The Impact of Servitization on Manufacturing Industry: A Literature Review and Prospects for Future Research

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Abstract

The manufacturing strategy should be dynamic in order to adapt to the changes. One example of change is the customer's preference influenced by service. The involvement of service in the manufacturing industry has resulted in a new term, i.e., servitization. This paper aims to investigate the effect of servitization on the manufacturing industry by reviewing 29 journals. In addition, the selected journals are mapped in accordance with the similarity of the discussion topics. Based on the literature review, it is generally concluded that the involvement of services in the manufacturing industry has a major influence on manufacturing strategy. The integration between products and services causes a mix that sometimes does not see the boundaries between products and services themselves. In general, servitization is defined as the tendency of manufacturing companies to integrate services into their manufactured tangible products. Furthermore, this review of the literature can be used to identify future research opportunities. Some future research topics that are visible to carry out are the effectiveness of the role of service embedded in a product, the way to determine the amount of service dominance in a product, and the cost-benefit ratio analysis to integrate product and service.

Keywords:
Manufacturing Strategy, Servitization, Product and Service System, Future Research, Literature Review

1. Introduction

Competition between manufacturing firms varies throughout time. These changes correspond to market-wide alterations in customer preferences or behaviors. This situation requires manufacturing companies to have an adaptive strategy. Manufacturing firms employ a strategy of attempting to follow the order qualifiers in accordance with the industry's development when creating and offering their products. Cost, quality, speed, and flexibility are order qualifiers. Numerous developments happened in manufacturing enterprises with the start of the industrial revolution. Companies that could previously only make a few things manually were able to generate a high volume of products with the assistance of machines. As a result, production costs were kept low. At the time, cost became the order winner in terms of market competition. The manufacturer who can offer the goods at the lowest price wins the competition. When many businesses recognized that cost was a decisive factor in order placement, they began competing to produce at the lowest possible cost. As a result, the cost became standard and became an order qualifier. Following that, quality emerged as a new order winner in the competition, requiring manufacturing enterprises to evaluate the quality of their offered products in their strategy. Numerous research on quality was conducted during this era. Due to the manufacturing industry's development and customer response, order winners were also replaced by order qualifiers. Then, customer responses would influence newly created order winners, compelling manufacturers to develop new methods. This trend has been maintained through the industrial revolution and into the modern era. The rise of services in the manufacturing business is becoming increasingly noticeable at the moment. Service is regarded as being able to add value to the product, increasing the likelihood of client acceptance. As a result, adding enhanced service to the product might be a game changer. This trend has resulted in the development of a new term in the manufacturing industry, i.e., servitization. Thus, this article discusses the previous research related to servitization for the following purposes:

1. Understanding the definition of service is related to determining its scope.

2. Understanding the effect of servitization on several aspects of the manufacturing industry through the current trend of servitization
3. Understanding the relationship between servitization and product-service systems
4. Identifying the future research opportunities

2. Literature Review

2.1 Servitization Scope

Servitization has grown in popularity over the last decade. Numerous studies are also conducted to determine the extent to which service plays a role in the manufacturing industry. However, it is necessary to acknowledge the constraint imposed by the development of servitization. As a result, it is necessary to first comprehend the definition of servitization. By departing from this definition, the scope of servitization becomes visible, which can be beneficial when conducting a servitization benefit analysis. As illustrated in Table 1, there are numerous definitions of servitization. However, in general, servitization can be defined as a manufacturing company's tendency to incorporate services into the manufactured tangible products (Mustafa et al. 2020).

Table 1. Description of Servitization

No	Source	Servitization description
1	(Kanatlı & Karaer 2021)	Servitization is the process of selling the products' services rather than the products themselves. It is a business model that has the potential to be more environmentally friendly than conventional selling.
2	(Kozłowska 2021)	Servitization is the process of incorporating services as an add-on to products or as a component of a product-service solution offered to customers, which has a number of implications.
3	(Rondi et al. 2021)	Servitization necessitates manufacturers adopting an open innovation strategy to transform their products into platforms that incorporate knowledge and solutions from the outside in (using external partners' ideas in a firm's own business) and the inside out (allowing external partners to use a firm's ideas in their businesses).
4	(Kohtamäki et al. 2021)	Servitization is described as the process through which products are transformed into integrated product-service systems. It is able to be accelerated by digitalization
5	(Rabetino et al. 2021)	Servitization is the preferred term for the growing number of service-oriented activities observed in manufacturing.
6	(Zhou & Song 2021)	Servitization refers to the process of transitioning from selling product to offering system solutions that incorporate both products and services. It is influenced by global economic situation.
7	(Sousa & da Silveira 2020)	Servitization is offering advanced service and product influenced by complex market to build the differentiation
8	(Mar'Atus Sholihah et al. 2020)	Servitization is process of organizational change, in which it is represented as a difference in form, quality, or state over time from product-oriented to a more service-based organization by considering organization's capability
9	(Mustafa et al. 2020)	Servitization is the process through which manufacturers of physical products transition to offering enterprise solutions and value-added services to customers.
10	(Tan 2010)	Servitization is a constituent component of product-service system focusing on adding service
11	(Kim & Lee 2021)	Servitization is inextricably linked to product-service system and business solutions

