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Supply chain ambidexterity and performance under uncertainty: The case of inter-island logistics in Indonesia

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A B S T R A C T

This study investigated the impact of supply chain ambidexterity on supply chain performance (SCP) under uncertainties. The dynamic capability theory of firms was adopted in the supply chain to design a research framework that recommends a supply chain strategy under uncertainties pertaining to inter-island logistics in Indonesia. This study involved the survey of 140 large-scale companies delivering products across the Indonesian islands to identify the supply chain uncertainties by analyzing data using SmartPLS. The supply chain ambidexterity (SAM) was identified to exhibit no direct correlation with SCP; however, agile supply chain (ASC) and lean supply chain (LSC) could indirectly relate the SAM and SCP. For supply chain professionals, the results indicated that SCP cannot be achieved solely through SAM, thereby necessitating the development of LSCs and/or ASCs, driven from SAM, to achieve SCP. Thus, this study empirically confirmed ASC and LSC to be effective practices for mitigating supply chain uncertainties by mediating supply chain ambidexterity on SCP.

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1. Introduction

The influence of organizational ambidexterity remains ambiguous since its introduction by March (1991), who proposed exploitation and exploration as two competing dimensions. Consequently, exploitation and exploration, as proposed by Gupta et al. (2006), were considered as complementary and mutually beneficial for companies. Further, many researchers have empirically shown that organizational ambidexterity is positively correlated with the performance of a company (Gibson & Birkinshaw, 2004; He & Wong, 2004; Lubatkin et al., 2006; Solís-Molina et al., 2018). However, Partanen et al. (2020) found that supply chain ambidexterity (SAM) exhibited a negative correlation with firm performance, unless mediated by an effective supply chain collaboration. In contrast, a study by Venkatraman et al. (2007) identified no correlation between ambidexterity and firm performance. Several characteristics of ambidexterity that can achieve firm performance, such as resource constraints (Cao et al., 2010; Simsek, 2009) and types of industry (Dranev et al., 2020), have been discussed. However, many studies have reported that SAM does not correlate directly with firm performance, thus necessitating a mediating variable (Kristal et al., 2010). Therefore, the effect of SAM has been observed to be situational; it can have a direct correlation with or be mediated by certain variables, thereby aiding the achievement of supply chain performance (SCP).

Currently, most supply chain studies are limited within a continent with highly developed infrastructure and low supply chain uncertainty, in contrast to the inter-island distribution of goods that has been considered in this study. Therefore, the Indonesian context in the supply chain is different. Indonesia is among the largest archipelago in the world, with 17,000 islands, which creates enormous challenges for manufacturing companies, owing to the existence of a multitude of distributors and retailers (Magni & Razdan, 2015). The geographic setting and infrastructural conditions of Indonesia,

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coupled with frequent occurrence of natural disasters (the highest frequency in the world in 2020) (Kusumastuti et al., 2014; Statista, 2021), results in high uncertainties in the supply chain (Simangunsong et al., 2012). Consequently, most Indonesian manufacturers are forced to accommodate a cost increase of up to 19–20% in logistics, with inventory cost constituting 26% of the total logistics cost (Sandee, 2017). Therefore, the geographic setting and less-developed infrastructure of Indonesia render supply chain, logistics, and distribution of manufacturing products, a highly complex and fascinating topic. A survey was conducted in this study, the respondents of which were manufacturers distributing their products across the islands. The obtained data was used to capture the supply chain uncertainties within the operating environment. Previous studies have reported that the uncertainty in the supply chain contributes to higher supply chain risk (Flynn et al., 2016; Sreedevi & Saranga, 2017), and this study aims to demonstrate that this high uncertainty in the Indonesian supply chain context results in increased complexity in the relationship between SAM and SCP owing to high uncertainties.

Leanness and agility are the two variables that may influence management of supply chain uncertainty, in terms of reducing and coping with the same (Simangunsong et al., 2012; Zimmermann et al., 2020). Lean Supply chain (LSC) is a strategy that decreases the cost of manufacturing products, while improving product quality and availability (Vrijhoef & Koskela, 2000). It addition, it aids in producing cost efficiencies in the supply chain via successful management of inventory, and by prioritizing quality improvement through the minimization of non-value-added processes (Christopher & Towill, 2001; Huang et al., 2002), and positive correlation with SCP (Tortorella et al., 2017). Empirical evidence indicating the mediating capability of LSC in the cases of SAM and SCP has yet to be appropriately presented. Owing to the high cost of inter-island logistics, manufacturers must consider applying LSC.

