Supply chain integration and supply chain performance: evidence from the textile industry

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ABSTRACT – REZUMAT

Supply chain integration and supply chain performance: evidence from the textile industry

This study aims to determine the impact of supply chain integration on supply chain performance and the Internet of Things (IoT) mediating role in Sindh Pakistan's textile industry. Primary data was gathered with the help of questionnaires from previous studies. The employees were requested to complete the questionnaire online, and the concerned HR department was officially contacted. To achieve the research objectives of this study, SmartPLS version 3 is applied. The findings of this study confirmed the direct effect of internal integration, supplier integration, and the Internet of Things on supply chain performance. In addition to this, the present study also confirmed the partial mediation effect of IoT between internal integration, supplier integration, and supply chain performance in the textile industry of Sindh, Pakistan, a developing country. This research uses RBV theory to examine the textile industry's supply chain and effectiveness. Internal integration, partner integration, IoT, and supply chain performance are discussed in the research. This clarifies how these technologies operate together to give organizations a competitive advantage. The study shows how the Internet of Things (IoT) is a go-between for integration and supply chain success. Textile business managers should consider investing money into IoT devices and using their benefits. Companies can get real-time information about their supply chain by using IoT devices and monitors.

Keywords: supply chain integration, Internet of things, supply chain performance, textile industry

Integrarea și performanța lanțului de aprovizionare: dovezi din industria textilă

Acest studiu își propune să determine impactul integrării lanțului de aprovizionare asupra performanței acestuia și al rolului de mediere a Internetului obiectelor (IoT) în industria textilă din Sindh, Pakistan. Datele primare au fost colectate cu ajutorul chestionarelor din studiile anterioare. Angajaților li s-a cerut să completeze chestionarul online, iar departamentul de HR în cauză a fost contactat oficial. Pentru atingerea obiectivelor de cercetare ale acestui studiu se aplică SmartPLS versiunea 3. Concluziile acestui studiu au confirmat efectul direct al integrării interne, al integrării furnizorilor și al Internetului obiectelor asupra performanței lanțului de aprovizionare. În plus, studiul de față a confirmat și efectul de mediere parțial al IoT între integrarea internă, integrarea furnizorilor și performanța lanțului de aprovizionare în industria textilă din Sindh, Pakistan, o țară în curs de dezvoltare. Această cercetare utilizează teoria RBV pentru a examina lanțul de aprovizionare și eficiența din industria textilă. Integrarea internă, integrarea partenerilor, IoT și performanța lanțului de aprovizionare au fost examinate în cadrul studiului. Acest lucru clarifică modul în care aceste tehnologii funcționează împreună pentru a oferi organizațiilor un avantaj competitiv. Studiul arată cum Internetul obiectelor (IoT) este un intermediar pentru integrarea și succesul lanțului de aprovizionare. Managerii din domeniul industriei textile ar trebui să ia în considerare investirea banilor în dispozitivele IoT pentru beneficiile acestora. Companiile pot obține informații în timp real despre lanțul lor de aprovizionare utilizând dispozitive și monitoare IoT.

Cuvinte-cheie: integrarea lanțului de aprovizionare, Internetul obiectelor, performanța lanțului de aprovizionare, industria textilă

INTRODUCTION

Supply chain integration is the degree to which different parts of the supply chain are linked and work together smoothly [1]. Coordinating the flow of goods and information also means bringing wholesalers, producers, dealers, and stores together. Supply chain merging that works well can improve prices, speed, and the ability to meet customer needs [2]. On the other hand, supply chain performance is how well a supply network meets customer needs while keeping costs and earnings in check. This includes measuring wait times, inventory levels, on-time delivery, customer happiness, and product quality. High performance in the supply chain could lead to more loyal customers, better financial results, and an edge in the market [3]. Supply chain integration could significantly affect how well the supply chain works. When different parts of the supply chain are linked, information may move more quickly and adequately. This makes planning and coordinating more effective. Because of this, wait times might get shorter, product control might get better, and the company might be better able to respond to changes in market demand.

Putting the supply chain together may help find and lower supply chain risks [4]. By knowing more about how their suppliers are doing and how much product they have, companies can better plan for possible delays and take steps to lessen their effects. This could strengthen the supply chain and ensure people keep getting the things and services they need. Integrating and having a successful supply chain go hand in hand. Businesses may improve their supply chain performance by putting integration at the top of their list of priorities [5]. This can help their finances and give them an edge over their competitors.

