

## **Digital Supply Chain: Is It Important For Enhancing Supply Chain Performance?**

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### **ABSTRACT**

*A supply chain based on technology is very important in Industry 4.0. Unfortunately, several manufacturing companies have not been using optimally this technology. However, big manufacturing companies are. This paper proposes a solution providing good insight based on the digital supply chain. The aim of this study is to provide acceptable digital supply chain implementation, especially for manufacturing companies which still not using the technology in their supply chain process. This research used RBV theory in order to compare the prior study with the current situation. In this research, all the variable studies are positively affecting the supply chain performance. In this study, the implementation of digital supply chain can improve supply chain performance by combining with supply chain quality management practices. Especially with Supply chain agility as a mediating process.*

**Keywords:** *Digital Supply Chain, Supply Chain Performance, Supply Chain Quality Management, Manufacture Industry, Resource Based View.*

### **ABSTRAK**

Rantai pasokan berbasis teknologi sangat penting dalam Industri 4.0. Sayangnya, beberapa perusahaan manufaktur belum menggunakan teknologi ini secara optimal. Namun, perusahaan manufaktur besar adalah. Makalah ini mengusulkan solusi yang memberikan wawasan yang baik berdasarkan rantai pasokan digital. Tujuan dari penelitian ini adalah untuk memberikan implementasi rantai pasokan digital yang dapat diterima, terutama bagi perusahaan manufaktur yang masih belum menggunakan teknologi dalam proses rantai pasokan mereka. Penelitian ini menggunakan teori RBV untuk membandingkan penelitian sebelumnya dengan situasi saat ini. Dalam penelitian ini, semua studi variabel secara positif mempengaruhi kinerja rantai pasokan. Dalam studi ini, penerapan rantai pasokan digital dapat meningkatkan kinerja rantai pasokan dengan menggabungkan dengan praktik manajemen kualitas rantai pasokan. Apalagi dengan *Supply chain agility* sebagai proses mediasi.

**Kata kunci:** *Digital Supply Chain, Kinerja Supply Chain, Manajemen Kualitas Supply Chain, Industri Manufaktur, Resource Based View.*

### **INTRODUCTION**

The supply chain is a collaboration of upstream and downstream partner companies between suppliers and customers (RuzoSanmartín et al., 03). The current era of globalization provides companies with both opportunities and challenges. At a

broader level, companies can build geographically connected factories, distribution centers, and warehouses for various reasons such as cost advantages, specialized human resource skills, and access to sources of raw materials (Pham et al., 03). The company cooperates with its main suppliers in the preparation of decisions, plans, procedures, and tasks to mutually meet customer needs. Many of the challenges facing manufacturers are operating in today's everchanging environment.

Companies strive to improve their supply chain, achieve higher levels of performance, and maintain their competitive position. Moreover, competition among individual companies has shifted to competition between supply chains, which has led academics and practitioners to underscore the need to implement quality throughout the supply chain network. (Abdallah et al., 01). Besides that, Quality is also considered as a common goal of the distribution chain and as the responsibility of multi-echelon supply chain participants, especially in contexts where the value chain proves a growing trend in service, internet of Things (IoT), and circular economy models (Abdallah et al., 01a)

Currently, technology can help to connect between lines in the company. Technology allows companies to connect and interact via the web. Technology also has the potential to offer a variety of organizational benefits, including increased supplier and customer collaboration (Mora-Monge et al., 03). Because a modern supply chain is more complex than a traditional supply chain, manufacturers are integrating digital technologies to increase the efficiency and capability of the supply chain function. The implications of digital technology in supply chain practices usually called digital supply chain (DSC) are becoming a potential area in the current information systems literature. Digitalization and supply chain flexibility significantly affect sustainable performance (Shahadat et al., 03).

