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The Role of Supply Chain Integration and Agile Practices In Improving Lead Time

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ABSTRACT

Lead time is one of the main factors which always significantly affects supply chain competitiveness. The recent COVID-19 pandemic has harmed the lead time, and an exceptional increase in the lead time has been experienced because of it. However, there are a few variables which can have a positive effect on the lead time. Aim: This research study was aimed at how the variables like Agile Practices and Supply Chain Integration may influence lead time. Methods: Research data was collected from the respondents, who were supply chain executives and managers, through a closed-ended questionnaire, and the Statistical Package for Social Sciences (SPSS) was employed to drive the results. Results: The findings of this study indicates that Supply Chain Integration and Agile Practices contribute to the reduction of lead time. Conclusion: Findings also suggest that the lead time can be significantly reduced with the employment of Supply Chain Integration and Agile Practices.

Keywords: *Lead time, Supply chain integration, Agile practices, COVID-19, Integration*

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The Role of Supply Chain Integration and Agile Practices in Improving Lead Time

1. Introduction

1.1 Background of the Study

The benefits of global sourcing and the convenience of modal transfer that comes with containerization have all spurred the integration of ports into supply chains—the importance of ports in the supply chain (Seuring & Gold, 2012). Disruptions have grown as port functions have evolved. From the standpoint of the supply chain, the advantages of internal and external integration or collaboration can develop practical solutions that increase the chains' performance outcomes (Pilbeam et al., 2012). A recent global Corona Pandemic (COVID-19) has caused widespread supply chain disruption, making it difficult for firms to restore their supply chains quickly. We provide a recovery technique for supply chain disruptions with the goal of modifying the original product. Pilbeam et al., 2012). COVID-19 has severely influenced how the supply chain should work in case of unprecedented catastrophes. Subsequently, countries stopped trade activities, travel, and local movement (Ubaid-ur-Rehman et al., 2021). Therefore, these restrictions have had a significant influence on lead time. This was more tragic in the underdeveloped country, where the country's economy relies on the fragile agri-food sector (Ubaid-ur-Rehman et al., 2021). Uninterrupted supply chain flow is necessary for the success and competitiveness of businesses. In order to ensure the constant flow of supply chain activities, a manufacturer must focus on the supply chain disruption caused by a pandemic like COVID-19 that may occur at the supplier's end (Konstantaras et al., 2019; Paul et al., 2018) or at the retailer's end (Paul et al., 2018). These disruptions cause an increase in the lead time in the supply chain process. Organizations need to allocate their resources to enhance and develop their supply chain capabilities through coordination, adaptability, collaboration, information exchange and agility, which would subsequently help them achieve greater efficiency and performance in lead time.

Time taken by the dimensions in the lead time reduction process, like sourcing, pre-processing, manufacturing and post-processing, determines how much time will be taken to complete the process (Fattahi et al., 2017). Customers always want to know the accurate delivery time or order fulfilment. Reducing the lead time will increase the enhanced performance and greater productivity of the supply chain operations. This can be achieved with concrete supply chain planning, adaptability in the presence of unprecedented events, agility, and information-sharing on run-time (Alzoubi et al., 2022).

Moreover, studies have been conducted to determine how the lead time is affected by supply chain integration and agile practices. The study conducted by Alzoubi et al. (2022) in the healthcare sector for the same variables has shown that agile practices can reduce lead time by emphasizing and exploiting value-added activities and mitigating unnecessary activities. Secondly, it also shows that supply chain integration can help make the supply chain process seamless and increase customer satisfaction by doing so. Lastly, it also showed how a pandemic like COVID-19 affected this sector (Alzoubi et al., 2022).

1.2 Problem Statement

The risk of disruption in the supply chain has become one of the most researched topics in recent years. The risk stemming from the disruption can be categorized into two main categories, risk originating from the abnormal shift between demand and supply in the market or the risk disrupting the routine supply chain activities in the product's supply chain life-cycle (Singh et al., 2020).

