

Supply Chain Capabilities to Improve Sustainability Performance of Product-Service Systems

by Dian Retno Sari Dewi

Submission date: 20-Apr-2023 10:20AM (UTC+0700)

Submission ID: 2069958231

File name: 4-Supply_chain_capabilities_to_improve_.pdf (1.09M)

Word count: 7837

Character count: 47968

Supply Chain Capabilities to Improve Sustainability Performance of Product-Service Systems



Dian Retno Sari Dewi^{1*}, Yustinus Budi Hermanto²

¹ Industrial Engineering Department, Widya Mandala Catholic University, Surabaya 60114, Indonesia

² Faculty of Economic and Business, Darma Cendika Catholic University, Suraabaya 60117, Indonesia

Corresponding Author Email: dianretnosd@ukwms.ac.id

<https://doi.org/10.18280/ijstdp.170824>

ABSTRACT

Received: 31 August 2022

Accepted: 3 December 2022

Keywords:

dynamic capabilities, sustainability performance, product-service systems, supply chain capabilities

This study aims to investigate the supply chain (SC) capabilities required for manufacturers, intermediaries and service partners to improve the Sustainability Performance of Product-Service Systems (SPOPSS). A considerable challenge faced by the SC is how manufacturers collaborate with intermediaries and service partners to develop SC capabilities in order to improve SPOPSS. This paper presents a conceptual framework using dynamic capabilities theory for investigating the relationship between SC capabilities and SPOPSS. By qualitative approach through semi-structured interviews with six senior managers from four motorcycle companies—manufacturers and intermediaries, the conceptual framework was validated using thematic analysis. This study identified six SC capabilities: collaboration, partner development and knowledge transfer, innovative service delivery, reflexive control, re-conceptualisation and sustainable product-service capability to improve SPOPSS, also identified microfoundation of dynamic capabilities for each six SC capabilities. The findings proposed two significant contributions to the body of knowledge; first, by developing six identified SC capabilities to improve SPOPSS; and second, by presenting qualitative empirical evidence on how these SC capabilities' development is inseparable from the SC and could be interactively transferred from manufacturers through intermediaries to a network of service partners.

1. INTRODUCTION

Companies around the world are faced with fierce market competition nowadays [1, 2], so more of them are now offering Product-Service Systems (PSS) [3, 4]. This is driven by changing customer preference i.e., a decision to buy an automotive product is not only about a product quality but also after-sales services that include maintenance throughout the product's life cycle [5, 6]. PSS is defined as a business model offering a marketable bundle of product and service to fulfil customer needs by considering three aspects of sustainability performance - the economic, environmental and social [7]. Sustainability performance has been gaining attention in the Indonesian motorcycle industry [8]; and it needs to be considered alongside the economic and commercial advantages of motorcycle production [9]. Thus, the implementation of PSS is expected not only to bring a competitive edge, but also to reduce the environmental impact [10].

Manufacturers as producers might not have the capacity to provide all-round services as they focus more on production; and so their resources and expertise to deliver PSS are limited [11]. Therefore, they choose to develop their SC capability by, for example, transforming their business processes in order to enable PSS [11, 12]. Meanwhile, other manufacturers prefer to collaborate with intermediaries and a network of service partners [13]. This is because PSS is complex; it needs expertise in customer relationship building and assessment of customer expectations about products and services [14]. Such

requirements are likely to be met by a network comprising manufacturers, intermediaries and service partners instead of by manufacturers alone [15].

Dynamic capabilities (DC) has been the predominant theory in the field of PSS [13]. DC are a dynamic framework suitable for a PSS offering as DC create, extend, and modify valuable resources and capabilities over time to provide an organisation's competitive advantage [16]. DC develop through companies' learning and experiences [17] and then create new processes and routines [18]. Furthermore, Teece et al. [19] proposed a more general framework of DC by dividing DC into three categories microfoundations: sensing, seizing and reconfiguring. Sensing is the capability to identify opportunities, including scanning and interpreting the internal and external environment. Seizing is the capability to take advantage of the opportunities, and it includes maintaining and enhancing organisational competencies. Reconfiguring is the capability to transform assets and organisational structures. DC work with two or more organisations collaborating on capabilities and resources in the SC to achieve sustainability performance [20]. DC are hard to develop alone as they should be developed together within the network [21]. This study, therefore, aims to contribute to the theory by discussing the SC capabilities develop by several organisations within SC to improve SPOPSS.

A review of literature in PSS studies shows that they focus more on the development of PSS delivery capabilities [22, 23], and less on the SC concept that is associated with collaboration of many companies in the network. Several studies using a

canvas business model have proposed a PSS empirical model, leading to the identification of key capabilities i.e., customer segmentation, customer relationship, value proposition, key resources, key activities, distribution channels, key partners, cost structures and resources model [24, 25]. Meanwhile, studies using dynamic capabilities emphasise on service development; for example, Ayala et al. [13] proposed four capabilities i.e., service offering, resource, activity and service supplier; whereas Raddats et al. [26] proposed that the four capabilities should be service enablement, service development, knowledge assessment and risk management. Story et al. [23], on the other hand, claimed that capabilities should be customer-focused, comprising customer intimacy, coordination and service delivery. Meanwhile, other studies have concentrated on innovative service delivery, suggesting that service quality, capability to deliver PSS at operational level and capability to improve service capacities and facilities are crucial [22]. Overall, the SC capabilities examined in the literature have not fully performed PSS as most of the studies focus only on the economic aspect, and not the holistic—economic, environmental and social—aspects as defined by Vezzoli et al. [27].

From the SC concept and sustainability, this study has looked into Sustainable Supply Chain Management (SSCM), which is a concept of management of material, information, capital flow and collaboration among companies in the SC aiming to achieve sustainability by considering the economic, environmental and social aspects [28]. For example, Beske [20] proposed three more variables to complement the SC capabilities—knowledge assessing and collaboration—proposed by Defee and Fugate [21]. They argue that partner development, reflexive control and re-conceptualisation are needed to improve sustainability performance. Meanwhile, in their subsequent study, Beske et al. [17] enhanced their model by adding SSCM practices.