According to the various definitions above, servitization strategies can be classified into two categories (Mustafa et al. 2020). The two classifications are as follows:

a. product-focused servitization strategy with the goal of providing related products and services when interacting with customers on time.
b. service-focused servitization strategy with the goal of providing related services or products in the right time.

As a result, the strategy for servitization will be inextricably linked to the management of innovation. Currently, research on servitization is concentrated on product innovation. However, macro innovation management is a topic that is rarely discussed in servitization research (Rondi et al. 2021). This will be discussed as part of the subject of servitization. Along with innovation management, another area of servitization is digitalization. Digitalization plays a critical role in accelerating a business's ability to innovate in the service sector (Paiola et al. 2021). Additionally, digitization of servitization has the potential to alter the supply chain's relationship and power structure (Mosch et al. 2021). However, the success of digitalization in facilitating the implementation of servitization is contingent upon the broadcasting of a compelling narrative (Kohtamäki et al. 2021). The narrative is used to establish an image and becomes an integral part of the company's positioning strategy. The adaptation of the business to digitalization must be carefully considered, as it is directly related to internal capabilities. The efforts of manufacturing firms to implement a servitization strategy must be matched to their capabilities (Mar'Atus Sholihah et al. 2020). SWOT analysis is required in this case prior to developing a strategy map for servitization (Mar'atus Sholihah et al. 2019). However, there will be difficulties in implementing the strategy of servitization. One of the difficulties encountered during the servitization transition is global economic insecurity (Zhou & Song 2021). The strategy of servitization is considered adaptive in light of these uncertainties. By implementing a servitization strategy, the business focuses not only on product sales but also on service sales. Additionally, as a result of the complexity of the servitization strategy, manufacturing activities, business models, customers, planning realization, activity control, and evaluation may all present challenges. These obstacles will dictate the scope of the company's servitization.

2.2 Influence and Development of Servitization

In the last decade, the involvement of service in the manufacturing industry has becomes increasingly visible. Additionally, service is regarded as an intangible product of the manufacturing industry. The increase in the involvement of services in the manufacturing industry is not without reason. The service is considered to have a significant influence on manufacturing strategy. Several studies investigate these effects. Service is considered to have the ability to provide added value so that it can lead to product differentiation (Kozłowska 2021). This is slightly different from Sousa & da Silveira (2020),who in their research found that even though service really provide added value, it is not significant for product differentiation. However, the service chosen to be offered to customers will affect the differentiation of the service itself. These results are obtained from empirical observations related to the causality relationship between variables in servitization. These variables include market complexity, advanced service, product differentiation and service differentiation. Apart from differentiation, the addition of services to products can build a new positioning. Hence, it is necessary to do a SWOT analysis before compiling a servitization strategy map (Mar'Atus Sholihah et al. 2020). Consequently, servitization will require manufacturing companies to pay attention to innovation management (Shen et al. 2021). Furthermore, servitization will have an effect on profitability, competitiveness, customer loyalty, and sustainability (Wang et al. 2021).This effect supports servitization as a solution to global economic uncertainty. Therefore, it is not surprising that servitization is able to force the global manufacturing industry into a transition. An example is the trend of the shifting of manufacturing strategy in China. Servitization has become an important choice in realizing China's national goals for the manufacturing industry. This is stated in the national mid-term plan and the implementation of Made-in-China 2025 program (Wang et al. 2021). Although servitization is a global trend in the manufacturing industry, currently there are still research gaps related to the servitization transformation method. The implementation of servitization should consider the uniqueness of each manufacturing company. This uniqueness can be influenced by organizational culture or local wisdom. Developing a servitization strategy must be on the basis of service location determination, methods of increasing competition, and business models (Wang et al. 2021). Another trend of servitization is digital servitization which is defined as a continued transition from product and service integration that is capable of capturing and creating value through monitoring, control, optimization, and autonomous functions (Simonsson & Agarwal 2021;Mosch et al. 2021). Digital servitization is a form of response to the Industrial Revolution 4.0. Digitalization becomes an intermediary for servitization to realize innovation (Shen et al. 2021;Paiola et al. 2021). Besides digitalization, the trend of servitization is also related to sustainability (Hao et al. 2021). Servitization can support a circular economy through the process of material recovery and can provide a business alternative for manufacturing companies that sell not only products but

also services (Doni et al. 2019). Servitization occurs across time and regions. The services that are integrated into the product will be extremely diverse. Transition speeds between regions will also vary. As a result, a careful examination of the global and detailed evolution of service integration in products is required. Regarding the servitization journey, Rabetino et al. (2021) and Zhou & Song (2021) decipher the changes in research topics that become markers of servitization development over time. Those changes are presented in Table 2.