Internet of Things (IoT) products and monitors are used everywhere [6–8]. These devices can be built into various things, like goods, tools, equipment, and cars. They gather and send real-time information about things like location, speed, usage, weather, and humidity. After IoT devices send their data, it is collected and put into a central system or platform [1]. Large amounts of data from different sources inside the company can be stored, processed, and analysed using this method. The whole business can be seen when IoT data is combined with data from other internal systems, like enterprise resource planning (ERP) or supply chain management (SCM) systems. When companies combine IoT with internal integration, they can use real-time data to make choices based on data, simplify processes, and improve teamwork. Businesses can become more competitive in the market by using these tools and methods to make their operations more efficient, cut costs, and make processes run more smoothly [7].

Information and communication technology (ICT) may significantly affect the supply chain's performance by making it easier for people in the chain to talk to each other and share information more quickly, accurately, and effectively [6]. ICT can show how the supply chain works in real-time, so businesses can see how goods and raw materials move through the chain, keep track of their stock, and spot any problems or slowdowns that might happen. Businesses can quickly adapt to changes in customer demand or the supply chain, which could help cut down on wait times and make the supply chain more flexible overall [7]. ICT can make it easy for people in the supply chain to work together and plan things. For example, cloud-based systems and data analytics tools could let wholesalers, producers, and dealers talk to each other in real time. For example, electronic data exchange (EDI) lets partners in the supply chain share data instantly. This means that no one has to enter the data by hand, which lowers the chance of mistakes. This could improve the supply chain and reduce the cost of entering and handling data [8]. ICT can help everyone in the supply chain see what is going on in real-time, work together, and share data, all of which can significantly enhance the success of the supply chain. When companies spend money on ICT solutions, they can improve how their supply lines work. This can lead to happier customers, more money, and an edge in the market [9].

Even though there is more and more publishing about the benefits of IoT and integrating suppliers in supply chain management, more real-world research is needed to fully understand the unique challenges and opportunities that Pakistan's textile industry supply lines face. In the textile business in Pakistan, there may be little information about how internal integration helps companies get the most out of IoT and partner integration. "Internal integration" refers to how well-coordinated and separate company units work together. It is well known that integrating with providers on the outside has benefits, but more attention should be paid to how internal integration makes these benefits possible. A possible study could be to look into the role that internal integration plays in enabling the benefits of IoT and provider integration on the performance of supply chain management in the Pakistan textile industry. This study might help supply chain managers in the Pakistani textile industry who want to improve their methods and make their businesses more efficient and competitive.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Theoretical framework

The Resource-Based View idea says that a company's tools and skills affect how well it does [2]. The independent factors in this case are Supplier Integration and Internal Integration. A company can use These essential tools and resources to improve supply chain performance, which is the dependent variable. Supplier integration is how well a company works with and combines with its sources. Sharing information, organizing methods, and building relationships that are good for both sides are all part of it. Integrating suppliers can help businesses access expert knowledge quickly and save money [3]. The level to which a company combines its tasks and departments is called its "internal integration". Sharing information, ensuring everyone is working toward the same goals, and organizing processes between different parts of the company are all part of it. Internal integration can help the company communicate, work together, and make better decisions, making the company more efficient and effective [4]. In this approach, information technology can be seen as an intermediate variable. It is a significant part of integrating suppliers and employees within the company. Information technology allows different parts of the supply chain to share information, coordinate actions, and connect their systems [5]. It can help people talk to each other, work together, and make decisions better, which can help the link between the seller and internal integration and supply chain performance. As a result, the theoretical basis for this model would include looking at the clear links between Supplier Integration, Internal Integration, and Supply Chain Performance, as well as the role that IT plays in making these links possible. It is possible to look at how these different factors affect a

company's general supply chain success through the lens of the RBV theory (figure 1).

Hypothesis development

Internal integration

Internal integration is all about aligning and merging a business's internal operations and teams [6]. The goal is to make the supply chain more effective and efficient. This could mean combining tasks like buying, making, sending, and selling and setting shared goals and measurements for all of these tasks. Internal integration could significantly affect the supply chain's efficiency by making it easier to coordinate, shortening wait times, and making the supply chain more efficient [7]. By coordinating their actions and areas, businesses can get a better result of how their whole supply chain is doing and find ways to make it better. By improving production plans and ensuring that internal operations have the tools and resources they need to meet customer needs, internal integration may also help to cut costs and improve product quality. By setting the same goals and key performance indicators (KPIs) for all of their internal processes, companies can improve supply chain management and make people more responsible and capable of making decisions. Internal mergers might not go as planned because of the need for good tools for working together and communicating and the fact that some internal functions and departments might want to stay the same [8]. Internal integration requires unity and dedication from all roles and departments, which some firms may need help with. Internal integration is an essential part of supply chain management that can significantly improve efficiency. Aligning internal departments and processes can help companies save money, work together better, and make customers happier [9].