The majority of PSS studies limit their research to the downstream SC perspectives. Indeed, they consider the PSS process as being limited only to the service partners' SC capabilities, while they neglect the manufacturers' and intermediaries' SC capabilities. In fact, PSS literature focuses more on developing networks and knowledge for PSS delivery capabilities and does not emphasise the product life cycle concept. Hence, an integrated perspective involving the concepts of sustainable supply chain management (SSCM) and the product life cycle will provide a broader perspective. Thus, this study contributes to the currently scarce literature on PSS by integrating the concept of SSCM to provide a broader perspective of the product life cycle concept within a single framework. This study uses the SC capabilities postulated by Beske et al. [17] and Kindström et al. [22] as the proposed conceptual framework, as both studies represent overall SC capabilities required for PSS to improve SPOPSS. Sustainable product-service capability is also key determinants to improve SPOPSS [29]; hence, it is included in the conceptual framework.

All in all, since only few empirical studies address what and how the SC capabilities affect and improve SPOPSS [23], this study proposes two research questions as follows: (1) what SC capabilities are required to improve SPOPSS; and (2) how SC capabilities transfer from manufacturers through intermediaries to a network of service partners; and whether this needs to be developed within the SC network. In terms of practical implication, this study could help practitioners in the motorcycle industry to improve their SPOPSS. Other

industries and other developing countries with similar characteristics as Indonesia may also find this study beneficial to inform their practices.

2. METHOD

The current study adopts 'dynamic capabilities' with a qualitative approach by using data from in-depth interviews with six senior managers from four motorcycle companies—manufacturers and intermediaries in Indonesia. For analytical purposes, dynamic capabilities are discussed into three different capabilities: sensing opportunities, seizing opportunities and reconfiguring resources to improve the goal [22]. The interview questions were built based on a comprehensive literature review of PSS and SSCM studies. The set of interview questions was validated by two academics and two motorcycle industry experts (Appendix). The semi-structured interviews consisted of two parts. Part one was about the participants' demographic information, covering their position at the company, total duration of service at the company, and duration of service at the current position. Part two asked questions about the SC capabilities required to improve SPOPSS, covering collaboration, partner development and knowledge transfer, innovative service development, reflexive control, re-conceptualisation and sustainable product-service capability.

There are five motorcycle manufacturers in the population (the Indonesian motorcycle industry), namely Honda (75.7 per cent market share), Yamaha (22.1 per cent market share), Suzuki (1.1 per cent market share), Kawasaki (1.1 per cent market share) and TVS (0.01 per cent market share) [8]. Six interviews with four Indonesian motorcycle manufacturers and intermediaries were conducted (Table 1), excluding TVS because its market share was too small. As such, all population have been included in the interviews (99.99%). The interview invitations and consent forms were sent to the Head of Technical Service Development in advance to ensure that interviewees are well-informed. The Head of Technical Service Development is the highest position in the company, so their position can be categorized as the Chief Executive Officer (CEO). Considering the sampling has covered almost all population with the CEO position, then six interviews have been justified. All interviews lasted between 37 and 55 min, which were recorded and subsequently transcribed.

Table 1. The interviewee participants

Participant	Motorcycle brand	Manufacturer/ Intermediaries	Start experience/ Current position
A	W	Manufacturer	1993/2003
B	W	Intermediary	1996/2006
C	X	Manufacturer	2010/2017
D	X	Intermediary	1995/1998
E	Y	Intermediary	1995/2000
F	Z	Intermediary	2000/2008

The validity and reliability in the research findings are crucial. This study adopts five types of criteria, namely credibility, transferability, dependability, confirmability and reflexivity [30]. To ensure the credibility, notetaking was carefully done during the interviews and were cross-checked with the recording. The identified themes were then checked

with interview transcripts during the data analysis to ensure the transferability. In the thematic analysis, the accuracy of meaning was checked with several interviewees to ensure that thoughts, experiences and viewpoints were interpreted correctly. This is for ensuring dependability. Furthermore, confirmability was carried out during the thematic analysis process by pattern matching. For explanation building, the interviewees' direct quotations were provided in findings. Finally, reflexivity is the process of critical self-reflection about own biases and the research relationship. This was done by spending a considerable time for studying the interviewees' backgrounds to build detailed explanation for the thematic findings.

The thematic analysis was used for the qualitative data analysis in this research due to its clarity and flexibility [31]. The aim is to identify, analyse and report themes found in the data [32]. All statements from interviewees were categorised according to their similarities and then coded. The coding results with similar characters were then clustered into a theme. The coding was deductive in nature, developed based on an existing concept. Selected quotations reported in the current study has been translated into English by a language expert to optimise data reliability and validity.

3. RESULTS AND DISCUSSION

As PSS studies focus on developing capabilities within the SC network, 'dynamic capabilities' is best suited for this study. The conceptual model has come from the literature review [17, 22, 29]; the SC goal of SPOPSS is influenced by six SC capabilities, namely collaboration, partner development and knowledge transfer, innovative service delivery, reflexive control, re-conceptualisation and sustainable product-service capability. Thematic saturation concluded the analysis as no new themes appeared in this study.

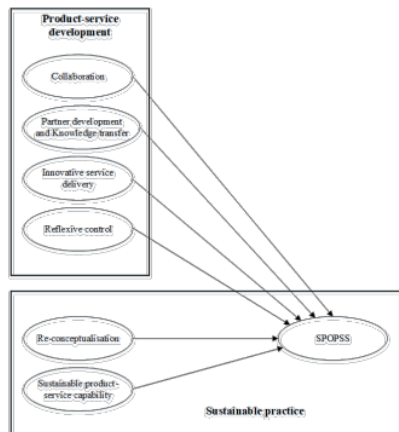


Figure 1. Conceptual model

3.1 Product-service development

This section outlines the findings on the four components of product-service development from the interview data, namely

collaboration, partner development and knowledge transfer, innovative service delivery and reflexive control.