Table 2. Servitization development based on research attention

No	Research attention	Development
1	Appropriate strategic alignment for a propitious service transformation.	In the late 1980s, much research aimed at investigating the implications of service on competitiveness was conducted. In the early 2000s, service became inextricably linked to products. Numerous studies have been conducted to ascertain the service's character and strategy. In the recent decade, much research has been carried out to align service and product integration strategies by considering value creation processes, resource capabilities, management of risk, performance implications, and experience (challenges and failures).
2	Infusion of B2B services: customer relationships and business logic	Research on the company's strategy for maintaining B2B relationships in terms of integrated product and service solutions started in era of 2006–2009. During the last decade, research focused on relational capital, service logic, and the evaluation of service infusion in B2B situations.
3	Delivery and marketing solutions	In the 1980s, service was considered a break through. At that time, research related to service implications in the field of marketing began to emerge. From the early 2000s to the present, research has focused on the importance of balancing customer needs, organizational structures, and company capabilities when developing marketing strategies in the servitization era.
4	Complex capital goods solutions	At the end of the 1980s, much research on complex solutions focused on iterative solution preparation, particularly technology management, policymaking, innovation management, organizational capabilities, and learning in project-based complex product systems. Between 2001 and 2009, researchers added value system configuration elements to complex product systems and high-value integrated solutions. Service is becoming increasingly visible in the manufacturing industry at the moment.
5	Organized performance-focused contracting and performance system	Prior to 2014, performance management research focused on performance measurement, supply chain governance, relational assets, benefits, and uncertainties associated with performance measurement systems. However, beginning in 2014, complex performance metrics that account for the service component of the industry have begun to emerge. For instance, performance measurement research for inovation management and relationship management.
6	Management of supply chain and operation for after-sales service	From 1988 to 2000, SCM and after-sales service research focused on the product life-cycle as a strategic opportunity. Between 2001 and 2009, servitization began to have an effect on research topics. Several topics were discussed during this era, including service offerings and delivery strategy, product support

No	Research attention	Development
		strategy and after-sales service profitability, and industrial system maintenance concepts. Since 2009, research attention has increased on the prediction of the after-sales service life cycle.
7	Product-focused servitization	In 2006, research on product-focused servitization began and continues to grow. Between 2006 and 2009, research examined the numerous challenges and financial implications associated with delivering integrated products and services. Additionally, the topic was developed to discuss operational strategies that support servitization, business partnering and network development in servitization, ICT in servitization, and reversed servitization paths in the 2010–2013 era. Research continues to grow on managing customer solutions in project-based firms, such as capabilities, configurations, resource integration, modularity, knowledgse, and strategic learning in the cocreation of integrated product-service solutions within multi-actor business networks

While the kind of services integrated to the product are illustrated in Figure 1. (Tan 2010; Mathieu 2001; Oliva & Kallenberg 2003).

