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Antecedents of Maritime Supply Chain Resilience Affecting Supply Chain Performance– An Empirical Study Based on Pharmaceutical Industry

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Abstract

The maritime supply chain is a complex area of study due to the existing vulnerabilities. The interdependency of maritime SC on other entities makes it prone to disruptions. This study investigates maritime factors including advanced information and communication technologies, strategic alliance, and their effect on supply chain performance in the pharmaceutical sector. The data is collected from 109 respondents via a Likert-scale questionnaire. PLS-SEM is deployed to evaluate the measurement and structural models. The results show that the maritime factors namely, advanced ICT and strategic alliance have a significant positive impact on agility and robustness (supply chain resilience), which in turn affect maritime supply chain performance significantly. The study provides useful insights to the practitioners enabling them to cope with the uncertainties raising the SC performance level.

Keywords: maritime, supply chain resilience, pharmaceutical industry, factors, supply chain performance

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1. Introduction

Prescription drugs are produced and distributed to patients through the pharmaceutical supply chain. Although it may seem simple, maintaining a functioning medicine supply chain is rather difficult and necessitates several measures to be followed (Sabouhi et al., 2018). Manufacturers, maritime chains, wholesale distributors, as well as pharmacy benefit managers are all engaged in the pharmaceutical supply chain (PSC).UNCTAD (2021) claims that 80% of the goods are transported through maritime routes. Although Organization for Economic

Development & Cooperation (OECD) claims it to be about 90%. Maritime transportation and its associated operations have a significant economic influence on a wide range of sectors, while transportation through the sea is regarded as the backbone of global commerce, a wide range of materials are brought to industrial centers by this mode of transportation a. Around 40% of the blue economy's value contributed and 24% of its employment comes from maritime transport and allied sectors (shipbuilding, maintenance, and port operations)

But this area is more prone to disruptions in the entire chain. Kashav et al. (2022) claimed that the Maritime Supply Chains (MSCs) have a greater probability of receiving disruptions due to a high level of interdependencies over entities involved at the off-shore side and the land side i.e., at the port which leads to disrupt the chain-wide performance level, resulting in lower customer value at the end-consumer. Besides the ports being the most crucial point of the maritime transport network and the entry point for Impex (import/export) goods, disruption at the port may cause cascading effects into the entire supply chain network (Bosco & Nicholson, 2020). However, this disruption may be due to catastrophic, man-made calamities, and political or economic conditions. Studies show that about 9 months a year organizations face disruptions within their SCs (Scholten et al., 2020; Haris et al., 2020). Furthermore, due to the increasing world population, supply chains are facing more vulnerabilities Guha-Sapir and Ph, (2015). This in turn pressurizes the pharmaceutical sector, as the increasing population demands more and speedy supplies.

In comparison to the maritime sector, the pharmaceutical sector is also the most dynamic and complicated because of the wide variety of goods and diverse stakeholder interests. Because of the high level of change, businesses must take more initiative to stay successful and competitive. Medication production, research, and marketing are all the responsibility of the pharmaceutical business, a massive worldwide conglomerate. Pharmaceutical supply chains (PSC) generally consist of five tiers: primary manufacturers, secondary manufacturers, maritime chains involving major and local distribution centers (DCs), destination zones, and demand points (e.g., pharmacies, hospitals, clinics, etc.). To produce the needed active ingredients (RAI), primary manufacturers are often responsible for either chemical synthesis including separation phases to accumulate the involved complex compounds, or purification as well as product recovery in the case of biological procedures (Hasani et al., 2021). It is the responsibility of secondary manufacturers to carry out further manufacturing operations, such as packing and finishing SKU-based items. Primary manufacturers may be thought of as raw material providers, whilst secondary manufacturers can be thought of as production hubs. Because of this, secondary manufacturers play an important part in the creation of final products (Sazvar et al., 2021), but they are also able to keep a limited number of items in the facility. The maritime chain is responsible to carry inventory i.e., raw ingredients, work-in-process inventory (partially manufactured), and finished medicine and distributing globally. The DCs in charge of stocking items for the market is the main DC and the local DCs. Local DCs have lower capacity and are more scattered than central DCs, allowing them to serve more demand locations. In many cases, despite the use of advanced technology and the development of new goods, many firms are still unable to meet market needs regarding the issues that have developed in the marketplace (Ganguly & Kumar, 2019).