3.1.1 Collaboratiⁿ

Collaboration is defined as the capability of creating new resources by enhancing cooperation and collaboration within the SC [21]. The thematic analysis revealed that the manufacturers collaborate with their intermediaries and service partners to provide PSS, building an intimate SC network relationship among manufacturers, intermediaries and service partners. In this vein, manufacturer sense and seize the opportunities to reconfiguring resourcing by exploiting the SC network capabilities to develop PSS in order to improve SPOPSS. They continuously assist their suppliers through partner development and knowledge transfer [33].

In the current study, the data revealed that collaboration among manufacturers, intermediaries and service partners has been maintained for more than 15 years. The strong ties between stakeholders in the Indonesian motorcycle industry as observed in the current study is the representation of the Japanese keiretsu SC network commonly found in Japanese companies' culture in Indonesia [34]. It is a form of relational contract that binds the suppliers to the manufacturer [33]. To continuously expand the PSS SC network, the manufacturers and intermediaries continually seek for service partners to fully exploit PSS.

All motorcycle brands require their service partners to undertake several steps in order to become an authorised service partner and members of their SC network. These steps are: (1) A candidate to become service partner formally applies with a proposal that addresses the specifications required by the intermediary, (2) The intermediary interviews the candidate and surveys the location, (3) After the proposal has been verified, the interview held and related documents checked the intermediary decides whether to accept or decline the application, (4) The intermediary evaluates the new service partner's performance for a set period, (5) If the service partner passes the evaluation, they receive their full license and become an official motorcycle service partner. In return, the intermediary provides a commitment to provide knowledge transfer and partner development, tools, facilities, information technology, help with service facilities improvements and guidance to the service partner on relevant government policy and regulations, including those on environmental impact. All steps above ensuring the capability to orchestrate PSS to improve SPOPSS.

The term 'main dealer' is commonly used in lieu of intermediaries in the motorcycle industry. All interviewees agreed that the intermediaries' role is to facilitate service implementation, mediating manufacturers and a network of service partners. The manufacturers do not directly collaborate with their service partners, but they delegated the jobs to the intermediaries. In a sense, they worked together in delivering PSS. Our data from six participants clearly highlighted the important role of the main dealers as intermediaries in collaboration. For example, manufacturer A expressed his opinion as follows:

"My role as technical service development head is supporting the main dealers by transferring knowledge and building strong partnerships with main dealers throughout Indonesia. We have several obligations to all the main dealers within our network. We manage the network to provide our knowledge and expertise to our service partner network through the main dealers. We have several modules of training

that we deliver to the main dealers' instructors. We distribute manuals and books including service books, motorcycle manuals, network manuals and spare part catalogues. We also distribute tools to the main dealers." (Manufacturer A).

Likewise, the intermediaries have to maintain a network of service partners by supporting them through partner development programs. Intermediary B explained his specific obligations:

"My role in technical service development is working together with the manufacturer to provide knowledge and build strong partnerships with a network of service partners throughout Indonesia. We manage to support our service partners' network by dividing the service partners based on their location. Then, each supervisor is responsible for about 30 service partners. The supervisor has to coach, share information, supervise and control through regular meetings and measuring their Key Performance Indicators (KPI)." (Intermediary B).

It is apparent in the thematic analysis that collaboration is a commitment to share information (sense) and building up relations (seize), including demand planning, customers' expectations, information technology systems, logistic distributions and long-term commitment. All interviewees believed that SPOPSS could only be improved with a long-term commitment to collaboration, which is consistent with the finding by Do Canto et al. [35] proved that sustainability achievement could be enhanced through a long-term collaboration within an SC network. As the evidence on how these SC capabilities is developed inseparably from the SC, manufacturers in the current study mentioned that they learned from the feedback concerning the product's problems and failures given by the service partners in order to develop product knowledge continuously. This is consistent with Defee and Fugate [21] that SC capabilities should be developed within network.

3.1.2 Partner development and knowledge transfer

Enhancing partners' capabilities and assisting knowledge transfer are important in developing suppliers' capabilities that will help improve sustainability goals [20]. All interviewees believed that both components are integral to the enhancement of SPOPSS. However, the thematic analysis further revealed that the service partners may lack of product technical knowledge, maintenance and sustainability knowledge. Therefore, manufacturers, the party who owns the product knowledge and intellectual property need to assist the service partners in improving their capability through the role of intermediaries. Intermediary E exemplified it as follows:

"My role in technical service development is working together with the manufacturer to build strong partnerships with service partners throughout Indonesia. We have training center facilities and develop training programs. We also provide access and enhance the understanding of knowledge about product's feature, maintenance, IT, customer care, management of service facilities and environmental regulation to support sustainability to our service partners". (Intermediary E).

The qualitative findings also indicated that an accumulation of tacit knowledge has been developed through long-term collaboration (sensing). This includes reporting and solving problems via feedback and is enhanced by the close interactions among manufacturers, intermediaries and service partners. The manufacturers also facilitate meetings with their intermediaries to discuss further development of the PSS.

Meanwhile, the intermediaries have close working relationships with the service partners that allow them to visit the workplace and discuss problems as they arise. In order to replicate the explicit knowledge and provide access across company boundaries within the network, knowledge assessment is formalised into more tangible materials that allow more organisations to use them, in this case, manufacturers transfer capabilities to intermediaries and service partners in order to improve the SC network competencies (seizing). Intermediary B added more detailed information regarding partner development and knowledge transfer, as follows:

"Training for service partners is divided into two sections: technical and non-technical training. The former is for motorcycle maintenance and repair, consisting of regular maintenance, troubleshooting, business management and sustainability. The latter is to provide guidance in handling customers at different stages, follows Network Operation Standard—by security officers, customer service officers, administrators and mechanics." (Intermediary B).