These disruptions can be explained as the factors which incapacitate the supply chain. The disruptions incapacitating routine activities could be natural calamities, accidents, intentional acts, or pandemics (Shahid et al., 2021). These disruptions do not only hijack the supply chain flow but also hurt the brand image. In the past couple of years, supply chain disruption has become one of the most interest-oriented topics in terms of research. For manufacturers to remain in business have to maintain

the flow of production and keep profit floating, disruption on either the supplier side; accidents or natural incidents or disruption at the retailers' side; shift in the demand curve and change in behaviour of the market can affect the production capacity (Shahid et al., 2021). Resultantly, manufacturers will lose their customers. Most of the study in the disruption area is focused on only one end: suppliers or retailers.

This disruption in the supply chain has significantly affected the lead times of the processes from sourcing to delivery of the product. Businesses have been struggling to reduce this lead time between the different stages of the product's supply chain to meet the surge in demand, e.g., especially in the food and wellness sector, where an abnormal shift in the demand curve was seen because of COVID-19. This was unanticipated, and the global supply chain was not ready to face that catastrophe, resulting in the global food crisis. According to the United Nations Report on Crisis 2020, 136 million people are experiencing 'crisis' levels of acute food insecurity, while 184 million are experiencing stressed levels of acute food insecurity and are in high danger of entering the crisis phase (Ubaid-ur-Rehman et al., 2021).

1.3 Research Questions

On the supply side, there are challenges in global supply networks that are beyond individual firms' control. Due to shortages, restricted unloading capability, and warehouse space limits, stranded containers have yet to be emptied. Around 80 ships carrying more than 500,000 cargo were awaiting unloading. It will take some time to get through this backlog. Another factor contributing to the backlog is the increased number of empty containers waiting to be returned to exporters at ports. As a result, we could pose these questions in our study questions, which are listed above.

- *What is the effect of supply chain integration on the lead time?*
- *What is the effect of agile practices on the lead time?*

1.4 Purpose of Research

This study aims to assess the factors impacting logistics and disruptions in the food and beverage industry due to the post-pandemic that has been widely spread worldwide. The virus has ruined the economy and many individuals ruthlessly. The demand and supply of several products were severely affected due to strict lockdowns, and the after-effects of these lockdowns made the industry sluggish and caused several difficulties in the supply chain sector. It unveils the instability of the supply chain internationally, leaving businesses, officials, and authoritative policymakers to re-evaluate a decades-long emphasis on productivity and minimizing costs by implementing a 'just in time' practice. Because of the labour shortage, operational and logistics disruptions were encountered in restricted zones. The purpose of this research is to gauge the post-epidemic results, find out the problem, and then work on the outcomes to overcome these for the advancement of the supply chain sector, especially the freight, logistics issues, and international disruptions. We highlighted the significance of these effects on Logistics businesses engaged with transferring, loading, storage, and movement of goods, which have been affected by COVID-19 and now the post-pandemic results. Therefore, Supply chain disruptions induced by the pandemic could influence competitiveness, global financial growth, and job creation. The purpose of this review is to the impact of post-Covid on the food & beverage sector and to present the recommendations required in a condensed manner to implement the reduction and control of the pandemic.

1.5 Significance of the Study

The significance of the study is to examine the supplier risk of disruption based on their strategy, supply chain structure, and attributes in the turbulence time. The primary role of supply chain management disruption is to identify risk, uncertainty and classify risk. This study overcomes the supply chain disruption and generates a logistics strategy to minimize the risk of uncertainty in the supply chain network. However, the supply chain describes the proactive relationship and supplier integration. The

significant role of this study is to reduce supply chain disruption and develop a logistics strategy through endogenous and exogenous uncertainty. Moreover, these variables indicate that the supply chain can resolve inside and outside market dynamics with the support of their supplier relationship and economic factors, including inflation, interest rate. Supply chain disruption can also be mitigated through the supply chain strategy and its structure with the help of lean, agile, and supplier types. This scope of work supports the contingency theory to resolve conflicts among the supply chain management with the market dynamics.