This research paper explores the factors that affect maritime supply chain resiliency and its impact on supply chain performance and customer value. The pharmaceutical industry is constantly under pressure from various factors that can have an impact on its maritime supply chain. As a result, companies in this sector need to be able to respond quickly and efficiently to any challenges that may arise. The pharmaceutical industry is one of the most highly regulated industries in the world, meaning that companies must adhere to a set of strict regulations to produce and sell their products. Unfortunately, this high level of regulation has sometimes led to companies feeling unnecessarily stifled when it comes to their supply chains. This study will focus on the pharmaceutical industry and examine how various factors have impacted maritime supply chain resiliency. Consequently, this study has following objectives:

- The factors affect maritime supply chain resiliency in the pharmaceutical industry.
- The impact of maritime supply chain resiliency over supply chain performance and customer value in the pharmaceutical industry.

2. Literature review

2.1 Theoretical Framework

The Resource-Based View (RBV) measures performance via competitive advantage based on the internal unique expertise (i.e., resource) of a firm (Barney, 1991; Wernerfelt, 1984). The RBV has been widely used in Supply Chains research to identify diverse resources that are considered to be performance antecedents, such as strategic capacities (Ordanini & Rubera, 2008), innovative IT resources (Wu & Chiu, 2015), strategic logistics capabilities (Wong & Karia, 2010) and Supply Chain Resilience capabilities (Wieland, A., & Wallenburg, 2013).

The traditional Resource-Based View focused on the firm's internal resources. However, the perspective can be expanded to the inter-organizational level (Dyer, 1997), which further has an extended scope of achieving competitive advantage via an inter-organizational setting (Dyer & Singh, 1998). To create and build a competitive advantage, Dyer and Singh (1998) suggested that firms should extend the relationship from an arm's length to a more intensified relationship Chang et al. (2014), which current era, demands a strategic alliance with strategic partners by investing in knowledge and resource sharing capabilities.

Past studies have analyzed the factors that affect firms' ability to enhance supply chain resilience, such as supply chain visibility (Brandon-Jones et al., 2014) and human capital capabilities (Blackhurst et al., 2011). Nevertheless, SC-Resilience has also been observed as an organizational resource that helps firms to adapt to the environment (Ponomarov & Holcomb, 2009), which demands SC-Ambidexterity, which may lead to improved operational performance. Moreover, RBV can also be utilized as a basis to illustrate the contribution of SC-Resilience to cargo operational performance (Liu et al., 2017). Different types of SC-Resilience come under the canvas of RBV's explanation of resources, such as agility (Chiang et al., 2012; Christopher & Peck, 2004; Sharifi & Zhang, 2001), integration (Rodríguez-Díaz * Espino Rodríguez, 2006), robustness (Wieland, A., & Wallenburg, 2013), which are more probable to enhance the profitability of the organization. Furthermore, (Liu et al., 2017) used the RBV perspective to analyze the effect of SC-Resilience on firm performance.

Moreover, in this research, the Relational View (RV) is also introduced as a complement to the Resource-Based View (RBV). The unit of analysis in this study is companies mainly import and export departments of the pharmaceutical sector. Blackhurst et al. (2011) simplified from a case study data that, relational competencies, such as pre-established communication systems, relationship management systems, and monitoring systems are positively linked up with resilience (Wieland, & Wallenburg, 2013). In this study, the relational view is the foundation of understanding how intense relational competencies can enhance resilience in two dimensions namely, agility, and robustness.

2.2 Supply Chain Resilience

Shah, (2004) said that PSC is critical to the growth of the medical and health industries. Supply and demand in the industrial supply chain are very sensitive in most nations, as illustrated by Yousefi and Alibabaei, (2015). It is the primary purpose of PSC to guarantee that pharmaceuticals are delivered to patients on time, at the best possible price, and with the smallest possible stock out and optimized lead times. Managing the chain's upstream and downstream flows has significant strategic and systemic ramifications, and this is what is meant by a company's supply chain orientation (Modgil & Sharma, 2017a). When dealing with PSC from a global viewpoint, Esper et al. (2010) report that geographic variety, localized mandatory norms, and a competing organizational structure create problems for them. According to Tucker et al. (2008), globalization, technical innovation, short product life cycles, and the shifting needs of consumers have made PSC very competitive. The link between supply management, supply flexibility, as well as supply chain performance has been investigated and shown to have a favorable impact on supply chain performance in the global market setting (Tripathi et al., 2019). It has been found that risk mitigation within the supply chain has become increasingly critical for global PSC. In the risk mitigation techniques of the worldwide PSC, it has been established as risk reduction is much more significant than risk avoidance Companies have begun high-value-adding R&D (Wang & Jie, 2020) operations as well as innovation activities in low-cost manufacturing locations to reduce risk, according to Zhao et al. (2019). Aiming to please both customers and the company, pharmaceutical companies are adopting a fast-paced, agile strategy that allows them to take advantage of valuable possibilities quickly (Huq et al., 2016).