Overall, all interviewees agreed that partner development and knowledge transfer are crucial to improve SPOPSS as the motorcycle industry is a knowledge-intensive industry. Managing and continuously supporting the service partners through the main intermediaries can lead to the reconfiguring of new capabilities in the SC network, particularly to the development of PSS and sustainability knowledge. This only be possible if the manufacturers and intermediaries have a close relationship. All interviewees agreed that their customers demand all service partners to be professional in providing services relating to the product they have purchased.

3.1.3 Innovative service delivery

Innovative service delivery is an inherently dynamic process, seeking to identify and exploit the benefit of service innovation, by offering PSS to fulfil customer needs [22]. The analysis shows that the proficiency in delivering innovative services could be reflected through the quality of maintenance and repair. A standard certification issued by the intermediaries is expected to guarantee the quality as quoted by manufacturer C below:

"To ensure that our service delivery meet the national quality standard, we provide four mechanic certifications: basic training for regular maintenance (standard training), advanced training for troubleshooting, refreshment training for senior mechanics and new product training. Moreover, we constantly develop the innovative service delivery programmes to improve our customer satisfaction." (Manufacturer C).

Several intermediaries also regularly discussed with their service partners to gauge insights from customers. This capability is categorised as sensing. The service partners who have direct contact with the customers always ask for feedback from their customers. In order to sense the PSS opportunities, companies need the mechanism to get the feedback from customers then learn from it (seizing) and incorporate it into improved innovative service delivery (reconfiguration) of the SC network. There was evidence that the intermediaries then developed an innovative service delivery programme based on the feedback from customers; for example, a 'proactive service' that offers motorcycle pick up at public places such as offices, shopping malls and campuses. Intermediary B added more detailed information regarding innovative service delivery, as follows:

"We have also developed innovative service programs, such as at home servicing, servicing in public places, 24 hours emergency cars and ride thru facilities" (Intermediary B).

These programmes were developed following complaints from customers about the queue and waiting time at the official service centres. This finding shows how intermediaries could contribute value to the SC network because they know how to manage and transform (reconfigure) the innovative service delivery, also managing the service partners to deliver PSS. Likewise, all interviewees acknowledged that innovative service delivery needs to be developed within the SC network to improve SPOPSS.

1 3.1.4 Reflexive control

Reflexive control is defined as the capability of gathering information, evaluating and sharing it; hence, it aims to control the SC functionality [36]. Controlling the performance of service partners is crucial in keeping the standard of PSS. The findings from the interviews show that the manufacturers and the intermediaries have controlled the performance of their service partners using a key performance indicator (KPI) developed by the manufacturers, which is evaluated periodically. Intermediary B remarked as follows:

"Besides KPI, we control our service partners' performances by distributing questionnaires directly to customers. The marketing independent as our outsourcing then will analyse the Customer Satisfaction Level and Technical Satisfaction Index. In addition, we supervise how to keep standard items minimum for components availability. Using mechanic, service management and environment certifications are also as our effort to control our network". (Intermediary B).

The interaction among manufacturers, intermediaries and service partners in controlling the processes impacts to the improved controlling mechanism. There is no environmental certification for service partners, but the intermediaries internally control service partners' compliance with environmental regulations. In addition, local government authorities also regularly check the service partners' compliance with environmental regulations. All the manufacturers had environmental management systems certification, whether ISO 14001, the China Compulsory Certification system for environmental protection or from the Thai Industrial Standards Institute. In this study, the interviews confirmed the importance of controlling the SC and how reflexive control positively affects SPOPSS.

3.2 Sustainable practices

This section outlines the findings on three key components of sustainable practices, namely re-conceptualisation, sustainable product–service capability and SPOPSS.

3.2.1 Re-conceptualisation

Re-conceptualisation refers to the ability to change the SC business models on a wide scale to improve SPOPSS [17]. Closed-loop SC activities such as reuse, recycle and remanufacture enhance the re-conceptualisation of the SC [37]. Post-sales product maintenance is also considered as part of re-conceptualisation [38]. All interviewees claimed to have encouraged their service partners to advise customers about service and maintenance, as intermediary F expressed below:

"Our goal in adopting the PSS is to provide a bundle of product and service to customers. We believe that market

competition is not only about selling products but also about providing services. Regular maintenance could prolong the motorcycles' life span so we advise our customers on how to use their motorcycle in way that save energy and enhance its longevity." (Intermediary F).

Nevertheless, the Indonesian government has yet to formulate a policy to regulate recycle, and reuse of materials and components [39]. Currently, several service partners have offered motorcycle take-back programmes for customers to trade-in with a new model. However, the obstacles to implement recycling is the lack of technology and facility, as well as the high investment for both the collection and recycle processes. Additionally, the government has not provided an incentive for EOL handling of automotive products. It is also indicated that offering a recycling product is not feasible economically, as illustrated by manufacturer A below:

"We are not offering refurbishment of motorcycle as our technology does not accommodate recycled components. If we find a component in a faulty condition, we do not use it. In fact, we must reject it. Thus, the refurbishment idea seems to be a far cry. On top of that, the infrastructure to support motorcycle collection and recycling facilities are not economically viable for us now." (Manufacturer A).

Though all interviewees recognised that re-conceptualisation as part of reconfiguring process is an essential determinant for improving SPOPSS, they have not been able to implement the closed-loop SC practices—reuse, recycle and remanufacture—as these are not economically feasible. Due to the absence of the Original Equipment Manufacturer (OEM), all recycling processes in Indonesia almost rely on the informal sectors, which could still make profit because the economic values of the material remain high. Although these practices could harm the environment, they are essential to the recyclers, who are mostly from the low-income economy. Apart from that, all interviewees mentioned that they required their service partners to follow environmental regulations, especially on the management of hazardous and toxic waste.

