systematic strategy within the supply chain. The realization of the integration would allow the company's customers and suppliers to engage in the value development phase, adding new customers and vendors to the process (Beheshti et al., 2014; Meidute-Kavaliauskiene et al, 2020).

Increasing diversity and uncertainty in the environment pushes firms to be more flexible to respond to their environment more quickly. Flexibility can increase firms' competitiveness, especially in decision processes, regarding adopting new technologies (Martínez Sánchez et

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al., 2005). Flexibility has an essential place in gaining and maintaining a competitive advantage. Therefore, companies should adopt appropriate strategies to achieve flexibility targets in their purchasing activities (Chaudhuri et al., 2018).

In today's competitive environment, the importance of learning, supply chain integration, and the supply chain's production flexibility is undoubted. To better understand these concepts, this study looks into the effects of supply chain learning on supply chain integration and flexibility.

2. THEORETICAL FRAMEWORK

2.1. Supply Chain Learning

“Learning” is related to the idea of knowledge and brings new skills to companies. These abilities are knowledge-intensive abilities and are dynamic. Even though information is an essential tool in terms of competitiveness, it is not easy to create a learning organization that can use the power of information. Firms should maintain both required capabilities and new product information while obtaining information about future products and technologies (Loke et al., 2011).

Firms code and share their employees' individual experiences by bringing them together and facilitate their accessibility within the organization in the organizational learning process. Subsequently, this information is transferred to organizational routines. Thus, knowledge is raised from individual to group and ultimately to the corporate level (Scholten et al., 2019).

The learning organization is a system that supports knowledge application processes for growth and development and is structured for this purpose. Organizations try to improve their performance by using their employee's and shareholders' knowledge with the learning process. By incorporating the know-how of workers and other companies, organizations seek to enhance their efficiency on these three fronts: costs, time, and consistency (Sweeney et al.,, 2005). Learning can provide continuous environmental adaptation and develop learning-based information management systems for organizations (Sporleder & Peterson, 2003).

According to Flint et al. (2005) organizational learning is an inter-institutional learning process in which two or more companies in a supply chain interact while solving logistics and supply chain problems. It refers to the active management of companies and suppliers, and customers in the learning process regarding supply chain management issues (Flint et al., 2008). While inter-organizational learning can occur between two organizations, supply chain

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learning occurs along the supply chain, and it also involves suppliers and customers in the learning process (Yang et al., 2019).

Firms use inter-firm governance mechanisms to enhance their supply chain learning. Both partners wish to learn as much as possible from their relationship. However, both also attempt to limit their partnership's scope to prevent lost business advantage. Therefore, supply chain learning is tied to trust, which is essential to the learning process (Lambrechts et al., 2012). Joint commitment is lacking among all supply chain members. In these instances, using a strategic resource such as learning can help improve success (Hult et al., 2003).

On a substantial level in supply chain learning, firms actively monitor how well their organizational processes work and continuously improve their processes. As a result of these inspections, they can see both how well they are organized and the level of their relationships with their customers (Willis et al., 2016).

Supply chain learning has an enhancer effect on both research and application dimensions. Classification of learning orientation according to the capacity to create and the channel helps identify research and implementation dimensions and ultimately allocate appropriate learning resources to improve firm performance (Ojha et al., 2018).

It requires a low level of learning when the aimed outcome is simple. A relatively small adjustment to the manufacturing system to increase productivity and adapt to new standards requires minor changes. A higher learning level occurs in more extensive situations than those exemplified (shifting from old to new paradigm). In the supply chain context, process-oriented supplier change may require a higher learning activity level than result-oriented change (Theodorakopoulos et al., 2005).