The geographic setting and high frequency of natural disasters necessitate the use of agile supply chain (ASC), which is known to directly correlate with SCP (Altay et al., 2018; Blome et al., 2013; Tarafdar & Qrunfleh, 2017), organizational resilience (Aslam et al., 2020), and firm performance (Degroote & Marx, 2013). Associating these results in the continent-based supply chain, this study aims to prove the necessity of ASC in supply chain uncertainties and in the context of inter-island logistics. This aligns with the supply chain agility concept as defined by Swafford et al. (2006) and Ismail & Sharifi (2006), wherein ASC has been described as "the ability of the SC as a whole and its partners to rapidly align the network and its operations to the dynamic and turbulent requirements of the demand network." Therefore, the major drivers of ASC are quick responses with acceptable cost and efficiency (Wieland & Marcus Wallenburg, 2012). In addition, Swafford, Ghosh, and Murthy (2006) believed that ASC facilitated quicker and effective response to volatility in the marketplace. Moreover, considering the conditions of inter-island logistics, ASC may mediate between SAM and SCP under uncertainties.

Previous studies have reported that SAM is significantly correlated with ASC (Altay et al., 2018; Aslam et al., 2018; Tuan, 2016). However, to the best of the authors' knowledge, there are limited studies on the mediating effect between SAM and SCP under uncertain environment. Therefore, the primary objectives of this study are as follows:

(a) Investigating the effect of SAM on SCP under supply chain uncertainty.

(b) Examining how ASC and LSC mediate the relationship between SAM and SCP under supply chain uncertainty.

These objectives were realized by testing 140 manufacturing firms that deliver and sell their products to other islands, to identify the supply chain uncertainties.

This paper is organized as follows: Section 2 provides the theoretical basis and hypotheses development. Further, Section 3 elaborates the method, whereas Section 4 presents the results. Section 5 discusses the results and the inferences drawn. Finally, Section VI presents the conclusions, managerial implications, and limitations of the study.

2. Theoretical basis and hypothesis

The perspectives of dynamic capabilities view (DCV) and organizational ambidexterity to supply chains were employed as the theoretical basis for this study to link SAM and SCP in the context of supply chain uncertainties (Aslam et al., 2020; Eisenhardt et al., 2000; Lee & Rha, 2016; Teece et al., 1997; Teece, 2007). Consequently, a set of three hypotheses were established, using which a model was developed that can provide insights into the influences of SAM, LSC, and ASC on SCP under supply chain uncertainties.

2.1. Supply chain uncertainty

To respond to delivery risk, a firm must manage uncertainties in its supply chain. Simangunsong et al. (2012) and Sreedevi & Saranga (2017) reported that uncertainties may be decreased via the application of lean principles, whereas building agile capability can facilitate mitigation. Owing to the nature of dynamic environments, the companies adopting an ASC are more adaptive than LSC firms (Zimmermann et al., 2020). Therefore, although ASC is not the lowest-cost supply chain, it can quickly sense and respond to supply chain uncertainties in a fast-changing environment. Moreover, in this study, it is considered that SAM (exploiting and exploring capabilities) may simultaneously enhance LSC and ASC to achieve SCP under supply chain uncertainties.

2.2. Dynamic capability view (DCV)

Previous studies (Teece et al., 1997; Starr & Van Wassenhove, 2014; Tabaklar, 2017) defined dynamic capabilities as the ability to sense, develop, and redesign internal and external business processes, to adapt to unpredictable changing environments, which are critical factors under uncertainty. The dynamic capability perspective was introduced to address the limitations of the resource-based view (RBV) (Bowman & Ambrosini, 2003). Deakins and Bensemann (2019) argued that a firm with a lean environment (RBV) can achieve innovation (dynamic capability) with an entrepreneurial perspective. Further, the dynamic capability perspective emphasized the importance of resource competencies and their execution capability to adapt to changes in technologies and customers (Helfat & Peteraf, 2003), which is crucial when dealing with supply chain uncertainties in the context of inter-island logistics. In addition, environmental dynamism is an important factor that positively affects dynamic capabilities and environmental uncertainty elements (Drnevich & Kriauciunas, 2011; Teece, 2014; Wilhelm et al., 2015). DCV is part of the building process to SAM, and aids in mitigating SC disruptions (Lee & Rha, 2016) or natural disasters. ASC is an essential dynamic capability of the supply chain within humanitarian settings that is crucial both during and after disasters (Altay et al., 2018).