2. Literature Review

2.1 Underpinning Theory

The research on supply chain disruption risks has gained much traction in previous or recent years (Rashid & Rasheed, 2023). The post-pandemics are not new for humanity. Various pandemics came over some time, and the world has been able to tackle them with time. The prominent high spot is that these pandemics impact the world's economy (Rashid et al., 2023). The food and beverage industry, the most critical pillar of the economy, has also suffered due to the pandemic. As now the result of post-pandemic. Due to this, the world witnessed the most harmful effect, especially from the consumer perspective. As we know, the food supply needs some entails to adjust to the quick change in food. Any supply may need help with the supply network due to the unavailability of the labour force, trucks and transport. Unfortunately, the dairy farmers and the FMCG Sector were directly practical by COVID-19 as the demand for Tea, Coffee, Milk and Dairy products was so low that they experienced enormous quantities of wastage, and the products in stock came near expiry because the long non-consumable practice in the of COVID (Ubaid-ur-Rehman et al., 2021). The transport of these products experiences several delays due to which the products do not reach on time (Aday & Aday, 2020). As for an efficient supply chain, moving goods from suppliers to manufacturers is essential. If, due to coronavirus, the imposition of the lockdown remains constant, then it could lead to severe consequences in the food market, which would then impact the organization in supplying the goods to the consumers, a disorienting snare of cooperations including ranchers, farming data sources, handling plants, delivering, retailers (Aday & Aday, 2020).

The drawn-out food & beverages supply will be more questionable, and it will affect ranchers; certain staple things delivered and put away in powered volumes and have remarkably proficient transportation and coordination frameworks will probably not encounter critical disturbances. The motivation behind this audit is to decide the connection between COVID-19 past and post disturbances in coordination and the inventory network. To comprehend the connection between COVID, that is, lockdown on the interest in food and the after-effects of covid so, to know and investigate the connection (Aday & Aday, 2020)

2.1.1 To understand the relationship between COVID-19 and disruption in logistics in the supply chain.

On a global basis, the supply chain has been severely disrupted. Increased border controls and customs restrictions cause longer delays, and a capacity shortage for long-haul and last-mile satisfaction creates extraordinary obstacles. Producers' solutions to supply chain disruptions worldwide will assist all businesses in organizing their responses. Many businesses and sectors are poorly affected by the COVID it is after effects like disruption in logistics and supply chain, creating a shortage of products & basic materials, which make the cost high & many financial losses due to non-delivery or wide-ranging lockdowns in a country from where the product and material are coming or going. The cost of supplies may rise due to overtime and expedited consignment expenses, as well as payments made to purchase up supply and maintain capacity. Companies are also experimenting with alternative sourcing options to overcome the post-COVID and future problems from natural climates and COVID-like situations.

All industrial sectors are interconnected with the complex logistics and supply chain; this

network was adversely affected by the impact of COVID-19 as all activities were halted. During the pandemic economic activities globally came to a halt, and WEF (World Economic Forum), World Bank, and International Monetary Fund (IMF) predicted global financial crises and acute economic recession (Lucchese & Pianta, 2020).

2.1.2 To understand the relationship between COVID-19, which is a lockdown on the demand for food & beverage.

COVID-19 has had a significant effect on the overall supply and demand of food and beverage around the globe. With the passage of time, the demand increased, and the supply has been uncommon due to the limitations in transportation and lockdown in many countries around the world. The reduction in world trade has also had a significant impact on the overall demand for food. In light of ongoing difficulties in the food store network, the food sector is currently tirelessly worried about food preparation, distribution, and requests. COVID-19 resulted in labourer development constraints, changes in frequent shoppers, the closure of food production offices, limited food exchange approaches, and financial pressures in the food inventory network (Ubaid-ur-Rehman et al., 2021). With the advent of COVID-19, there was a demand surge for necessities, especially food. In contrast, the pandemic has affected the supply of these necessities negatively because of the lockdown and trade restrictions. With the raw material being stuck on the other end of the world, countries failed to meet the demand with local production, resulting in an acute food crisis (Ubaid-ur-Rehman et al., 2021).