The current state of the market is characterized by intense competitive pressures and high levels of turbulence and uncertainty. Therefore, companies need agility in their supply chain to better manage the risk of disruption or changing market conditions. Companies must also ensure uninterrupted service and provide added value to customers. What is needed is a systematic increase in agility in all segments of the supply chain as well as the ability to anticipate and react to external changes, such as market changes, customer demands, etc., quickly and in a coordinated manner (Park et al., 03). Problems regarding this can be felt during the COVID-19 pandemic in 00 when many companies in Indonesia changed their supply chain processes so that business processes could continue. Manufacturers, suppliers, shippers, distributors, and customers are the main stakeholders in the supply chain of the manufacturing industry. Indeed, manufacturing companies have increasingly recognized the importance of supply chain performance and an efficiently managed supply chain is a critical factor to remain competitive. Not only that, but globalization also amplifies the effects of these factors, thereby increasing the need to incorporate technology into supply chain management (SCM) systems. (Tan et al., 0).

Based on previous research (Abdallah et al., 01a) found that Supply chain quality management (SCQM) plays a key role throughout the SC network in facilitating and developing Supply chain Agility (SCA) capabilities in micro, small, and medium enterprises (MSME). The results also expand on previous research work identifying the positive effects of SCQM on performance by providing meaningful insight into SCQM's role in promoting SCA capabilities, which, in turn, further enhances SCP. Based on previous research, digital supply chain (DSC) is a significant contributor to improving a company's supply chain capabilities. The results of this study also show that digital technology has a direct effect on supply chain capability and supply chain performance in RMG companies. The stream of research on the integration of Industry 4.0 and supply chain, known as Supply Chain 4.0, exploded in 015 with an increasing number every year. There is a large amount of evidence for the successful application of disruptive technologies to supply chain management. Most of the research streams regard this aspect as the main driver that delivers cutting-edge results of the performance transformation of Supply Chain 4.0. (Bui et al., 0)

This study aims to bridge the knowledge gap highlighted in the review literature by expressing the value that supply chain quality and digital supply chain can facilitate supply chain performance and exploring supply chain agility as a reinforcing or supporting factor as well as examining the application of technology and the utilization of quality management in the supply chain in manufacturing companies in Indonesia which is a developing country in the form of an archipelago which makes it a challenge to implement these two things. And seeing the current conditions, where not all regions in Indonesia have adequate quality Internet of Things which also affects quality management. In short, this study examines the effect of SCQM and DSC on SCP with SCA as mediation in large companies, especially in manufacturing companies. Studies highlight that SCA plays a key role in connecting SCQM, DSC, and SCP; thus, the following research questions have been formulated:

1. Does supply chain quality support supply chain agility?
2. Does the digital supply chain support supply chain agility?
3. What is the effect of supply chain agility on supply chain performance?
4. Does supply chain agility provide a mediating effect in linking supply chain quality to supply chain performance?
5. Does supply chain agility provide a mediating effect in connecting digital supply chains to supply chain performance?.

## **METHODS**

This study analyzes the variables that affect the supply chain performance. These variables include the SCQM Practices, Digital supply chain, and Supply chain agility as moderating variable.

In conducting research related to this digital supply chain, accurate data is needed to produce relevant results. This research adopts a quantitative approach. Data were collected through electronic media (google form), social media platforms (WhatsApp), and email to expand the distribution of questionnaires. The questionnaire is divided into two parts. The first part focuses on participant criteria, type of company, position, job function, and length of work in supply chain-related parts, and continues with participant demographics which include gender, age, and last education. The second part includes the adopted items representing the main research variables.

## RESULTS AND DISCUSSION

### Results of Testing the Validity and Reliability of SCQM Practices

The results of processing validity check for SCQM Practices variables consisting of 3 indicators resulted in conclusions that all proved valid because they resulted in an outer loading of  $> 0.5$ . The ten indicators are also interconnected in forming the SCQM Practices variable because it produces an AVE value of  $0.834 > 0.5$ . Reliability message produces a Cronbach alpha value of  $0.901 > 0.7$  which means that 3 reliable measurement indicators are proven (consistent). Thus all 3 variable indicators of SCQM Practices are valid and reliable, more details can be seen in Table 1.