H2a: Internal integration is positively related to supply chain performance.

H2b: Internal integration positively related to the Internet of Things.

Supplier integration

Partnering closely with providers to make the supply chain work better and more efficiently is called supplier integration [10]. Part of this could be working together to find and fix supply chain problems and bottlenecks, sharing information, and ensuring output plans are in sync. Supplier mergers affect the supply chain's efficiency by making it quicker, cutting down on wait times, and making the supply chain more efficient. By working closely with their suppliers, companies can get real-time information about their suppliers' performance [11]. This lets them respond quickly to changes in demand or the supply chain. Supplier integration also helps improve product quality and lower costs by ensuring sellers have the right tools and skills to meet customer needs and optimize production plans. Setting up long-term relationships with key providers is another way for companies to lower supply chain risk and generally make the chain more stable [12].
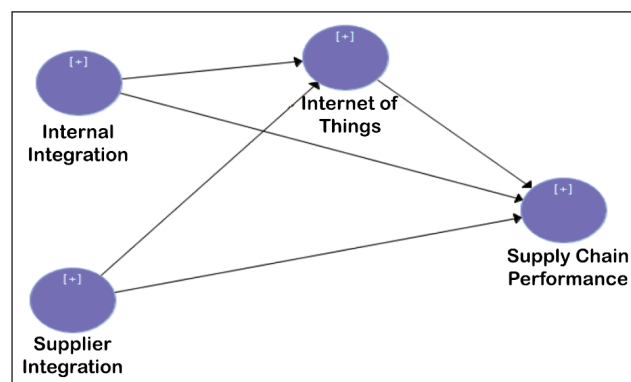

Fig. 1. Proposed conceptual framework

Nevertheless, integrating suppliers might be challenging because researchers need good tools for working together and talking to each other. There is a chance that the company has disagreements with suppliers. It also takes time for both sides to build the trust and commitment needed for provider integration.

H1a: Supplier integration positively related to supply chain performance.

H1b: Supplier integration positively related to the Internet of Things.

The mediating role of the Internet of Things

Along the supply chain, IoT devices and sensors can be built into goods, cars, and warehouses, among other places. These gadgets can show where things are, their state, and how they work in real-time as they move through the supply chain. Improved productivity, fewer stock-outs, and improved customer service result from simpler tracking, monitoring, and management. Supply chain partners can collaborate better using IoT [13]. Partners can see the whole supply chain network by merging IoT data from producers, shops, wholesalers, and transportation businesses. Sharing a perspective and data makes it simpler to collaborate, communicate, and make choices, improving supply chain efficiency and sync. Real-time data collection and analysis using IoT may enhance the supply chain. IoT devices can help you find bottlenecks, flaws, and ways to improve things by collecting data on stocking levels, shipping routes, and production methods. This data-driven improvement helps players in the supply chain simplify processes, cut costs, and improve the performance of the whole chain [14]. IoT creates enormous amounts of data that can be used to learn valuable things. IoT data can be used with advanced analytics methods like machine learning and artificial intelligence to find trends, predict demand, find the best stocking levels, and make supply chain forecasts more accurate. These views into the future help supply chain partners make intelligent decisions and stay ahead of how the market changes [15].

H3: The Internet of Things mediates the relationship between supplier integration and supply chain performance.

H4: The Internet of Things mediates the relationship between internal integration and supply chain performance.

METHODOLOGY

Data and procedure

The questionnaire used in this study was adapted from one used in earlier research and the poll method. The last study used an online survey of 380 supply chain managers in the Indian retail business to get real-world data. The results were then checked using structural equation modelling (SEM). The aim is to find out how supply chain performance measures (SCPM) affect retail organizations' success and test the regulating role. Also, the study needs to look at people's opinions in other industries for more helpful information. In the same way, another study uses the organizational capability theory to create an empirical model that looks at how IoT capabilities affect different aspects of integrating supply chain processes. This improves both the performance of the supply chain and the performance of the organization as a whole. Structural equation modelling (SEM) examined cross-sectional poll data from 227 Australian retail businesses. The current study, on the other hand, is based on the textile business in Pakistan, and IoT is used to measure the success of the supply chain. Due to their policy on privacy concerns, responders were asked to fill out an online questionnaire through Google Forms. The link to the questionnaire was shared with the appropriate HR department of the textile industry of Sindh, Pakistan, through WhatsApp, email, and Facebook. Because of this, the study's population comprises companies working in the industry. Middle-level only agreed to fill out the poll on their own. The employee's name was kept secret. From May to July 2023, three months will be used to gather information. There were 300 surveys sent to workers at Pakistani production companies. However, after cleaning up the data, the writers only looked at 250 surveys. So, 83% of people asked to participate in this study did so. The questionnaire was adopted from [16, 17].