2.2. Supply Chain Integration

The notion of supply chain integration (SCI) is defined as the coordination and cooperation among actors in a supply chain (Wong et al., 2017). SCI represents the central producer's degree who works together with supply chain partners and manages both intra-organizational and inter-organizational processes to gain a competitive advantage (Flynn et al., 2010). SCI refers to strategic cooperation, knowledge sharing, joint decision-making, and system consolidation between the producers and supply chain partners, especially at the production stage (Shou et al., 2018; Al Majzoub et al., 2020). SCI is defined as the degree to which a firm works with supply chain partners to integrate material, information, and financial

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flows to facilitate fast and practical integration. In short, SCI covers the strategic harmony of functions and processes both within the organization and among supply chain members.

An integrated supply chain is organizationally interconnected, and the flow of information within the chain is coordinated from raw materials to timely delivery of final products to customers. Supply chain integration ensures the cooperation of the supply chain actors to ensure timely delivery and thus coordinates the information flow and processes by connecting them (Boon-Itt et al., 2011). In other words, an integrated supply chain means interaction and cooperation among the firm, customers, and suppliers. To a significant degree, ensuring such a supply chain will be established necessitates an extensive level of information exchange and collaborative activity between supply chain members (Novais et al., 2019).

Therefore, SCI can be characterized by information sharing, interdependence, and degree of joint actions between firms (Huang & Huang, 2019). SCI includes applying new technologies to improve both the flow of information and financial flow and coordinate the flow of materials between supply chain partners (Zolait et al., 2010).

SCI is characterized by a situation where the chain members collaborate and work together for better performance and profitability while meeting the customer's demands. Companies that integrate information and material flow will ensure optimum management of the supply chain. It includes aligning management functions within the company and with supply chain partners to reduce costs, improve customer value and overall performance in the chain for all partners (Kumar et al., 2017).

There are two types of integration in supply chains. Internal integration refers to what extent it facilitates the sharing of information and joint decision-making among companies' internal functions to streamline workflows and make collaborative decisions. This type of integration enables joint planning and decision-making by increasing communication and information sharing between internal functions (Wong et al., 2017). Internal integration is the basis for successful supplier and customer integration, as it provides a suitable ground for the company to deal with its external environment (Shah et al., 2020).

There are two types of external integration, supplier integration and customer integration. The cooperation and collaboration formed among the target company and its suppliers for the purposes of managing the activities between companies can be defined as supplier integration (Wong et al., 2017). Supplier integration ensures more effective planning,

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projecting, design, and operation management opportunities by providing insight into suppliers' processes, capabilities, and constraints. Customer integration refers to close cooperation and information sharing with key customers, which provides the company with strategic insight into market expectations and opportunities. (Han, 2018).

2.3. Flexibility

Flexibility is defined as a goal on its own within the company's product strategy. Flexibility is a tool by which a firm can respond to changes in the market (Wilson, Ali, 2014). With this tool, companies can improve their competitive position by accelerating their decision-making processes to adopt and implement new technologies (Arias Aranda, 2003). Flexibility is expressed as making environmental uncertainty more predictable with little cost in terms of time, effort, cost, or performance or react to environmental uncertainty.

Therefore, proactive and reactive flexibility offers companies unique advantages in improving business performance (Mishra, 2018). Flexibility is a production system's ability to deal with external uncertainties. Using this capability, companies can transcend the impact of both volume and timing variations on suppliers, manufacturers, and customers (Yazici, 2005).

There are six primary forms of flexibility. These are production flexibility, volume flexibility, mix flexibility, labor flexibility, routing flexibility, and rig flexibility. Production flexibility is defined as the capacity to share or redistribute by efficiently managing production resources as environmental changes require (Duguay et al., 1997).

Volume flexibility is defined briefly as the "ability to change the output volume of a production process according to customer orders." In other words, a company can respond rapidly and effectively to variations in demand. This ability is an essential dimension of flexibility as orders fully reflect the actual demand fluctuations (Husseini et al., 2006). Mix flexibility is the ability to work with many products and various options to make the process more flexible. One method of determining mix flexibility is to consider the number of new or different products and parts produced by the manufacturing facility and the number of part types generated by a flexible production system.