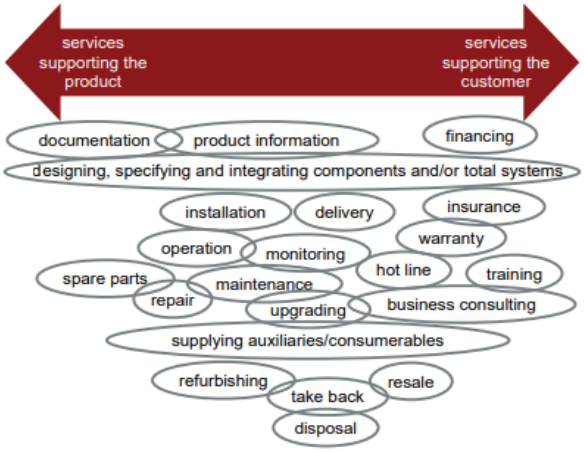


Figure 1. Various Services those are able to be integrated to product

2.3 Product and Service System (PSS) as The Concrete Form of Servitization

Observing the trend toward servitization, many businesses make a concerted effort to transitionfrom product to product and service integration. This product and system integration is often referred to as a product and service system (PSS). Thus, the real manifestation of the servitization trend is PSS. In order to design and develop PSS, it requires multidisciplinary science because of the complex scope of servitization (Tan 2010). This complexity can be viewed from the internal or external aspects of the company affected by servitization such as the use of technology, the provision of support networks, infrastructure improvements, shifting customer tastes, increasing competitiveness, environmental impacts and others (Haase et al. 2017). The PSS design and development method can be accomplished by paying attention to the service blue print (Kim & Lee 2021). By paying attention to the service blue print, the parties involved and their roles in the value co-creation process can be identified.Kim and Lee (2021) observed eight cases and obtained the following information:

1. Stakeholder collaboration
   The nature of customer participation observed in the blue printisrelated to the time and frequency of involvement. In the process, a balanced level of distribution of customer involvement will greatly benefit the development of PSS.

2. Visualization of process and detailed information
   The service blue print provides a good overview of the process of value creation and development of PSS from process to process so that several characteristics can be identified visually and intuitively.

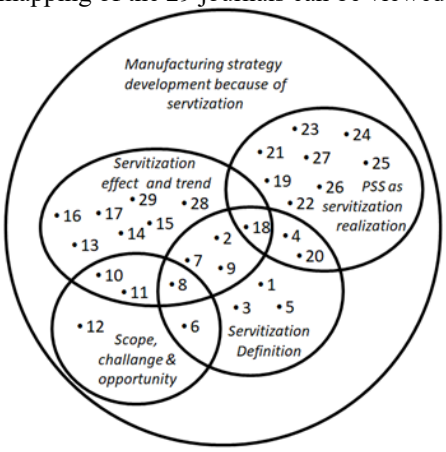
Following the current developments, the design and development of PSS as a tangible form of servitization is carried out by involving technological aspects so that smart PSS appears (Kohtamäki et al. 2021; Wu et al. 2021;Li et al. 2021). In addition, adding value to PSS is also performed by understanding the uniqueness of customers so that personalization appears on PSS(Chiu et al. 2021; Yang et al. 2021). Another trend in the design of PSS is related to sustainability issues (Negash et al. 2021;Hernández Pardo et al. 2012).Research on the design and development of the PSS will always be connected with the development of servitization trends which have global impact(Annarelli et al. 2021). This will have an influence on the strategy of the manufacturing industry from time to time. This dynamism provides many new research opportunities for the development of the manufacturing industry itself.

3. Method

A literature review was the initial stage in the preparation of this paper. The selection of literature was carried out by taking into account the topics of discussion that were relevant to the objectives. This topic was also the storyline in the preparation of this literature review. Through a systematic and coherent flow, the identification of future research opportunities becomes easier. The literature review began with an understanding of the definition of servitization. Based on this definition, the internal or external aspects related to the implementation of servitization could be determined. These related aspects can serve as a support or a challenge in implementing servitization and can be the scope of servitization. Through this scope, future research opportunities are easier to identify. After obtaining information related to the definition and scope, the influence and trends of servitization in the manufacturing industry were described. Prior knowledge related to the definition and scope of servitization can help understand the effect of servitization and understand the reasons for the rise of servitization in the manufacturing industry. After that, a concrete example of the form of servitization in the manufacturing industry was presented, i.e., the product and service system. As a conclusion of the literature review, an identification of future research opportunities was carried out as the output of the literature review.

4. Literature Collection

The preparation of this paper was carried out by collecting 27 literatures with a composition of 19 literatures published in 2021, 3 literatures published in 2020, 2 literatures published in 2019, 1 literature published in 2017, 1 literature published in 2012, 3 literature published before 2011. The literature review was dominated by literature published in 2020-2021. The consideration of this method was to determine the latest trend of servitization development in the last one year. In the process, the literatures that discussed state of the art of servitization and PSS for the last few decades were also reviewed. In addition, several literatures were selected from the publications of 2019, 2017, 2012 and 2010 to complete the information to answer the objectives of this study. From the 29 literatures, a mapping was carried out based on the topic of discussion. Furthermore, the topic was employed as a literature review flow. The results of the mapping of the 29 journals can be viewed in Figure 2.