The research instrument is taken from the study of [16, 17]. The supply chain management performance three items are "Improve supply chain delivery reliability, Reduce the total supply chain management cost, and Improve supply chain flexibility (react to product changes, volume, mix". The second variable supplier integration also has three items "Improve information exchange with our suppliers, accurately plan and adopt the procurement process in collaboration with our suppliers and Share real-time demand forecasts with our suppliers". The third concept internal integration had four items such as "Improve the integration of data among internal functions, improve real-time communication and linkage among all internal functions, improve inventory management in collaboration with cross-functional teams and Improve real-time searching of logistics-related operating data". Lastly, the internet of things items are "To provide real-time information to optimize supply chain activities, To provide real-time intelligence of supply chain operations, To strengthen inter and intra organizational information sharing within the supply chain and to strengthen communication and coordination between operators".

Statical tools

Structural equation modelling (SEM) is used to test the suggested theory in this work [18]. Through numerical proof, SEM helps to prove that current ideas are correct. So, the SEM is used to make sure that there is a link between hidden variables and their factors. As an extra sample, 5,000 bootstrap samples were also used. When dealing with complicated models like mediation or moderation, Smart-PLS should be taken into account [19].

RESULTS

Instrument's reliability and validity

When a researcher uses an online survey to get data, reliability means how stable and consistent those measures are. It ensures that the device always gives the same results, even if it is used by different experts or more than once [20]. High dependability means the tool measures the construct regularly and with a little mistakes. Cronbach's alpha checks how consistent a poll is by determining how strongly items on a scale or concept are linked. In this case, a more considerable number means more internal stability. Most people agree that Cronbach's alpha value of 0.70 or higher means the stability is good, though higher values are better [21]. Like Cronbach's alpha, composite reliability is a way to measure how consistent something is with itself [22]. This test checks how well different parts of a scale or design help measure the same central idea. Many 0.70 or higher is usually considered good, just like Cronbach's alpha. The validity of a poll is how well it measures what it is supposed to measure. It ensures the tool correctly measures the vital concept and gives valuable results. To correctly draw conclusions and inferences from the questionnaire data, it is crucial to ensure the data is accurate [23]. The average Variance Extracted is the term AVE stands for. Structural equation modelling (SEM) is a statistical measure used to check if a measurement scale or concept is accurate across all cases. AVE shows how much variation in a construct's signs can be explained by measuring error. The amount of variation recorded by the items is compared to the measuring error to get the AVE. Most of the time, an AVE level of 0.50 or higher means that the items explain at least half of the variation in the construct [21]. All the numbers in this study are good enough, so the theory can now be tested (table 1).

Hypothesis testing

The beta values, also called regression coefficients or slope coefficients, show how much the dependent variable changes when the related independent

Table 1

INSTRUMENT'S RELIABILITY AND VALIDITY					
Variable	SPSS code	Item loading	Value of Cronbach alpha	Value of Composite Reliability	AVE
Supply Chain Performance	SCP1	0.766	0.778	0.871	0.694
	SCP2	0.878			
	SCP3	0.850			
Supplier Integration	SI1	0.914	0.862	0.916	0.785
	SI2	0.888			
	SI3	0.854			
Internal Integration	II1	0.894	0.899	0.930	0.768
	II2	0.897			
	II3	0.819			
	II4	0.892			
Internet of Things	IOT1	0.871	0.861	0.907	0.709
	IOT2	0.897			
	IOT3	0.852			
	IOT4	0.740			

variable changes by one unit [20]. All other independent variables stay the same. The sum of the squared gaps between what was observed for the dependent variable and what was expected based on the independent variables is minimized to find these factors. The t-values, on the other hand, figure out how statistically significant the beta values are. To find them, divide the predicted regression coefficient by its standard error. The number of standard mistakes in the expected coefficient is not zero, as shown by the t-value. Statistically significant means that the coefficient is bigger than a particular value (usually a significance level like 0.05), and the t-value is more significant than that value [21]. These numbers, beta, and t-values, are essential because they show how a regression model's independent and dependent factors are related. The t-values show whether the effects of the independent variables on the dependent variable are statistically significant, while the beta values show the direction and size of the effects.