**Table 1 Validity and reliability testing.**

Variable	Item	Outer Loading	AVE	Cronbach Alpha
<i>SCQM Practices</i>	SCQM1	0.910	0.834	0.901
	SCQM2	0.899		
	SCQM3	0.931		
<i>Digital Supply Chain</i>	DSC1	0.885	0.799	0.874
	DSC2	0.928		
	DSC3	0.867		
<i>Supply Chain Agility</i>	AG1	0.878	0.757	0.946
	AG2	0.845		
	AG3	0.872		
	AG4	0.909		
	AG5	0.836		
	AG6	0.897		
	AG7	0.853		
<i>Supply Chain Performance</i>	PER1	0.873	0.714	0.802
	PER2	0.784		
	PER3	0.875		

*Source: processed data*

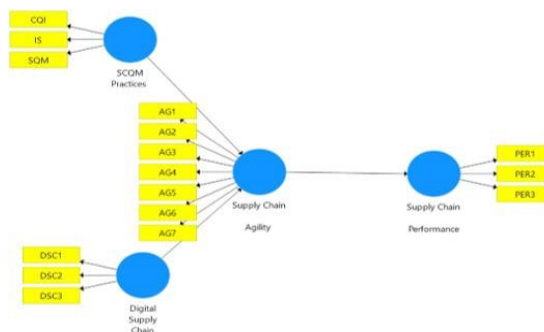
The results of processing validity check for Digital Supply Chain variables consisting of 3 indicators resulted in all conclusions proving valid because they resulted in an outer loading of  $> 0.5$ . The three indicators are also interconnected in forming the Digital Supply Chain variable because it produces an AVE value of  $0.799 > 0.5$ . Reliability message produces a Cronbach alpha value of  $0.874 > 0.7$  which means that 3 reliable measurement indicators are proven (consistent). Thus all 3 Digital Supply Chain variable indicators are valid and reliable,

The results of processing validity check for the Supply Chain Agility variable consisting of 7 indicators resulted in conclusions that all proved valid because they resulted in an outer loading of  $> 0.5$ . The integrity of indicators is also interconnected in forming the Supply Chain Agility variable because it produces AVE values of  $0.757 > 0.5$ . Reliability message produces a Cronbach alpha value of  $0.946 > 0.7$  which means that 7 indicators of measurement of the variable Supply Chain Agility are reliable (consistent). Thus all 7 variable indicators of Supply Chain Agility are valid and reliable,

The results of processing validity check for the Supply Chain Performance variable consisting of 3 indicators resulted in conclusions that all proved valid because they resulted in an outer loading of  $> 0.5$ . The three indicators are also interconnected in forming the Supply Chain Agility variable because it produces an AVE value of  $0.714 > 0.5$ . Reliability message produces a Cronbach alpha value of  $0.80 > 0.7$  which means that 3 indicators of measurement of the Supply Chain Performance variable are reliable (consistent). Thus all 7 variable indicators of Supply Chain Performance are valid and reliable.

### Interpretation of the PLS-SEM model

PLS-SEM Model Used in research is carried out after eliminating invalid and reliable indicators as shown in the following figure:



**Figure 1. Model SEM-PLS research**

### Model Precision Testing

### Multicollinearity Testing

Multicollinearity testing is used to test that between independent variables in the research model should not be interconnected. The processing results for multicollinearity testing can be seen in it. Multicollinearity testing is only carried out on regression models with more than one independent variable whereas in the PLS-SEM model, this is only on the Supply Chain Agility equation. The processing results show that multicollinearity for the Supply Chain Agility model produces VIF values for both independent variables, namely Digital Supply Chain and SCOM Practices  $< 10$  which means that there is no multicollinearity for Digital Supply Chain and Supply Chain Agility variables.

