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## Article

# Impact of Internal Integration, Supply Chain Partnership, Supply Chain Agility, and Supply Chain Resilience on Sustainable Advantage

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**Abstract:** The global order has suddenly changed due to the COVID-19 pandemic. Many countries, including Indonesia, have applied lockdown policies to stop the spread of COVID-19. Lockdown policies have disrupted the supply of raw materials and the demand for finished goods. The manufacturing industry is one of the sectors that has suffered most in this situation, and they have struggled to reconfigure their internal and external supply chain network and partnership. This study examined the impact of internal integration, supply chain partnership, supply chain agility, and supply chain resilience on sustainable advantage. The participants of this study were from manufacturing companies in Indonesia. For data collection, a questionnaire was used, with a five-point Likert scale to obtain the respondents' opinions. Using Google Form link, the questionnaire was distributed via email and the WhatsApp social media application to the predetermined set of manufacturing companies. Respondents filled out 672 questionnaires, and 456 respondents (corresponding to 67.86%) filled it out correctly and were considered valid for further analysis. Partial least squares (PLS) regression was used to analyze the data using the SmartPLS software version 3.3. The results supported all nine hypotheses proposed. Internal integration through interdepartmental data sharing affects supply chain (SC) partnerships, SC agility, and SC resilience. Moreover, SC partnerships, through the on-time delivery of materials and by coping with changing demand, improve SC agility, SC resilience, and sustainable advantages. SC agility, in keeping the production process running normally and regulating the production capacity, affects SC resilience and sustainable advantage. SC resilience improves sustainable advantage by providing timely product delivery and reliable sales volumes in pandemic conditions. These results provide insights for managers into enhancing the sustainable advantage by improving supply chain agility, supply chain resilience, and supply chain partnerships. This study could contribute and extend the acceptance of previous studies in the context of the manufacturing industry.

**Keywords:** internal integration; SC partnership; SC agility; SC resilience; sustainable advantage



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## 1. Introduction

The COVID-19 pandemic has caused sudden disruption and has affected all areas of life, including health services, and the economic, agriculture, education, sport, and manufacturing industries. As of 15 March 2021, COVID-19 has infected 119,603,761 people and 2,649,722 people have died, as stated by the World Health Organization [1]. In 2021, there has been a significant increase in cases, compared to the previous year. As of 11 March 2020, the world community had confirmed 118,000 people were infected and 4291 had died in 114 countries, as declared by the World Health Organization [2]. There has been a significant increase of more than 1000% within one year.

Many countries, including Indonesia, are trying to stop the spread of the COVID-19 pandemic by implementing a lockdown policy [3]. However, the implementation of

the lockdown has impacted the economic sector as well. For example, the Philippines experienced a significant decline of 16.5% GDP in the second quarter of 2020 due to the lockdown policy. An estimated economic loss of USD 42 billion was contributed to from the trade sector by 29.19%, the manufacturing sector by 13.11%, and the private sector by 13.11% [4]. One of the sectors suffering most from the COVID-19 pandemic is the manufacturing industry. The pandemic has disrupted the global manufacturing supply chain network, increased the lead time, and resulted in high uncertainties in supply and demand. The bullwhip effect, due to raw material supply disruptions, has made customers face scarcities of finished products. Manufacturing companies are trying to fulfill product demand quickly by increasing the number of products available [5]. The global pandemic has also significantly increased pharmaceutical product demand, such as drugs required for COVID-19 treatment, which have suddenly and continuously scaled up the supply chain challenges [6].

The COVID-19 pandemic has significantly created an imbalance between supply and demand. The imbalance between downstream (demand) and upstream (supply) affects the planning and production recovery plan model [7]. Changes to the upstream—or suppliers—include raw materials delivery, and to the downstream—or customers—include the finished goods flow, product loss, and even product scarcity [8]. In other words, COVID-19 has suddenly resulted in uncertainty about the supply and demand for manufacturing companies covering raw materials delivery and finished product demand with scarcity [3]. The imbalance between product demand and the availability of raw materials has affected companies' production process [7]. The global supply chain (SC) experienced rapid disruption due to the loss of raw materials and labor and has had a global impact [4]. COVID-19 resulted in many people losing their jobs and resulted in uncertainty between the supply and demand in the supply of clothing products [9]. Given this pandemic situation, manufacturing companies have no choice but to reconfigure their supply chain network capability in response to the high uncertainty in supply and demand. Many issues are emerging in the COVID-19 conditions, such as a lack of SC flexibility, a lack of government support, a lack of trust between suppliers and customers, a lack of security and safety, the imbalance between supply and demand, changes in consumer behavior, a lack of medical facilities, and a lack of access [10]. The COVID-19 pandemic requires companies to have SC resilience, the ability to provide products or services in safe and healthy conditions for the community, even in a time of crisis [11]. Furthermore, the current pandemic also requires companies to respond to external changes easily, quickly, and responsively, which is called the "agile supply chain." A company's ability to meet immediate customer demand changes by involving all internal functions of the company is called "supply chain (SC) agility" [12]. The rapid changes in the fashion industry have greatly determined companies' fast responses to building competitiveness [13]. Companies require collective capabilities between internal and external functions to provide accurate and quick responses to disrupted changes [14]. Collective capabilities are related to human resources and information resources within a single database that can integrate its internal capabilities [15]. Information technology owned by a company can provide effectiveness and efficiency in all activities and the supply chain flow. Internal integration in manufacturing companies can enhance the supply chain (SC) partnership to balance supply and demand [16].

Internal integration is a system that is implemented internally in a company to integrate all internal functions. Internal integration built at 539 Taiwanese third-party logistics (3PLs) companies impact SC partnerships with external integration, namely, customer and logistics collaboration integration [17]. Internal integration in manufacturing companies in Malaysia affects SC resilience [18]. Internal integration in companies is implemented by aligning business information systems at the operational level, namely, structural and social collaboration, to pursue increased organizational agility [19]. Information systems used in company operations to synchronize, manage, control, and fulfill demand, can increase SC agility [20]. Information sharing and supplier relationships in increasing supplier innova-

tiveness in manufacturing companies can impact the increase in SC agility [21]. Internal integration and external integration can improve company performance and generate sustainable advantages for fast-moving consumer goods companies [22]. SC integration and SC agility improve organization performance by producing new products and improving customer satisfaction as a sustainable advantage [14].