Internal integration

There is a positive link between internal integration and supply chain performance, as shown by the positive beta number for internal integration. The size of the beta number (0.282) shows that the link is moderately strong. The Internet of Things (IoT) has a positive beta number, which links with supply chain performance well. The more significant beta number (0.544) also indicates a more robust link than Internal Integration. The t-value of 3.562 shows a statistically significant link between internal integration and Supply Chain Performance. To put it another way, it probably did not happen by chance alone. The t-value for Internal Integration is 8.403, less than the t-value for the Internet of Things. It shows a statisti-

cally significant link between the Internet of Things and Supply Chain Performance, better than the link with Internal Integration (table 2 and figure 2).

Supplier Integration

These numbers help us understand what the results mean. They are the beta values and t-values for the regression coefficients for the variables "Supplier Integration" and "Internet of Things" concerning the dependent variable "supply chain performance". Supplier integration and supply chain performance are linked well if the beta number is positive. The beta number of 0.232, on the other hand, shows that the link could be more robust. The Internet of Things (IoT) has a positive beta number, which links with supply chain performance well. The more significant beta number (0.363) also indicates a more substantial link than supplier integration. The t-value of 3.068 shows a statistically significant link between supplier integration and supply chain performance. To put it another way, it probably did not happen by chance alone. A t-value of 5.591 for the Internet of Things is more significant than a t-value of 5.591 for supplier integration. It shows a statistically significant link between the Internet of Things and supply chain performance, which is better than the link between supplier integration (table 2 and figure 2).

Internet of Things (IT)

The number of betas for supplier integration is 0.119, which means a positive link exists between supplier integration and the Internet of Things. Internet of Things (beta = 0.119): The fact that the beta number is favourable for the Internet of Things shows that it positively affects supply chain performance. The t-value of 3.058 shows a statistically significant link between supplier integration, the Internet of Things,
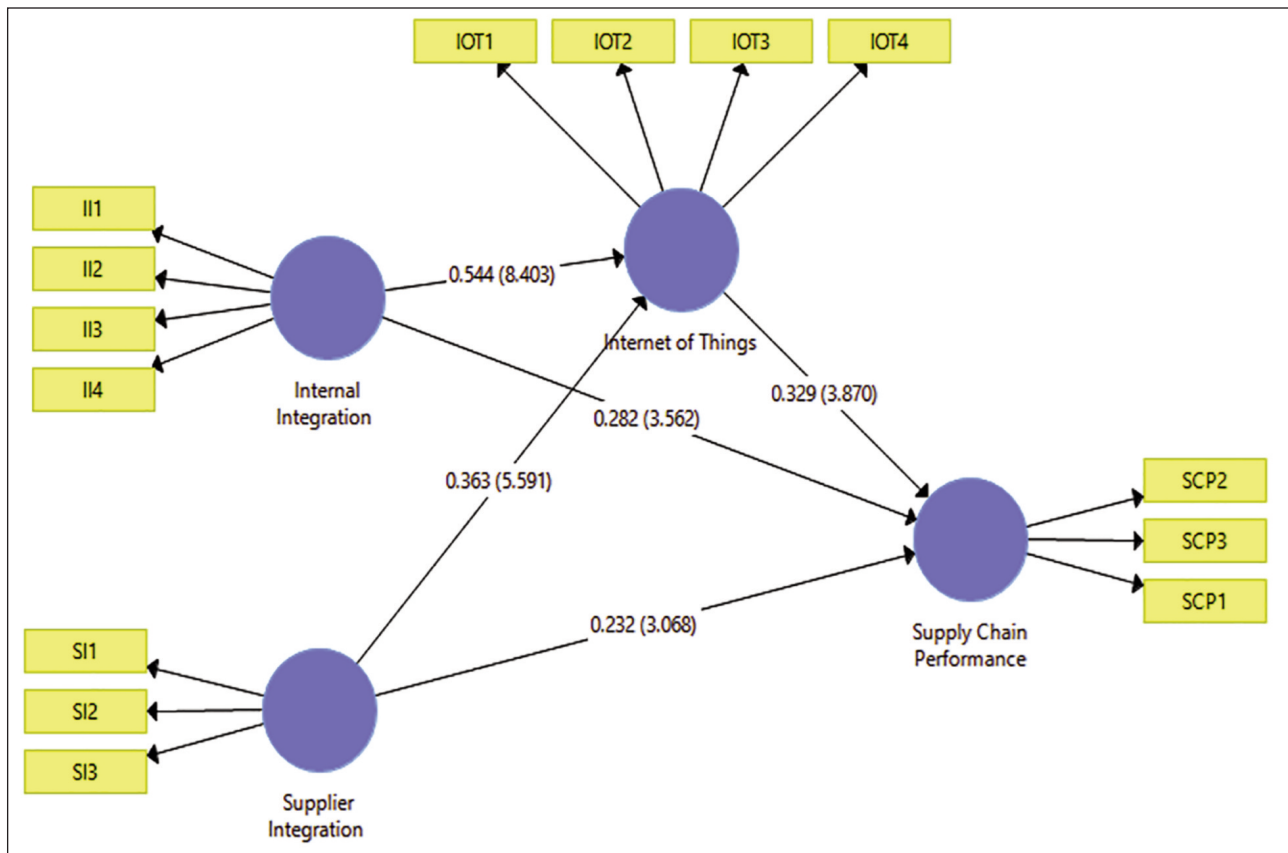
Fig. 2. Structural Equation Modelling