Labor flexibility has defined the ability to assign different numbers of workers as needed. Labor flexibility allows for multitasking, which means that each operator must be well-trained in various tasks. Routing flexibility is the ability to use alternative processing routes to produce a product. This flexibility is achieved with multi-purpose machines and similar

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grouping machines. The orientation flexibility reflects the versatility of material handling systems and the operational flexibility of parts. Routing flexibility can further balance machine loads, contributing to the need to meet strategically important customer lead times (Yazici, 2005).

The definition of rig flexibility has been derived in various ways. Worn or broken tools and fixtures can be replaced without the downtime and long setup times with a new tool. The level of flexibility that the system provides in changing the parts required to produce a particular product is rigidity. While also known as the capacity of equipment, it is commonly used to describe how well a piece of equipment performs a task (Mohamed et al., 2001).

The downsides to production flexibility are that the firm's existing technologies are rapidly aging. Simultaneously, opportunities emerge as new technologies that encourage the firm to adapt faster to improve production flexibility. Such incentives can be channeled to benefit the firm's needs and strategy (Pinheiro et al., 2020).

2.4. Research Hypotheses

Supply chain relationships are getting more involved in scope and an ideal place where organizational learning activities can provide synergy, and competitive advantage represents the area (Hult et al., 2000). It is essential to examine the potential of applying the learning organization concept to an organization's understanding and activities to reveal the supply chain collaboration ability (Opengart, 2015).

Firms with a learning orientation can better run their organizational processes, be better organized, and better connect with their environment to serve customers (Braunscheidel & Suresh, 2009). Learning orientation can be a driving force for supply chain integration because the underlying assumption of the integration is that cross-departmental and inter-organizational knowledge sharing improves performance. Many research studies (e.g., Ellinger et al., 2015, Willis et al., 2016) demonstrate the positive effect of learning orientation on various integration processes.

In companies with a high learning level, intra-firm and inter-firm learning processes always generate and disseminate information about the highly competitive global environment and facilitate supply chain integration (Ellinger et al., 2015). A learning supply chain is a dynamic and integrated supply chain for learning and responding to changing market environments. The additional benefits of a supply chain, which is in the process of learning, to

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a core integrated supply chain originate not only from supply chain process efficiency but also from tighter coordination among member firms based on shared knowledge management in the market response process (Sporleder & Peterson, 2003).

Supplier learning helps the supplier and manufacturer establish standard norms and goals so that both parties can carry out their activities (Lisi et al., 2020). Firms that possess an exceptional supply chain learning capacity can better engage in process investigation and systemization. These companies can also utilize a broader range of integrated strategies to manage procurement and customer relationships (Willis et al., 2016). Thereby, the following hypothesis is offered:

- H1: Supply chain learning significantly affects supply chain integration.

  Organizational learning allows the firm to develop its core competencies and control its operational processes better. It helps the firm maintain a broader knowledge base, absorb new information, and gain flexibility (Willis et al., 2016). Firms with advanced learning skills increase their problem-solving abilities by acquiring critical information such as material selection and energy efficiency from suppliers and collaborating with suppliers in developing new products or processes (Lisi et al., 2020).

  The effective learning process also accelerates adaptation to changing market conditions. Thus, companies can respond faster in the face of changing needs and customer demands by improving their flexibility (Lant, Mezias, 1992). Therefore, organizational learning increases the firm's flexibility (Englehardt, Simmons, 2002), and contributes to its performance (Hernández-Espallardo et al., 2010). Thereby, the following hypothesis is offered:

- H2: Supply chain learning significantly affects flexibility performance.

  As markets rapidly change, companies must adapt supply chain processes to respond more quickly to meet customers' needs because they require products that are delivered faster and more reliably (Richey et al., 2009). To obtain a competitive advantage, firms should seek mutual benefit with their stakeholders, customers, and suppliers by tracking external changes and the surrounding environment (Shukor et al., 2020). Besides, firms should focus on integrating suppliers, manufacturers, and customers to improve cost efficiency and lead time (Zolait et al., 2010).

