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Supply chain integration and agile practices

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ABSTRACT

Lead time is one of the main factors that has always significantly affected supply chain competitiveness. The recent COVID-19 pandemic has hurt lead time, and an exceptional increase in lead time has been experienced because of it. However, there are a few variables which can have a positive effect on the lead time. This research study was aimed at how variables like agile practices and supply chain integration may influence the lead time. 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 was employed to drive the results. The findings of this study indicate that supply chain integration and agile practices contribute to the reduction of lead time. Findings also suggest that the lead time can be significantly reduced with supply chain integration and agile methods.

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

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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; Rashid et al., 2023a)). 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) outbreak 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 to modify the original product (Pilbeam et al., 2012). COVID-19 has severely influenced how the supply chain should work in the event of unprecedented catastrophes. Since then, the primary reason for the propagation of the virus has been the increasing rate of globalization and international travel and trade. Subsequently, countries stopped trade activities, travel, and the local movement (Ubaid-ur-Rehman et al., 2021). Therefore, these restrictions have had a significant influence on lead time. It was more tragic in underdeveloped countries, where the 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. 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; Sarkar et al., 2019). 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 help them achieve greater efficiency and performance in lead time (Cheung et al., 2018; Rashid et al., 2023b).

The 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; Rashid & Rasheed, 2023). Customers always want to know the accurate time of delivery or order fulfilment. Reducing the lead time will result in enhanced performance and greater productivity in supply chain operations. This can be achieved with concrete supply chain planning, adaptability in the face of unprecedented events, agility, and information sharing in real-time (Alzoubi et al., 2020; Rasheed & Rashid, 2023).

Moreover, studies have been conducted to determine how the lead time is affected by supply chain integration and agile practices. The survey conducted by Alzoubi et al. (2020) in the healthcare sector for the same variables has shown that agile methods can reduce lead time by emphasizing and exploiting value-added activities and mitigating unnecessary actions. Secondly, it also indicates 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.

1.1 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 disorder can be categorized into two main categories: risk originating from the abnormal shift between demand and supply in the market or risk disrupting routine supply chain activities in the product's supply chain life-cycle (Singh et al., 2021; Rasheed et al., 2023). These disruptions can be explained by the factors that hinder the supply chain. The troubles that hinder routine activities include natural calamities, accidents, intentional acts, or pandemics (Shahid et al., 2021; Baloch & Rashid, 2022). 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 exciting topics in terms of research.

For manufacturers to remain in business, they have to maintain production flow and keep profit

floating. Disruptions on the supplier's side, accidents or natural incidents, or disruptions on the retailers' side, shifts in the demand curve, and changes in the behaviour of the market can affect the production capacity (Shahid et al., 2021; Rashid et al., 2022a). Consequently, manufacturers will lose their customers. Most of the study in the disruption area is focused on one end, which is either the supplier's side or the retailer's side.

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 demand curve was seen because of COVID-19, which was unanticipated, and the global supply chain was not ready to face that catastrophe, resulting in a significant food crisis across the globe. 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 great danger of entering the crisis phase. (Ubaid-ur-Rehman et al., 2021).

1.2 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 still need to be emptied. Around 80 ships carrying more than 500,000 cargoes were waiting for 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 were able to pose these questions in our study questions, which are listed below:

1. *What is the effect of supply chain integration on the lead time?*
2. *What is the effect of agile practices on the lead time?*

1.3 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 wide spread worldwide. The virus has ruthlessly ruined the economy and many individuals. The demand and supply of several products were severely affected due to strict lockdowns, and the aftereffects 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. This research aims to gauge the post-epidemic results, find the problem, and then work on the outcomes to overcome them to advance the supply chain sector, especially freight, logistics issues, and international disruptions. We highlighted the significance of these effects on logistics businesses engaged in the transfer, loading, storage, and movement of goods, which have been affected by COVID-19 and the post-pandemic results. Therefore, supply chain disruptions induced by the pandemic could influence competitiveness, global financial growth, and job creation. This review aims to assess the impact of post-COVID on the food and beverage sector and present the recommendations required in a condensed manner to implement the reduction and control of the pandemic.

