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LARGS PERFORMANCE INTEGRATIONS IN A LAUNDRY SUPPLY CHAIN

Rafly Galih Saputra[1], Evieana R. Saputri[2], Hermala Kusumadewi[3]
Magister Teknik Industri, Universitas Islam Indonesia, Yogyakarta, Indonesia[1]
Accounting, Politeknik YKPN, Yogyakarta, Indonesia[2]
Tax Accounting, Politeknik YKPN, Yogyakarta, Indonesia[3]
Email: 21916032@students.uii.ac.id[1], evieanars4@gmail.com[2], hermala@aaykpn.ac.id[3]

Abstract

This research is conduct with the object to observe whether that lean, agile, resilience, green, and sustainable can be applied into a laundry supply of supply chain management. Literature review are reviewed to build a foundation regarding SCM to achieve the objectives. Model of lean, agile, resilience, green, and sustainable are built on the theoretical review of literature. The novelty of this research is to classify scheme of a laundry supply chain paradigm in SCM was developed. The result indicates that lean, agile, resilience, green, and sustainable have a important role to achieve successful performance, and customer satisfaction.

Keywords: LARGS, SCM, laundry

Introduction

Supply chain management (SCM) is very dynamic in seeing an increase or decrease in a distribution system that aims to create an effective and efficient service, product and low cost (Basuki, 2021). In its implementation which has been implemented for several decades, supply chain management (SCM) has experienced several challenges both internally and externally. External challenges can be related to matters relating to the environment/nature and society (Dahlmann & Roehrich, 2019; Dey et al., 2019; Tasdemir & Gazo, 2018); customers' demand uncertainty (Lotfi & Saghiri, 2018): technological disruptions with a shorter product life cycle (Carvalho & Voigtländer, 2014) and global sourcing (Parkouhi et al., 2019). Anvari (2021) all obstacles make the supply chain (SC) ineffective, unstable, unable to adapt, and shaken (S. Azevedo et al., 2013; Centobelli et al., 2020; Lotfi & Saghiri, 2018).

Several researchers compiled by Hosseinet al. (2018), Sharma et al. (2021), and Chavez et al. (2024) focuses on the importance of various emerging practices and theories and suggests restructuring traditional management philosophies such as lean, agile to stay in business. Azevedo et al. (2016), Luthra et al. (2016), Anvari (2021), Dey et al. (2019), and Izadyar et al. (2020), discusses the important role of various variables that arise or are integrated with these variables such as lean, agile, tough, and green (LARG), green with sustainability, and lean, green with agility and resilience in this highly competitive supply chain environment. In recent years, research on integrating various combinations of lean, agile, resilient, green and sustainable (LARGS) paradigms in the SC domain has received considerable attention from academic researchers and practitioners. However, no research studies have addressed how much integration of the aforementioned

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paradigms is possible. Also, how is research based on this paradigm evolving in the supply chain domain? Previous research studies have addressed the synergies and differences between these paradigms and their attributes, considering a few at a time. Mason-Jones et al. (2000), Bruce et al. (2004), and Agarwal et al. (2006); discussing the interrelationships of lean and agile (LA) paradigms; Christopher and Peck (2004) discuss the interconnectedness of the agile and resilient paradigms, and Lartey et al. (2020) discussed the link between lean and green paradigms.

All companies that produce both services and finished products, require good supply chain management to create an effective and efficient business process, in this case even small companies, especially laundries, in running a laundry business need to have supply chain management in order to run their business. effectively and efficiently for the sake of the resilience and development of the company. In addition to the business that needs to be optimized in a laundry company, it is also necessary to pay attention to the processing of production waste, there are several production wastes that occur during the production process in laundry. That is; heat, water use, and detergent waste. Therefore, we need a theory that can solve and describe how to deal with and manage a laundry business. And the LARGS theory was chosen which in this theory includes lean, agile, tough, and green. What helps the company to manage well economically is based on the health of the surrounding environment. This research is conduct with the object to observe whether that lean, agile, resilience, green, and sustainable can be applied into a laundry supply of supply chain management.

