

THE MULTI-DIMENSIONAL HIERARCHICAL STRUCTURE OF THE SERVITIZATION TRANSFORMATION

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ABSTRACT

Purpose: This paper is studying the hierarchical structure of the six servitization dimensions, in order to help the reader understand the potential relational maturity effects emerged among these.

Design/Methodology/Approach: This study is framed upon a theoretical reasoning of nine hypothetical relations among servitization dimensions. These postulated relations are investigated by a statistical partial least square analysis, based on 101 observations of Danish SME manufacturers.

Findings: Seven significant relations were identified which emphasise the coexistence of a multi-dimensional transformation. None of these relations were found to add a negative effect.

Originality/Value: As one of the first quantitative studies to investigate the coexistence of multiple servitization dimensions, this study leads to valuable insight and a set of new research avenues.

KEYWORDS: servitization, maturity, multi-dimensional, consequential effects, partial Least Square

1. INTRODUCTION

Servitization is an organisational transformation embracing the entire organisation (Baines et al., 2009). Previous literature has assumed that this transformation is following a redefined and structured path (Oliva et al., 2003), and while the structured progression models are mainly based on large manufacturing firms (Brax et al., 2017), it seems that the versatility of SMEs, facilitate them to succeed through various value constellation in a multifarious progression (Kowalkowski et al., 2013). This indicates that the servitization transformation, in reality, is unstructured and following a continuum. Hence, the maturity of servitization should be understood in a similar manner. Additionally, it is believed that the servitization transformation should be viewed in a multi-dimensional perspective (Baines et al., 2017). While servitization is following a continuum, such multiple dimensions follow a simultaneous progression, which potentially entail a relational influence among each other. Thus, a superior understanding of such relations is crucial to understand the full effects toward a successful progression of servitization. Furthermore, such understanding includes the relational consequential effects among the dimensions (Kindstrom et al., 2014). For this reason, it is the researcher' vision to identify the pathway towards a successful servitization transformation, through unique maturing combinations of the servitization dimensions and underlying components. Firm maturity is defined as the increased capability to manage specific domains (Rapaccini et al., 2013, p. 302). By adopting the view of positive and negative consequential effects, it is believed that a successful transformation consists of the right proportion of several dimension' maturity level. To consider the maturing proportion a profound understanding of the dimensional relations is necessary. Yet, although recent servitization research have successfully presented a comprehensive, or even holistic, framework for understanding the servitization maturity in a multi-dimensional perspective (Adrodegari et al., 2020). It have been emphasised that a profound maturity model embracing the transformation as a whole are still missing, as important components like management and strategic dimensions are absent in current models (Andersen et al., 2020). Extending the thoughts of Adrodegari et al. (2020), Andersen et al. (2020) identified six generic dimensions (organisational governance; strategic management; value function activities; market reach; digital integration; and service integration) consolidated by existing literature of servitization and conceptualised upon prior servitization maturity models (e.g. Jin et al. (2014)). For this reason, these extended dimensions are employed in the further investigation. However, prior research overlooked the importance of understanding the relation among co-existing dimensions, hence failing in taking the fluctuating progression into account. As It is reasonable to believe that such relations are not equivalent among each dimension, a certain hierarchical order may

occur. For this reason, the research is studying the hierarchical structure of the six servitization dimensions, in order to help the reader understand the relational effects emerged among these.

2. THEORY AND HYPOTHESIS

2.1 The Relation of Servitization Maturity Components

As stated by Adrodegari et al. (2020), only few studies have constructed a servitization maturity model (MM) of the transition toward service businesses. The degree of maturity has been assessed upon multifaceted levels, and consist in the literature of pre-defined levels of maturity (Rapaccini et al., 2013), theoretical defined prescriptions (Wikström et al., 2009), and evaluating own performance scores (Coreynen et al., 2018). A similarity for the prior MM is it, that each of the presented MM' evaluate the maturity level of each component individually, and not in relation to each other. Neither do they consider the outcome of other components. An exception is the study by Coreynen et al. (2018), who evaluate the maturity level of each component on multiple observable variables, but who did not consider the relations among the components. For this reason, it leaves a potential to further develop our understanding of MM' by incorporating such balanced view of the relational connections among each dimension, which to our best knowledge has not been achieved within servitization.

