Social Science and Humanities Journal
Everant Journal
ISSN: 2456-2653
Volume 09 Issue 01 January 2025
https://sshjournal.com/
Impact Factor: 2024: 6.576
2023: 5.731
DOI: https://doi.org/10.18535/sshj.v9i01.1455

The Impact of Knowledge Transfer, Partnership Development, Logistic Integration and Information Sharing on Improving Supply Chain Agility

Dian Retno Sari Dewi[1] | Elizabeth Tait[2] | Lorensia Putri Natalia[3] | Luh Juni Asrini[4] | Martinus Edy Sianto[5*]

[1,3,4,5]Widya Mandala Catholic Unversity, Kalijudan 37, Surabaya, Indonesia
[2]University of South Australia, 61-68 North Terrace, Adelaide, South Australia
[1]dianretnosd@ukwms.ac.id,[2]elizabeth.tait@unisa.edu.au,[3]Lorensiapn26@gmail.com,
[4]juniasrini@ukwms.ac.id, and [5]martinus.sianto@ukwms.ac.id

Received 10-12-2024
Revised 11-12-2024
Accepted 02-01-2025
Published 04-01-2025

Abstract:

This paper explores the impact of knowledge transfer (KT), partnership development (PD), logistics integration (LI), and information sharing (IS) on enhancing supply chain agility (SCA). This study empirically examines a framework that proposes the influence of four capabilities on supply chain agility. Data were gathered from 400 official motorcycle service partners in Indonesia, all of whom are branch managers with over a year of work experience. The data were analyzed using structural equation modelling. The results of this study show that KT, PD, LI, and IS positively affect SCA. The theoretical contribution of this study lies in its ability to demonstrate that these four capability factors can enhance supply chain agility performance. The second contribution is the utilization of the standard loadings of the items to recognize the relative importance of each capability in improving SCA. This allows motorcycle industry practitioners to more effectively assess how to leverage these capabilities to enhance their supply chain agility.

Keywords: Knowledge Transfer, Partner Development, Logistic Integration, Information Sharing, Supply Chain Agility.

Introduction:

Supply chain challenges are varied, often arising from fluctuating market demand, distribution issues on both the supply and demand sides, and production difficulties. These disruptions in the distribution flow necessitate the implementation of supply chain agility to effectively manage them. An agile supply chain is crucial for companies to quickly respond to any distribution interruptions. Agility refers to the capability to promptly adapt to changes in the market and customer needs. To achieve agility, companies must be flexible and able to react swiftly [1]. This agility is crucial for maintaining competitiveness and is generally linked to supply chains that deliver and create innovative products.

In the face of constantly evolving business competition, agility is vital for companies to remain resilient and continue growing. An agile supply chain enables companies to swiftly adapt to

future changes [2]. The product service system (PSS) is a business development approach with significant potential to offer solutions for industries while addressing consumer needs by integrating products and services. PSS brings about a structural transformation in services, promoting sustainable production and consumption [3]. It also provides strategies to reduce the environmental footprint of both production and consumption [4]. The advantages of PSS lie in its ability to deliver a comprehensive solution that affects environmental, social, and economic dimensions, allowing companies to optimize resource usage and boost their competitiveness [5][6].

To establish an agile supply chain, official motorcycle workshops need the support of KT, PD, LI, and IS within their supply network, including the main dealer acting as an intermediary from the manufacturer. These workshops must engage in KT to acquire insights from the company, not only regarding the products but also in terms of technical skill development. PD helps strengthen the connection between the company and the official motorcycle workshops, enhancing overall agility. Effective information sharing is essential for both the company and the workshops to openly communicate about products and services. Additionally, LI is vital to broaden knowledge and integrate processes among supply chain partners, particularly between intermediaries and manufacturers [7][8][9][10]. There are still few studies that incorporate the PSS supply chain in their research. This study addresses the PSS supply chain in the integrated provision of a bundle of products and services. The focus is on manufacturers' ability to extend their capabilities within their supply chain network, specifically in the areas of knowledge transfer, partnership development, logistics integration, and information sharing, in order to improve supply chain agility.

Theoretical Background and Hypothesis Development:

In this section, the theoretical framework is constructed to confirm the relationships between KT, PD, IS, and LI on SCA, as well as the hypotheses that connect them.