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The flexibility gained by an effective supply chain integration is an operational capability that increases companies' capacity to respond faster to changing market conditions (Shukor et al., 2020). A high level of integration facilitates the flow of information along the supply chain and can help develop business processes that can quickly detect and respond to market changes (Willis et al., 2016). Many studies in the literature emphasize that supply chain integration increases flexibility (Petroni & Bevilacqua, 2002; Schoenherr & Swink, 2012; Willis et al., 2016) and firm performance (Braunscheidel & Suresh, 2009; Willis et al., 2016). Thus, the following hypotheses are offered:

- H3: Supply chain integration significantly affects flexibility performance.
- H4: Supply chain integration has a mediating role in the impact of supply chain learning on flexibility performance.

The research model is seen in Figure 1.

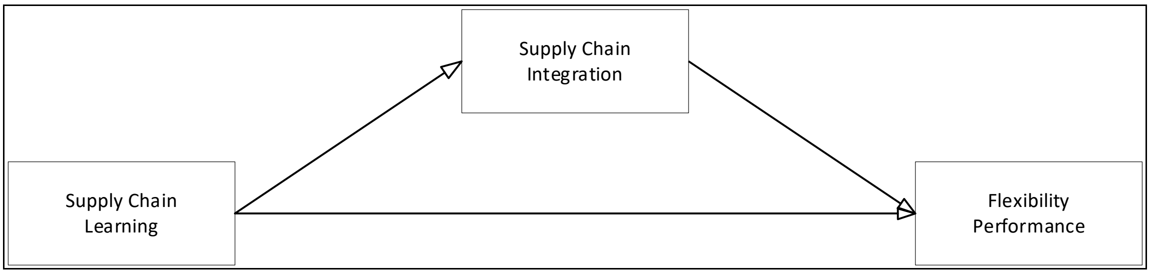

Figure 1: Research Model

3. METHODOLOGY AND FINDINGS

3.1. Sample and Measurement Questionnaire

This study examined the effect of supply chain learning on production flexibility and the mediating role of supply chain integration in this effect. The study's population comprises the first 1000 exporting firms declared in 2019 by the Turkey Exporters Assembly. A questionnaire was issued to respondents in November 2020. A questionnaire was sent to the companies in the list via email. In the first stage, 97 usable responses were obtained. A second email was sent after 4 weeks, and 47 valid questionnaires were received. As a result, 144 valid questionnaires were collected, accounting for 14.4% of the population. The questionnaire in Willis et al. (2016) was used in the study.

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3.2. Analysis and Results

Table 1: Participant firms sector

Sector	Frequency	Percent
Cement	3	2,1
Iron/ Steel	14	9,7
Electrical Electronics	11	7,6
Food	29	20,1
Carpet	4	2,8
Pharmacy	2	1,4
Chemistry	10	6,9
Mining	5	3,5
Machine	9	6,3
Metal	2	1,4
Furniture	5	3,5
Automotive	8	5,6
Defense Industry	3	2,1
Agriculture	5	3,5
Textile	34	23,6
Education Status		
High school	19	13,2
University	102	70,8
Higher Education	23	16,0
Department		
Production	19	13,2
Purchase	16	11,1
Marketing	25	17,4
Management	84	58,3

According to demographical results, most of the companies that participated in the research operate in the textile, food, and iron/ steel industries. The vast majority of the company officials participating in the study hold managerial positions.

Before testing the research hypotheses, the validity and reliability of the research scales were tested. Exploratory and confirmatory factor analysis and reliability analysis have been conducted to ensure the appropriate measurements have been obtained. The results of the exploratory factor analysis of the scales are given in Table 2.