As per the Global Report on the Food Crisis 2020, approximately 135 million suffered from the 'crisis level' food security issues and demanded immediate attention. Similarly, the number of people with 'stressed level' food issues with the threat of moving into the 'crisis level' was projected to be around 183 million (Food and Agriculture Organization of the United Nations [FAO], 2020). The global pandemic had a coercive impact on the world economy, and the forecasted number of people suffering from acute food security has increased significantly.

2.1.3 To understand and analyze the relationship between the unavailability of labour, transport due to COVID-19 and its impact on the supply chain.

COVID-19 has immensely impacted all the intensive sectors. The areas confronting the most monetary danger are development, assembling, convenience and food administrations, discount and retail exchange, transport and capacity, and land and business exercises. Each of these entities contributes majorly to the entire supply-chain process. Administratively these have been most terribly hit because of the COVID-19 lockdown imposed in the country. Fundamental work insurance, sufficient living wages, pleasant working hours, social security and safe working environments ought to be accessible to everybody regardless of agreement/business status. Between the inaccessibility of work because of COVID-19 and its effect on the production network.

The countries implementing complete lockdowns and restrictions over international trade resulted in a workforce shortage, and the logistic disruption became the reason for the supply-side constraint. This pandemic influenced the purchase behaviour of the people, and people started panic buying and hoarding the necessities, which resulted in a sudden surge in demand-side for the food supply chain (Hobbs, 2020). The lockdown was the best solution without a cure, a necessary measure to slow down the pandemic. However, it weakened the economy and halted the global supply chain network (Singh et al., 2020). The functionality of logistics with a seamless cycle is necessary for the revival and recovery of the supply chain (Remko, 2020; Rasheed et al., 2023). The significant flaws in the global supply chain were exposed during the pandemic and resulted in the fulfilment of the demand and the revenue loss.

2.2 Empirical Reviews

An extreme example of force majeure is the COVID-19 pandemic; it is applying disruptions to the supply chain and creating firms make strong capabilities to decrease their impact with the help of making systemic measures to deal with the disruption in the overall supply chain & business. The

Manufacturer's survival and growth in unstable periods have become very important. Disruptions show supply chain risks that force manufacturers to react to disruption. Then firms must make or develop new solutions, capabilities, and resources to Survive & enhance the safety measure to avoid extreme disruptions (Aday & Aday, 2020). The exploration of several researchers on disruption in the supply chain has identified several opportunities. The impacts of COVID-19 on these opportunities are intended not to address immediately, but the weaknesses that the COVID-19 pandemic has exposed in Supply Chain Management (Aday & Aday, 2020). Earlier researchers have performed numerous optimization and simulation models to conquer the supply chain network uncertainties, e.g., the supply chain model has been exceptionally conceptualized based on agility & resilience (Rashid et al., 2022a). To prevent supply chain disruption issues, a complete plan is needed to resist an imminent recession. Technological advancement, digitalization of the supply chain network, planning, decision forecasting etc., need to be considered to avoid more or the same situation.

2.2.1 Pandemic COVID-19 on supply chain

The most promptly apparent effects of the pandemic are supply chain sustainability and environmental, social, and economic impacts. Generally, these investigations adversely affect maintainability and raise the chance of losing progress on long-haul supportability drives and developments. Moreover, the investigations have uncovered that there could likewise be adverse consequences on financial execution that endure across whole supply chains, not just in individual firms. In this manner, firms require a checking framework system for following the long-term impacts of systemic shocks on supply chain social sustainability, environment, and financial performance.

2.2.3 Supply chain improving resilience for viability

Research is a wake-up call for resiliency to the pandemic's disturbances. COVID-19 discovered that the management literature on supply chains was still in the early stages of development and that researchers were only considering the effects of pandemics in a relatively limited setting. The supply chain resilience research conducted during COVID-19 revealed that this limited perspective needed to be more adequate to address the scale and scope of a pandemic's challenges to supply chains, exceptionally globalized supply chains, perishable supply chains, and those still developing. This necessitates far more thorough research into supply chain resilience from a broader and more global viewpoint to comprehend supply chain needs and how to handle the difficulties that have surfaced. Thus, Supply chain resilience is being integrated.