1.4 Significance of the Study

The significance of the study is to examine the supplier's risk of disruption based on their strategy, supply chain structure, and attributes during turbulence. 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 delay 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 logistics strategies

through endogenous and exogenous uncertainty. Moreover, these variables indicate that the supply chain can resolve inside and outside market dynamics with the support of supplier relationships and economic factors, including inflation and interest rates. 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 supply chain management and 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 (Govindan et al., 2020). Pandemics are not new for humanity; various pandemics come over some time, and the world has been able to tackle them with time. The main high point is that these pandemics impact the world's economies (Singh, 2020). The food and beverage industry, the most critical pillar of the economy, has also suffered due to the pandemic. As of now, the results of the pandemic Due to this, the world witnessed the most harmful effects, especially from a consumer perspective. As we know, the food supply needs some adjustments; with the quick change in food, any collection 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 affected by COVID-19, as the demand for tea, coffee, milk, and dairy products was so low that they experienced enormous quantities of waste and the products in stock came near expiration because of the long non-consumable practices in COVID (Ubaid-ur-Rehman et al., 2021; Rashid et al., 2022b). The transport of these products experiences several delays, so the products don't arrive on time (Aday & Aday, 2020). As an efficient supply chain, the movement of goods from suppliers to manufacturers is essential. If, due to the coronavirus, the imposition of the lockdown remains constant, then it could lead to severe consequences for the food market, which would then impact the organization's supply of goods to consumers in a disorienting snare of cooperation, including ranchers, farming data sources, handling plants, delivering, and retailers. (Aday & Aday, 2020).

The drawn-out food and beverage supply will be more questionable and affect ranchers. Certain staple things delivered and put away in powered volumes and have remarkably proficient transportation and coordination frameworks will probably not avoid critical disturbances. The motivation behind this audit is to determine the connection between COVID-19 past and post disturbances in coordination and the inventory network. To comprehend the relationship between COVID, which is a lockdown on the interest in food, and the aftereffects of COVID, we must know and investigate the link (Aday & Aday, 2020; Hashmi, 2023)

2.1.1 To understand the relationship between COVID-19 and disruptions in logistics on 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 around the world will assist all businesses in organizing their responses. Many companies and sectors are badly affected by COVID, and its aftereffects, like disruptions in logistics and supply chain, create shortages of products and basic materials, which make the cost high and 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, expedited consignment expenses, and payments made to purchase supplies and maintain capacity. Companies are also experimenting with alternative sourcing options to overcome post-COVID and future problems from natural climates and COVID-like situations (Singh, 2020). All industrial sectors are interconnected with the complex network of logistics and supply chains; 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 the WEF (World

Economic Forum), the World Bank, and the International Monetary Fund (IMF) predicted global financial crises and an acute economic recession (Lucchese & Pianta, 2020).

2.1.2 To understand the relationship between COVID-19 and the lockdown on the demand for food and beverages

COVID-19 has had a significant effect on the overall supply and demand of food and beverages around the globe. The demand has increased with time, and the collection has been uncommon due to the limitations in transportation and lockdowns in many countries worldwide. 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 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 surge in demand for necessities, especially food. In contrast, the pandemic has negatively affected the supply of these necessities 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; Hashmi et al., 2021a).

As per the global report on the Food Crisis 2020, approximately 135 million people 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 at 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 insecurity 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 COVID-19 have immensely impacted all the intensive sectors. The regions facing the most monetary danger are development, assembly convenience and food administration, discount and retail exchange, transport and capacity, and land and business exercises. Each of these entities contributes significantly to the entire supply-chain process. These have been 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 should be accessible, regardless of agreement or 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 on international trade resulted in a workforce shortage, and the logistic disruption became the reason for the supply-side constraint. This pandemic influenced people's purchasing behaviour, and people started panic buying and hoarding necessities, resulting in a sudden surge in the demand side of the food supply chain (Hobbs, 2020). The lockdown was the best solution without a cure, a necessary measure to slow down the pandemic. Still, 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 et al., 2020). The significant flaws in the global supply chain were exposed during the pandemic and resulted in the unfulfillment of demand and revenue loss.

2.2 Empirical Reviews

An extreme example of force majeure is the COVID-19 pandemic. It applies disruptions to all the supply chains. It creates firms with solid capabilities to decrease their impact with the help of systemic measures to deal with the trouble in the overall supply chain and business. The manufacturer's survival and growth in unstable times have become very important. Disorders show supply chain risks that force manufacturers to react to trouble. Then, firms must develop new solutions, capabilities, and resources to survive and enhance safety measures to avoid extreme disruptions (Aday & Aday, 2020).