2.3. The effect of SAM to SCP

The organizational ambidexterity theory states that exploration practices target long-term success, whereas exploitation strategies address short-term outcomes (Wang et al., 2019). Previous studies have identified that the simultaneous adoption of these strategies is necessary for firms to succeed in dynamic markets (March, 1991, 2005; O'Reilly & Tushman, 2008), including overcoming supply chain uncertainties. Market demands constantly change, and firms with the ability to adapt quickly to change can survive long, as indicated by ambidextrous organizations (Gibson and Birkinshaw, 2004). Similarly, competitive advantage can be gained via the implementation of ambidexterity through the exploitation of existing resources and exploration of new opportunities (Aslam *et al.*, 2018). Recent studies (Aslam et al., 2018; Wamba et al., 2020; Ojha et al., 2018; Bui et al., 2021; Partanen et al., 2020) have shown that ambidexterity can be applied to effectively manage supply chains. SAM combined with the ability to exploit and explore strengthens the ability of firms to manage uncertain and unexpected environments (Lee and Rha, 2015). Therefore, the better the organization either balances or combines ambidexterity, the higher its impact on firm performance. Moreover, in the supply chain, ambidexterity strengthens quality, cost, delivery, flexibility (Kristal et al., 2010), innovation capability (Benitez et al., 2018), operational efficiency, and information technology (IT) (Burin et al., 2020; Im & Rai, 2008; Wamba et al., 2020), and flexibility (Blome et al., 2013; Rojo et al., 2016). Thus, the following hypothesis was posited:

H_1: *SAM relates significantly with SCP.*

2.4. Mediating roles of LSC and ASC

Previous studies found that agility and leanness are two mediating variables exhibiting a positive correlation between collaboration (Srinivasan et al., 2020), environmental uncertainty (Zimmermann et al., 2020), manufacturing capability (Iqbal et al., 2019), and SAM (Aslam et al., 2020) to firm performance. Further, the extant literature proves the effect of SAM on ASC and certain selected aspects of agile and lean supply chains on SCP, including inventories, lead time, and other internal operations performance metrics. Thus, the operational benefits result in improved SCP that are usually associated with lean production (Srinivasan et al., 2020). In addition, using the theory of lean production, Hofer et al. (2012) (Hofer et al., 2012) confirmed the mediating impact of inventory leanness on business firm performance, which is usually associated with lean production and cost effectiveness. As discussed earlier, although several studies have been conducted on the effect of LSC, the mediating role of LSC toward achieving SCP under uncertainties has not been investigated thoroughly. The RBV theory has been employed in several studies, which resulted in the discovery of the mediating roles of lean practices between IT investment and human resource management (HRM) practices on firm performance (Ghobakhloo & Hong, 2014; Wickramasinghe & Wickramasinghe, 2017). Consequently, LSC may influence the impact of SAM on SCP; thus, the following hypothesis was posited:

H_2: *LSC mediates the relationship between SAM and SCP.*

The direct impacts of SAM on ASC (Tuan, 2016) and ASC on SCP (Wamba et al., 2020) have been previously reported. Further, Aslam et al. (2018) reported the necessity of ASC for SAM; however, our study argues that ASC mediates the impact of SAM on SCP. The literature review has indicated minimal research on examining the mediating role of ASC. A study covering 190 large Turkish companies, (Kale et al., 2019) found the mediating capability of strategic agility for the relationship between absorptive capacity and firm performance. Further, Li et al. (2013) determined the mediating role of SAM on the impact of IT capabilities on firm performance. Another recent study reported business intelligence competence and agile capabilities, exhibiting a significant correlation toward enhancing supply chain agile performance (Sangari & Razmi, 2018). Meanwhile, another empirical study found that SCA mediates the relationship between absorptive capacity and organizational performance (Kale et al., 2019; Martinez-Sanchez & Lahoz-Leo, 2018). Consequently, the following hypothesis was proposed:

H3: *ASC mediates the relationship between SAM and SCP.*

3. Method

3.1. Research Design

This study considered the manufacturing companies in Indonesia that distribute their products across the islands, while encountering supply chain uncertainties, in the context of inter-island logistics. A theoretical framework was proposed to address the challenges of supply chain uncertainties. Further, the relationships between the variables to support SCP were conceptualized, hypothesized, and tested using empirical data. Our primary aim was to determine a suitable strategy for improving SCP in inter-island logistics operations. Inter-island logistics in the Indonesian archipelago is a challenging aspect when considering product distribution for consumers. SAM with exploration and exploitation capabilities (Kristal et al., 2010; March, 1991) can aid in improving the SCP of inter-island logistics companies. In addition, the use of ASCs and LSCs was proposed in this study to improve inter-island SCP. These variables were considered because of their effect on supply chain business performance (Altay et al., 2018; Cheung et al., 2018; Tarafdar & Qrunfleh, 2017). The proposed construct framework for the study is depicted in Fig. 1.