Research Method

The object of this study are the owner and laundry employees around Universitas Islam Indonesia, consist of 30 people. This research was conducted around the UII Campus by distributing questionnaires and data collection was carried out in November 2022. This study uses a structural equation modeling (SEM) approach because it can analyze the relationship between LARGS criteria to improving SCM performance. This project study uses five types of exogenous latent variables (ξ) and one endogenous variable (ε) along with their indicators which are described as follows:

Table 1. Criteria to Measure the Performance

Criteria		Sub-Criteria
P1	Operational Performance	The level of influence of Operational Performance on the overall performance of the laundry business
P2	Economic Performance	The level of influence of Economic Performance on the overall performance of the laundry business
P3	Environmental Performance	The level of influence of Environmental Performance on the overall performance of the laundry business

Table 2. Criteria to Measure LARGS

Criteria		Sub-Criteria		Explanation
T1	Leanness in SC	T11	Timely Production	Daily scheduled processing time
		T12	Supplier Communication	Effective and efficient communication with suppliers

Criteria		Sub-Criteria		Explanation
		T13	Number of Defects	The amount of laundry results is less clean or smelly
T2	Agility in SC	T21	Speed in customer response	Speed of responding to customers
		T22	Flexibility in producing values	Flexible in making products
		T23	Ability to change at production time	Ability to respond to sudden changes
T3	Resilience in SC	T31	Flexibility in production according to inventory and supply conditions	Real time data inventory level
		T32	Waiting time	Long waiting time for consumers
		T33	Distribution of product on demand	Accuracy of distribution of laundry results
T4	Greenness in SC	T41	Reduce the variety of materials used	The use of environmentally friendly detergents
		T42	Cooperation of suppliers to reduce environmental impacts	Level of Cooperation reduces environmental impact with suppliers
T5	Sustainability in SC	T51	Economic Approach (cost reduction, high profitability, inventory management)	Application of an economic approach in the laundry business
		T52	Environmental factors (fuel reduction, greenhouse gases, waste)	The level of influence of the laundry business on environmental factors
		T53	Social factors (health and safety, law and regulation)	The level of influence of social factors on the laundry business

The type of data in this study uses primary data, where the researcher's data is obtained from the results of the questionnaire distribution. The questionnaire measurement process is carried out by providing a Likert scale level or measurement value using an interval scale as follows:

Table 3. Supply Chain Indicators

Criteria	Sub-Criteria	Explanation	Scale
T1	T11	Daily scheduled processing time	Higher is better
	T12	Effective and efficient communication with suppliers	Higher is better

Criteria	Sub-Criteria	Explanation	Scale
	T13	The amount of laundry results is less clean or smelly	Lower is better
T2	T21	Speed of responding to customers	Higher is better
	T22	Flexible in making products	Higher is better
	T23	Ability to respond to sudden changes	Higher is better
T3	T31	Real time data inventory level	Higher is better
	T32	Long waiting time for consumers	Lower is better
	T33	Accuracy of distribution of laundry results	Higher is better
T4	T41	The use of environmentally friendly detergents	Higher is better
	T42	Level of Cooperation reduces environmental impact with suppliers	Higher is better
T5	T51	Application of an economic approach in the laundry business	Higher is better
	T52	The level of influence of the laundry business on environmental factors	Lower is better
	T53	The level of influence of social factors on the laundry business	Lower is better

The collected data were taken from the population using a Likert 1-5 scale questionnaire as a data collection tool. SEM research uses the Likert scale, where the Likert scale is ordinal data, that is, data that has sequential categories (Ghozali, 2015). In this study, the number of samples taken was 30 people, taking into consideration that if the missing data can be deleted as long as the amount of data lost does not exceed 10% (Hair et al., 2018).

In this study, it used the Structural Equation Modeling (SEM) method with SPSS AMOS 24 software and Generalized Least Square correction as an alternative to the data used for estimating abnormal structural models.

Hypothesis Testing

Hypothesis testing observes three variables, namely operational, economic, and social. Performance variables are also observed which are used to assess lean, agile, robust, green, and sustainable construction in the laundry supply chain.

The relationship between variables that are considered successful is estimated with successful performance required more than 0.20, which is then acceptable. The table below shows that each variable manages to do more than 0.20 which is why lean, agile, resilient, eco-friendly and sustainable in the laundry supply chain has an immediate positive effect.