SC agility requires increased cooperation and dependence on supply chain partners to meet customer requirements with acceptance costs, and overall response time is minimized [19]. The supplier–buyer relationship enhances collaboration and improves organization agility [23]. The strategic partnership with external partners impacts the company's operational performance and competitive advantage [24–26]. The implementation of SC agility requires managers to know when to invest in resources, how much to invest, and where to invest in the supply chain flow to achieve improved performance [27]. SC agility can balance supply and demand to improve operational performance [28]. The company's SC agility, supported by its SC capability, can improve the company's competitiveness [29]. SC agility reduces instability and increases response to customers with rapid environmental changes [30,31]. Organizations that have good SC agility will be able to face disruption quickly. SC agility reflects the capability of the supply chain network to resolve the disruptions and return to normal conditions quickly in the supply chain flow process [32]. A company's goal should be how to survive and not be susceptible to disruption in the supply chain.

Furthermore, SC resilience is a company's capability to cooperate with its partners to resolve and recover from any unexpected disturbance and carry out normal activities in its operational functions and structures [33]. Operation capability related to resource planning, production capability in producing products, market the products, and use of resources will determine a manufacturing company's resilience [14]. A strong company can manage internal company resources and establish a good system to resolve any sudden emerging problem [34]. Companies always try to return to normal conditions quickly from sudden disruptions in the supply chain and with minimized consequences [35]. Exchange companies in Tehran, by building SC partnerships through trust and information sharing, affected the increase in SC resilience [36].

Meanwhile, SC partnerships in companies can increase supplier innovativeness and carry out strategic sourcing that can be implemented to impact SC resilience on an ongoing basis [37]. A survey of 207 supply chain professionals indicated that the relationship between SC partnerships and internal integration could balance supply and demand visibility and affect SC resilience significantly [16]. Big data analytics capability is moderated by organization flexibility and SC agility as a form of fast and responsive response to its functional recovery to increase organizational resilience and competitive advantage in India's automotive components manufacturers [38]. The SC resilience that companies achieve, along with SC integration, can impact their sustainable advantages through customer service and cost-efficient performance [18]. The conditions during the COVID-19 era required scarce raw material resources due to lockdowns in many countries [5]. The company's dependence on scarce resources that can be accessed, controlled, and utilized optimally can be a competitive advantage in the market [39]. A company's SC resilience deal with rapidly changing problems when returning to normal conditions. The condition of COVID-19 had a big impact and changed the manufacturing environment drastically. The ability of a company's management to maintain its readiness in response to disruption, quickly recover from disruption, and quickly return to normal conditions is a conceptualization of SC resilience [40]. SC resilience is a manifestation of maintaining the supply chain network, adapting, and recovering from disruption to meet customer needs and ensure company performance [41].

As discussed above, in this study, five constructs were selected from the literature, namely, internal integration, supply chain partnership, supply chain agility, supply chain resilience, and sustainable advantage. The reason for selecting those constructs is their relevancy with the current pandemic situation, characterized by disrupting supply and

demand and higher risk due to increasing uncertainty. Then, supported by previous studies, this research builds a model relating those constructs. Many studies have discussed the conceptual relationship between two or three of these constructs. However, to the best of the authors' knowledge, no study has dealt with these five constructs in one single model. This model aims to examine the effect of internal integration on sustainable advantage through the mediating role of SC partnership, SC agility, and SC resilience. Therefore, this research model raised three primary research questions. Firstly, it asks whether internal integration affects SC partnership, SC agility, and SC resilience. Secondly, it asks whether SC partnership, SC agility, and SC resilience improve sustainable advantage. Thirdly, it asks whether SC partnership, SC agility, and SC resilience mediate the influence of internal integration on sustainable advantage. This study used a quantitative research approach to examine and answer the research questions developed. Data collection used questionnaires, and data analysis used the partial least square (PLS) technique. The study is expected to provide managerial insights to help companies to recover from the disruption era caused by the COVID-19 pandemic. This study is also expected to enrich the current research in supply chain management.

The rest of the paper is organized as follows: Section 2 deals with the literature review, which explores previous studies to support and develop the research hypotheses. Section 3 is the research methodology, which describes the methodology used to collect and analyze the data obtained from respondents. Furthermore, Section 4 deals with data analysis and discussion to examine the hypotheses. Finally, Section 5 provides the conclusions and summarizes the main results and their relevance to the research questions.

## 2. Literature Review

### 2.1. Internal Integration

The adoption of information technology in companies allows for internal integration to provide flexibility, visibility, traceability, and reliability [10]. Internal integration is integration between departmental functions within the company [17]. A company's internal integration with information technology implementation is used for gathering data, processing information, and utilization [35]. Internal integration can access data information from other departments together and in real time [14]. Information obtained from information technology systems can support decision making. Internal integration is coordination between purchasing, production, manufacturing, finance, marketing, and other functions [18]. A company's information technology will build a strategic response to changes in upstream SC and strategic sensitivity in downstream SC and make it a collective capability [15]. Internal integration is built by one company by increasing the integration process. Process integration within the company is carried out by collaborative planning and trust development activities between internal functions [13]. Measurement items used to measure internal integration include smooth operation of data integration between departments (In.In1), quick coordination between departments with regard to changes (In.In2), quick confirmation of changes in data to other functions (In.In3), on-time integration of data during a pandemic (In.In4), and on-time access to company data for all departments (In.In5).

### 2.2. Supply Chain (SC) Partnership

Companies' ability to build SC partnerships is a good strategy for overcoming uncertainty conditions [24]. The SC partnership develops the needs for both parties' commitment between the supplier and the customer [42]. The conditions of clothing manufacturers in India during the COVID-19 pandemic showed that 72.1% of buyers refused to pay the cost of fabrics and used buyer's power so that suppliers would discount heavily, which is an unsustainable form of SC partnership [9]. Items determine SC partnership in the form of trust between the company and its suppliers, i.e., the customer is certain that the information submitted by the supplier is true and accurate, and the supplier fulfills the promises that have been made and provides the best assessment for the company that it can

rely on [36]. Strategic purchasing, determined by the company through conducting long-term contracts and jointly making long-term plans, affects its competitive advantage [26]. Supplier innovativeness is one of the impacts of SC partnerships to develop suppliers.