Table 2: Results of exploratory factor analysis

Items	Factor Loads	Skewness	Kurtosis	Mean	Std. Deviation
Supply Chain Learning					
SCL1	,813	-,776	-,008	3,95	1,053
SCL2	,881	-,604	-,037	3,80	,986
SCL3	,837	-,517	-,138	3,78	,986
SCL4	,848	-,485	-,087	3,87	,926
SCL5	,776	-,492	-,353	3,81	,984
KMO: ,849	Approx. Chi-Square: 392,112	df: 10	sig.: ,000	Total Variance Explained: 69,216%	
Supply Chain Integration					
Internal Integration					
II1	,911	-,628	,256	3,83	,908
II2	,676	-,785	,893	3,85	,893
II3	,722	-,699	,193	3,79	,967

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II4	,760	-,591	,057	3,72	,993
External Integration					
EI1	,668	-,190	-,705	3,78	,873
EI2	,601	-,249	-,513	3,65	,927
EI3	,867	-,527	,101	3,73	,977
EI4	,743	-,742	,153	3,89	1,018
KMO: ,903	Approx. Chi-Square: 626,218	df: 28	sig.: ,000	Total Variance Explained: 69,435%	
Flexibility					
FP1	,812	-,704	,176	3,72	1,041
FP2	,819	-,276	-,642	3,79	,945
FP3	,818	-,501	-,140	3,73	1,012
FP4	,818	-,327	-,187	3,72	,921
KMO: ,789	Approx. Chi-Square: 213,094	df: 6	sig.: ,000	Total Variance Explained: 66,727%	

The factor analysis results were extracted from the calculation of principal components and a VARIMAX rotation. As seen in Table 2, the factor loading of the scales is sufficient. The KMO values are greater than 0.70, and the Barlett sphericity tests significant for all scales. This finding means that the sample size is sufficient for factor analysis. It was also found that the supply chain learning scale explains 69.216%, supply chain integration scale explains 69,435%, and flexibility scale explains 66,727% of the total variance. Also, skewness and kurtosis values were examined to test whether the scale data has a normal distribution. Since the values are between -2 and +2, it is assumed that the data is normally distributed.

Confirmatory factor analysis was performed for scales after exploratory factor analysis and normality test. The model fit indices obtained from the confirmatory factor analysis are seen in Table 3.

Table 3: Model fit indices

Variable	χ^2	df	χ^2/df	GFI	CFI	TLI	SRMR	RMSEA
Criterion			≤5	≥.90	≥.90	≥.90	≤.08	≤.08
Supply Chain Learning	19,211	5	3,842	0,946	0,963	0,927	0,0360	0,141
Supply Chain Integration	40,998	19	2,158	0,929	0,964	0,947	0,0409	0,09
Flexibility Performance	8,06	2	4,03	0,971	0,971	0,914	0,0345	0,146

Confirmatory factor analysis results show that the scales met the criteria for the goodness of fit. The SRMR value was calculated because the sample size was less than 250. Since the SRMR value is less than 0.08, the criteria are provided.

After confirmatory factor analysis, reliability analysis was performed. Also, AVE and CR values were calculated to test component validity. Validity and reliability analysis results are seen in Table 4.

Table 4: Validity and Reliability

Variable	AVE	CR	Cronbach' Alpha
Supply Chain Learning	0,618	0,888	,887
Supply Chain Integration	0,587	0,919	,907

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Internal Integration	0,572	0,842	,841
External Integration	0,602	0,857	,857
Flexibility Performance	0,555	0,833	,833

As a result of the reliability analysis, Cronbach's Alpha coefficient values were obtained above 0.80 for all scales. This finding shows that the scales are reliable. AVE values greater than 0.50 and CR values greater than 0.70 were obtained. These findings also show that the scales provide component validity.

The structural equation model was analyzed to test the research hypotheses. The analyzed model's (Figure 2) model fit indices are shown in Table 5.