The practitioners in this industry need the support from the Indonesian government such as an incentive for the production of products with lower environmental characteristics. Without the support from the government, then the price of these products will not be able to compete with the other commercial products [40]. The thematic analysis further reveals that the current re-conceptualisation activities which support maintenance and service, such as following the environmental regulations and suggesting that customers regularly maintain their product and use it in an energy-efficient manner, can contribute to re-conceptualising the SC. These activities are considered as the seizing the opportunities through the collaboration with intermediaries and service partners to be able to re-conceptualised. Although the Indonesian motorcycle industry does not have the capabilities to reconfigure a closed-loop SC, the industry can still contribute to SPOPSS.

3.2.2 Sustainable product–service capability

The capability of designing and using natural resources effectively in product manufacturing and services is essential in achieving sustainable goals [29]. Sustainable product design considers the life span of materials, ease in disassembly, and possibilities for rework and recycle. All interviewees agreed that sustainable product design has a positive effect on SPOPSS; and that maintenance and repair supported by the

service partners will prolong a product life span. These activities are considered as the reconfigure the opportunities through the collaboration with intermediaries and service partners to be able to build sustainable product–service capability. This was demonstrated by a quote from manufacturer A below:

"We design our products to be easy to disassemble for maintenance and repair purposes. We also consider the environmental effect of material choices, i.e., this needs to follow the standard environmental regulations determined by the Indonesian government and the Indonesian motorcycle industry association. In addition, we provide a bundle of product and service to prolong the motorcycle lifespan." (Manufacturer A).

In addition to the sustainable product design and PSS scheme, all practitioners in the interviews claimed to have adhered to the environment standard and regulations set by the Indonesian government. The design that allows for easy disassembly has contributed to product longevity; for example, when a component fails, it is easy to repair or to upgrade. In another example of environmentally friendly design, the manufacturers had designed their product using fuel injection technology to save on gasoline consumption. Moreover, the big four motorcycle brands have agreed to jointly develop a battery for electric motorcycles, and they have started to develop electric motorcycles. Accordingly, all interviewees stressed that sustainable product–service capability could improve SPOPSS.

3.2.3 SPOPSS

The interview data show that the significance of SPOPSS is acknowledged by the motorcycle industry as the performance from three aspects of economic, environmental and social. This results consistent with Dewi et al. [41]. Zooming in on the economic aspect, all interviewees acknowledged that their business goal is to expand the market share and gain more profit from PSS offering. Meanwhile on social aspect, the data

from the Coordinating Ministry for Economic Affairs in 2021 showed that motorcycle manufacturers and the supporting companies have recruited almost 1.5 million employees [42]. In this respect, Intermediary D shared his opinion regarding corporate social responsibility as follows:

"We have helped many automotive vocational school graduates by employing teachers, providing tools and motorcycles for their practicum. We also helped small-medium enterprises (SMEs) through entrepreneurship programmes by giving them training and capital to start their business." (Intermediary D).

All interviewees expressed that they were aware of the environmental aspect. Sustainable awareness that has been practiced is the avoidance of hazardous materials and the battery recycling effort. Manufacturer C, for example, expressed his comment as follows:

"We have banished the use of asbestos for brake spare parts. We advise customers not to dispose batteries for the sake of the lithium inside. They have to send batteries to the manufacturer instead. We will recycle the battery waste properly. We have designed motorcycles to be easy to disassemble, while lengthening the life cycle by using injection technology, fuel reduction and green production. The air filter has also been designed to last longer." (Manufacturer C).

The interview data revealed that the Indonesian motorcycle industry has adhered to government regulation with regards to hazardous materials handling. Despite the fact that the motorcycle practitioners acknowledge the importance of the three aspects of SPOPSS, naturally they emphasise their strategic orientation towards the economic viability. In that case, the government needs to play a more active role in raising the awareness of the environment and social aspects. This is also the case in the developed countries, where authorities impose those manufacturers are responsible for product disposal at EOL as part of the extended producer responsibility (EPR) [43]. Table 2 summarises the SC capabilities identified in this study.

Table 2. Summary of the SC capabilities identified for manufacturers and intermediaries

SC Capabilities build through interaction	Manufacturers	Intermediaries
Collaboration	Collaboration is a commitment to share information (sense) and building up relations (seize), including demand planning, customers' expectations, information technology systems, logistic distributions and long-term partnership.	Intermediaries collaborate closely with manufacturers and service partners and receive support from manufacturers. Intermediaries and service partners provide manufacturers feedback to improve product quality and knowledge.
Partner development and knowledge transfer	Manufacturers as a source of knowledge, they facilitate knowledge transfer and provide training materials for intermediaries in order to improve SC network capability.	Intermediaries are required to enhance service partners' capabilities through partner development and knowledge transfer, including technical knowledge of PSS, customer care and sustainability.
Innovative service delivery	Manufacturers develop standards and certification for technical knowledge and service facilities to standardise products and services nationally and share these with the intermediaries.	Intermediaries ensure the innovative service delivery is of high quality by certifying the service partners' technical knowledge and service facilities. In addition, the intermediaries have to continuously develop innovative service delivery programs to support the service partners.
Reflexive control	Manufacturers develop the evaluation and control functions using KPIs, certification and measurements of technical competency and customer satisfaction, and share these with the intermediaries.	Intermediaries ensure the KPI is to be implemented in order to control service partners' performances.
Re-conceptualisation	Manufacturers acknowledge that the practice of closed-loop SC is a crucial factor for sustainability, but they have yet to implement remanufacturing and recycling. Collaboration with the intermediaries to provide PSS could be considered as the closest step towards re-conceptualisation capability.	Intermediaries provide the PSS guideline to the service partners so that they can advise and educate customers about the proper usage and maintenance of their motorcycle.