Developing an agile supply chain will need to have a wide range of characteristics, such as capability, reactivity, speed, and suppleness. PSC's agility is shaped by a variety of elements, including market research, client demand, input from all stakeholders, and forecasts (Olfat et al., 2014). Moreover, Supply chain management has also been evaluated in both centralized and decentralized supply chain settings, according to Jain et al. (2017). Decentralized settings may benefit from the availability and accessibility of supply information (Modgil & Sharma, 2017b).

2.3 Advanced ICT system and Maritime Supply Chain Agility

IT infrastructure involves the implementation of modern technology including Enterprise Resource Planning (ERP), and Electronic Data Interchange (EDI). The synchronization of inventory flow with that of information flow enhances the flexibility of the Supply chain. In the context of maritime, advanced IT systems play a significant role to raise warnings regarding forthcoming damages resulting in the proactiveness of shipping vessels by rescheduling their respective routes creating an agile maritime supply chain (Lam & Bai, 2016). Moreover, (Loh & V. Thai, 2014) claim that the level of Agility is established by employing quality information exchange which thus affects port efficiency which is mainly due to the importance of communication exchange and routine port procedures. The benefit achieved includes better collaboration with other transport nodes and efficient utilization of resources (Notteboom & Winkelmans, 2001). This in turn helps the port to be integrated into the entire network and deployment protocols to establish agility in the port (Loh & Thai, 2014).

However, according to Fischer-Prebler et al. (2020), IT infrastructure enables companies to gain real-time information and also facilitates the process of information sharing among various entities of the maritime supply chain. Resultantly, operational risks are minimized due to reduced uncertainty and better responsiveness towards potential risk factors. In light of the presented arguments, it can be hypothesized that:

Hypothesis 1*(*a*)*: Advanced ICT (with an ability to integrate chain-wide via IT infrastructure such as ERP) system has a positive impact on Maritime SC agility.

2.4 Advanced ICT system and Maritime Supply Chain Robustness

Advanced IT infrastructure refers to the tools and systems that have been deployed for the sake of integration and enhanced visibility throughout the supply chain. Lavastre et al. (2012) claimed that attempts to enhance the chain-wide visibility via risk-related information sharing may help in risk mitigation plans, therefore a consistent and synchronized IT infrastructure can play a vital role in the exchange of information chain-wide (Hall et al., 2012; Speier et al., 2011). Moreover, Felix, Andreas, et al. (2015) also conducted a literature-based study and found that the exchange of information at lower relationship echelons actively actuates robustness. Furthermore, (Zhang & Wang, 2012) also claimed that advanced chain-wide infrastructure provides supply chains the ability to resist risk.

However, after adaptation technologies like RFID and GPS, the supply chain became efficient, cost-effective, and capable resulting in reduced response time, especially for real-time scenarios for the execution of contingency plans (Blackhurst et al., 2005). Moreover, IoT, the dynamic infrastructure with self-capabilities of controlling, monitoring, and intelligently exchange of desired information utilizing intelligent interfaces, have made the supply chain capable enough to effectively trace and authenticate the shipment, providing information about their destination location, storage conditions, an ETA (estimated time of arrival (Katsaliaki, Galetsi & Kumar, 2020). This results in data transparency and visibility, which mitigates the risk among all the entities of the pharmaceutical sector and integrates the planning and production of the supply chain, thus making it robust. Therefore, it can be hypothesized as:

Hypothesis 1(b): Advanced ICT system (with an ability to integrate chain-wide via IT infrastructure such as ERP) has a positive significant impact on Maritime SC robustness.