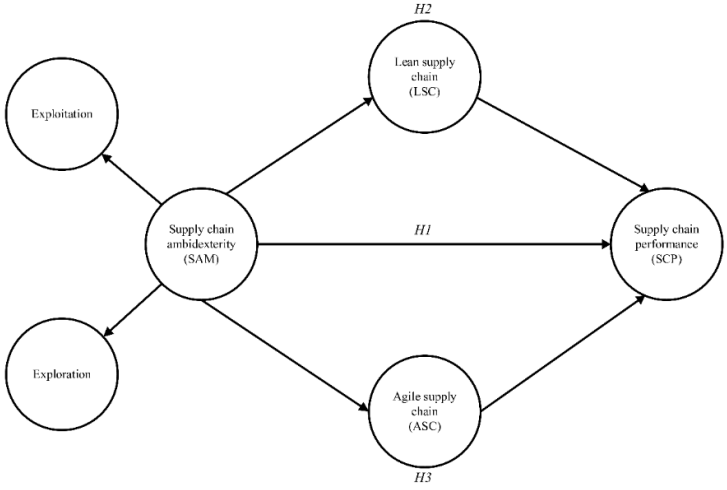


Fig. 1. Theoretical framework

3.2. Data collection

The data were collected through questionnaires distributed to medium- and large-scale companies in Java and the other islands of Indonesia, with prevalent inter-island logistical operations. The supply chain uncertainty was captured, as all respondents delivered their products across the island (see Ojha et al., 2018). The data was collected from May to August 2021, from the sample space of 140 manufacturing companies. A significant number of respondents were from large-scale companies established on Java Island, which were characterized by the number of employees and total sales. A purposive sampling technique with the qualifications of the respondents was applied, including middle managers and directors of supply chain operations in the inter-island logistics company. The questionnaire was designed based on a theoretical framework and a hypothesis, comprising 34 questions. It comprised two parts: respondent profiles and 5-Likert scale questions related to the hypothesis test. The questionnaire was distributed using online survey tools through convenience sampling. Further, during the process of data collection, all respondents were ensured to represent inter-island companies from various large-scale industries.

3.3. Measurement, validity, and reliability

A theoretical framework for SCP using ambidexterity, leanness, and agility variables was proposed in this study. First, theory-based operations were defined based on a literature review. Consequently, three hypotheses were proposed to analyze the correlations between variables and the SCP of inter-island logistics companies. Subsequently, 140 companies were surveyed to investigate the effects of supply chain practices on ambidexterity, leanness, and agility, on SCP, under uncertainties, in the context of inter-island logistics. In addition, the survey collected the demographic profiles of the respondents.

A structured questionnaire was developed based on the hypotheses developed, comprising 34 questions, of which 28 were related to the theoretical framework, with the remainder covering respondent profiles. The constructs and items that were to be measured were adopted from existing literature and are as follows (further details in Appendix 1):

(a) Eight questions related to SAM variables were adopted from Kristal et al. (2010).
(b) Seven questions related to LSC contributing to SCP of inter-island logistics were adopted from Qrunfleh and Tarafdar (2013).
(c) Seven questions related to ASC contributing to SCP for inter-island logistics were adopted from Qrunfleh and Tarafdar (2013).
(d) Six questions related to the SCP of inter-island logistics were adopted from Rodrigues et al. (2004).

The hypotheses were analyzed after the reliability and validity of the research instrument was established through a reliability test conducted to ensure the consistency of the 28 questions items between multiple measurements. Cronbach's α technique was applied to determine the reliability coefficient. According to Mehdi & Ahmed (2019) and Uddin and Khan (2016), for the question items to be valid, the coefficient should be greater than 0.6. Further, a validity test was conducted to ensure valid responses on the part of the respondent. According to Mehdi and Ahmed (2019) the validity coefficient should be greater than 0.5. The validity and reliability were completed using SPSS software. Partial least squares (PLS) using SmartPLS software with 500 bootstrapping samples was employed to test the hypotheses. This model can capture the direct and indirect effects of the variables on SCP in inter-island logistics settings.

4. Result

4.1. Descriptive and Statistical Analysis

A total of 154 respondents participated in the survey; however, 14 respondents were excluded, because they did not deliver their products across the islands. Data were collected through 140 responses obtained via supply chain professionals from large-scale companies in Indonesia. Several large-scale companies are involved in inter-island logistics in Indonesia. The demographic profiles of the respondents are shown in Table 1. The reliability test was conducted for 28 questions to evaluate the degree of consistency among multiple variables. The reliability test results showed that the measurements were reliable at a Cronbach's value of 0.940. Further, the validity test conducted to ensure that the respondents provided valid responses showed that most of the question items were valid except for item EI1 (ambidexterity), which yielded a validity score of 0.373 (Malhottra & Dash, 2010; Mehdi & Ahmed, 2019)). Furthermore, EI1 does not consider evaluating the hypothesis test. These results indicate that the measurement tool was consistent. The validity test results are presented in Appendix 1.