Table 5: Model fit indices

	χ^2	df	χ^2/df	GFI	CFI	TLI	SRMR	RMSEA
Criterion			≤5	≥.90	≥.90	≥.90	≤.08	≤.08
Model	233,895	113	2,07	0,841	0,921	0,905	0,0504	0,086

As shown in Table 5 the model's fit indices met the goodness of fit criteria. The regression weights of the variables in the model are given in Table 6.

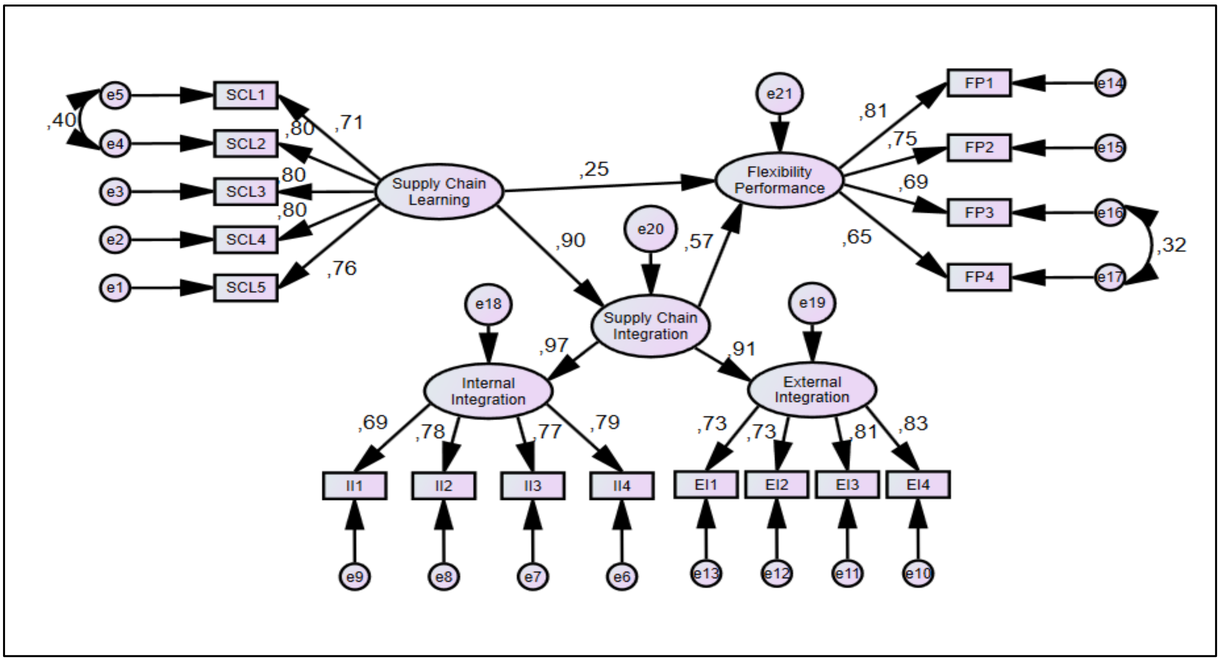

Figure 2: Structural Equation Model

Table 6: Model Regression Weights

Tested way			Standardized Regression Weights	S.E.	C.R.	P
Supply Chain Integration	<---	Supply Chain Learning	0,897	0,094	9,728	***
Flexibility Performance	<---	Supply Chain Integration	0,57	0,273	2,296	0,022
Flexibility Performance	<---	Supply Chain Learning	0,25	0,276	1,021	0,307

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Analysis results show that supply chain learning positively affects supply chain integration. Also, it has been found that supply chain integration positively affects flexibility performance.

Besides, the significance of the regression coefficients was examined to evaluate the model fit. It was determined that the significance level (p) for the model was less than 0.05 in all. According to this result, it can be said that observed variables and hidden variables are well predicted. The regression coefficients are significant according to the critical ratio and significance results.