Furthermore, manufacturing companies achieve strategic sourcing that is implemented well [37]. The SC partnership that the company builds in the form of supplier-buyer collaboration can increase trust and ease of fulfilling product requirements [23,25]. The measures used for SC partnerships in the pandemic era are extra coordination with partners during a pandemic (SCP.1), on-time delivery of materials from suppliers (SCP.2), suppliers understanding order changes during a pandemic (SCP.3), suppliers' collaboration in helping companies during a pandemic (SCP.4), and coordinate activities with suppliers during the pandemic (SCP.5).

### 2.3. Supply Chain (SC) Agility

COVID-19 has resulted in the bullwhip effect in the supply chain of manufacturing companies, leading to the scarcity of finished products because the raw materials supply were limited due to lockdowns [5,8]. Pharmaceutical manufacturing companies whose products are badly needed need to pay attention to agility, resilience, and sustainability in producing drugs for the international community [6]. SC agility is a strategic capability established by the company to respond quickly to external changes in the company [12,29]. SC agility shows a company's ability to compile mindset, intelligence, and fast processes throughout the supply chain organization to respond to environmental uncertainty [43]. SC agility is the ability of a company to respond to changes easily and quickly, handling business changes with dexterity, and SC agility strategy is needed. The company's agility strategies include agility sensitivity, response, and collective capabilities [15]. Supply chain agility in fashion industry companies with high uncertainty in demand necessitate a quick response to market changes and accurate forecasting of heterogeneous customer needs [13]. SC agility is a company's tactic in carrying out operations to provide a fast response to the market at an efficient cost [27,41]. The SC agility is assessed using five indicators, namely, the production process runs normally during a pandemic to fulfill orders (SCA.1), production capacity is adjusted to pandemic conditions (SCA.2), production planning changes quickly to adjust to conditions during a pandemic (SCA.3), production processes change rapidly according to needs during a pandemic (SCA.4), and the work system is adjusted rapidly according to government regulations (SCA.5).

### 2.4. Supply Chain (SC) Resilience

Supply chain managers who focus on cost savings of 5–10% for logistics or purchasing costs in companies experience a change in focus when COVID-19 seeks to build an integrated system, improve total costs, and resilience [5]. Organizational resilience is the ability of a company to manage human resources properly and have a reliable system in overcoming disruptions in the supply chain [17,34]. Reducing diversification products can increase supply chain resilience for effective and efficient company production [3]. SC resilience is the company's ability to normalize by improving operations after a disruption occurs. Companies' supply chain resilience that needs to be considered is durability based on the number of products shipped and durability based on the average delivery distance [32]. SC resilience can be measured by redundancies, real-time monitoring, visibility systems, and recovery plans [11]. SC resilience is also the company's resilience in facing the disruption that occurs to return to its initial state or even much better than the previous state [30,31]. SC resilience is a company's ability to respond quickly to vulnerabilities and disruptions in the supply chain and return to normal conditions after it occurs [18,41]. SC resilience, as a supply chain system, shapes the company's ability to reduce the possibility of disruption and the consequences of such disruption after it occurs and reduces the time to restore normal performance [35]. In this study, SC resilience is defined as manufacturing companies' ability to identify risks, improve their impacts, and quickly return to normal conditions from the disruption of COVID-19. Items that measure SC resilience include the

ability to overcome SC disruption, easily adapt to SC disruption, respond quickly to SC disruption, and maintain high situational awareness [17]. The research indicators used to measure SC resilience are that the company maintains a buffer stock during a pandemic (SCR.1), production capacity remains a priority during a pandemic (SCR.2), the company can still serve customer demands during a pandemic (SCR.3), and the company continues to adapt quickly during a pandemic (SCR.4).

### 2.5. Sustainable Advantage

A sustainable advantage is a company's capability to achieve a value creation strategy based on its unique capabilities and competencies. The competitive advantage that a company has is different from the company's performance, but competitiveness is the obtained results from the continuous performance that has been achieved [44]. The sustainable advantage is the company's long-term competitiveness that has been recognized by customers, accepted by the market, and able to compete with competitors' products [26]. Companies are always trying to produce new products or redesign new products and redesign the roles of supply chain components in determining inventory and customer needs to improve operating performance and have a continuous competitive advantage [39]. The indicators set for sustainable advantage in the COVID era are that sales volumes are reliable compared to competitors in pandemic conditions (SA.1), product quality can be maintained during a pandemic (SA.2), products are delivered on time during a pandemic (SA.3), production costs are affordable compared to competitor products during a pandemic period (SA.4), and company profits can be relied on during the pandemic (SA.5).

### 2.6. Relationship between Research Concepts

#### 2.6.1. Internal Integration, Supply Chain Partnerships, Supply Chain Agility, and Resilience

Internal integration is built in the company so that it can collaborate with suppliers and customers. Internal integration in 539 Taiwanese third-party logistics (3PLs) positively impacts customer integration and logistics collaborator integration [17]. Companies' information technology to carry out internal integration impacts SC partnerships related to the flow of raw materials and information sharing [35]. Internal integration formed in a company can connect the company and its suppliers to SC partnership [42]. Internal integration in manufacturing companies that have implemented enterprise resources planning (ERP) as a single database system can impact companies in coordinating and integrating with suppliers to determine a purchasing strategy [26].

Internal integration that occurs in the company will provide rapid coordination of company operations. The characteristics that need to be improved in a company's internal communication is integrating the internal information to improve SC agility in terms of collaborative planning, service level improvement, trust development, improved data accuracy, and increased information technology tools utilization [13]. The company's information system is related to fast decision making by evaluating, adopting, and implementing new technology to increase SC agility [20]. The agility of the system is built internally with resources, a lean organizational structure, and a concise operational system with information technology that can respond quickly to external changes [43]. Information systems in business can build alignment at the level of company operations with components in the supply chain, especially in internal integration, to increase organizational agility [19]. Companies' information sharing between 272 supply and purchasing executives in manufacturing companies impacts the increase in SC agility [21]. Internal integration is built by the company through communication and coordination of company goals and priorities with a formal schedule of regular meetings, which can quickly respond and build company resilience [18].