The exploration of troubles in the supply chain by several researchers has identified several opportunities. The impacts of COVID-19 on these opportunities are intended to address immediate issues and 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. For example, the supply chain model has been exceptionally conceptualized based on agility and resilience (Altay, 2018). 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 in the future.

2.2.1 Pandemic covid-19 on supply chain

The most promptly apparent effects of the pandemic in terms of supply chain sustainability, environmental, social, and economic impacts generally; these investigations adversely affect maintainability and raise the chance of losing progress on long-term supportability drives and developments. Moreover, the studies have uncovered that there could likewise be adverse consequences for 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, environmental performance, and financial performance.

2.2.2 Supply chain improving resilience for viability

Research is a wake-up call for strength 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 little perspective needed to be revised 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 (Hashmi et al. 2021b).

2.2.3 Innovation and technology for sustainable supply chains

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.

2.2.4 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 research and practice are inextricably linked.

2.3 Research Framework

Lead time can be explained as the duration between customer requests and the time that the order is delivered to the customer; in other words, it can also be defined as the amount of time it will take to complete the order fulfilment process (Udokporo et al., 2020; Hashmi et al., 2020a). During COVID-19, there has been a surge in the demand for FMCG products. However, this sudden change in demand pattern has led to a gap between supply and demand, thus creating a shortage. This study

contributes in two ways to the body of literature already in existence. First, it suggests integrating supply chain processes, which can proportionally decrease lead time and improve 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 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 sourcing to delivery, and bringing all the links involved into a closer relationship to create a better service or product (Malakouti et al., 2017; Hashmi et al., 2020b). Moreover, supply chain integration can be explained as the smooth coordination and communication within the supply chain (Malakouti et al., 2017). Supply chain integration consists of different dimensions, and each size plays a pivotal role. Some of these dimensions are strength, 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 depends on timely and smooth communication, the flow of information, effective collaboration between departments, and transparency between inter-department and supply chain activities overlapping between different departments within the organization. External integration includes timely communication with customers, engaging and managing suppliers, and creating a strategic bond with them, resulting in a strategic alliance (Christopher, 2000).

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 fast enough to comprehend market changes, detect and forecast market opportunities, and convert those changes to your benefit via innovative, creative organizational learning (Gligoric et al., 2019). 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 is associated with the goal of supply chain management, which is to respond quickly to market demands. Reducing the lead time increases productivity throughout the supply chain operations (Alzoubi et al., 2021). The customer demands the estimated delivery time of the product; being late or unavailable reduces customer satisfaction and tarnishes the brand image.

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 depicts that these variables would have a substantial association with the reduction of lead time. Therefore, the hypothesis are as follows:

H1: Supply chain integration has a significant relationship with lead time.

H2: Agile practices have a significant relationship with lead time.

3. Research Methodology

The research method is the fundamental part of the research as it determines the complete methodology of the study, and statistical tests were tested. 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 a quantitative research method and deductive reasoning to evaluate the existing theory with the analysis (Sezen et al., 2012; Rashid et al., 2021; Hashmi & Mohd, 2020). This study used a cross-sectional research design (Rashid et al., 2019). However, beneficial assumptions cannot be determined due to the cross-sectional research design in this study. Moreover, a survey was conducted of reliable respondents to certify the reliability and validity of the collected data by the statistical test and their results by enough sample size (Sezen et al., 2012).

3.1 Sampling

One hundred five were used for analysis, greater than 100 (Fincham, 2008; Rashid et al., 2020). The sample size of 105 respondents, including executives and managers, was used to collect and analyze data from respondents from different organizations and departments of the supply chain to have reliable and accurate results and findings (Fincham, 2008; Rashid & Amirah, 2017). In this study, we have used a purposive sample technique and non-probability so the respondents answered relevant to the study (Sezen et al., 2012; Khan et al., 2022a; 2022b). This sample technique helps in finding the reliability and validity of the research. Moreover, it helps the researcher determine the data to show accurate results (Sezen et al., 2012; Khan et al., 2023). The researcher used a close-ended questionnaire based on a Likert scale for data collection (Ankur et al., 2018). 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 executives in the supply chain department (Rashid, 2016; Hashmi, 2022).