Knowledge Transfer

Knowledge transfer involves the exchange of varied knowledge and information about competitors, consumers, and the current market landscape [11]. When KT is conducted by official motorcycle workshops, it can provide valuable insights into market needs, enabling companies to better anticipate and respond to market uncertainties. Proper implementation of KT allows companies to remain current with market trends and respond to changes with agility [12]. Effective KT practices enable official motorcycle workshops to acquire knowledge from manufacturing companies on topics such as products, product innovations (e.g., bundling of products and services), and technician training. This helps Official Service Partners (OSPs) to swiftly adapt to consumer demands. Engaging in KT can enhance the SCA of official motorcycle workshops, allowing them to better navigate changing market conditions and compete effectively [11]. These findings highlight the importance of examining the relationship between KT and SCA. Thus, the hypothesis proposed is as follows:

H_1: Knowledge transfer has a positive effect on supply chain agility.

Partnership Development

Partnership development can be defined as the development of business strategies to enhance collaboration among supply chain partners through long-term cooperation and partner development [13]. The long-term relationship between automotive companies and official service partners (OSP) is one of the strategies to achieve business success. Manufacturers can collaborate on business strategies to cover business shortcomings [13]. In the delivery of PSS to customers by automotive companies through OSP, the role of OSP development is crucial for the company. For example, PD in the field of teaching and mentoring technicians to provide knowledge on product and service innovation. This long-term relationship is

used by manufacturers to build commitment and trust with partners, which can start by establishing cooperation on several important matters that will spread throughout the supply chain. This factor is a determinant for achieving SCA. Based on these findings, it strengthens the need to test the relationship between PD and SCA. Based on the above problem, the hypothesis is formulated as follows:

H_2: Partnership development has a positive effect on supply chain agility.

Information Sharing

Information sharing is a very important aspect of the supply chain, as transparent and accurate IS can accelerate the supply chain process from suppliers, and manufacturing companies to consumers [14]. IS also allows supply chain partners to acquire, maintain, and convey the needed information. This is done to ensure effective decision-making and strengthen overall collaborative elements. Industrial bottlenecks can be reduced through IS [15]. If IS from automotive manufacturers is carried out, it can increase flexibility and OSP can make quick and precise decisions if there are disruptions or changes in market conditions, and vice versa. The ability in IS impacts the enhancement of SCA [16]. Based on these findings, it strengthens the need to test the relationship between IS and SCA. Based on the above problem, the hypothesis is formulated as follows:

H_3: Information sharing has a positive effect on supply chain agility.

Logistic Integration

Logistic integration is a collaboration between suppliers and consumers to minimize costs, increase time efficiency, and achieve accurate information exchange. Motorcycle manufacturing companies can obtain this information through official motorcycle workshops [17] [18]. In a business, LI encompasses various activities across different divisions within a company. This collaborative process is integrated by involving manufacturing companies and official motorcycle workshops [19]. LI is developed in a manufacturing company to create an integrated logistics flow. LI can also help manufacturers in dealing with disruptions. Rapid integration from official motorcycle workshops can enhance the quick response of manufacturing companies to fulfill their logistics. A quick response from manufacturers can reduce lead time for product creation and services to align with market needs. An example of such market needs is information obtained through official motorcycle workshops about popular and frequently used products. This requires good coordination and LI between manufacturing companies and official motorcycle workshops to achieve good SCA [20]. Based on these findings, it strengthens the need to test the relationship between LI and SCA. Based on the above problem, the hypothesis is formulated as follows:

H_4: Logistic integration has a positive effect on supply chain agility.

The conceptual framework model can be seen in Fig. 1 below:

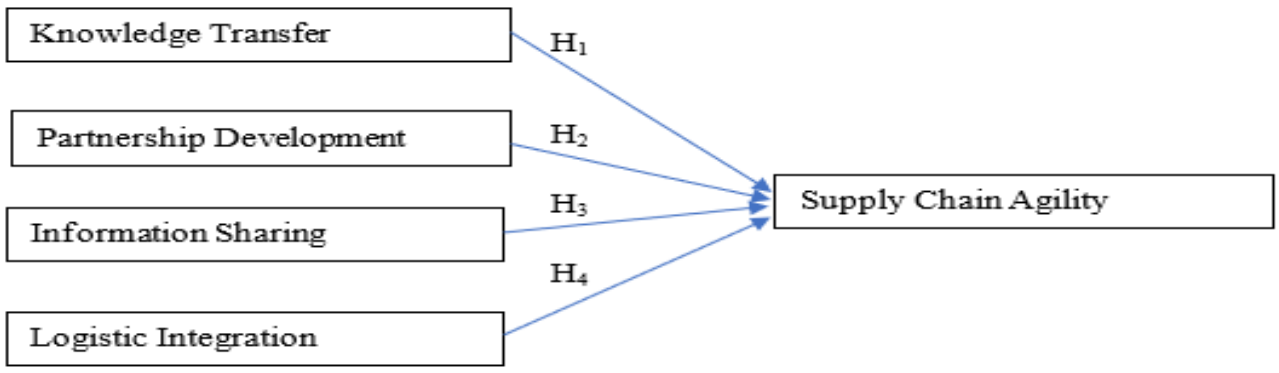

Figure 1 The conceptual framework

Methods:

The questionnaire was developed based on a comprehensive literature review and consists of measurement items for five constructs: KT with 5 items, PD with 5 items, IS with 5 items, LI with 5 items, and SCA with 7 items. Each item is rated on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." An interrater agreement survey was then conducted with 20 respondents. Three criteria were used to determine whether to remove any items: (1) removing items with an average value of less than 95%, (2) removing remaining items from (1) if the ρ-value is greater than 0.05, and (3) removing remaining items from (2) if the statistical power is below 0.8 [21]. As a result, no items met these criteria for removal, leaving all 26 items in the final questionnaire.

Table 1. Theoretical domain of constructs and items

Code	Domain of Construct and Items	References	Loading Factor
Knowledge transfer is defined as the activity of exchanging diverse knowledge from work partners [22].			
KT1	We have access to partners on product knowledge.	[22] [23]	0.81
KT2	Our work partners enhance our knowledge of technical expertise in motorcycle repair to improve quality.	[22] [23[	0.86
KT3	We were provided with knowledge by our work partners about product bundling and service offerings.	[22] [23]	0.88
KT4	We gained knowledge from our work partners about market desires and the voice of the customer.	[22] [23[	0.90
KT5	We learned about innovations in product bundling and services from our work partners.	[22] [23]	0.87
Partnership development is defined as the development of business strategies aimed at enhancing the agility of the supply chain between manufacturing chain companies and authorized motorcycle workshops through long-term collaboration. [22]			
PD1	We have partners who have the ability to enhance our knowledge.	[22] [23]	0.67
PD2	We received basic technical product training from our partner to enhance our speed, responsiveness, flexibility, and innovation capabilities.	[22] [23]	0.86
PD3	We are provided with a development program to learn about the products and service systems.	[22] [23]	0.78
PD4	We have partners who improve their services and capabilities with the goal of achieving an agile supply chain.	[22] [23]	0.74
PD5	We have partners who strengthen the technical expertise of the Product Service System (PSS) that is related to products and service offerings to customers.	[22] [23]	0.66
Information sharing is defined as the flow of communication carried out by chain manufacturing companies and official motorcycle workshops to enhance agility in their supply chains. [24]			

IS1	We have a highly integrated information system across the entire supply chain.	[24]	0.94
IS2	We have face-to-face meetings and communications with partners.	[24][25]	0.94
IS3	We communicate intensively and regularly with partners.	[24]	0.96
IS4	We are willing to share information with partners.	[24] [26]	0.94
IS5	We share information with partners regarding products, finances, competition, and services.	[24] [26]	0.93
Logistic integration is defined as the collaboration between chain manufacturing companies and official motorcycle workshops to achieve integrated product and service flow. [25]			
LI1	We have well-coordinated internal logistics activities within the company and with partners.	[27]	0.83
LI2	We have highly integrated logistics activities with our partners.	[27]	0.91
LI3	Our logistics integration is characterized by excellent distribution, transportation, and/or warehousing facilities.	[27]	0.90
L14	We have tightly coordinated logistics activities with partners (deleted).	[27]	
LI5	We have excellent inbound and outbound distribution integration with our partners.	[27]	0.82
Supply chain agility refers to the ability of official motorcycle workshops to deliver Product Service Systems (PSS) quickly, flexibly, responsively, and innovatively to customers. [24]			
SCA1	We are always quick to improve PSS services for customer satisfaction.	[24]	0.98
SCA2	We are always quick to improve PSS delivery.	[24]	0.98
SCA3	We are always quick to change PSS capabilities to adopt market changes.	[24][28]	0.97
SCA4	We are always quick to adapt PSS capacity to respond to uncertain markets.	[29]	0.84
SCA5	We can quickly adjust PSS processes to reduce product service time.	[28]	0.95
SCA6	We can quickly adjust capabilities to meet customer demands.	[30]	0.79
SCA7	We can quickly innovate PSS offerings.	[30]	0.83

Data Collection and Sampling

This study employed random sampling to gather data. The target population consisted of owners, managers, or branch managers of authorized motorcycle workshops in Indonesia. The data collection was conducted online, resulting in a total of 400 successfully gathered questionnaires.