2.2 The Hypothetical Relations of Servitization Maturity Dimensions

2.2.1 Organisational Governance

The organisational governance (OG) refers to a firms' ability to build, integrate and align the organisation with the transformational properties from embarking on the servitization journey (Andersen et al., 2020), from which new experiences and realities emerges for the manufacturer (Oliva et al., 2003). These new realities comprise of the need for re-engineer new organisational structures to facilitate service design and delivery (Jin et al., 2014; Rapaccini et al., 2013), and the awareness on managing strategic choices by developing clear, implementable service management policies, process and resources (Tukker et al., 2006). The degree of formalised procedures and processes have been seen as a progression of servitization, as these ensures consistency and quality (Jin et al., 2014). While such formalisation of the organisation follows the organisational concept (Wikström et al., 2009), it is reasonable to believe that such elements have a positive influence on service infrastructure, thus relating to integration of services. Service integration comprise among other things of the firm's ability to seize service opportunities (Coreynen et al., 2018), whereas elements as processes, capabilities and available resources influences the outcome of this dimension. For this reason, are the following hypotheses stated: **H¹**: *A manufacturing firms' degree of organisational governance have an impact on the degree of service integration.* In similar constellations, are the value function activities positively influenced by the allocation of resources, and the organisational structure to facilitate co-created value (Huikkola et al., 2016), this in term of procedure and processes (Coreynen et al., 2018), organisational concept, and personnel approach (Wikström et al., 2009). This in particular by establishing dedicated teams and roles for new service development, and developing specific sales tools, methods and procedures for cost of ownership models (Adrodegari et al., 2020): **H²**: *A manufacturing firms' degree of organisational governance have an impact on the degree of value function.* Further, the availability of resources, formalisation of procedures and processes, and the organisational concept all are seen as instruments for the management to implement new strategic directions. Hence: **H³**: *A manufacturing firms' degree of organisational governance have an impact on the degree of strategic management.*

2.2.2 Strategic Management

Strategic management (SM) refers to firms' ability to build and maintain strategies in order to successfully implement servitization (Andersen et al., 2020; Baines et al., 2017). Prior research investigating the consequences of servitization have emphasised that servitization is a beneficial strategy if managed properly and with strategic focus (Baines et al., 2009; Neff et al., 2014). The managerial commitment poses a fundamental role in maintaining and building strategies of the

transition (Lexutt, 2020; Neff et al., 2014), and is seen as an important element for the value function activities. As the managerial mindset changes toward customer-centric logic, it will facilitate better value propositions through customer integration, hence leading to new value creation and optimised cost structures (Huikkola et al., 2016; Liu et al., 2019). As well as the fundamental change of the organisational culture as accommodative to service provision (Baines et al., 2009). Hence, **H⁴**: *A manufacturing firms' degree of strategic management have an impact on the degree of value function.*

2.2.3 Value Function Activities

The value function activities (VF) refer to firms' ability to embrace servitization by developing new business models that can create and capture value that servitization promises (Andersen et al., 2020; Baines et al., 2014). Particular emphasis are placed on the value chain activities, regarding the responsibility to support service-products throughout the product life-cycle, along with finding an innovative way to make service more tradable, with a functional cost structure (Spring et al., 2013). Managing the value chain activities within servitization can be challenging, and required skills have to be acquired through organisational governance (**H²**)(Adrodegari et al., 2020), as well as new up- and downstream partnerships. The latter, need to be managed effectively in order to leverage the needed capabilities in a strategic management perspective (**H⁴**)(Adrodegari et al., 2020; Cui et al., 2019). For this reason, market reach is an important component for the VF as the co-creation and solution development are enabled through the integration of customer needs (Lenka et al., 2017) and utilising network capabilities (Coreynen et al., 2017). Hence, **H⁵**: *A manufacturing firms' degree of market reach have an impact on the degree of value function activities.*

2.2.4 Market Reach

The market reach (MR) refers to firms' ability to scan the business environment to identify and apply external capabilities and resources in supporting the servitization journey through new and optimised service solutions (Andersen et al., 2020). Prior literature agrees on the importance of value co-creation of whom a particular emphasis is put on the role of customers and network partners (**H⁵**) (Rapaccini et al., 2013). Accordingly, digitalisation enables a deeper integration into customers processes, to reach new levels of servitization through increased network involvement and value creation (Coreynen et al., 2017), which potentially influences both the MR and VF of the firm. Hence, **H⁶**: *A manufacturing firms' degree of digital integration have an impact on the degree of market reach.*