The company's ability to reconfigure internal resources to respond to environmental changes quickly impacts the increase in SC resilience [34]. Internal integration between the company's functions, including purchasing, manufacture, marketing, finance, can

regularly coordinate to determine company goals to increase SC resilience [18]. Internal integration proposed in gathering data, processing information, and utilization is related to its SC resilience [35]. The integration quality obtained in the logistics services supply chain can positively impact SC resilience [33]. Information sharing is an important factor for businesses to increase SC resilience [40]. Internal integration in sharing information among company members, as a support strategy for better management, can increase SC resilience [31,41]. Based on the relationship between these concepts, three research hypotheses can be established:

**Hypothesis 1 (H1).** *Internal integration has an impact on SC partnerships in manufacturing companies.*

**Hypothesis 2 (H2).** *Internal integration has an impact on SC agility in manufacturing companies.*

**Hypothesis 3 (H3).** *Internal integration has an impact on SC resilience in manufacturing companies.*

#### 2.6.2. Supply Chain Relationship Partnership, Supply Chain Agility, and Supply Chain Resilience

The company's ability to involve SC partnerships in meeting customer needs and responding quickly to changes in the external environment is also known as increasing SC agility [43]. A good relationship between supply and demand in the company can mediate between SC agility and operational performance [28]. The company's ability to perform demand sensing by assimilating and transforming information into a company mindset and culture can increase SC agility [20]. SC partnerships with suppliers are needed to build strong cooperation to meet customers' requirements [19,24]. Companies need to increase their capability level by collaborating with channel partners in responding to rapid market changes as a form of the company's SC agility [21]. The company's ability to build collaborative supplier–buyer relationships as a practice of SC partnerships impacts SC agility performance [23].

Customer integration and supplier integration as a form of SC partnership can impact the increase in SC resilience with preparations used to overcome uncertainty and respond quickly to supply chain disruptions [18]. SC collaboration, as a company's ability to deliver products in a short lead time in the model, positively affects SC resilience [31]. Trust in SC partnerships positively impacted SC resilience through information sharing between 330 production companies in Tehran's exchange companies [36]. SC partnerships that have long been formed in companies with increasing innovativeness suppliers can impact SC resilience because the company has sufficient capacity to operate normally and has strong relationships with partners so that it is easy to return to its previous condition [37]. Based on the explanation of the relationship between the concepts above, two research hypothesis can be formulated as follows:

**Hypothesis 4 (H4).** *SC partnership affects SC agility in manufacturing companies.*

**Hypothesis 5 (H5).** *SC partnership influences SC resilience in manufacturing companies.*

#### 2.6.3. Supply Chain Agility Relationship to Supply Chain Resilience

The company's ability to respond quickly to external changes can increase its recovery and resilience [12]. The company's readiness and the speed of its response to change define the company's SC agility so that it can quickly return to normal and grow quickly, which is a concept of SC resilience [40]. Companies build SC agility to respond quickly to dynamic market changes and uncertain environmental changes, increasing organizational resilience in Pakistan's manufacturing companies [30]. SC agility, as a company's ability to deliver products in a short lead time in the model, positively affects SC resilience [31].



**Hypothesis 6 (H6).** *SC agility affects SC resilience in manufacturing companies.*

#### 2.6.4. Relationship of Supply Chain Partnerships, Agility, and Resilience to Sustainable Advantage

The company's SC partnership, by developing customer integration and supplier integration, affects its performance in terms of customer service, cost efficiency, and flexibility, which increased sustainable advantage in manufacturing companies in Malaysia [18]. With SC partnerships, supply risk management impacted sustainable competitive advantage in 300 manufacturing companies [44]. Innovative suppliers in manufacturing companies state that suppliers' innovations contribute to companies in introducing new products and services and aggressively marketing innovative services that increase sustainable advantage [37].

COVID 19 resulted in natural SC agility due to an imbalance in supply and demand. Availability of raw materials and loss of products for customers led to changes in company work patterns that focus on efficiency and effectiveness to reduce production costs in mass production in the short term to meet market needs [5]. COVID-19 affects companies, requiring them to build SC agility to recover quickly and devise a plan for maintaining company operations and performance after a disruption [11]. SC agility is a form of internal capability and external partner suppliers or customers to adapt quickly to market changes [43]. SC agility in the fashion industry is needed to respond quickly to changes in customer needs and carry out a high degree of maneuverability to have competitiveness [13]. SC agility, carried out by managers in 3058 manager companies in the USA, impacted customer response and cost efficiency [27]. Company performance can be improved by implementing SC agility to increase 121 professional supply chain management practitioners [28]. The company's SC agility can impact its competitive advantage [38]. SC agility in the company leads to a fast and responsive response to customer needs in a fast change and maintains a dynamic environmental balance to increase company competitiveness [30].

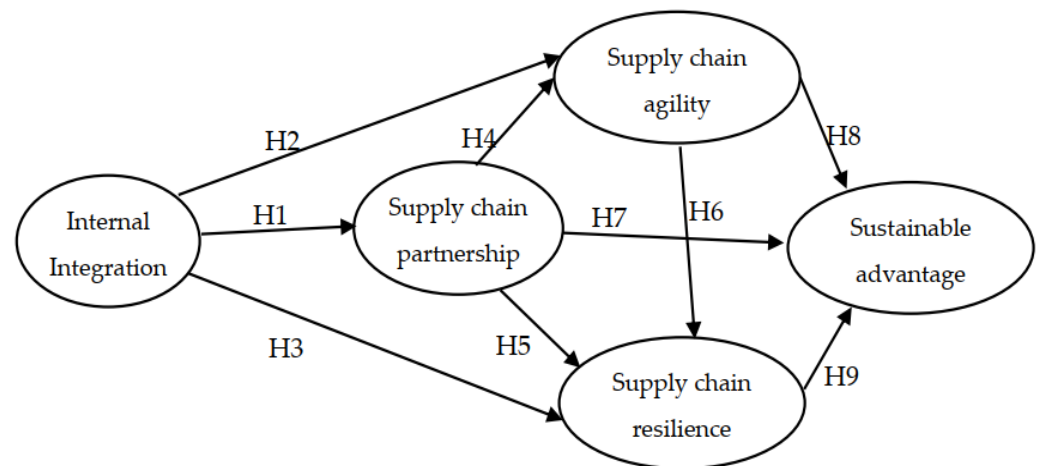
SC resilience applied to Taiwanese companies with a fast response and adaptability to SC disruption reduced complaints from customers and increased customer satisfaction, thereby increasing sustainable advantage [17]. The company's SC resilience impacts sustainable advantage by improving its performance in terms of customer service and cost efficiency but does not impact flexibility [18]. Analytics of capabilities in companies can be strengthened by organizational flexibility, and SC agility, as a form of a company's ability in SC resilience, affects increasing competitive advantage [38]. Companies that are already operating and performing better will have good resilience and contribute to manufacturing companies' competitive advantage [44]. SC resilience can positively impact the company, especially on the production process's sustainability [40]. Based on the results of the explanation on the relationship between concepts, three research hypothesis can be determined as follows:

**Hypothesis 7 (H7).** *SC partnerships influence sustainable advantage in manufacturing companies.*

**Hypothesis 8 (H8).** *SC agility has an impact on sustainable advantage in manufacturing companies.*

**Hypothesis 9 (H9).** *SC resilience affects sustainable advantage in manufacturing companies.*

Internal integration is an information technology system applied to companies capable of being integrated with SC partnerships to form SC integration [22]. It is defined as the company's ability with its partners to produce SC agility that can respond quickly to a change. The company's speed and reliability in responding to changes in the external environment can achieve SC resilience and sustainable advantage. Based on the explanation of the relationship between concepts, a conceptual research model is presented in Figure 1.



**Figure 1.** Model of SC internal integration, partnership, agility, resilience, and sustainable advantage.

### 3. Research Methodology

#### 3.1. Data

The population of this study is composed of manufacturing companies in Indonesia, and the respondents are the management level of the companies. Data collection used a questionnaire based on a five-point Likert scale with 1: strongly disagree, 2: disagree, 3: neutral, 4: agree, and 5: strongly agree [45]. As described in the literature review, measurement indicators were adopted from previous research and adapted to the conditions of the COVID era. The internal integration consists of five indicators, SC partnership consists of five indicators, SC agility has five indicators, SC resilience consists of four indicators, and the sustainable advantage has five indicators. The measurement indicators were initially tested for validity and reliability before distributed to the respondents. This initial test was conducted by the production and operational management students who understood the manufacturing and industry practitioners. The initial version of the test was improved considering the feedback of the validation stage. The revised questionnaire was created using Google Form, and the link was distributed to Indonesia's industry practitioners between March 2020 and November 2020. The dissemination is conducted by sending a link via email to the manager's association assisted by several enumerators and a WhatsApp group by utilizing relationships in the manufacturing industry. Data collection received as many as 672 respondents who filled out the questionnaire, and 512 of the 672 questionnaires were related to the manufacturing companies, while the rest, 160 questionnaires, were services companies. Further data screening results in only 456 questionnaires (corresponding to 67.86%) considered valid for further analysis.

#### 3.2. Validity and Reliability

The data were analyzed using the partial least square (PLS). PLS is broadly used in the quantitative research approach. This technique is a variance-based approach instead of covariance-based used in the SPSS technique. PLS performs the analysis in two steps: First, it assesses the measurement model and examines the inner model. Measurement model assessment verifies whether the indicators of each variable are valid and reliable against the predetermined acceptable values. The inner model assessment examines whether the proposed hypothesis is supported or not. The validity and reliability of the indicators are assessed using factor loading and cross-loading, while reliability is assessed using the composite reliability, average variance extracted (AVE), and Cronbach alpha. An indicator is considered valid when the factor loading value exceeds 0.50, and the cross-loading is less than factor loading.

In the second step, each variable's block of indicators is considered reliable when the composite reliability exceeds 0.70, AVE exceeds 0.50, and Cronbach alpha exceeds 0.70. Table 1 demonstrates the measurement model analysis results. The lowest loading factor

is obtained in the internal integration variable with the item In.In5 (all departments can access company data in real time), with the value of 0.554; SC partnership has the lowest loading factor for SCP1 items (extra coordination with partners during the pandemic), with the value of 0.602; SC agility has the lowest loading factor on items SCA.5 (work is adjusted quickly based on government regulations), with the value of 0.632; SC resilience has the lowest loading factor on item SCR.1 (the company maintains a buffer stock during the pandemic), with the value of 0.599; and lastly, the sustainable advantage has the lowest loading factor on item SA.1 (sales volume reliable compared to competitors in pandemic conditions), with the value of 0.585. The loading factor's result is greater than 0.500, and the loading factor's value is larger than its cross-loading with other variables [46]. Hence, those indicators are considered valid.

**Table 1.** Indicator factor loading and cross-loading assessment.

Indicator	Internal Integration	SC. Partnership	SC. Agility	SC. Resilience	Sustainable Advantage
In.In1	0.867	0.567	0.537	0.534	0.575
In.In2	0.834	0.644	0.486	0.520	0.556
In.In3	0.845	0.579	0.522	0.576	0.525
In.In4	0.795	0.551	0.503	0.538	0.483
In.In5	0.554	0.393	0.333	0.405	0.323
SCP.1	0.559	0.602	0.359	0.477	0.523
SCP.2	0.455	0.733	0.457	0.453	0.418
SCP.3	0.537	0.797	0.478	0.447	0.455
SCP.4	0.452	0.704	0.399	0.402	0.338
SCP.5	0.547	0.812	0.466	0.501	0.495
SCA.1	0.365	0.350	0.774	0.449	0.262
SCA.2	0.362	0.348	0.768	0.447	0.264
SCA.3	0.400	0.437	0.723	0.383	0.398
SCA.4	0.459	0.441	0.743	0.392	0.401
SCA.5	0.569	0.517	0.632	0.472	0.511
SCR.1	0.343	0.363	0.263	0.599	0.28
SCR.2	0.421	0.398	0.363	0.697	0.337
SCR.3	0.551	0.539	0.509	0.771	0.651
SCR.4	0.544	0.486	0.524	0.817	0.567
SA.1	0.309	0.247	0.257	0.267	0.585
SA.2	0.537	0.502	0.480	0.566	0.803
SA.3	0.536	0.498	0.489	0.567	0.689
SA.4	0.426	0.458	0.252	0.471	0.713
SA.5	0.304	0.345	0.258	0.353	0.663

Table 2 shows that the Cronbach's alpha value and composite reliability of all research variables are above 0.700, and the average variance extracted (AVE) value is above 0.500 [46]. Cronbach's alpha value, composite reliability, and average variance extracted (AVE) have met reliable requirements. Then, those indicators of variables are considered reliable, and further analysis can proceed.