3.2 Statistical Technique

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, which is why this technique is superior to the others (Khan et al., 2021). 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 (Ankur et al., 2018; Agha et al., 2021; Haque et al., 2021).

4. Results and Findings

The given model of the agile practices and supply chain integration factor is a good fit, which shows that it has an influential power on the lead time. Cronbach alpha shown inside consistency means that items are correlated. Therefore, we are testing the reliability of each variable.

Table 1: Reliability model

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 Reliability and Validity

As per the above-given reliability statistics in Table 1, 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% (Das et al., 2021; Alrazehi et al., 2021). However, the given statistics data shows Cronbach Alpha is more significant than 0.70, which means that Agile practice variables are reliable. As per the above-given reliability statistics table, Cronbach's Alpha table shows that there is 0.746, which is 74.6%, meaning Supply Chain Integration variable data is 74.6% reliable (Alzoubi et al., 2020). 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., 2020).

4.2 Descriptive Profile and Data

The model summary shows the value of R^2 is 0.294, which 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 illustrated the fitness of good for the multiple regression model. It explains 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 that were not considered part of the research study.

Table 2: ANOVA test results

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

Dependent Variable: Lead Time

Source: SPSS output

As per Table 2 of the ANOVA test results, the F value must be greater than 4, and in this model, the F value is 10.211; the sig value is lesser than 0.05; actually, it is 0.000*, which predicts our model is significant. However, the null hypothesis and, hence, the model is substantial, and the independent variable (agile practices and supply chain integration) showed a positive relationship with the dependent variable (lead time), so the model is said to be a good fit.

4.3 Hypothesis Testing

Table 3: 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

a. Dependent Variable: Lead Time

Source: SPSS output

The above-given coefficient Table 3 shows that the beta is positive, which means that agile practices and the supply chain integration table have a direct relationship with the lead time. The t value is more significant than the 2, which is 4.71, and the sig value is less than 0.05, which is 0.027** Rejecting the null hypothesis means this model is essential. 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 decline in the lead time would be increased by 67%. Table 4 presents a summary of the results of the hypotheses.

Table 4: Hypotheses assessment

Hypotheses	Sig	Results
The p-value is 0.001, less than 0.05, and the T-value is 3.666, greater than 2. Therefore, the null hypothesis is rejected, and the Alternate theory is accepted.	.001	Accepted
The p-value is 0.002, less than 0.05, and the T-value is 2.390, greater than 2. Therefore, the null hypothesis is rejected, and the Alternate theory is accepted.	.002	Accepted

Source: SPSS output

5. Discussions, Conclusion and Recommendations

5.1 Discussion

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 or 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. 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. 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's 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 both agile practices and supply chain integration impact the process of lead-time reduction. Supply chain integration and agile practices are necessary in times of calamities and critical times like COVID-19. The study shows a direct relationship between agile practices and the reduction of lead time. If the supply chain integration increases by 1 %, then the lead-time reduction 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 the past research (Alzoubi et al., 2021).

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 & and 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 don't 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 reduced 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 the adoption of 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 Limitation

The sample size of 130 respondents, including executives and managers from supply chain departments, took a lot of work to collect. Consequently, there were two conditions that were enforced on the collection: the size itself and 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 option to reduce the lead time when it comes to unprecedented events like COVID-19.

5.4 Recommendation

The companies need to enhance the flexibility level by paying attention to the flexible supply chain strategy with the help of employing information & sharing information with updated technology & production technology with the complete the 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 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 accomplish their target while maintaining customer demand. Companies should adopt agile methods for quick response, which 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 process supply chain and 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. During the COVID-19 pandemic, companies must move with the strategy of multiple suppliers, all the work divided into various suppliers, which increases the company's efficiency and customer satisfaction.

5.5 Conclusion

The study determined how supply chain integration and agile practices contribute to lead-time reduction. The study signifies better supply chain integration and implementing the best agile practices. Therefore, the study aimed to determine the best performance of agile practices following the supply chain integration, which reduces lead time. Moreover, as the data shows, with the scalability of agile methods, it is necessary to adapt and respond to changes in market requirements to increase lead-time reduction.

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