Table 1
Demographic profile of the respondents

No	Demographic	Frequency	Percent
1	Respondent job title		
	Supply chain/Logistics/Operations manager	33	23.6
	Purchasing manager	6	4.3
	Sales and marketing manager	15	10.7
	General manager	28	20.0
	Director	35	25.0
	Others	23	16.4
2	Location		
	Java Island	107	76.4
	Outer Java Island	12	8.6
	Both	21	15.0
3	Industrial sectors		
	Food and beverages	30	21.4
	Textile	38	27.1
	Electronics	8	5.7
	Chemical	3	2.1
	Automotive	9	6.4
	Pharmacy	8	5.7
	Fast moving consumer goods	19	13.6
	Others	25	17.9
4	Number of Employees		
	<100	12	8.6
	100–499	27	19.3
	500–999	32	22.9
	1000–4999	51	36.4
	5000–9999	10	7.1
	>10000	8	5.7
5	Total sales in year (IDR)		
	<100 billion	12	8.6
	100–199 billion	20	14.3
	200–299 billion	18	12.9
	300–399 billion	34	24.3
	400–499 billion	19	13.6
	>500 billion	37	26.4
	Total	140	100.0

4.2 Structural model and measurement result

The contribution of SAM, LSC, and ASC to SCP in inter-island logistics management ought to be analyzed from a practical perspective. The 140 survey responses were tested to define an effective strategy to achieve SCP. The data analysis was performed using the PLS method, which comprised two main steps: analyses of the outer and inner models. In the first stage, a validity test was conducted through an outer model analysis, where, according to Hair et al. (2019), the loading factor scores should be above the standard value of 0.7. The first outer loading scores are presented in Appendix 1. Fig. 2 confirms that certain items were removed from the hypothesis test (including EI1, LE1, LE7, AG2, SP1, and SP2), owing to the outer loading factor values being below the standard value.

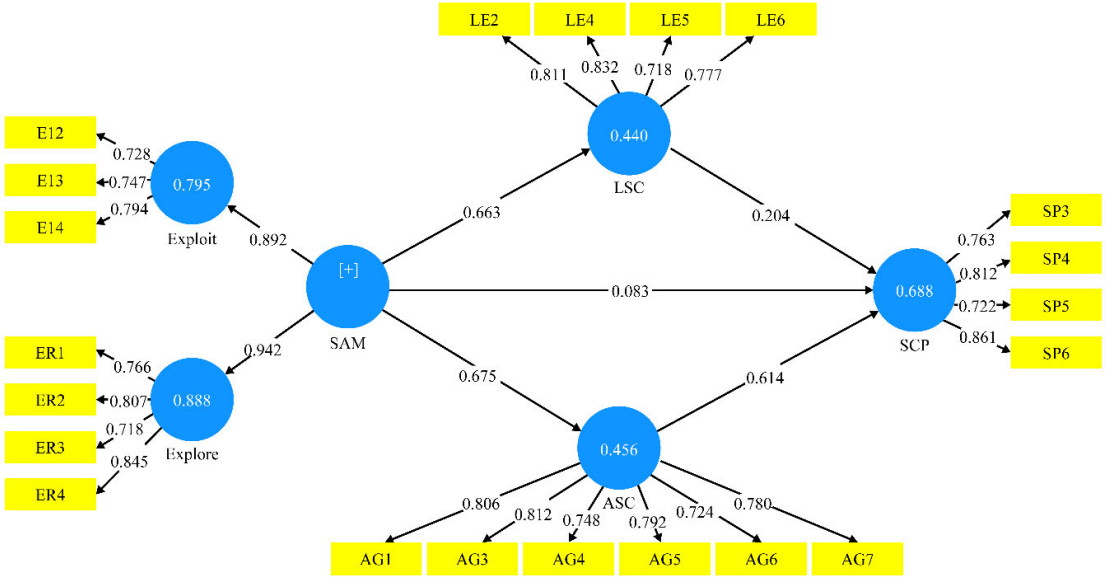


Fig. 2. Outer loading factor scores of items, fulfilling standard value

In the second stage of the validity test, an inner loading analysis was conducted using discriminant validity. The cross-loadings of indicators ought to be higher than their scores on other constructs for the test to be valid. Fig. 2 confirms that the inner loading analysis of the validity test was completed. Thereafter, the reliability analysis was performed using Cronbach's α and composite reliability (CR), which are required to assure the scale indicator to the underlying factors in the developed theoretical framework (Lee & Rha, 2016). Table 2 shows the reliability analysis score of the construct, indicating that Cronbach's α and CR fulfilled the recommended minimum standard score of 0.70 (Cheung et al., 2018; Hair et al., 2019).