Table 4. Research Hypothesis Testing

No	Hypothesis	Factor Loading
1	Leanness is critical to the successful performance of a supply chain	0.29
2	Agility is critical to successful supply chain performance	0.34
3	Resilience is critical to successful supply chain performance	0.28
4	Greenery is critical to successful supply chain performance	0.22
5	Sustainability is critical to successful supply chain performance	0.30

In this study, the influence of lean, agile, resilience, green and sustainable in the laundry supply chain on successful performance has been studied. It can be seen that by using the PLS technique, the effect of each variable is observed by considering the effect of the variables simultaneously. The model of the PLS technique using Amos software and t-statistics is displayed to assess the significance of the output relationship shown in the figure below.

The image below shows the output from the Amos software. In the figure below, the influence of the five variables of leanness, agility, resilience, green, and sustainability on the success variable of the laundry supply chain performance is observed. It shows the strength of each relationship between hidden factors or variables and variables that can be observed by factor loading. Factor assignment has a value range between zero and one. If the factor loading is less than 0.3, it is a weak relationship and should be ignored. If the factor loading is between 0.3 and 0.6, it is an acceptable relationship. If it is greater than 0.6, it is a highly desirable relationship. Therefore, according to the factor loading coefficients, all the coefficients are within the specified range.

Calculation of the t-statistic to measure the significance of the relationship between variables is shown in the C.R value in the Amos software below. The t-statistic value among all variables is greater than 1.96. Therefore, based on the results of the general model it can be concluded that the technique learned plays a decisive role in the success of the performance.

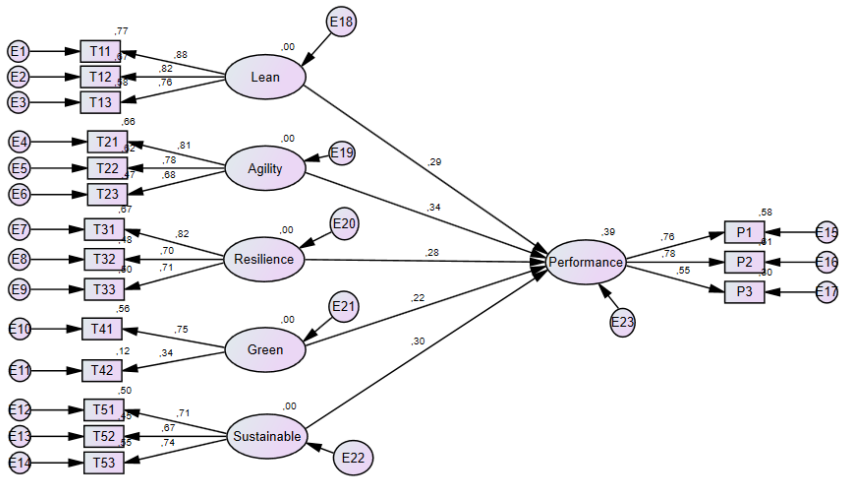

Figure 1. PLS Technique Model of Separated Model Using Amos Software

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Performance	<---	Lean	,269	,019	14,174	***	par_11
Performance	<---	Agility	,111	,020	5,509	***	par_12
Performance	<---	Resilience	,251	,024	10,664	***	par_13
Performance	<---	Green	,269	,062	4,367	***	par_14
Performance	<---	Sustainable	,271	,026	10,407	***	par_15
P1	<---	Performance	1,000				
P2	<---	Performance	,990	,018	53,805	***	par_1
P3	<---	Performance	,701	,019	37,846	***	par_2
T13	<---	Lean	1,000				
T12	<---	Lean	1,056	,021	49,565	***	par_3
T11	<---	Lean	1,168	,023	51,021	***	par_4
T23	<---	Agility	1,000				
T22	<---	Agility	,950	,025	38,138	***	par_5
T21	<---	Agility	1,082	,028	38,188	***	par_6
T33	<---	Resilience	1,000				
T32	<---	Resilience	,948	,026	35,928	***	par_7
T31	<---	Resilience	1,164	,032	36,544	***	par_8
T41	<---	Green	1,000				
T53	<---	Sustainable	1,000				
T52	<---	Sustainable	,937	,029	31,787	***	par_9
T51	<---	Sustainable	,939	,029	32,214	***	par_10
T42	<---	Green	,501	,102	4,912	***	par_16

Figure 2. T-Statistic of Model of Separated Model Using Amos Software

Final Research Model

Finally, in this section, using the PLS technique, the overall effect of the different performance techniques is investigated in terms of a general model. The final structural model is shown in the figure below, and the t-statistic to assess the significance of the relationship is shown in figure below.