Table 2

HYPOTHESIS TESTING			
Path direction	**Value of Beta**	**T-Value**	**Remarks**
Internal Integration → Supply Chain Performance	0.282	3.562	Supported
Supplier Integration → Supply Chain Performance	0.232	3.068	Supported
Supplier Integration → Internet of Things	0.363	5.591	Supported
Internal Integration → Internet of Things	0.544	8.403	Supported
Supplier Integration→ Internet of Things → Supply Chain Performance	0.119	3.058	Partial medication
Internal Integration → Internet of Things → Supply Chain Performance	0.179	3.506	Partial medication

and supply chain performance. To put it another way, it probably did not happen by chance alone. Internet of Things (beta = 0.179): The fact that the beta number is favourable for the Internet of Things shows a positive link between it and supply chain performance. A mediating strong link exists between internal integration and supply chain performance, as shown by the beta number of 0.179. The t-value of 3.506 shows a statistically significant link between internal integration, the Internet of Things, and supply chain performance. To put it another way, it probably did not happen by chance alone (table 2 and figure 2).

DISCUSSION AND CONCLUSION

Supplier integration and supply chain performance are related effectively, which means that when sup-

pliers are well integrated into the supply chain processes, performance can go up [24]. This result shows how important it is to work together, share information, and coordinate with providers to make the supply chain more efficient and effective. The fact that the Internet of Things and supply chain performance are positively related shows that using and adopting IoT technologies can positively affect how well the supply chain works [25]. IoT makes it possible to see, collect, and analyse data in real time, which helps people make better decisions, improve processes, and make the supply chain more flexible. This study highlights the possible benefits of IoT to improve supply chain management efficiency. It is possible to compare how strong the links are between the factors and supply chain performance

by looking at the beta numbers. The beta value for the relationship between internal integration, the Internet of Things, and supply chain performance is 0.179, which is higher than the beta value for the relationship between supplier integration, the Internet of Things, and supply chain performance, which is 0.119. This means that internal integration has a more enormous effect on supply chain performance than supplier integration.

One important thing for managers in the textile industry to remember from the study is that they should first integrate different areas within the company before attempting to integrate with customers or providers outside the company [24]. This suggestion can help managers plan strategically and decide how to use their resources. Focusing on better internal integration helps managers set priorities for tasks like making it easier for teams within the company to communicate, coordinate, and work together. This can include assembling cross-functional teams, encouraging people to share information, and setting up good ways to measure success [26]. Once internal integration works well, managers can look for ways to integrate with users and sellers outside the company. Getting close to important clients and suppliers, working together on planning and projecting, and sharing valuable data and resources along the supply chain are some things that can be done to do this [27].