Participant Demographics

Following data selection, outlier identification, and normality testing of the respondents, 400 valid data points were obtained, which serve as a representative sample of the population. The demographic details of the respondents are presented in Table 2.

Table 2. Participant Demographics

Demographic Items	**Freq. (n=400)**			**Demographic Items**	**Freq. (n=400)**
Domicile				**Position**	
Jawa	252			Branch Manager	273
Bali	21			Manager	19
Nusa Twnggara	4			Workshop Manager	92
Sumatera	59			Owner	14
Sulawesi	32			Other	2
Kalimantan	24			**Most recent education**	
Maluku	4			Senior High School	108
Papua	4			Diploma (D1 / D2 / D3)	78
Motorcycle brand				Scholar (Bachelor / Master /Doctor)	214
Honda	325			**Gender**	
Yamaha	54			Male	348
Suzuki	11			Female	52
TVS	8			**Ages**	
Lainnya	2			≤ 28 years	172
Employment period				29 – 34 years	100
≥ 15 years	52			35 – 40 years	94
6 – 10 years	92			41 – 46 years	24
1 – 5 years	159			47 – 52 years	4
Number of employees				53 – 58 years	4
5 – 15 persons	254			≥ 59 years	2
16 – 26 persons	104				
27 – 37 persons	28				
≥ 37 persons	14				

Result and Discussion:

Construct Validity and Reliability

A confirmatory factor analysis (CFA) was performed to evaluate the validity of all factors using AMOS software. The CFA results, including the loading factors, are presented in Table 1. The goodness of fit (GOF) index was utilized to evaluate the fit of the covariance matrix, which is necessary for using Structural Equation Modeling (SEM). Hu and Bentley [31], along with Yu [32], provided the GOF threshold values as guidelines: $p > 0.01$, norm $\chi 2 \leq 2$, RMSEA < 0.05, SRMR < 0.07, CFI > 0.95, and TLI > 0.95. Based on these criteria, several items were excluded from the model, including PD5, LI4, IS3, IS4, SCA1, SCA3, and SCA4.

Discriminant Validity

Discriminant validity was conducted to ensure that the constructs had strong relationships with one another [33]. The discriminant validity between the six constructs was determined by analyzing the average variance extracted (AVE) value for each construct. As shown in Table. 3, all AVE values were greater than the squared correlations between constructs, confirming that the developed model is valid.

Table 3. The AVE values and squared inter-construct correlations.

	KT	PD	IS	LI	SCA
KT	**0,863**				
PD	0,504	**0,768**			
IS	0,569	0,548	**0,932**		
LI	0,490	0,534	0,561	**0,883**	
SCA	0,656	0,736	0,670	0,674	**0,936**

Assessment of Structural Model and Result of Hypotheses

The outcomes of the proposed structural model are illustrated in Fig. 2. The model demonstrates an excellent fit with normed $\chi 2 = 1.95$, SRMR = 0.057, RMSEA = 0.049, CFI = 0.98, and TLI = 0.978. Four hypotheses were tested using Structural Equation Modeling (SEM). The results indicated that KT has a positive association with SCA (0.330 at $p < 0.001$), confirming H_1. Hypothesis H_2, which examines the effect of PD on SCA, is supported by a path coefficient of 0.213 at $p < 0.001$. Similarly, H_3 is validated by showing that IS has a positive relationship with SCA (0.244 at $p < 0.001$). Finally, H_4 is supported by the finding that LI has a positive relationship with SCA (0.380 at $p < 0.001$).

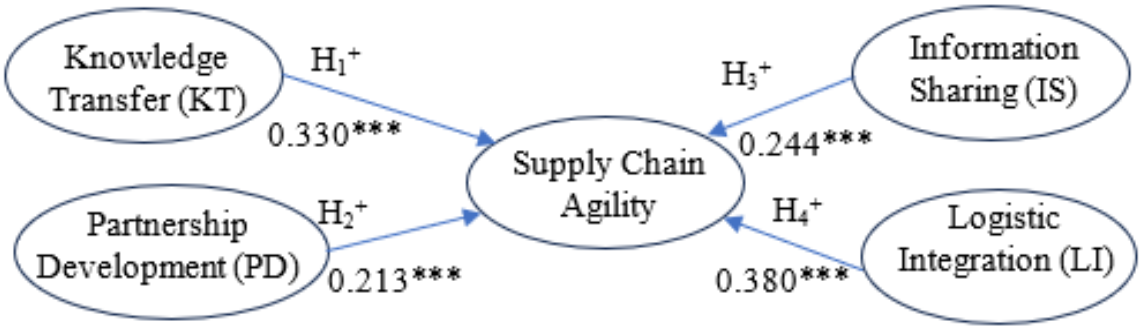

Figure 2. Research Hypothesis Testing Results

Based on Fig. 2, which presents the results of the hypothesis testing, the following findings were obtained:

- H_1: Knowledge transfer positively influences supply chain agility.