SC Capabilities build through interaction	Manufacturers	Intermediaries
Sustainable product–service capability	Manufacturers design products that are environmentally friendly, facilitate disassembly, consider the environmental effects of materials used, adhere to environmental standards and regulations, and prolong product life span by providing the PSS. The manufacturers advise the intermediaries of their expectations about adhering to the environmental regulations and providing the best maintenance and repair to prolong the product’s life span.	Intermediaries closely collaborate with service partners to adhere to the environmental regulations by recycling waste and providing maintenance and repair to prolong the product’s life span
SPOPSS	Manufacturers gain more market share and profit from the economic aspect. They help SMEs and vocational schools through social responsibility programs. They also comply with environmental standards and seek to decrease the use of hazardous materials. The manufacturers require the intermediaries to follow their lead towards achieving SPOPSS	The intermediaries and service partners gain profit and market share from the PSS scheme. They follow the manufacturers guidance in the social and environmental aspects of SPOPSS, advise and support the service partners to do likewise.

4. CONCLUSIONS

This study has significant contributions on theory building and research. This study contributes to the existing PSS literature by identifying and developing six SC capabilities: collaboration, partner development and knowledge transfer, innovative service delivery, reflexive control, re-conceptualisation and sustainable product–service capability, and their importance on SPOPSS. The second theoretical contribution is that the analysis of dynamic capabilities as an underpinning theory represents these six SC capabilities are built up through the companies’ learning and experience then applied to renew the SC capabilities across the SC network. It does so by identifying the microfoundation of dynamic capabilities: sensing, seizing and reconfiguring. Finally, by providing empirical evidence of dynamic capabilities collected from the Indonesian motorcycle industry, enhance our understanding through reaching an integrated perspective of the bundle of product and service, and the resultant obligations of manufacturers as producers and intermediaries and service partners as providers of a product and service bundle, may be novel. The findings from this study found manufacturers, the intermediaries and service partners have distinct roles in providing the PSS, but they work in close collaboration within network so that the PSS can be optimally delivered to customers. The main dealers play an important role as intermediaries in supporting the development of six SC capabilities for the service partners to improve SPOPSS.

The findings from this study offer the motorcycle practitioners and the policy makers the following recommendations to improve SPOPSS. First, manufacturers and intermediaries must focus on developing and maintaining collaboration within the network of service partners. The manufacturers as the initiator of the partnership with the service network should develop strategies for evaluating the current state of the collaboration and how to create more value and improve long-term collaboration with the service partners in the future. Second, as the motorcycle industry is such a knowledge-intensive industry, more training, workshops and other opportunities for skill development should be offered for the service partners to show how the manufacturers through the intermediaries are keen to assist development of innovative service capabilities. Finally, efforts to improve SPOPSS still largely focus on the economic aspects, so re-conceptualisation and sustainable product–service capability are the areas to

improve in order to improve SPOPSS. The important findings related to the absence of OEM in the implementation of closed-loop SC is that it has allowed the informal sector to take a key role in the waste management. Therefore, it would counter-productive to remove or even discourage the existing informal sector. What could be a better solution is for the government to integrate the informal sector into the formal waste management planning, improve their working condition, equip the players with knowledge on environmental law and improve the efficiency of the methods. Other possible suggestion for the Indonesian government would be to strengthen policies in order to minimise the environmental impact; for example, by applying the EPR programmes, internalisation of environmental costs through pollution charges and support the motorcycle industry through the implementation of result-oriented PSS.

As six in-depth interviews only validated the conceptual framework then the generalisability is still limited. A large-scale quantitative survey will overcome the limitation of this study. Furthermore, the current study’s scope covers only specific industry in the limited geographical area due to convenience factor; therefore, further research should look into different industries and broader geographical coverage to examine whether the interactive developed capabilities remain as they are. Finally, it would be compelling to incorporate a longitudinal approach to examine how capabilities evolve over time throughout the process of delivering PSS.

ACKNOWLEDGMENT

This research is supported by the Indonesian Education Scholarship (LPDP) under Beasiswa Unggulan Dosen Indonesia (BUDI) scheme.

REFERENCES

- [1] Brondoni, S. (2021). Global competition & state intervention. The genesis of Japan’s motorcycle global leaders: Honda, Suzuki, Kawasaki & Yamaha. *Symphony Emerging Issues in Management*, 1: 7-22. <http://dx.doi.org/10.4468/2021.1.02brondoni>
- [2] Alali, A.M., Abu Al Rejal, H.M., Abu, N.H.B., Alali, H. (2022). The impact of supply chain preparedness on