2.2.4 Innovation and technology for sustainable supply chain

Much of the research on digital technology has focused on additive manufacturing, artificial intelligence, 3D printing, and big data analytics, all of which can potentially improve supply chain management processes. How businesses are prepared to use these technologies to improve supply chain management procedures needs to be clarified.

2.2.5 COVID-19 supply chain risk management

The COVID-19 pandemic's long-term implications for supply chain resilience and risk management might significantly impact how companies manage risk. However, there are a few recommendations for improving risk management, such as reshoring and supplier collaboration. As a result, more study into creating improved supply chain risk management systems to deal with pandemic risks or other systemic hazards that still need to be foreseen is possible. Supply chain management and sustainable, resilient supply chain research and practice are inextricably linked.

2.3 Research Framework

Lead Time can be explained as the duration between customer requests until the time that the order is delivered to the customer; in other words, it can also be explained as the amount of time it will take to complete the order fulfilment process (Rashid et al., 2022b). During COVID-19, there has been

a surge in demand for FMCG products. However, this sudden change in demand pattern has led to the gap between supply and demand and thus creating a shortage. This study contributes in two ways to the body of literature already in existence. First, it suggests that supply chain processes be integrated. It can proportionally decrease the lead time, improving the performance and customer experience. Second, it proposes that implementing agile practices in supply chain activities can be used to focus on value-added activities, reducing the lead time and eliminating time constraints.

Supply Chain Integration can be defined as the large-scale business practice of integrating all the processes involved, from the sourcing to the delivery, and bringing all the links involved in a closer relationship to create a better service or a product (Malakouti et al., 2017; Das et al., 2021). Moreover, supply chain integration can be explained as the smooth coordination and communication within the supply chain (Malakouti et al., 2017; Haque et al., 2021). Supply chain integration consists of different dimensions, and each dimension plays a pivotal role. Some of these dimensions are strengths, depth, and scope (Malakouti et al., 2017). Strength, depth, scope, and duration are four dimensions that can be used to theorize supply chain integration in any business. Although these dimensions are distinct, they must be blended, integrated, and managed (Malakouti et al., 2017).

Lastly, there are two levels to the integration process: internal integration and external integration. Internal integration is dependent on timely and smooth communication. Moreover, the flow of information, effective collaboration between departments, and transparency between inter-department and supply chain activities overlap between different departments within the organization (Dove, 2006). External integration includes timely communication with the customers, engaging and managing suppliers, and creating a strategic bond with them which will result in a strategic alliance (Christopher, 2000; Baloch & Rashid, 2022).

Agility in the supply chain can be defined as the ability of an organization to be alert and quick to respond. Being agile means being quick enough to comprehend the market changes, detect and forecast the market opportunities amidst the change and then convert those changes to your benefit via innovative, creative organizational learning (Gligori et al., 2015). Agile approaches are used in the supply chain to quickly respond to any uncertainty in the environment or the marketplace and deliver what customers demand without jeopardizing the brand or customer satisfaction. One way to define the agile method approach associated with the goal of supply chain management is to respond quickly to market demands. Reducing the lead time increases productivity throughout the supply chain operations (Alzoubi et al., 2022). Customer demands the estimated delivery time of the product; being late or unavailability reduces customer satisfaction and tarnishes the brand image.

2.4 Hypothesis Development

In response to the literature, this study aims to examine the aspects and exploratory position by incorporating variables, including Lead Time through Supply Chain Integration and Agile Practices which depict that these variables would have a substantial association with the reduction of lead time. Therefore, the hypothesis given is as follows:

H1: Supply Chain Integration has a significant relationship with Lead Time.

H2: Agile Practices have a significant relationship with Lead Time.