The mediation hypothesis tested using Process Macro developed by Hayes (2017). Model 4 was selected in the Process Macro module for mediating effect. In the test, X (supply chain learning) represents the independent variable, Y (flexibility Performance) represents the dependent variable, and M (supply chain integration) represents the mediating variable. It must be considered that there is no 0 between lower (BootLLCI) and upper (BootULCI) bounds to determine the mediating effect. Analysis results are shown in Table 7.

Table 7: Process Macro Outputs

		Outcome Variables				
		M (Supply Chain Integration)			Y (Flexibility Performance)	
Predictors		β	S.E.		β	S.E.
X (Supply Chain Learning)	a	.7039***	.0488	c’	.2761**	.0962
M (Supply Chain Integration)	-	-	-	b	.4828***	.1073
Constant		1.0770***	.1830		.8540***	.2610
		R^2=.6163			R^2=.4740	
		F(1;142)=228.105; p<.001			F(2;141)=63,527; P<.001	

As seen in the table, the effect of supply chain learning on supply chain integration (path a) is positive and significant. (β :.0.7039 95% CI [.6118,.7961], t: 15.1032, p <.001) The confidence interval's lower bound is 0.6118, and the upper bound is 0.7961. The specificity coefficient was found to be 0.6163. This finding shows that 61.63% of supply chain integration is explained by supply chain learning (R^2 =.6163).

As with path a, supply chain integration significantly affects flexibility performance (path b). (β :.0.4828 95% CI [.2707,.6950], t: 4.4995, p <.001).

According to results, supply chain learning has also positively affects flexibility performance at the 0.05 level of significance. (β :.2761, 95% CI [.0859,.4663], t: 2.8692, p <.005). The coefficient (R^2) was obtained as 0.4740. This finding shows that 47.40% of flexibility performance is explained by supply chain learning and integration (R^2 =.4740)

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In the absence of supply chain integration (mediator variable) in the model, the impact of supply chain learning on resilience performance (c path - total impact) is also significant. (β :.6160, 95% CI [.49047415], t: 9.6985, p <.001).

If the supply chain integration is also included in the model, the indirect effects calculated were significant. (β: .3399, 95% BCA CI [.1482, .5404]. The effect size (K^2) is 0.3483. The fact that the effect size is close to 0.25 indicates that the supply chain integration has a high mediation effect.

As a result of the analysis, all research hypotheses were supported.

4. CONCLUSION

In this study, the effect of supply chain learning on supply chain integration and flexibility performance has been investigated. Also, the effect of supply chain integration on firm flexibility performance was examined.

In all the hypothesis tests performed, statistically significant results were obtained, and all four hypotheses (H1, H2, H3, H4) of the study were supported. These findings show that learning activities within the supply chain consisting of suppliers, manufacturing companies, and customers are essential because only an integrated supply chain will positively impact performance. If there is low integration in the supply chain, information sharing will also be adversely affected. Supply chains that are not integrated cannot collaborate in production activities (New & Westbrook, 2004).

It is essential to activate learning processes between supply chain members to achieve integration for firms. According to the findings, the impact of supply chain learning on firm flexibility performance is due to a high supply chain integration. It is understood that manufacturing companies that want to increase their flexibility performance should increase their learning activities within the supply chain. As a result, they should provide integration.

Research results show that manufacturing company managers should focus on continuous learning and development by establishing a good network between their suppliers and customers. If managers improve information sharing and trust within the supply chain, they will achieve high integration. Due to the intense environmental dynamism, customers expect different and innovative products continually. In order to meet this, manufacturing companies must have flexible production systems. Research results show that the essential way to ensure flexibility in production is through learning and integration.

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The most important limitation of this research is that there is no sector separation in the study sample. Another important constraint is that research data were collected online due to the Covid-19 pandemic process. Learning, integration, and flexibility were evaluated in the research. However, innovation and agility have an important place in supply chains. Studies examining innovation capacity and agility together with the variables examined in this study can contribute to the relevant literature.

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