Information:

1. (Kanatlı & Karaer, 2021)
2. (Kozłowska, 2021)
3. (Rondi et al., 2021)
4. (Kohtamäki et al., 2021)
5. (Rabetino et al., 2021)
6. (Zhou & Song, 2021)
7. (Sousa & da Silveira, 2020)
8. (Mar'Atus Sholihah et al., 2020)
9. (Mustafa et al., 2020)
10. (Paiola et al., 2021)
11. (Mosch et al., 2021)
12. (Mar'atus Sholihah et al., 2019)
13. (Shen et al., 2021)
14. (Wang et al., 2021)
15. (Simonsson & Agarwal, 2021)
16. (Hao et al., 2021)
17. (Doni et al., 2019)
18. (Tan, 2010)
19. (Haase et al., 2017)
20. (Kim & Lee, 2021)
21. (Wu et al., 2021)
22. (Li et al., 2021)
23. (Chiu et al., 2021)
24. (Yang et al., 2021)
25. (Negash et al., 2021)
26. (Hernández Pardo et al., 2012)
27. (Annarelli et al., 2021)
28. (Mathieu, 2001)
29. (Oliva & Kallenberg, 2003)

Figure 2. Prior Research Maping

5. Discussion for future research

The review of the journals above can provide knowledge that the manufacturing industry strategy has developed from time to time to follow the customer taste which is manifested in order qualifiers and order winners. Currently, the customer taste is related to not only the products offered by the company but also the services that support these products. This indicates that innovation management is critical. The possible research is related to the estimated time between innovations and the thing that should be innovated. The problem that often arises on this topic is that the timeliness when innovating is often left behind or inappropriate with the dynamic shifting of customer tastes. Likewise, innovation materials must be appropriate and in accordance with customer tastes. The determination of the innovation material will also be related to the scope of the servitization transition. The determination of the scope will determine whether the selected research area is appropriate for developing innovation. This will be a research topic focusing on effective and efficient innovation management. The research topic is motivated by the complex scope of servitization which may differ from one manufacturing company to another. These differences depend on the unique capabilities of each company.

Another research opportunity that can be carried out is to identify factors that can affect servitization activities so that companies are more adaptive in an effective and easy way. If these factors are identified, the company can focus on controlling these factors so that the transition from product to product and service integration becomes directed and easy. The topic of this research is related to research related to agility in manufacturing strategy in the face of dynamic servitization. The purpose of that research is to increase the company's flexibility and competitiveness.
The flexibility and competitiveness can also be obtained from PSS exploration as a tangible manifestation of servitization. This exploration can be carried out by discussing how far the service components can be embedded in the product. This will affect the effectiveness of the manufacturing strategy applied to compete in the market. The research can be started from the characters of tangible product that has been offered so far. According to the characters of the product, the company can also determine the type of service that is relevant, desirable and effective. Another thing that requires further investigation is related to the cost and benefit ratio analysis. This topic will be very interesting because the addition of services will have other possible consequences such as increased product value, customer acceptance opportunities, product innovation opportunities, and the others. On the other hand, other possible but opposite consequences are additional resources, decreased product awareness by customers, and the others. In this situation, there will be an interesting trade off to study. Thus, research that can be carried out before conducting a cost and benefit ratio analysis is the method of designing and developing a product and service system to determine how much the involvement of effective service is in supporting the product. The findings of this paper's literature study reveal that servitization is having an increasingly affecting on the manufacturing. Product and service system is an example of servitization. The type of service that can be incorporated into the product is determined by the value that will be delivered.

6. Conclusion

Based on the description of the development of servitization trends affecting the development of the manufacturing strategy above, several important points can be noted as follows:

a. In regard to the increasing involvement of service in the manufacturing industry, several previous studies have proposed the definition of servitization and examined the limitations of servitization itself. From several previous studies, various definitions of servitization were obtained. However, in general it can be concluded that servitization is the tendency of manufacturing companies to integrate services into the manufactured tangible products. The existence of integration between products and services causes a mix that sometimes does not see the boundaries between the product and the service itself. Therefore, further research is required to determine the level of service added to the product so that the efforts to integrate products and services become effective.
b. The involvement of service in the manufacturing industry has a big influence on the shift in customer tastes. Eventually, it forced the manufacturing company to adjust the selected business strategy. The shift in customer tastes is caused by additional value to the product that is acquired by the customer. Therefore, many manufacturing companies are transitioning from manufacturing products to integrating products and services.
c. Currently, there are many studies that discuss product and service systems as an alternative manufacturing strategy. Some examples of these research topics are the product and service system development framework, product and service system evaluation, product and service system design case studies and the others. Research on the design and development of PSS will always be connected with the development of servitization trends that have a global impact.

d. The future research opportunities that arise are related to determining the scope of servitization which may vary between companies, related to an effective and efficient innovation management framework, an analysis framework for alignment of servitization transitions with company capabilities, formulation of agility in manufacturing strategies related to servitization, PSS design and development, and evaluation of cost and benefit ratio on the implementation of servitization.

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