2.5 Conceptual Model

The conceptual work model has been defined below in Figure 1

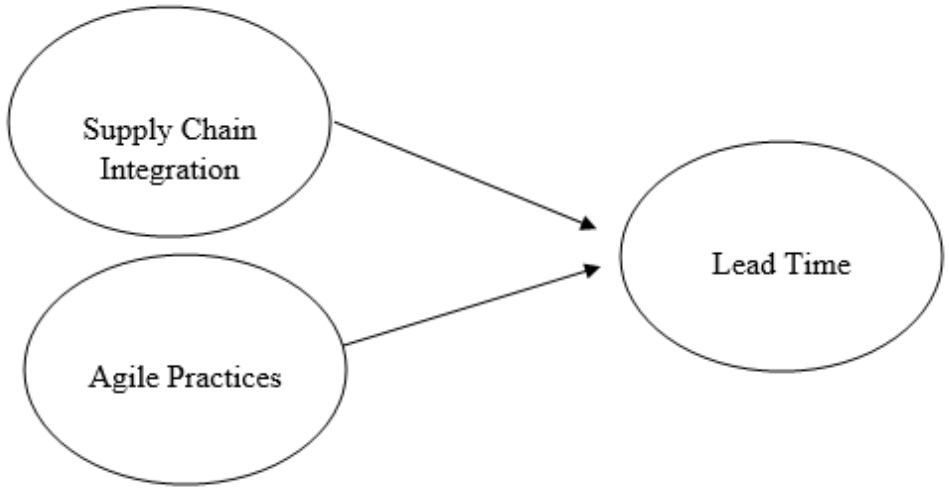

Figure 1 Conceptual Model

Source: Literature (author's creation)

3. Research Methodology

The research method is the fundamental part of the research as it determines the complete methodology of the study, and the statistical test was tested in the research. However, the research method examines the details of the research design, research approach, sampling design, data collection instrument, data collection procedure, sample size, and statistical technique applied to interpret the study. This research used the quantitative research method and deductive reasoning to evaluate the existing theory with the study (Hashmi et al., 2021a; Khan et al., 2023a). This study pertained to using a cross-sectional research design. However, beneficial assumptions not be determined as a consequence of the cross-sectional research design in this study. Moreover, a survey was conducted on reliable respondents to certify the reliability and validity of the collected data by the statistical test and their results by enough sample size (Hashmi et al., 2020a, b).

150 Questionnaires were distributed, 105 were retrieved, and 105 were used for analysis. The sample size of 105 respondents, including executives and managers, we use to collect and analyze data from respondents from different organizations and departments of the supply chain to have reliable and accurate results and findings (Rashid et al., 2020; Hashmi et al., 2021b). In this study, we have used purposive sample technique and non-probability so the respondent answered relevant to the study (Rashid & Rasheed, 2022; Khan et al., 2023b). This sampling technique helps in finding the reliability and validity of the research. Moreover, it was also helping the researcher to determine the data to show accurate results (Rashid et al., 2021). In this research, the researcher used a close-ended questionnaire based on the Likert scale for data collection (Hashmi & Mohd, 2020)

A survey was conducted for primary data collection in this study. Moreover, data was collected through a closed-ended questionnaire. In data collection, both genders were involved, including male and female. Respondents were the managers and the executives serving in the supply chain department. Multiple business management professionals and industry experts reviewed the content validity of the questionnaire. Moreover, Cronbach's Alpha was used as a perimeter to determine the reliability of the questionnaire. A descriptive analysis of the variable was conducted. ANOVA and Regression Analysis provide a healthy and robust statistical method, so this technique is superior to the others (Rashid et al., 2023). ANOVA and regression analyses were used to determine how supply chain integration affects the lead time. Similarly, ANOVA and regression analyses determine how agile practices affect lead time (Rashid, 2016; Hashmi, 2022; 2023).

4. Results and Findings

4.1 Reliability of Model

The given model of the Agile Practices and Supply Chain Integration factor is a good fit, showing that it has an influential power on the Lead Time. Cronbach alpha shown inside consistency means that items are correlated. Therefore, we are testing each variable's reliability, which has been defined below in Table 1.