**Table 2.** Reliability test results.

Research Variable	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Internal Integration	0.840	0.889	0.620
Supply Chain Agility	0.782	0.850	0.533
Supply Chain Partnership	0.781	0.852	0.538
Supply Chain Resilience	0.711	0.815	0.527
Sustainable Advantage	0.739	0.822	0.482

The goodness of fit test is required to seek whether the model as a whole could match the data obtained. The goodness of fit used the  $Q^2$  (called predictive relevance) to assess it. The  $Q^2$  is calculated using the following formula:  $Q^2 = [1 - (1 - R_1^2)(1 - R_2^2)(1 - R_3^2)(1 - R_4^2)]$ . The  $Q^2$  value using the  $R^2$  in Table 3 resulted in  $Q^2 = [1 - (1 - 0.426) \times (1 - 0.493) \times (1 - 0.521) \times (1 - 0.522)] = 0.9334$ . The model has a good predictive relevance when the  $Q^2$  value greater than 0.00. This result shows that the model can predict the sustainable advantage very well. In summary, the requirements for using all research constructs have met the predetermined requirements, and hypothesis examination can proceed.

**Table 3.** R square assessment results.

Variable	R Square	R Square Adjusted
Supply Chain Agility	0.426	0.424
Supply Chain Partnership	0.493	0.492
Supply Chain Resilience	0.521	0.517
Sustainable Advantage	0.522	0.519

#### 4. Data Analysis and Discussion

##### 4.1. Results

There are 456 questionnaires considered valid for analysis, and the respondents' profile is demonstrated in Table 4. Most of the respondents (80%) are located in Java island, while the rest are located in Sumatera, Kalimantan, Sulawesi, Nusa Tenggara, and Papua.

**Table 4.** Respondents' profile.

Criteria	Description	Number	%
Gender	Male	300	66
	Female	156	34
Department	Production	150	33
	Marketing	137	30
	Finance/Accounting	86	19
	Purchasing	26	6
	Warehouse	21	5
	Planning Production Control	19	4
	Supply Chain Management	10	2
	IT Department	6	1
Position	Lower-Level Management (Foreman level)	148	33
	Middle Management (Department head)	192	42
	Top Management (General Manager, Director, and Owner)	116	25
Length of work	Less than two years	68	15
	2–5 years	126	28
	5–10 years	72	16
	10–15 years	36	8
	More than 15 years	154	33
Company size (number of employees)	Small size (<20 employees)	104	23
	Middle size (20–100 employees)	233	51
	Large size (>100 employees)	119	26

Based on the gender, it was found that the respondents consist of 66% male and 34% female, which means that men dominate the employee working in the manufacturing companies. The respondents are in charge of various departments, including production (33%), marketing (30%), finance/accounting (19%), purchasing (6%), warehousing, PPC, supply chain management, and IT (12%). This department's composition indicated that respondents covered all the internal functions of an organization. The position of the respondents shows a balance between the lower level (32%), middle management (42%),

and top management level (25%), thus indicating their respective roles in the supply chain based on individual roles and functions. Based on the length of work, most of the respondents have working experience of more than two years (85%), which shows that employees have understood the company's working system well and are eligible to answer questionnaires. Most of the companies are of medium and large size since 77% have more than 20 workers.

A hypothesis is accepted when the t-statistic value of the path coefficient exceeds 2.36 for a significant level of 1% or 1.96 for the significant level of 5%, and 1.65 for the significance level at 10%. This study considers that the path coefficient with a significant 10% or t value level greater than 1.64 is acceptable. Table 5 shows that the minimum value of the t-statistic is 1.919, which means that this study supports all nine hypotheses proposed. The result supported eight hypotheses with a significant level of 1%, while one hypothesis (H8) with a significant level of 10%. However, Table 5 and Figure 2 demonstrate the only direct relationship of each two consecutive constructs. Simultaneously, the research model presents three intervening variables that mediate internal integration influence on sustainable advantage. Based on these findings, this result reveals that internal integration only affects the sustainable advantage through the mediating role of the three intervening variables, namely, SC agility, SC partnership, and SC resilience.

**Table 5.** Path coefficients.

Direct Effect	Original Sample	Standard Deviation	t-Statistics
Internal Integration -> Supply Chain Partnership (H1)	0.702	0.028	25.203
Internal Integration -> Supply Chain Agility (H2)	0.387	0.056	6.847
Internal Integration -> Supply Chain Resilience (H3)	0.333	0.054	6.190
Supply Chain Partnership -> Supply Chain Agility (H4)	0.321	0.053	6.019
Supply Chain Partnership -> Supply Chain Resilience (H5)	0.247	0.055	4.468
Supply Chain Agility -> Supply Chain Resilience (H6)	0.246	0.044	5.620
Supply Chain Partnership -> Sustainable Advantage (H7)	0.285	0.047	6.063
Supply Chain Agility -> Sustainable Advantage (H8)	0.097	0.051	1.919
Supply Chain Resilience -> Sustainable Advantage (H9)	0.436	0.044	9.836

The first hypothesis (H1), internal integration affects SC partnerships in manufacturing companies, is supported as the t-statistic value is 25.203. The second hypothesis (H2), internal integration influences SC agility, is supported in manufacturing companies with the t-statistic value is 6.847. The third hypothesis (H3) that internal integration affects SC resilience is accepted since the t-statistic value is 6.190.

The fourth hypothesis (H4) testing indicated a t-statistic of 6.019, which means the hypothesis is accepted, i.e., SC partnership affects SC agility in manufacturing companies. The fifth hypothesis (H5), with a t-statistic (4.468), is also accepted, i.e., SC partnership has an impact on SC resilience in manufacturing companies. The sixth hypothesis (H6) with a t-statistic of 5.620 is accepted, which means that SC Agility impacts SC resilience in manufacturing companies. The seventh hypothesis (H7), with a t-statistic of 6.063, is also supported, i.e., SC partnerships impact sustainable advantage in manufacturing companies. The eighth hypothesis test (H8) obtained a t-statistic value of 1.919; therefore, it is supported that SC agility has an impact on sustainable advantage in manufacturing companies at the level of significance 0.1. The ninth hypothesis (H9), with a t-statistic of

9.836, is supported, namely, that SC resilience has an impact on sustainable advantage in manufacturing companies.