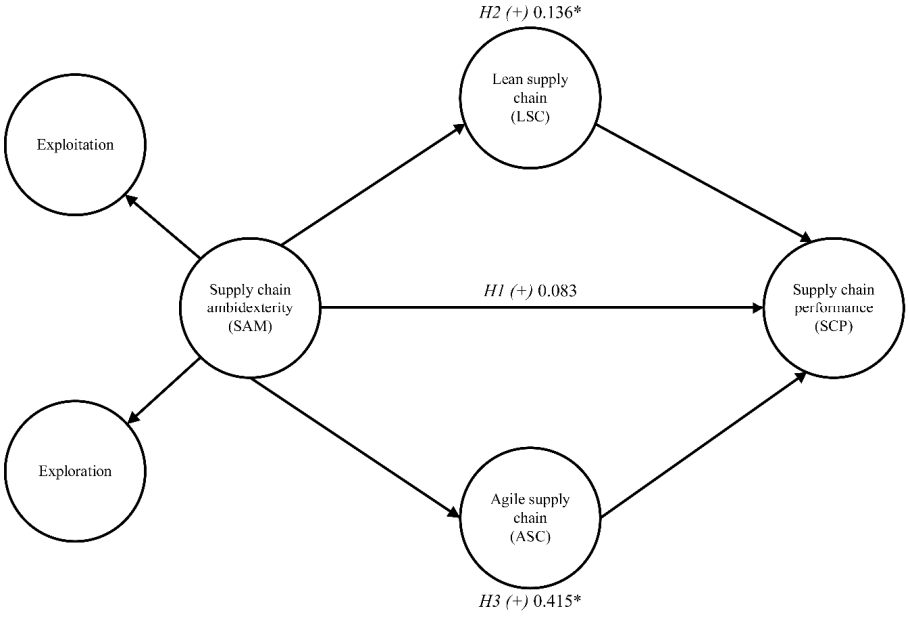
Table 2
Reliability scores

Variable	Cronbach α	Composite reliability	R-Square
Supply chain ambidexterity (SAM)	0.841	0.878	
Lean supply chain (LSC)	0.793	0.865	0.440
Agile supply chain (ASC)	0.869	0.902	0.456
Supply chain performance (SCP)	0.799	0.869	0.688

The outer loading, validity, and reliability scores confirmed that the parameters could be used to test the developed hypotheses. As proposed in the theoretical framework, 3 hypotheses were tested in this model considering direct and indirect effects on SCP. Hypothesis 1 indicates the direct effect of SAM on SCP, with the measurement result implying no significant effect (p-value > 0.001). In contrast, for indirect effect, the remaining two hypotheses involved testing the mediation of SAM on SCP through LSC and ASC. The hypothesis test for H2 and H3 yielded p-values < 0.001, thereby confirming the significance of the indirect effect in the constructed model. In addition, the SAM was confirmed to be completely mediated through LSC and ASC on SCP. The result of the hypotheses test with original estimate (β), p-values, t-statistic scores are shown in Table 3. Fig. 3 presents the hypothesis test result of the proposed framework.

Table 3
Hypotheses test results of supply chain performance (SCP)

Hypothesis no.	Effect	Construct	Original estimate (β)	t-statistic	p-values	Result
1	Direct	SAM	0.083	1.166	0.244	Not significant
2	Indirect/mediating	LSC	0.136	2.375	<0.001	Significant
3	Indirect/mediating	ASC	0.415	6.579	<0.001	Significant



Notes: * *p-values* < 0.001

Fig. 3. Significant path coefficient

The original estimate (β) coefficient of SCP shows that the indirect effect yielded a higher score than the direct effect, indicating that the mediating role exerted a greater impact on SCP. Furthermore, in the indirect effect model, LSC and ASC exhibited β values of 0.136 and 0.415, respectively, which indicate that the latter exerted a greater impact on SCP in mediating role settings with SAM. In addition, the respondents confirmed that it mostly originates from industries that depend on agile strategies.

4.3 Respondent responses and issues during inter-island logistical operations

The survey questionnaire allowed the respondents to comment on delivering customer demands. They mentioned several obstacles, including delivery time, bad road facilities that affected transportation time, pandemic restrictions at regional levels, communication issues, bureaucracy and administration, and unpredictable weather during transportation. Overall, most respondents indicated that the major issues were related to cost and transportation time to deliver the product to the consumer. To decrease any issues and risks during inter-island logistical operations, practitioners mostly pay attention to lead time, extension of product lifetime to minimize shrinkage, delivery of large volumes of products to minimize cost, and the improvement of product packaging and safety. Based on the responses received, most of the respondents were identified to have provided lean and agile supply chain strategies. Further, response to logistic operations was consistent with the hypothesis test results that show that the SAM ought to focus on LSC and ASC to improve SCP.