Table 1: Reliability statistical

Variables		Cronbach's Alpha	N of Items
Agile Practices	Speed	0.832	3
	Competence	0.709	3
	Flexibility	0.890	3
	Responsiveness	0.743	3
Supply Chain Integration		0.746	6
Lead Time		0.796	5

Source: SPSS output

4.1.1 reliability and validity of agile practices

As per the above-given reliability statistics table that Cronbach's Alpha table shows that there is 0.832 of speed, which is 83.2%, 0.709 of competence, which is 70.9%, 0.890 of flexibility, which is 89% and 0.743 of Responsiveness, which means 74.3%. However, the given statistics data shows that Cronbach Alpha is more significant than 0.70, which means that the Agile Practices variable is reliable.

4.1.2 reliability and validity of supply chain integration

As per the above-given reliability statistics table that Cronbach's Alpha table shows that there is 0.746, which is 74.6%, which means Supply Chain Integration variable data is 74.6% reliable (Alzoubi et al., 2022).

4.1.3 reliability and validity of lead time

As per the above reliability statistics table, Cronbach's Alpha table shows that there is 0.796, which is 79.6%, meaning Lead Time variable data is 79.6% reliable (Alzoubi et al., 2022).

4.2 Demographic Profiles

The above model summary table shows the value of R2 is 0.294 means that the variation in the Lead Time is 29.4% concerning Agile Practices and Supply Chain Integration. Adjusted R square in the model summary illustrates the fitness of good for the multiple regression model. It explicates the extent to which independent variables have variations with dependent variables. The adjusted R square calculated is 0.265 showing that two independent variables (Agile Practices and Supply Chain Integration) explain 26.5% of variation with the dependent variable (Lead Time). The remaining 73.5% is influenced by other variables not considered as part of the research study.

Table 2: Demographic Frequency

Demographic	group	Frequency	Percentage
Gender	Female	28	26.7
	Male	77	73.3
Age group	26-35	62	59
	36-50	10	9.5
	Above 51	3	2.9
	Below 25	29	27.6
Education Level	Graduate	35	33.3

	M. Phil	5	4.8
	Masters	48	45.7
	Others	5	4.8
	Under Graduate	12	11.4
Work experience	10 to 15 years	13	12.4
	5 to 10 years	27	25.7
	Less than 5 years	56	53.3
	More than 15 years	9	8.6

Source: SPSS output

4.3 Descriptive Profile and Data

As per the above given ANOVA, table 3 shows the F value, which must be greater than 4, and in this model, the F value is 10.211; the sig value, which is lesser than 0.05, actually is 0.000*, predicts our model is significant. However, reject the null hypothesis and hence the model is significant. The independent variable (Agile Practices and Supply Chain Integration) showed a positive relationship with the dependent variable (Lead Time), so the model is a good fit.

Table 3: ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	131.351	2	65.676	10.211	.000[b]
	Residual	315.168	49	6.432		
	Total	446.519	51			

Dependent variable: Lead time

Source: SPSS output

4.4 Hypothesis Testing

The above-given coefficient Table 4 shows that the positive beta means that Agile Practices and Supply Chain Integration table directly relate to the Lead Time. Hence, the t value is more significant the 2, which is 4.71, and the sig value is less than 0.05, which is 0.027** Reject null hypothesis means this model is significant. It also shows that if the Supply Chain Integration is increased by 1 %, the lead time reduction would be increased by 35.3 %, and if the Agile Practices are increased by 1 %, then the reduction in the lead time would be increased by 67%.

Table 4: Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.587	2.821		4.71	.027
	Supply Chain Integration	.353	.096	.442	3.666	.001
	Agile Practices	.670	.280	.288	2.390	.002

Dependent Variable: Lead Time

Source: SPSS output

5. Discussion, Implications, Limitations, and Recommendations

5.1 Discussion

The study focused on determining how supply chain integration and agile practices contribute to reducing lead time. The study signifies better supply chain integration and implementing the best agile practices. Therefore, the study aimed to determine the best implementation of the agile practices following the supply chain integration leads to reduced lead time. Moreover, as the data shows, with the scalability of agile practices, it is necessary to adapt and respond to the change of the market requirement to increase the lead-time reduction.

In general, supply chain integration might be defined as all organizational processes that engage all customers and suppliers and combine them to create a good or service. Meanwhile, the supply chain refers to every input needed to produce a product, deliver a service, and fulfil a specific need. Supply chain integration may be considered close alignment and coordination inside a supply chain.