- healthcare service quality: A literature review. *International Journal of Sustainable Development and Planning*, 17(5): 1425-1430. <https://doi.org/10.18280/ijstdp.170506>
- [3] Gaiardelli, P., Pezzotta, G., Rondini, A., Romero, D., Jarrahi, F., Bertoni, M., Wiesner, S., Wuest, T., Larsson, T., Zaki, M. (2021). Product-service systems evolution in the era of Industry 4.0. *Service Business*, 15(1): 177-207. <http://dx.doi.org/10.1007/s11628-021-00438-9>
- [4] Vandermerwe, S., Rada, J. (1988). Servitization of business: Adding value by adding services. *European Management Journal*, 6(4): 314-324. [http://dx.doi.org/10.1016/0263-2373\(88\)90033-3](http://dx.doi.org/10.1016/0263-2373(88)90033-3)
- [5] Mahut, F., Daaboul, J., Bricogne, M., Eynard, B. (2017). Product-Service Systems for servitization of the automotive industry: A literature review. *International Journal of Production Research*, 55(7): 2102-2120. <http://dx.doi.org/10.1080/00207543.2016.1252864>
- [6] Sitinjak, C., Ismail, R., Bantu, E., Fajar, R., Simanullang, W.F. (2022). Study of public perception toward end-of-life vehicles (ELV) management in Indonesia. *International Journal of Sustainable Development and Planning*, 17(4): 1341-1347. <https://doi.org/10.18280/ijstdp.170431>
- [7] Annarelli, A., Battistella, C., Nonino, F. (2016). Product service system: A conceptual framework from a systematic review. *Journal of Cleaner Production*, 139: 1011-1032. <http://dx.doi.org/10.1016/j.jclepro.2016.08.061>
- [8] Herman. (2019). Ini target baru Asosiasi Sepeda Motor Indonesia. <http://www.beritasatu.com/otomotif/420149-ini-target-baru-asosiasi-industri-sepeda-motor-indonesia.html>, accessed on Oct. 8, 2019.
- [9] Astra. (2014). Sharing our spirit of sustainability, <https://www.astra.co.id/Public/files/Sustainability%20Report/AstraSR2014.pdf>, accessed on Oct. 8, 2018.
- [10] Mont, O. (2004). Product-service systems: Panacea or myth? Lund University.
- [11] Gebauer, H., Paiola, M., Saccani, N. (2013). Characterizing service networks for moving from products to solutions. *Industrial Marketing Management*: 42(1): 31-46.
- [12] Martinez, V., Bastl, M., Kingston, J., Evans, S. (2010). Challenges in transforming manufacturing organisations into product-service providers. *Journal of Manufacturing Technology Management*, 21(4): 449-469.
- [13] Ayala, N.F., Gerstlberger, W., Frank, A.G. (2018). Managing servitization in product companies: the moderating role of service suppliers. *International Journal of Operations & Production Management*, 39(1): 43-74. <http://dx.doi.org/10.1108/IJOPM-08-2017-0484>
- [14] Mathieu, V. (2001). Product services: from a service supporting the product to a service supporting the client. *Journal of Business & Industrial Marketing*, 16(1): 39-61. <http://dx.doi.org/10.1108/08858620110364873>
- [15] Kowalkowski, C., Kindström, D., Witell, L. (2011). Internalisation or externalisation? Examining organisational arrangements for industrial services. *Managing Service Quality*, 21(4): 373-391.
- [16] Helfat, C., Finkelstein, S., Mitchell, W., Peteraf, M., Singh, H., Teece, D., Winter, S. (2009). *Dynamic Capabilities: Understanding Strategic Change in Organizations*. John Wiley & Sons, New Jersey, United States.
- [17] Beske, P., Land, A., Seuring, S. (2014). Sustainable supply chain management practices and dynamic capabilities in the food industry: A critical analysis of the literature. *International Journal of Production Economics*, 152: 131-143. <http://dx.doi.org/10.1016/j.ijpe.2013.12.026>
- [18] Zollo, M., Winter, S.G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3): 339-351. <http://dx.doi.org/10.1287/orsc.13.3.339.2780>
- [19] Teece, D., Pisano, G., Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7): 509-533. [http://dx.doi.org/10.1002/\(SICI\)1097-0266\(199708\)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z](http://dx.doi.org/10.1002/(SICI)1097-0266(199708)18:7%3C509::AID-SMJ882%3E3.0.CO;2-Z)
- [20] Beske, P. (2012). Dynamic capabilities and sustainable supply chain management. *International Journal of Physical Distribution & Logistics Management*, 42(4): 72-387. <http://dx.doi.org/10.1108/09600031211231344>
- [21] Defee, C., Fugate, B.S. (2010). Changing perspective of capabilities in the dynamic supply chain era. *The International Journal of Logistics Management*, 21(2): 180-206. <http://dx.doi.org/10.1108/09574091011071915>
- [22] Kindström, D., Kowalkowski, C., Sandberg, E. (2013). Enabling service innovation: A dynamic capabilities approach. *Journal of Business Research*, 66(8): 1063-1073. <http://dx.doi.org/10.1016/j.jbusres.2012.03.003>
- [23] Story, V.M., Raddats, C., Burton, J., Zolkiewski, J., Baines, T. (2017). Capabilities for advanced services: A multi-actor perspective. *Industrial Marketing Management*, 60: 54-68. <http://dx.doi.org/10.1016/j.indmarman.2016.04.015>
- [24] Kindström, D., Kowalkowski, C. (2014). Service innovation in product-centric firms: A multidimensional business model perspective. *Journal of Business and Industrial Marketing*, 29(2): 96-111. <http://dx.doi.org/10.1108/JBIM-08-2013-0165>
- [25] Adrodegari, F., Saccani, N., Kowalkowski, C., Vilo, J. (2017). PSS business model conceptualization and application. *Production Planning and Control*, 28(15): 1251-1263. <https://doi.org/10.1080/09537287.2017.1363924>
- [26] Raddats, C., Zolkiewski, J., Story, V.M., Burton, J., Baines, T., Ziaee Bigdeli, A. (2017). Interactively developed capabilities: evidence from dyadic servitization relationships. *International Journal of Operations & Production Management*, 37(3): 382-400. <http://dx.doi.org/10.1108/IJOPM-08-2015-0512>
- [27] Vezzoli, C., Ceschin, F., Diehl, J.C., Kohtala, C. (2015). New design challenges to widely implement Sustainable Product-Service Systems. *Journal of Cleaner Production*, 97: 1-12. <http://dx.doi.org/10.1016/j.jclepro.2015.02.061>
- [28] Seuring, S., Aman, S., Hettiarachchi, B.D., de Lima, F.A., Schilling, I., Sudusinghe, J.I. (2022). Reflecting on theory development in sustainable supply chain management. *Cleaner Logistics and Supply Chain*, 3: 100016. <http://dx.doi.org/10.1016/j.clscn.2021.100016>
- [29] Garetti, M., Taisch, M. (2012). Sustainable manufacturing: Trends and research challenges. *Production Planning & Control*, 23(2-3): 83-104. <http://dx.doi.org/10.1080/09537287.2011.591619>
- [30] Korstjens, I., Moser, A. (2018). *Series: Practical guidance to qualitative research. Part 4: Trustworthiness*