**Table 2. Multicollinearity testing**

Independent Variables	Supply Chain Agility	Supply Chain Performance
Digital Supply Chain	2.977	
SCQM Practices	2.977	
Supply Chain Agility		1,000

Source : processed data

## Coefficient determination (RSquare)

Fit model testing for the SEM-PLS model is shown by the value of the coefficient of determination where the processing results are shown in table 3. The table can be explained as follows:

For the *Digital Supply Chain model*, an adjusted R square value of 0.76 is obtained, which means that the variation or behavior of the independent variables, namely Digital Supply Chain and SCQM Practices, is able to explain the variation of the dependent variable, namely Supply Chain Agility by 76.%, while the remaining 3.8% is a variation of other independent variables that affect Supply Chain Agility *but* not included in the model. These results show that the *Supply Chain Agility* model has a good fit model.

For the Supply Chain Performance model, an adjusted R square value of 0.373 is obtained, which means that the variation or behavior of the independent variable, namely Supply Chain Agility, is able to explain the variation of the dependent variable, namely Supply Chain Performance by 37.3%, while the remaining 6.7% is a variation of other independent variables that affect Supply Chain Performance but not included in the model. These results show

**Table 3. Coefficient determination**

Structural Model	R Square	R Square Adjusted
Supply Chain Agility	0.768	0.762
Supply Chain Performance	0.382	0.373

Source: processed data

## Hypothesis Testing

The results of processing for testing research hypotheses are shown in Table 4.

**Table 4. Research hypothesis testing**

	Hypothesis	Coefficient	Statistics	P-value	Decision
H1	Digital supply chain has a positive effect on supply chain agility	0,713	6,768	0,000	Hypothesis supported
H2	SCQM positively affects supply chain agility	0,192	1,845	0,033	Hypothesis supported
H3	Supply chain agility has a positive effect on supply chain performance	0,636	7,770	0,000	Hypothesis supported
H4	SCQM positively affects supply chain performance with Supply chain agility as mediation	0,128	1,667	0,048	Hypothesis supported
H5	Digital Supply chain positively affects supply chain performance with supply chain agility as mediation.	0,448	5,380	0,000	Hypothesis supported

*Source: processed data*

### Hypothesis 1

It was carried out with the aim of testing the positive influence of the Digital supply chain on Supply chain agility, The processing results are shown with an estimated coefficient value of 0.713 which means that increasing the Digital supply chain will increase Supply chain agility and vice versa decreasing Digital supply chain will decrease Supply chain agility The statistical t value of 6.768 results in a p-value of  $0.000 < 0.05$  which means that it is proven that Digital supply chain has a positive effect on supply chain agility.

### Hypothesis 2

It was carried out with the aim of testing the positive effect of SCQM on Supply chain agility, the processing results are shown with an estimated coefficient value of 0.19 which means that increasing SCQM will increase Supply chain agility and conversely decreasing SCQM will decrease Supply chain agility. The statistical value of 1.845 results in a p-value of  $0.033 < 0.05$  which means that SCQM has a positive effect on supply chain agility.

### Hypothesis 3

It was carried out with the aim of testing the effect of Supply chain agility to positively affect supply chain performance, The processing results are shown with an estimated coefficient value of 0.636 which means that increasing Supply chain agility will improve supply chain performance and vice versa decreasing Supply chain agility will reduce supply chain performance. The statistical value of 7.770 results in a p-value of  $0.000 < 0.05$  which means that it is proven that supply chain agility has a positive effect on supply chain performance

### Hypothesis 4

It was conducted with the aim of testing the positive effect of SCQM on supply chain performance with supply chain agility as mediation. The processing results are shown with an estimated coefficient value of 0.18 which means that increasing SCQM

will improve supply chain performance with Supply chain agility as mediation and conversely decreasing SCQM will decrease supply chain performance with Supply chain agility as mediation. The statistical t value is 1.667 with a p-value of  $0.000 < 0.05$  which means that SCQM has a positive effect on supply chain performance with supply chain agility as mediation.