2.5 Strategic Alliance and Maritime SC Agility

Gunasekaran, Subramanian and Rahman (2015) claims that open communication between the focal firm and its member can enhance the members' responsiveness. This is, however, an initial phase toward Long-term relationships. The relationship is a factor that must be considered by focal companies via strategic contracting and technology sharing Gunasekaran, Subramanian and Rahman (2015). In the pharmaceutical sector, the formulation of strategic alliances with other maritime partners can mitigate the risk of technical downtime, and thus may better react back to the variating environment. Therefore, it can be posited that:

Hypothesis 2*(*a*)*: Strategic Alliances with international Logistics Service Providers have a positive impact on Maritime SC Agility.

2.6 Strategic Alliance and Maritime Supply Chain Robustness

The interactions among supply chain entities forming strategic alliances and collaborations lead to enhanced port coordination with the value chain. Greater coordination and cooperation will be the requirement for such collaborative actions (Loh & V. Thai, 2015), which results in a stronger bond between pharmaceutical, and internal logistics service providers i.e., maritime and entities involved in the entire chain, in turn enhancing production efficiencies and customer value of the PSC. The notion that SC firms must avoid individual competition reflects the fact that organizations must recognize the significance of the development of better partnerships and mutual alliances with one another (Green, McGaughey, and Michael Casey 2006; Loh and V. Thai, 2015), which results in the performance level being more strengthened. This is mainly due to sharing capacities and capabilities among alliance partners.

Furthermore, alliances assist in the exploitation of complementary resources among the collaborators mitigating risks and leading to greater stability (Inkpen 2001; Lin et al. 2007). For instance, for the pharmaceutical sector, the formation of a mutual alliance with freight forwards, port agents, and shipping lines might result in risk minimization due to resource sharing and rapid responsiveness. It is fruitful for small-sized shippers as these shipping pools enable them to maximize the days of earning revenues through mutual profits. In this regard, some measures such as building relationship alliances and SC relationship management must be implemented, hence, building up a more robust and firm supply chain. Therefore, it can be hypothesized as:

Hypothesis 2(b): Strategic Alliance with International Logistics service providers has a positive significant impact on Maritime SC-Robustness.

2.7 Maritime Supply Chain Resilience and Supply Chain Performance:

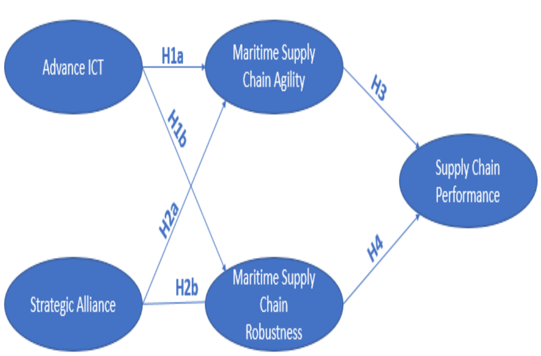
In today's world manufacturing firm function is categorized by expanding world competitiveness and increasing demanding customers (Rich & Hines, 1997). Operation system performance includes the capability to rapidly reconfigure operations to cope with customer tendencies (Wu, 2001; Lummus et al., 2003). However, at the maritime level, the port being the critical node of the entire supply chain, it is of noticeable significance and more prone to SC uncertainties. In such a scenario, the role of agility is to undertake quick actions at ports to minimize the impact of such disruptions (Paixao & Marlow, 2003; Bichou et al., 2007). Agility is the renowned feature of efficient and effective SCs (Lun, Lai, & Cheng 2010b; Paixão & Marlow 2003). In the global SC, agility is highly valuable and significant in port as the complementary part (Loh & V. Thai, 2014).

Correspondingly, supply chain resilience could be analyzed as a company's dynamic ability to restore from supply chain disturbances (Ponomarov & Holcomb, 2009) thus attaining the earlier optimum performance level. The prepared supply chains experience fewer negative effects when targeted by disruptions (Hendricks et al., 2009) which implies absorbing the shock and the performance of the supply chain is not affected. Additionally, the frequency of occurrence of such vulnerabilities in the maritime chain is increased due to the injection of more complexity in networks and due to minor disruption at port facilities. However, (Christopher S. Tang, 2006) claimed that a robust supply chain strategy will accommodate regular variabilities after a disruption and would help to implement the contingency plans effectively and efficiently, to cater to unprecedented circumstances i.e., building up the robustness. Thus, the disruptions of ports require to be catered to assure the functionalities of ports and to build up the robustness of the maritime supply chain. (Loh & Thai, 2014). Therefore, it can be hypothesized as:

Hypothesis3*:* Maritime SC Agility has a positive significant impact on Supply Chain Performance

Hypothesis 4*:* Maritime SC Robustness has a positive significant impact on Supply Chain Performance

Fig.1. Research Framework



3. Methodology

3.1 Sample Design and Data Collection

In our investigation, a quantitative approach is being deployed using a deductive approach. Only the Pakistani population working for import-export and international trade departments of pharmaceutical industry were included in the study's target population.