- and publishing. *European Journal of General Practice*, 24(1): 120-124. <http://dx.doi.org/10.1080/13814788.2017.1375092>
- [31] Braun, V., Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2): 77-101. <http://dx.doi.org/10.1191/1478088706qp063oa>
- [32] Kiger, M.E., Varpio, L. (2020). Thematic analysis of qualitative data: AMEE Guide No. 131, *Medical Teacher*, 42(8): 846-854. <http://dx.doi.org/10.1080/0142159X.2020.1755030>
- [33] Evers, H.D., Purwaningrum, F. (2013). Japanese automobile conglomerates in Indonesia: Knowledge transfer within an industrial cluster in the Jakarta Metropolitan Area. Working Papers Series, 111.
- [34] Irawati, D., Charles, D. (2010). The involvement of Japanese MNEs in the Indonesian automotive cluster. *International Journal of Automotive Technology*, 10(2-3): 180-196. <http://dx.doi.org/10.1504/IJATM.2010.032623>
- [35] Do Canto, N.R., Bossle, M.B., Marques, L., Dutra, M. (2020). Supply chain collaboration for sustainability: A qualitative investigation of food supply chains in Brazil. *Management of Environmental Quality: An International Journal*, 32(6): 1477-7835. <http://dx.doi.org/10.1108/MEQ-12-2019-0275>
- [36] Gruchmann, T., Seuring, S. (2018). Explaining logistics social responsibility from a dynamic capabilities perspective. *The International Journal of Logistics Management*, 29(4): 1255-1278. <http://dx.doi.org/10.1108/IJLM-08-2017-0200>
- [37] Pagell, M., Wu, Z. (2009). Building a more complete theory of sustainable supply chain management using case studies of 10 exemplars. *Journal of Supply Chain Management*, 45(2): 37-56. <http://dx.doi.org/10.1111/j.1745-493X.2009.03162.x>
- [38] Coenen, J., van Der Heijden, R.E.C.M., van Riel, A.C.R. (2018). Understanding approaches to complexity and uncertainty in closed-loop supply chain management: Past findings and future directions. *Journal of Cleaner Production*, 201: 1-13. <http://dx.doi.org/10.1016/j.jclepro.2018.07.216>
- [39] Hanafi, K., Jobiliong, E., Christiani, A., Halim, A.V., Santoso, D., Melini, E. (2011). The prospects of managing WEEE in Indonesia. *Glocalized Solutions for Sustainability in Manufacturing*, 492-496. http://dx.doi.org/10.1007/978-3-642-19692-8_85
- [40] Ceschin, F., Vezzoli, C. (2010). The role of public policy in stimulating radical environmental impact reduction in the automotive sector: the need to focus on product-service system innovation. *International Journal of Automotive Technology and Management*, 10(2-3): 321-341. <http://dx.doi.org/10.1504/IJATM.2010.032631>
- [41] Dewi, D.R.S., Pittayachawan, S., Tait, E. (2020). A conceptual framework for Servitisation of the manufacturing companies to deliver Product-Service Systems solutions: A study case of the Indonesian motorcycle industry. *IOP Conference Series: Materials Science and Engineering*, 847(1): 012056. <http://dx.doi.org/10.1088/1757-899X/847/1/012056>
- [42] Kemenko. (2021). Menko Perekonomian: Relaksasi PPnBM Geliatkan Industri Otomotif dan Ekonomi Nasional. <https://metrodua.com/2021/02/13/menko-perekonomian-relaksasi-ppnbn-geliatkan-industri-otomotif-dan-ekonomi-nasional/>, Accessed on Februari 13.
- [43] Chen, X.T., Li, B.Y., Li, Z.H., Goh, M., Wei, S.T. (2021). Take-back regulation policy on closed loop supply chain: Single or double target? *Journal of Cleaner Production*, 283: 124576. <http://dx.doi.org/10.1016/j.jclepro.2020.124576>

APPENDIX

1

Part 1 - Demographic information of respondent

- Q1) What is your position in the organisation?
 Q2) How long have you worked for the company?
 Q3) How long have you been in this position?

1

Part 2 – The purpose of this section is to examine the supply chain capabilities in providing the PSS in order to improve sustainability performance in the Indonesian motorcycle manufacturing.

1. The role of the interviewee

- Tell me about the extent of your role in managing PSS and improve sustainability performance? (Please give some examples)
- How does your role (as manufacturer/main dealer) in this company manage PSS and improve sustainability performance?

2. PSS and sustainability performance

- What is the process for managing stakeholders' collaboration in the supply chain, provide service delivery, partner development and knowledge transfer?
- What quality management processes are in place to set standards and monitoring to service partners?
- Can you give an example when there was an innovative PSS initiative that was developed in collaboration with stakeholders in the SC?
- How is the control and monitoring process?
- Do you have the same IT platform to communicate and share information in your service partners networking? Please describe how you communicate and share information if you do not have the same IT platform.
- Give me the example of your company concern about sustainability in term of economic, environment and social perspectives.
- How about the effort to become sustainable, i.e., recycling and reuse materials and components? Also, how about the sustainable product-service capability, i.e., design product that prolong the life of materials, facilitate disassembly, enable recycling? Is the company offering refurbished motorcycle?

Supply Chain Capabilities to Improve Sustainability Performance of Product-Service Systems

ORIGINALITY REPORT

2%

SIMILARITY INDEX

1%

INTERNET SOURCES

1%

PUBLICATIONS

2%

STUDENT PAPERS

MATCHED SOURCE



Submitted to RMIT University

Student Paper

2%

2%

★ Submitted to RMIT University

Student Paper

Exclude quotes On

Exclude matches < 1%

Exclude bibliography On