Furthermore, companies can get a competitive edge by learning how supplier integration, the Internet of Things, and supply chain performance are connected [28]. Businesses can use these connections to improve customer happiness, cut costs, and get ahead in the market by optimizing their supply chain processes. Employers can use this information to set themselves apart and boost their success. The results can help businesses make their operations more effective and efficient [29]. One example is that since supplier integration and supply chain performance are linked well, companies should improve their supplier management, get closer to their suppliers, and include them in their value chain. This can cut down on wait times, improve quality, make it easier to keep track of goods and make the whole supply chain run more smoothly [26, 27]. The data can help businesses figure out where they need to put more effort to improve their supply chains. For example, if the link between supplier integration and supply chain performance could be more vital, it could mean that the company must work together and coordinate with its sellers even more. In the same way, if there is a strong link between the Internet of Things and supply chain performance, companies may decide to spend more on IoT technologies and use their benefits to get ahead of the competition [30].

Theoretical contribution

Researchers in the textile industry used the Resource-Based View (RBV) theory to determine how internal integration, supplier integration, the Internet of Things (IoT) as a mediating variable, and supply chain performance are connected. This research uses RBV theory to examine the textile industry's supply chain and effectiveness. Internal integration, partner integration, IoT, and supply chain performance are examined in the research. This clarifies how these technologies operate together to give organizations a competitive advantage. We learn more about RBV theory by integrating the Internet of Things (IoT) as an intermediate variable. Adding technical capabilities to the RBV framework expands the study of how technology might enhance supply chain performance. Making this point clearer shows how important it is to use technology as a valuable tool to make integration work better for supply chain success.

Practical implications

The research on supply chain performance and how they work together in the textile industry, especially in Sindh, Pakistan, has many valuable applications for managers and workers in the textile industry. First, the study shows how important it is for textile companies to work together within their own companies. Managers should prioritize projects that make it easier for teams and functions within the company to talk to each other, work together, and coordinate. Second, the study stresses how important it is for textile companies to work with their suppliers. Managers should work together with critical providers and build strong relationships with them. Sharing information, planning and making predictions together, and ensuring that goals and objectives are all the same are examples. Lastly, the study shows how the Internet of Things (IoT) is a go-between for integration and supply chain success. Textile business managers should consider putting money into IoT devices and using the benefits they provide. Companies can get real-time information about their supply chain by using IoT devices and monitors. This information includes inventory amounts, production methods, and transportation.

FUTURE RESEARCH DIRECTION

First, the study may have had a small sample size, which could make it hard to apply the results to the whole textile business in Sindh, Pakistan. Second, because the study is cross-sectional, it only collects data at one point, making it harder to find causal links or look at how things change over time. Finally, the study's results only apply to the textile business in Sindh, Pakistan, and might not be easy to apply to other fields or places.

REFERENCES

[1] Shao, X.-F., Liu, W., Li, Y., Chaudhry, H.R., Yue, X.-G., *Multistage implementation framework for smart supply chain management under industry 4.0*, In: Technol. Forecast. Soc. Change, 2021, 162, 120354

[2] Sazvar, Z., Zokaee, M., Tavakkoli-Moghaddam, R., Salari, S.A., Nayeri, S., *Designing a sustainable closed-loop pharmaceutical supply chain in a competitive market considering demand uncertainty, manufacturer's brand and waste management*, In: Ann. Oper. Res., 2021, 1–32

[3] Cahyono, Y., et al., *The role of supply chain management practices on competitive advantage and performance of halal agroindustry SMEs*, In: Uncertain Supply Chain Manag., 2023, 11, 1, 153–160

[4] Mubarik, M.S., et al., *Resilience and cleaner production in industry 4.0: Role of supply chain mapping and visibility*, In: J. Clean. Prod., 2021, 292, 126058

[5] Ali, S.M., et al., *Modelling of supply chain disruption analytics using an integrated approach: An emerging economy example*, In: Expert Syst. Appl., 2021, 173, 114690

[6] Zhu, C., Guo, X., Zou, S., *Impact of information and communications technology alignment on supply chain performance in the Industry 4.0 era: Mediation effect of supply chain integration*, In: J. Ind. Prod. Eng., 2022, 39, 7, 505–520

[7] Nayal, K., Kumar, S., Raut, R.D., Queiroz, M.M., Priyadarshinee, P., Narkhede, B.E., *Supply chain firm performance in circular economy and digital era to achieve sustainable development goals*, In: Bus. Strateg. Environ., 2022, 31, 3, 1058–1073

[8] Sternberg, H.S., Hofmann, E., Roeck, D., *The struggle is real: insights from a supply chain blockchain case*, In: J. Bus. Logist., 2021, 42, 1, 71–87

[9] Pattnaik, M., Shah, T.R., *Role of Big Data to Boost Corporate Decision Making,* In: 2023 2nd International Conference on Edge Computing and Applications (ICECAA), IEEE, 2023, 105–111