The data was collected from 110 respondents using an online questionnaire. The participants were asked to record their responses on a 1 to 5 Likert scale. As a result of the questionnaire being published on Google Forms, participants were personally contacted and given direct links to fill out the form. The respondents were informed that the information they provided would be used only for academic purposes by asking a consent-related question at the beginning of the survey (Hashem, 2020).

The two components of the survey were used to create a five-point Likert scale questionnaire that was used to gather the data. Demographic data, such as age and socioeconomic status were evaluated in the first part of the research; however, the factors affecting maritime SC resilience were gauged in the second half, which comprised 24 questions.

3.2 Measures

The instrument was designed by adapting and adopting items from past measurement scales. The items of all constructs were assessed by a five-point Likert scale ranging from "strongly disagree" to "strongly agree". The 'Advanced IT System' was measured utilizing Brandon-Jones et al. (2014) scale having 4 items. Strategic Alliance was measured by adapting 4 items of Sambasivan and Yen (2010) scale and 3 items were designed to gauge the framework-related objectives. For Maritime SC Agility, the construct was gauged by utilizing 5 adopted items of Whitten, Green, and Zelbst (2012), and Lotfi and Saghiri (2017) scales. Moreover, Maritime SC Robustness was measured using Wieland and Wallenburg (2013) and Brandon-Jones et al. (2014) adapting 04 items and 01 items, respectively. Lastly, 04 items of SC Performance were designed to measure the developed framework.

3.3 Respondent's demographic profile

The demographics of the study are given in the form of gender, age, qualification, and experience. It can be seen in below

Table 1. The male respondents are 46.6% and the female respondents are 53.4%. Age group distribution of the respondents shows that 44.8% of respondents are from 18-25 years, 34.5% respondents from 26-35 years group, 15.5% of respondents are from 36-50 years, and only 5.2% of respondents are from above 50 years.

The distribution of the respondents according to qualification shows that 31% of respondents were university graduates, while 69% were Master's degree holders. The distribution of the respondents according to experience shows that 1.7% population have no experience while 24.1% have less than 1 year of experience, 41.4% population have 1-5 years of experience, and only 20.7% population have 6-10 years. The evaluation also showed that 12.1% population has experience of more than 10 years. The designation column tells us that 22.4% population was the chief executive manager, 17.3% of the import manager, 29.3% of the export manager, 20.7% of the operational manager, and 10.3% of the distributional manager were taken as the population for the present study.

Table 1: Demographic profile of respondents

		Count	Table N %
Gender	Male	46	46.60%
	Female	54	53.40%
Age	18-25	44	44.80%
	26-35	34	34.50%
	36-50	15	15.50%
	36-50, Above50	5	5.20%
Qualification	Graduation	30	31.00%
	Masters	68	69.00%
	None	2	1.70%
Experience	Less than 1 year	24	24.10%
	1 to 5 Years	40	41.40%
	6 to 10 Years	20	20.70%
	Above 10 Years	12	12.10%
Designation	Chief Executive Manager	22	22.40%
	Import Manager	17	17.30%
	Export Manager	29	29.30%
	Operational Manager	20	20.70%
	Distributional Manager	10	10.30%

4. Results

This empirical research is based on the investigation of the relationship between the maritime factors affecting SCR and SC performance and customer value. The questionnaire-based surveys were used to collect data from the target market. This data has been used for further analysis using smart PLS 3 to make useful insights. Consequently, reliability analysis, convergent, and discriminant validity were calculated and analyzed.

4.1 The Measurement/ Outer Model

The outer model is evaluated using construct validity and reliability analysis in which content, discriminant, and convergent validity are determined using their specific criteria. For the present study, the results calculated are presented and interpreted as follows:

4.2 Reliability Analysis

Reliability analysis is carried out to measure the internal consistency of the relevant constructs. It is measured using Cronbach's alpha, the value of which must be greater than 0.7 (Hair et al., 2016). The table shows that the values of Cronbach's Alpha for all the constructs are greater than 0.7, except for Advanced ICT for which the value is 0.6, which is also acceptable (Pallant, 2020).