- H_2: Partnership development positively impacts supply chain agility.

- H_3: Information sharing has a positive effects supply chain agility.

- H_4: Logistic integration positively affects supply chain agility.

Discussion:

Supply chain agility is essential for companies to adapt to rapid changes in the market and remain competitive. This study provides valuable insights for companies aiming to enhance their SCA in order to improve their PSS. To increase SCA, companies should focus on KT, as indicated in H_1. Manufacturers, typically through their main dealers, often provide partners with access to product knowledge and after-sales services. Furthermore, companies should gather feedback from partners about customer preferences and complaints. This information is crucial because partners are directly engaged with customers, enabling companies to respond swiftly by making product-related policy adjustments to meet consumer needs. These findings align with Jermsittiparsert & Sriswat [16], who found that KT helps official motorcycle repair shops improve their SCA, enabling them to better navigate market changes and compete effectively [11]. Regularly updated knowledge through KT plays a vital role as a source of information and insight for motorcycle repair shop owners, helping them enhance SCA. In line with advancements in knowledge, KT is essential to ensure that official service partner stay up-to-date, particularly in areas like product service innovation, such as bundling services and products.

Partnership development is equally critical for improving SCA. The positive impact of PD on SCA indicates that long-term collaborations are necessary to strengthen relationships with partners. This can be achieved by offering mutually beneficial contracts and providing training and seminars to enhance partner skills and knowledge. Structured cooperation in sharing information and data between companies and partners allows both parties to stay aligned with changes. The ability to respond quickly to changes through institutionalized collaboration is vital for improving SCA. Partners can also assist manufacturers in addressing business shortcomings, such as workforce shortages, raw material stock issues, limited capital, and other challenges. These findings are consistent with research by Khalid et al. [13], which emphasizes the importance of collaborative business strategies in overcoming operational deficiencies.

Developing partnerships can begin with establishing connections with other business entities that meet the company's needs. For example, when a company wants to promote its services in a specific district or city, it can collaborate with local governments to participate in events and showcase its products, such as motorcycle services. Partnership agreements can be formalized through memorandums of understanding that are valid for short, medium, or long terms. The partnership helps extend the product life cycle through maintenance and repairs, which potentially supports the improvement of agility in the supply chain [34].

Information sharing has a positive and significant impact on SCA, largely due to the rapid advancement of information technology. These findings are consistent with Rachbini's research [14], which highlights IS as a crucial component in the supply chain. Transparent and accurate IS can accelerate supply chain processes from suppliers. Effective and structured IS from manufacturers enhances partners' flexibility, enabling them to make quick and accurate decisions in response to disruptions or changes in market conditions. Conversely, a lack of IS can hinder this process. Successful IS requires openness from all parties, ensuring that any obstacles in the delivery process can be resolved through communication and the exchange of information.

Logistic integration also has a positive and significant effect on SCA. LI involves close cooperation within the supply chain, where key information like production plans, demand forecasts, and inventory levels are shared among stakeholders [35]. LI encompasses various activities across a company's divisions and integrates these activities between manufacturers and authorized motorcycle repair shops. Its goal is to minimize costs and increase efficiency, leading to higher customer satisfaction with repair shop services, while repair shops maintain consumer trust. These findings align with research by Irfan et al. [20], which emphasizes the need for coordination and LI between manufacturers and repair shops to achieve SCA. LI enables authorized workshops to implement effective inventory management, preventing stock shortages. For LI to succeed, strong communication and information sharing about popular products in the market are essential, allowing manufacturers to produce sufficient quantities to meet demand.

Conclusion:

The analysis reveals that knowledge transfer, partnership development, logistic integration, and information sharing all have a positive impact on supply chain agility. Consequently, to enhance supply chain agility, authorized workshops need to focus on improving and reinforcing these factors.

This study has several limitations but also provides avenues for future research. Firstly, the sample is restricted to motorcycle companies within Indonesia. To generalize the findings, future studies should include a wider range of industries across different geographic regions, allowing for comparisons with research published in other countries. Secondly, there is a possibility that some supply chain capabilities not included in the model may influence supply chain agility. These factors can be explored in future research, which might increase the model's coefficient of determination. Thirdly, this study was conducted using a cross-sectional research design, which may yield more interesting results if performed using a longitudinal approach to observe changes in supply chain capabilities over time.

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