### **Hypothesis 5**

It was conducted with the aim of testing the positive influence of the Digital Supply chain on supply chain performance with Supply chain agility as mediation. The processing results are shown with an estimated coefficient value of 0.448 which means that increasing Digital supply chain will improve supply chain performance with Supply chain agility as mediation and vice versa decreasing Digital supply chain performance will decrease supply chain performance with Supply chain agility as mediation. A statistical t value of 5.380 results in a p-value of  $0.000 < 0.05$  which means that it is proven that the Digital Supply chain has a positive effect on supply chain performance with Supply chain agility as mediation.

In a competitive market environment, manufacturing companies are very concerned about supply chain agility. This study uses a resource-based view approach to empirically investigate whether the combination of SCQM practices and digital supply chains leads to improved supply chain agility and supply chain performance. Therefore, this study explained the impact of digital supply chain and his SCQM practices on supply chain performance and the mediating effect of supply chain agility.

The results show that the influence of digital supply chain has a positive impact on supply chain agility, which is confirmed by the first hypothesis (H1) (Hallikas et al. This proves that by applying technology to supply chain processes, companies need to improve their business processes and increase the flexibility of their supply chains to become more competitive in the business market.

This study also found that SCQM has a positive impact on supply chain agility. This is confirmed by his second hypothesis (H2), which automatically ensures that SCQM practices have a direct and positive impact on his SCA. This shows that if quality control in the supply chain process is properly implemented, the company has good supply chain agility and has a good business process to be competitive in the business market.

The analysis also revealed that focusing on the positive and significant impact of supply chain agility (H3) can fully support supply chain performance. This means that supply chain agility has been proven to have a positive impact on supply chain performance. This result indicates that there is a positive mediating effect of SCA on the relationship between SCQM and SCP.

The study provides evidence that Supply Chain Quality Management (SCQM) has a positive impact on supply chain performance with supply chain agility as

mediation. This means that when quality control practices are effectively implemented in the supply chain process, it enhances the company's ability to respond quickly and effectively to potential suppliers and customers in a changing environment, ultimately improving its supply chain performance. It can be seen in a manufacturing company that implements rigorous quality control measures across its supply chain processes. By ensuring high-quality standards in its operations, the company can enhance its supply chain agility and, in turn, improve its overall supply chain performance. For instance, if the company consistently monitors and improves the quality of its products, it can respond more effectively to market changes and customer demands, ultimately improving its supply chain performance.

The study also highlights the positive relationship between DSC and supply chain agility, as well as the mediating effect of supply chain agility on the relationship between DSC and supply chain performance. It emphasizes the importance of real-time information, speed, visibility, cost optimization, and scalability in enhancing supply chain agility. It can be seen in a manufacturing company that implements advanced technology and analytical methods to create value and improve its supply chain capabilities. By leveraging digital platforms and smart technology systems, the company can anticipate customer needs, optimize network operations, and enhance end-to-end material flow visibility. This, in turn, improves the company's supply chain agility, allowing it to respond quickly to market changes and customer demands. As a result, the company achieves improved supply chain performance through the mediating effect of supply chain agility.

## **CONCLUSIONS AND ADVICE**

Based on the results of this study, it can be concluded that the implementation of digital supply chain (DSC) and supply chain quality management (SCQM) has a significant positive influence on supply chain agility (SCA) in manufacturing companies. Increased adoption of digital technologies in the supply chain as well as consistent quality management practices are proven to improve supply chain agility. Furthermore, this study shows that SCA plays an important role as a mediator in the relationship between DSC and SCQM with supply chain performance. This indicates that increased supply chain agility is a key factor in transforming the benefits of digital technology implementation and quality management practices into improved overall supply chain performance.

Based on these findings, it is recommended that manufacturing companies further increase the adoption of digital technologies in their supply chain processes, as well as ensure the implementation of consistent quality management practices throughout the supply chain. Focusing on improving supply chain agility also needs to be a priority, given its significant role in improving performance. Better integration between quality management practices and digital technologies in the supply chain is also recommended to achieve optimal results. For the development of science, further

research can be conducted to explore other factors that may affect the agility and performance of supply chains in the manufacturing industry. In addition, comparative studies between industry sectors or between countries can provide more comprehensive insights into the application and impact of DSC and SCQM in different contexts.

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