5. Discussion

This study empirically explored the connection between a firm's SAM under uncertainty and the conditions under which such supply chain risks can be mitigated to achieve SCP. To the best of the authors' knowledge, studies on supply chain uncertainties are scarce, particularly in the context of inter-island logistics. Moreover, most studies are in the context of continental-based empirical studies. The first discovery of this study was the revelation of the minimal correlation between SAM and SCP, as indicated by the insignificance of hypothesis H1. Consequently, although manufacturing firms with SAM exhibit either balanced or combined exploitation and exploration capabilities (He & Wong, 2004), the SCP is not automatically enhanced. This result is in contrast to previous studies, which theoretically revealed that SAM with exploitation achieves efficiency, whereas SAM with exploration achieves responsiveness (Kristal et al., 2010; Lee & Rha, 2016; Mehdi & Ahmed, 2019). However, in the context of inter-island logistics, it is concluded that in an uncertain environment, SCP, which is measured by low total cost, high inventory turns, and the ability to decrease order lead time, cannot be achieved. This may be because of the challenging delivery infrastructure framework from manufacturers to consumers, such as modes of transportation (roads, railways, air, and sea) (Al-Shboul, 2017). Additionally, it is consistent with the report by Sreedevi & Saranga (2017) that supply chain challenges in developing countries are primarily caused by incompletely developed infrastructure and challenging delivery risks. A report from the World Bank (https://lpi.worldbank.org/domestic/environment_institutions/2018/C/IDN#chartarea) attributed the lowest Logistics Performance Index (LPI) of Indonesia to infrastructure, which is an external factor from the firm, resulting in uncertainties. Although Indonesia's LPI ranking improved in 2018, the logistics cost remains high (23%), because poor infrastructure

hinders on-time delivery, an important indicator of SCP. The lens of dynamic capability theory (sensing, seizing, and reconfiguration) ought to be employed to address and strengthen the seizing part (Lee & Rha, 2016). Thus, a company must ensure focus on building exploiting and exploring capabilities, as well as on deploying SAM benefits, in terms of leanness, waste elimination, agility, or responsiveness.

Second, based on testing H2 and H3, the LSCs and ASCs were observed to completely mediate between SAM and SCP. These relationships contribute to SC literature related to how SAM can enhance SCP by offering either balance or combined exploitation and exploring practices. Thus, LSCs and ASCs are important supply chain capabilities that mitigate delivery risk in uncertain supply chain environments. The literature survey conducted by Simangunsong et al. (2012) was further extended by empirically proving that LSCs and ASCs are crucial variables for managing and coping with uncertainties. A longer lead-time delivery experienced by the firms results in higher forecast error (Merkuryeva et al., 2019; Van Donk & Van Der Vaart, 2005), and consequently, a bullwhip effect becomes probable (Dolgui et al., 2019; Lee et al., 2004). In addition, large coverage areas with significant delivery risks, such as inter-island logistics, difficult terrains, and long distances, are sources of uncertainty, owing to poor infrastructure (Gokarn & Kuthambalayan, 2019; Manuj et al., 2008; Prater et al., 2001). Al-Shboul (2017) reported that despite the minimal effect of the modes of transportation on SCA, they influenced the ability to respond immediately to the market, for dependable deliveries as mediators. Further, as observed in this study, it is important to deploy resources to achieve SC benefits.

Third, SAM ought to be build efficiency (exploitation) and responsiveness (exploration) to achieve lean and agile supply chains. Either LSC or ASC can be used to mediate between SAM and SCP. This study proposes that a manufacturer with functional products ought to exercise LSC, whereas those with innovative products characterized by many variants should be flexible with ASC (Fisher, 1997; Lee, 2002). Another discovery is that the combination of lean and agile (leanagile) contributes to firm performance (Ahmed & Huma, 2018; Iqbal & Waseem, 2012). The result for hypothesis H3 shows that SCA completely mediates the relationship between SAM and SCP. Thus, possessing a high level of response to varying customer demands, enhances the relationship between SAM and SCP.

Fourth, firms with high levels of ambidexterity, leanness, and agility exhibit better logistics costs, faster order to deliver lead time, and higher inventory turns, thus enhancing SCP. Previous studies by Flöthmann et al. (2018); Partanen et al. (2020) influence the perspective on SCP. However, they do not indicate and consider supply chain uncertainties in achieving SCP, considering the two crucial roles: leanness and agility. This study revealed that both LSCs and ASCs are essential resources for improving and enhancing the correlation between SAM and SCP. One explanation for this might be that by offering availability of SAM, firms can deliver better SCP using and adopting LSCs and ASCs that improve their supply chain cost effectiveness and responsiveness.