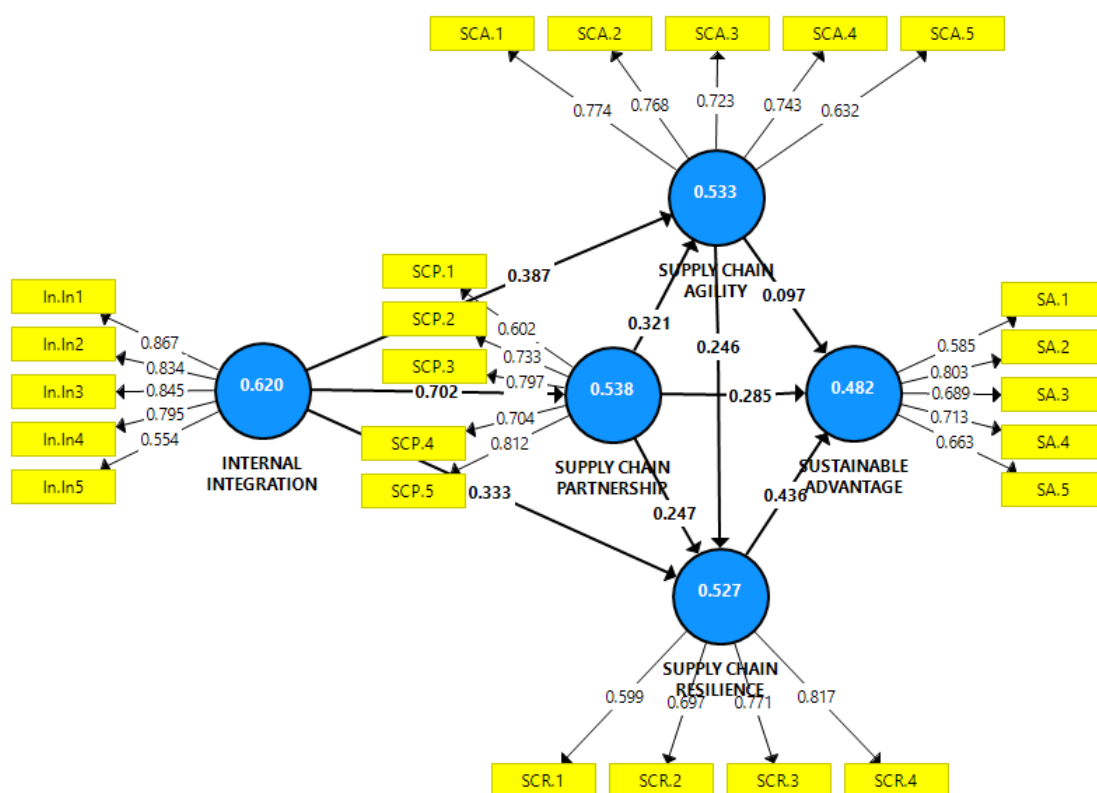


Figure 2. Path analysis of the research model.

#### 4.2. Discussion

The first hypothesis (H1), internal integration impacts SC partnerships in the manufacturing companies, is supported. Internal integration, which is implemented by data integration between departments, and data changes are communicated quickly to other functions, can improve SC partnerships. The marketing department could coordinate directly with the production department concerning the incoming customer orders. The company's purchasing department coordinates actively with suppliers when there is a change in orders from customers. This study supports previous research results stating that internal integration impacts SC partnerships in companies [14,16,17,35,42].

The second hypothesis (H2) states that internal integration impacts SC agility in manufacturing companies. Companies carry out internal integration to coordinate promptly between functions in charge, and data integration during the pandemic affects SC agility to respond to changes. Manufacturing companies can make changes to production planning quickly to adjust to conditions during a pandemic and simultaneously make the production process change rapidly according to a customer's needs. Manufacturing companies in Indonesia continue to run normally, but some companies keep working distance by replacing two shifts previously with only one shift to maintain production capacity. This research is in line with research that states that internal integration impacts SC agility in manufacturing companies [13,19–21,43].

The third hypothesis (H3), internal integration impacts SC resilience in manufacturing companies, is also supported. Internal integration shows that all departments can access company data in real time and coordinate quickly in interdepartmental changes affecting SC resilience. Manufacturing companies can still serve customer demands during a pandemic and adapt quickly during a pandemic to form SC resilience. The cross-functional ability to find information quickly can make the right decisions to adapt during a pandemic

quickly. Company employees can find out about the arrival and inventory of material stock, adjusted to the number of orders ordered, and decisions are made directly to the company's operations to fulfill customer orders. This study supports the research results that state that internal integration impacts SC resilience in companies [17,18,31,33–35,40,41].

Furthermore, the fourth hypothesis (H4) that SC partnership affects SC agility in manufacturing companies is accepted. The SC partnership built allows suppliers to understand changes in orders during a pandemic to adjust the production process to change quickly according to needs during a pandemic as a form of SC agility. Moreover, SC partnerships allow delivery of materials from suppliers on time, impacting the production process normally during a pandemic to fulfill predefined orders. The purchasing function, marketing function, and production function are coordinated every morning through online meetings. The resulting coordination can anticipate changes in the production process and can provide good service to customer needs. The results of this study support the results of research that state that SC partnerships have an impact on SC agility in companies [19–21,23,24,28,43].

As expected, the fifth hypothesis (H5) is also supported. SC partnerships impact SC resilience in manufacturing companies. SC partnership is in the form of a supplier understanding of order changes which allows the companies to maintain its buffer stock to keep products that customers may need are available during the pandemic. Partnerships that can collaborate with suppliers during a pandemic will increase SC resilience because they can serve customer demands during a pandemic normally. This study supports the research results that SC partnerships impact SC resilience in manufacturing companies [18,31,36,37].

The sixth hypothesis (H6) can be accepted, and it is stated that SC agility has an impact on SC resilience in manufacturing companies. The company keeps the production process running normally during the pandemic to fulfill orders as a form of SC agility, so it is necessary to maintain a buffer stock during the pandemic period in order to be able to maintain SC resilience. The company maintains the production process by changing it into two shifts so that the work system is adjusted quickly according to government regulations to determine the occurrence of SC resilience for customers by maintaining production capacity during a pandemic. The company's SC agility can increase SC resilience [12,30,31,40].

The seventh hypothesis (H7), SC partnerships have an impact on sustainable advantage in manufacturing companies, is also supported. A solid SC partnership allows suppliers to deliver material on time so that the company's production process runs according to a predetermined schedule and directly impacts product delivery on time during a pandemic period to increase the sustainable advantage. The company always coordinates every morning in carrying out production planning by taking into account the availability of raw materials. Additionally, SC partnerships that involve collaborating suppliers to help companies during a pandemic impact product quality that can be maintained during a pandemic period. SC partnerships impact manufacturing companies' sustainable advantage [18,37,44].