Lean and agile manufacturing's primary goals include reducing lead times, Work-In-Process (WIP) inventories, and improving material flow, all of which increase productivity. The main objective of Lean and agile manufacturing is to provide customers with high-quality products at reasonable prices. In order to maintain the ideal work-in-process inventory in the production flow, lean and agile manufacturing play a crucial role. By reducing inventory and lead times, lean manufacturing increases competitiveness while enhancing the process's quality (Rasheed & Rashid, 2023). In the manufacturing industry, a decrease in WIP leads to greater liquidity, better cash flow, better customer service, and lower business risks.

The agile supply chain focuses on flexibility and receptiveness. It responds quickly to changes in demand, customer preference, and industry. It is made to handle unpredictability in the market through "postponement"— waiting to see what the market will dictate before finishing production. As per the results derived from this study, it can be stated that agile practices and supply chain integration impact the process of lead-time reduction. Supply chain integration and agile practices are necessary during calamities and critical times like COVID-19. The study shows a direct relationship between agile practices and lead time reduction. If the supply chain integration increases by 1 %, then the reduction in lead time would be increased by 35.3 %, and if the Agile Practices are increased by 1 %, then the reduction in lead time would be increased by 67%. The findings of this study are also consistent with past research (Alzoubi et al., 2022).

5.2 Implication

Further, the implication of this can be seen with the help of trying many new methods that could contribute to the promotion of the overall implementation of the agile strategy of the supply chain, which includes the time production system, quality management & also production flow management to keep the cost little & maintain the reliability & quality level.

5.2.1 Theoretical implication

The study aimed to investigate how supply chain integration and agile principles may shorten lead times. It highlighted the relative importance of adopting the best agile methods of supply chain integration implementation. The ultimate goal of this research was the awareness of the best supply chain integration optimization, in line with the best agile practices. This would eventually decrease supply chain lead time by eliminating any processes or activities that do not add value to the supply chain operations. Additionally, by enhancing its capacity to respond to market demands quickly, agile practice's scalability is linked to a reduction in lead times.

5.2.2 Practical implication

Businesses can establish a high degree of flexibility by focusing on the flexible supply chain strategy, sharing information, and using information technology and production technology throughout all supply chain participants. To further reduce uncertainty through demand forecasting and inventory control to achieve a high degree of response efficiency, businesses could emphasize speed in the delivery of orders and reliability by selecting appropriate transportation according to the nature of the products. Other approaches that support adopting the agile supply chain strategy, such as Quality Management, just-in-time (JIT), and Production Flow Management, might be tried to lower costs and maintain the level of quality, resulting in additional implications.

5.3 Recommendation

The companies need to enhance the flexibility level by keeping attention to the flexible supply chain strategy with the help of employing information & sharing information with updated technology & production technology with the complete process in all supply chain parties so they can achieve a new high-grade of flexibility. The companies can also enhance and emphasize the in-delivery speed of orders and their reliability with the proper selection of transportation according to the nature of their all products so they can reduce the instability with the help of forecasting of inventory & demand control to gain a high degree of response efficiency.

Agile practices help the company to accomplish their target without breaking their customer demand, companies should adopt agile practices for quick response, and it only occurs with the help of the perfect team that delivers the right services to customers at the right time. Especially in the service sector, they need to enhance their supply chain process & integrate all of the actions to make a wide-ranging strategy to exclude the waste in the process to decrease the lead time, such as agile practices, typically in COVID-19-like situations. In the Covid-19 pandemic, companies must move with the strategy of multiple suppliers; all the work is divided into multiple suppliers, which increases the company's efficiency and increases customer satisfaction.

5.4 Limitation

The sample size of 130 respondents, including executives and managers from supply chain departments, took much work to collect. Consequently, there were two conditions which were enforced on the collection, which are one, the size itself and second, the respondent must be an executive or a manager from the supply chain area. Studies have yet to be conducted on the problem of how agile practices and supply chain integration are viable options to reduce the lead time when it comes to unprecedented events like COVID-19.

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