The strength of the relationship between LARG with engineering and sustainable supply chain performance was obtained at 0.78, which indicates a high correlation. Moreover, the calculated t-value is 33.619, which is higher than 1.96. Therefore, based on the results of the general model it can be concluded that LARG and sustainable supply chain techniques have an important role in the success of the show.

The strength of the relationship between LARG and sustainable supply chain techniques and satisfaction is 0.72, which indicates a high correlation. Furthermore, the t-value is 5.070, which is higher than 1.96. Therefore, according to the general model results it can be concluded that LARG and sustainable supply chain techniques have an important role in achieving satisfaction.

The strength of the relationship between the performance dimensions and satisfaction is 0.76, which indicates a high correlation. Furthermore, the calculated t-value was 23.975, which is higher than 1.96. Therefore, based on the results of the general model, it can be concluded that the performance dimension has an important role in achieving satisfaction.

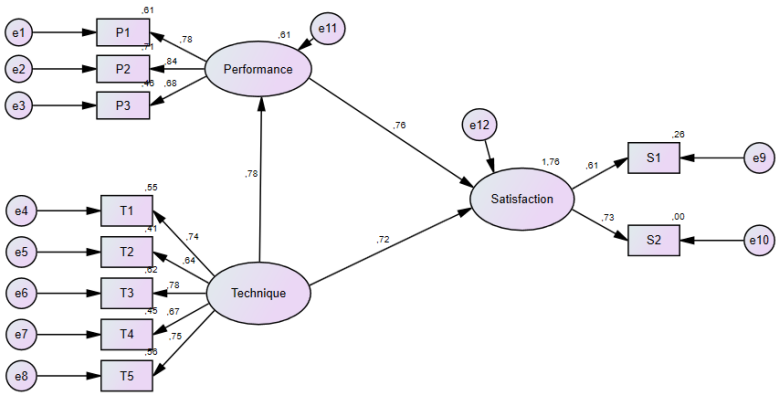

Figure 3. PLS Technique Model of General Model Using Amos Software

			Estimate	S.E.	C.R.	P	Label
Performance	<---	Technique	,660	,020	33,619	***	par_8
Satisfaction	<---	Technique	,198	,039	5,070	***	par_9
Satisfaction	<---	Performance	1,150	,048	23,975	***	par_10
P3	<---	Performance	1,000				
P2	<---	Performance	1,305	,031	42,214	***	par_1
P1	<---	Performance	1,246	,032	39,538	***	par_2
T3	<---	Technique	1,000				
T2	<---	Technique	,779	,020	39,841	***	par_3
T1	<---	Technique	1,033	,022	47,369	***	par_4
S1	<---	Satisfaction	1,000				
S2	<---	Satisfaction	,036	,019	1,932	,053	par_5
T4	<---	Technique	,747	,019	40,020	***	par_6
T5	<---	Technique	,882	,019	45,622	***	par_7

Figure 4. T-Statistic of Model of General Model Using Amos Software

Supply Chain Dimension Rating

In this study, the main performance criteria and sub-criteria were first ranked using AHP. In this step, based on the weight of the identified criteria, the existing techniques are prioritized using the VIKOR technique. LARG rating and engineering sustainable supply chain is based on performance and satisfaction indicators.

Table 5. Final Priority Ranking of Criteria Using AHP Technique

Criteria	Weight	Rank
Operational Performance	0.363	2
Economic Performance	0.373	1
Environmental Performance	0.263	3

Table 6. Final Priority Ranking of LARGS Using AHP Technique

LARGS Factor	Weight	Rank
Leanness	0.202	3
Agility	0.237	1
Resilience	0.195	4
Greenness	0.153	5
Sustainability	0.209	2

As it can be observed in Table 6, determining the importance degree and ranking of LARGS factors through PLS technique is supported by VIKOR technique. These results indicate that the development of LARGS model is highly reliable.

Conclusion

In this study, is done to develop LARGS in a laundry supply chain, which customer satisfaction factors including time, quality, cost, and service level are observed. IT is found that the effective factors of LARGS in the supply chain have an important role in achieving successful performance. Key factors of customer satisfaction, LARGS, and performance criteria affect the SCM. The cause-and-effect relation pattern among variable was evaluated and ranked. The results indicate that agility is the most prioritize factors of LARGS followed by sustainability, leanness, resilience and in the last place is greenness according to 30 questionnaire answerers.

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