The eighth hypothesis (H8) can be accepted, and it is stated that SC agility has an impact on sustainable advantage in manufacturing companies. According to pandemic conditions, the company's SC agility by adjusting the resulting production capacity is associated with reliable sales volume, compared to competitors in pandemic conditions due to the company's sustainable advantage. Besides that, the company's agility in determining production planning regarding rapid changes in adjusting to the situation during a pandemic is related to the timely delivery of products during the pandemic to achieve sustainable advantage. This study supports previous researchers who stated that SC agility impacts sustainable advantage in companies [5,11,13,27,30,38,43].

The ninth hypothesis (H9) is accepted that SC resilience impacts sustainable advantage in manufacturing companies. The company's ability to maintain buffer stock during a pandemic period makes SC resilience reliable, thus determining a sustainable advantage in delivering products on time during a pandemic and reliable sales volume, compared to

competitors in pandemic conditions. Many manufacturing companies experience difficulty in raw materials in the pandemic era, especially companies that are essential to preventing the spread of COVID. For companies with a high buffer stock, the disruption conditions are an advantage in meeting customer demands. Resilience during a pandemic condition for manufacturing companies still serves customer requests during the pandemic period because there is no lockdown, but the company runs a Health protocol while employees are working. Work activities carried out routinely maintain production capacity so that company profits can be relied on during a pandemic to increase the sustainable advantage. This research supports previous research that states that SC resilience impacts sustainable advantage in companies [17,18,38,40,44].

Manufacturing companies are always trying to make integrated information systems an important tool during a pandemic because the interaction between cross-functional parties can be reduced but still reliable for the company's internal and external coordination. Information systems are used for internal and external integration or SC integration, which relies on SC partnerships. The company's ability to involve external and cross-functional parties on the internal side increases SC agility and SC resilience. SC partnership, SC agility, and SC resilience impact increasing sustainable advantage during the COVID period to become a theoretical contribution to research. The practical contribution of research impacts top management to continue to empower all company internal and external functions. The company adjusted the work system by making two production shifts to carry out government regulations related to preventing the spread of the virus as a form of resilience organization, but still producing products according to customers' orders quickly within the built agility.

Other essential findings of this study are the revelation of the mediating role of the intervening variables, namely, supply chain partnership, supply chain resilience, and supply chain agility. As shown in the research model, the second research question examines whether the SC partnership, SC resilience, and SC agility mediate the relationship of internal integration on the sustainable advantage. The mediating role of the three variables was examined by looking at the two direct relationships consecutively. It has been noticed that internal integration directly affects the SC partnership (H1) and SC partnership directly affects sustainable advantage (H7). It implies that internal integration indirectly affects sustainable advantage through the mediating role of SC partnership. In other words, SC partnership does mediate the influence of internal integration on sustainable advantage. Similarly, internal integration influences SC agility (H2), and SC agility affects sustainable advantage (H8), implying that internal integration indirectly improves sustainable advantage through SC agility. Furthermore, since internal integration directly affects SC resilience (H3), and SC resilience directly influences sustainable advantage (H9), it can be concluded that internal integration indirectly affects sustainable advantage through SC resilience. As expected, the results indicate that those three intervening variables do mediate the relationship. This finding implies that internal integration has multiple effects on the sustainable advantage when a company implements supply chain partnership, supply chain resilience, and supply chain agility. These findings have highlighted the importance of internal integration to improve the sustainable advantage of a company. Moreover, the organization also needs to integrate with its external partners enabling quick coordination to pursue any customer demand changes. The integration with external partners allows the company to establish supply chain partnerships, develop supply chain agility, and supply chain resilience to pursue improved sustainable advantage. The collaboration with an external partner such as supplier and distributors, called supply chain partnership, enables the company and partner to forecast, plan, and adjust the production to any customer demand variation. SC partnerships allow suppliers to understand changes in orders during a pandemic, adjust the production process to change quickly, and increase their buffer stock and adjust to customer needs. Furthermore, the supply chain agility enables the company and its partners to cope with any sudden changes in demand volume, product varieties, and delivery schedule requested by the customer. At the same time, the supply chain



resilience allows the company and its partners to meet its promise to the customer even though any constraints due to disruption in supply, transportation, and logistic network. Finally, when the company implements internal integration and establishes supply chain partnerships, it enhances supply chain agility, and supply chain resilience will increase the sustainable advantage, enabling the company to meet any change in customer demand at any time.

## 5. Conclusions

The initial purpose of this study is to examine the impact of internal integration, supply chain partnership, supply chain agility, and supply chain resilience on sustainable advantage. As expected, the results indicate that data support all nine hypotheses developed, and all findings are in line with previous research referenced in this study. Internal integration influences SC partnerships (H1), internal integration affects SC agility (H2), internal integration affects SC resilience (H3), SC partnership influence SC agility (H4), and SC partnership improves SC resilience (H5). Furthermore, SC agility improves SC resilience (H6), SC partnerships affect sustainable advantage (H7), SC agility influences sustainable advantage (H8), and SC resilience affects sustainable advantage (H9). The interesting findings of this study are the existence of the mediating role of the three intervening variables—supply chain partnership, supply chain resilience, and supply chain agility. Internal integration indirectly influences the sustainable advantage through the mediation of SC partnership, SC agility, and SC resilience. In summary, the implementation of internal integration within an organization and the collaboration with the external party in establishing supply chain partnerships, supply chain agility, and supply chain resilience enable the manufacturing company to enhance its sustainable advantage. This result implies that internal integration provides multiple effects in improving the sustainable advantage. These findings have highlighted the importance of internal integration to improve the sustainable advantage of a company.

As discussed previously, this research provides a practical contribution on how the manufacturing companies could recover from the current disruption era due to the COVID-19 pandemic. The company needs to establish an excellent internal integration, enhance supply chain partnerships, supply chain resilience, and supply chain agility to pursue an improved sustainable advantage. This study could also enrich and extend the acceptance of the current research in the context of the manufacturing industry.

This work has some limitations, particularly in terms of the population and the variable involved. Further studies on the current topic are suggested to involve the variables such as supply chain risk management and customer relationship management to cover more stakeholders and functions involved in the supply chain network.

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