Table 2 Reliability Analysis

Constructs	Cronbach's Alpha
Adv. ICT	0.600
Strategic Alliance	0.806
Agility	0.760
Robustness	0.847
Maritime SC Performance	0.845

4.3 The Content Validity

The content validity test comprises factor analysis, which involves the examination of the outer loadings of the items formulating the construct. The coefficients representing the relationship between the latent variables and their respective indicators are often termed factor loadings (Bagozzi & Yi, 2012). According to the required criterion, the values of outer/factor loading should be greater than 0.7 (Fornell & Larcker, 1981). In this research, the results reveal that the model fits the required benchmark for all the indicators indicating a higher correlation between the items and their respective constructs.

4.4 Convergent Validity

Next, the convergent validity is evaluated to measure the outer model for the hypotheses formulated. Statistically, the factor loading values help in the estimation of the authenticity of the variables being examined. Furthermore, Composite Reliability and Average Variance Extracted (AVE) determine the convergent validity of the model. The model is said to be validated if the constructs have AVE values greater than 0.5, which means that the construct captures 50% of the variance (Chin, 1998).

Table 3 Standardized Outer Loadings

	Adv. ICT	Agility	Robustness	MSCP
Adv. ICT 1	0.763			
Adv. ICT 2	0.723			
Adv. ICT 3	0.745			
SA 1				
SA 2				
SA 3				
SA 4				
SA 5				
AG 1		0.77		
AG 2		0.872		
AG 4		0.82		
Robust-1			0.782	
Robust-2			0.868	
Robust-3			0.845	
Robust-5			0.803	
MSCP 2				0.754
MSCP 3				0.815
MSCP 4				0.9
MSCP 5				0.832

Table 4 Convergent Validity

	Composite Reliability	AVE
Adv. ICT	0.788	0.553
Strategic Alliance	0.865	0.562
Agility	0.861	0.675
Robustness	0.895	0.681
Maritime SC Performance	0.896	0.684

4.5 Discriminant Validity

Lastly, discriminant validity helps in understanding the relationship between dissimilar constructs. It can be evaluated based on respective criteria measuring differentiation in variables. Two criteria are used to evaluate the discriminant validity of the mode namely, Fornell and Larcker and the Heterotrait-Monotrait ratio (HTMT). According to Fornell and Larcker (1981), the square roots of the AVE of similar constructs must be greater than the correlation coefficients of the distinct pairs of constructs. Likewise, HTMT values must be less than 0.85 reflecting dissimilarity between the distinct pairs (Henseler et al., 2015). The results show that the model fits both criteria sufficiently representing the existence of discriminant validity.

Table 5(a) The Discriminant Validity (Fornell and Larcker criterion)

	Adv. ICT	Agility	Robustness	MSCP
Adv. ICT				
Strategic Alliance	0.75			
Agility	0.242	0.822		
Robustness	0.296	0.362	0.825	
Maritime SC Performance	0.474	0.324	0.39	0.827

Table 5(b) Discriminant Validity (HTMT Ratio)

	Adv. ICT	SA	Agility	Robustness	MSCP
Adv. ICT					
Strategic Alliance	0.248				
Agility	0.498	0.3			
Robustness	0.326	0.32	0.442		
Maritime SC Performance	0.387	0.56	0.395	0.443	

4.6 The Structural Model (Inner Model) and Hypotheses Testing

The existing paper possesses the structure model explaining the cause and effect relationship between the variables. Correspondingly, the designed model investigates maritime factors including advanced information systems and strategic alliance, and their impact on resilience and supply chain performance. Table 6 depicts the strength of the relationship represented by the path coefficients and prob values. Moreover, R square values are measured to explain the predictive power of the variables. Finally, it is deduced that all the hypotheses in the model are found to be statistically significant. Moreover, the R square values demonstrate that the variable advanced ICT and SA explain agility by 15%, whereas robustness is 12.9%. However, agility and robustness explain maritime SCP by 19.1%. Typically, these findings would help in further analysis of the model and provide useful insights for future researchers.