6. Conclusion

Ambidexterity is a capability that ought to deploy either leanness or agility to achieve SCP. Ambidexterity theories indicate a direct relationship between ambidexterity and performance, with the literature providing theoretical and empirical evidence on this (Lee and Rha, 2016; Kristal et. 2010). However, this is different in the context of Indonesian islands, as they are characterized by extremely high supply chain uncertainties (e.g., inter-island logistics, the highest number of natural disasters in the world, and poor infrastructure). Existing literature does not thoroughly capture this context, which increases the complexity of studying the relationship between ambidexterity and SCP because of the high uncertainties that it creates. Two variables involved in managing and mitigating the uncertainty context are agility and leanness, and these variables can mediate SAM to SCP in uncertain environments.

6.1. Managerial implications

To date, little empirical evidence exists in the supply chain literature to suggest that LSC and ASC mediate the relationship between SAM and SCP under uncertain environments. This study demonstrated the reasons that indicate that ambidexterity is not sufficient to optimize SCP; however, it improved when using either lean (efficient) or agile (responsive) supply chains, or both. Thus, firms that succeeded in establishing this relationship can improve their waste reduction, cost efficiencies, operating margins, agility, and responsiveness, and attain sustainable SCP. This study additionally showed that a responsive or agile supply chain can be directly related with SCP. In addition, it can mediate between lean and SAM for SCP. Thus, managers must develop SAM, LSC, and ASC to achieve high supply performance in an uncertain environment.

6.2. Limitations and future research

This study has many limitations that can provide directions for future research. First, the study was conducted at the firm level with a single respondent from each participating company. Future research may include several respondents from each organization, because an entire supply chain is represented by various job functions within a company. However, the limited number of respondents in this study is still comparable to other similar studies on supply chain uncertainty or risk management (Ahmed & Huma, 2018; Gokarn & Kuthambalayan, 2019). Further, future research may consider the uncertainties in delivery

risk in inter-island logistics. It would be beneficial to empirically test the mediating effects of leanness and agility, against functional and innovative products. This can provide further insight into the supply capability to bolster specific products. Moreover, future studies can display the validity of supply chain uncertainties in the context of the inter-island effect as a moderator. Finally, the mitigation efforts to deal with inter-island logistics can be further examined to provide insights into probable generalizations and extend the results obtained in this study.

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Appendix 1

Validity and Outer loading scores

No.	Items	Validity	SAM		ASC	LSC	SCP
			Exploitation	Exploration			
	Ambidextrous supply chain						
1	Company focuses on reducing operational redundancies in our existing processes (EI1)	0.373	0.673*				
2	Company focuses on improving our existing technologies (EI2)	0.541	0.707				
3	Leveraging our current technologies is important to our firm's strategy (EI3)	0.545	0.733				
4	Company develops strong competencies in our existing SC processes (EI4)	0.635	0.758				
5	Company proactively pursues new supply chain solutions (ER1)	0.561		0.766			
6	Company continually experiments to find new solutions to improve SC (ER2)	0.706		0.806			
7	Company continually explores new opportunities (ER3)	0.653		0.719			
8	Company is constantly seeking novel approaches in order to solve SC problems (ER4)	0.706		0.844			
	Agile supply chain						
9	Company responds quickly to our changing requirements of delivery time (AG1)	0.754			0.797		
10	Company responds effectively to our changing requirements of cost (AG2)	0.630			0.684*		
11	Company responds effectively to our changing requirements of design (AG3)	0.720			0.806		
12	Company can handle changes in product design (AG4)	0.704			0.754		
13	Company responds quickly to customization requirements (AG5)	0.660			0.769		
14	We customize products by adding feature models as per our requirements (AG6)	0.673			0.71		
15	We maintain a higher capacity buffer to respond to a volatile market (AG7)	0.697			0.776		
	Lean supply chain						
16	Manages inventory by delivering what we need (LE1)	0.697				0.69*	
17	Manages inventory by delivering when we need it (LE2)	0.693				0.77	
18	Manages inventory by delivering where needed (LE3)	0.608				0.684*	
19	Adopts quality practices as per our requirements (LE4)	0.626				0.763	
20	Manages quality as per our requirements (LE5)	0.553				0.706	
21	Inspects products frequently (LE6)	0.676				0.724	
22	Reduces any kind of waste (LE7)	0.561				0.59*	
	Supply Chain Performance						
23	The ability to achieve the lowest total cost of logistics through efficient operations, technology, and/or scale economies (SP1)	0.630					0.667*
24	The ability to reduce the time between order receipt and customer delivery to as close to zero as possible (SP2)	0.602					0.699*
25	Company delivers goods consistently in number and volume (SP3)	0.650					0.736
26	Company provides desired quantities on a consistent basis (SP4)	0.706					0.779
27	Company produces high inventory turns than the competitor (SP5)	0.656					0.715
28	Company fulfills customer satisfaction (SP6)	0.737					0.83

Note: *questions exhibiting values below the standard value 0.7 were removed in further analysis