[10] Putra, I., Wiagustini, N.L.P., Ramantha, I. W., Sedana, I.B.P., *Financial sustainability based on resource based view theory and knowledge based view theory*, In: Acad. Account. Financ. Stud. J., 2021

[11] Kalra, D., Ghazal, T.M., Afifi, M.A.M., *Integration of collaboration systems in hospitality management as a comprehensive solution*, In: Int. J. Adv. Sci. Technol., 2020, 29, 8s, 3155–3173

[12] Li, H., Wu, Y., Cao, D., Wang, Y., *Organizational mindfulness towards digital transformation as a prerequisite of information processing capability to achieve market agility*, In: J. Bus. Res., 2021, 122, 700–712

[13] Alzoubi, H., Yanamandra, R., *Investigating the mediating role of information sharing strategy on agile supply chain*, In: Uncertain Supply Chain Manag., 2020, 8, 2, 273–284

[14] Tarigan, Z., Mochtar, J., Basana, S., Siagian, H., *The effect of competency management on organizational performance through supply chain integration and quality*, In: Uncertain Supply Chain Manag., 2021, 9, 2, 283–294

[15] Lee, Y.K., *Transformation of the innovative and sustainable supply chain with upcoming real-time fashion systems*, In: Sustainability, 2021, 13, 3, 1081

[16] Villena, V.H., Gioia, D.A., *A more sustainable supply chain*, In: Harv. Bus. Rev., 2020, 98, 2, 84–93

[17] Gawankar, S.A., Gunasekaran, A.A, Kamble, S., *A study on investments in the big data-driven supply chain, performance measures and organisational performance in Indian retail 4.0 context"*, In: International Journal of Production Research, 2020, 58, 5, 1574–1593

[18] Liu, A., Liu, H., Gu, J., *Linking business model design and operational performance: The mediating role of supply chain integration*, In: Ind. Mark. Manag., 2021, 96, 60–70

[19] Wong, W.P., Sinnandavar, C.M., Soh, K.-L., *The relationship between supply environment, supply chain integration and operational performance: The role of business process in curbing opportunistic behaviour*, In: Int. J. Prod. Econ., 2021, 232, 107966

[20] Tiwari, S.P., *Knowledge Enhancement and Mobile Technology: Improving Effectiveness and Efficiency*, arXiv Prepr., 2022, arXiv2208.04706

[21] Roggeveen, A.L., Rosengren, S., *From customer experience to human experience: Uses of systematized and non-systematized knowledge*, In: J. Retail. Consum. Serv., 2022, 67, 102967

[22] Ghazal, T.M., Alzoubi, H.M., *Modelling supply chain information collaboration empowered with machine learning technique*, In: Intell. Autom. Soft Comput., 2021, 29, 3, 243–257

[23] Gawankar, S.A., Gunasekaran, A., Kamble, S., *A study on investments in the big data-driven supply chain, performance measures and organisational performance in Indian retail 4.0 context*, In: Int. J. Prod. Res., 2020, 58, 5, 1574–1593

[24] Lee, K., Azmi, N., Hanaysha, J., Alzoubi, H., Alshurideh, M., *The effect of digital supply chain on organizational performance: An empirical study in Malaysia manufacturing industry*, In: Uncertain Supply Chain Manag., 2022, 10, 2, 495–510

[25] De Vass, T., Shee, H., Miah, S.J., *The effect of 'Internet of Things' on supply chain integration and performance: An organisational capability perspective,* In: Australas. J. Inf. Syst., 2018, 22

[26] Adeniran, A.O., *Application of Likert scale's type and Cronbach's alpha analysis in an airport perception study*, In: Sch. J. Appl. Sci. Res., 2019, 2, 4, 1–5

[27] Nayak, M., Narayan, K.A., *Strengths and weaknesses of online surveys*, In: Technology, 2019, 6, 7, 0837–2405053138

[28] Tarka, P., *An overview of structural equation modeling: its beginnings, historical development, usefulness and controversies in the social sciences*, In: Qual. Quant., 2018, 52, 313–354

[29] Al-Khatib, A.W., *Can big data analytics capabilities promote a competitive advantage? Green radical innovation, green incremental innovation and data-driven culture in a moderated mediation model*, In: Bus. Process Manag. J., 2022, 28, 4, 1025–1046

[30] Al-Rakhami, M.S., Al-Mashari, M., *A blockchain-based trust model for the internet of things supply chain management*, In: Sensors, 2021, 21, 5, 1759

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