Fig.2. Framework model

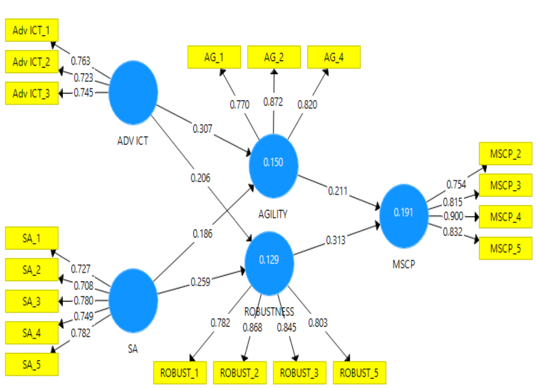


Table 6 Path Coefficients

Hypothesis	Coefficient	P Values	Decision
Adv. ICT → Agility	3.092	0.002	Supported*
Adv. ICT → Robustness	2.419	0.016	Supported*
SA → Agility	1.722	0.086	Supported*
SA → Robustness	2.928	0.004	Supported*
Agility → MSCP	1.67	0.096	Supported*
Robustness → MSCP	2.631	0.009	Supported*

*level of confidence for the model is assumed to be 10%

5. Discussion

Overall, it was found that factors affecting maritime supply chain resiliency have a significant impact on supply chain performance. These findings suggest the need to institute measures to increase supply chain resilience across various areas of the business to ensure optimal outcomes for all stakeholders. Looking specifically at the impact of maritime supply chain resilience on performance, it was found that occurrences and severity of disruptions in the supply chain have a significant impact on overall business outcomes. However, measures to increase supply chain resilience can help mitigate these impacts by deploying Advance ICT and by developing Strategic Alliance with International Logistics Service Provider

In today's business world, the pharmaceutical sector ensures the availability and flow of medicine/drugs are critical for both business success and customer treatment.

This research has explored the importance of supply chain resilience and discusses the impact of maritime factors that can affect it, as the maritime supply chain is more prone to get disruptions due to complexities and involvement of the number of entities.

From the perspective of Relational View (RV), Agility and Robustness are the two key resilience factors that play a critical role in building the supply chain resilient that results in better supply chain performance, as per RBV theory However, today's chain-wide

network demands enhanced ICT with a high level of tracking and tracing capabilities. Moreover, to cater to the varied disruptions, Dyer and Singh (1998) claimed that arms' length relations must be extended to an extent where entities jointly collaborate and effectively integrate. As a result, it's becoming increasingly important for pharmaceutical companies to develop strategic alliances with International Logistics Service Providers and to deploy management strategies to further strengthen the relationship.

In a fast-paced and ever-changing ICT landscape, effective integration and Cooperation of supply chains is critical to enable business agility and robustness. By understanding the impact of ICT on supply chain resilience, businesses can better align their operations with their changing needs resulting in better performance. The research has successfully revealed a positive impact of Resilience i.e., Agility and robustness in increasing the supply chain performance levels.

5.1 Managerial Implications

It is highly recommended to the managers of the pharmaceutical companies to develop and strengthen the ICT network with tracking a tracing capability as it would lead to chain-wide transparency which would not only help in developing the agile supply chain but also in making it more robust. Besides, having Strategic alliances with international Logistics service providers would develop collaborative efforts to keep the smooth functioning of the maritime supply chain. To achieve the objective, it is highly recommended for pharmaceutical sectors to integrate their Enterprise resource planning (ERPs) with Port Community System (PCS) to have clear visibility and transparency among the supply chain entities for better planning and production scheduling.

Moreover, the findings suggest that ensuring timely and accurate delivery of products is critical for maintaining high levels of patient satisfaction and treatment. By implementing measures to improve Supply Chain Resilience within an organization, it is possible to ensure ant vulnerability within the network may not actuate the cascading effect within the supply chain and may not have any significance on performance levels.

5.2 Avenues for Future Research

Besides the current factors affecting the maritime supply chain resilience, other factors may further be examined and evaluated within the context of the pharmaceutical industry such as SC Relationship Management, Contingency Plan, Monitoring & measurement. From the perspective of Relational View theory, trust, cooperation, and integration may be examined to gauge the MSCR and from the RBV viewpoint, Supply chain connectivity SC Ambidexterity and SC alignment may be examined.

Conflict of interest:

The authors do not hold any conflict of interest.

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