2.2.5 Digital Integration

Digital integration (DI) refers to firms' ability to integrate new technologies, increase external accessibility and apply data as a resource for new service offerings (Andersen et al., 2020). Digitalisation is breaking barriers between industry segments and changing traditional value chains into the provision of services (Kuula et al., 2018). As such, incorporating digital services aims to develop the capturing and processing of data and information, allowing manufacturers to develop new business models by exploiting the potential of their products (Neff et al., 2014; Vendrell-Herrero et al., 2017). Hence, **H⁷**: *A manufacturing firms' degree of digital integration have an impact on the degree of value function.* Digitalisation enables better allocation of resources and more accurate information sharing within and outside the boundaries of the firm (Kindstrom et al., 2014). Both of which positively influences the market reach (**H⁶**) and management governance. Hence, **H⁸**: *A manufacturing firms' degree of digital integration have an impact on the degree of management governance.* Further, digital technologies and appliance create new opportunities and is understood as a core enabler and driver for servitization (Sjödin et al., 2020). Digitalisation is seen as essential for effective delivery by optimising the service infrastructure and processes (Reim et al., 2019), which potentially influence the service integration positively as the maturity of service integration increases: **H⁹**: *A manufacturing firms' degree of digital integration have an impact on the degree of service integration.*

2.2.6 Service Integration

The service integration refers to firms' ability to integrate data appliance from service and product data, service infrastructure, and process and policy formalization into the development of new optimised service solutions (Andersen et al., 2020).

2.3 The multi-dimensional servitization maturity framework

The dimensions compose an essential role in the progression of servitization toward the achievement of it. Success is seen as a progression or development of the focal firm' performance toward a preferred situation (Bustinza et al., 2019), and should be assessed upon financial and non-financial measures. As such, the model is estimated to predict the servitization success (SS), and hence each dimension' prediction toward the endogenous variable (SS). The improvement of each dimension is believed to contribute to a successful achievement of servitization. Figure 1 illuminate the hypothetical relation among each dimension, and illustrates the complexity within the servitization field in a simplified manner. Further assessment of the dimensional impact of servitization success, are outside the scope of this study.

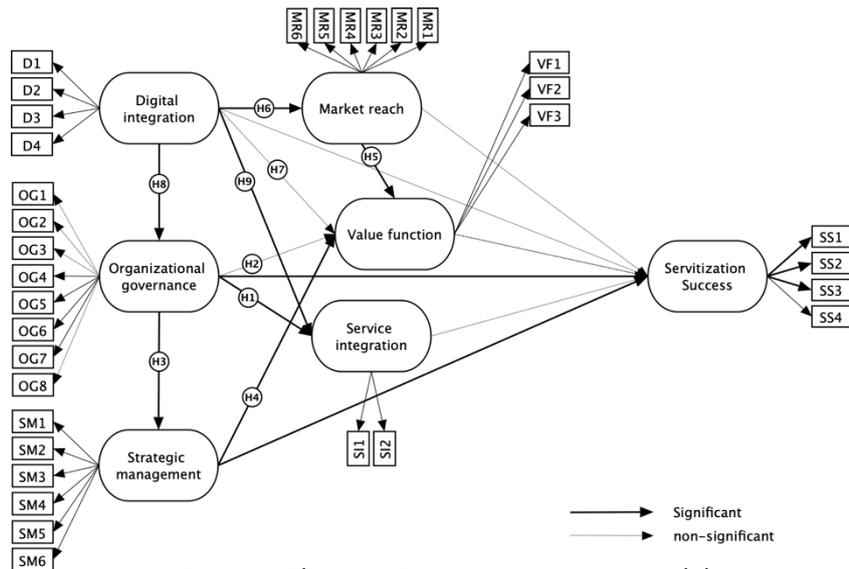


Figure 1 The servitization progression model

3. METHODOLOGY

Inspired by the study of Kohtamäki et al. (2013), the postulated relations are tested upon a partial least square (PLS), by computing the significance of the relations' path-coefficients. PLS is a suitable statistical tool for predicting the relationships rather than explaining them, in the latter covariance-based methods are preferred (Jöreskog et al., 1982). Generally, PLS is seen as more robust than other SEM techniques in violation of statistical assumptions, and are referred to as a distribution-free method (Vilares et al., 2010). The statistical tool SmartPLS 3.0 are used for this study.

3.1 Data Collection, Response Pattern and Respondents

The data collection was distributed through a web-based questionnaire sent to manufacturing firms registered under the Danish industry code 'C28. producers of machinery and tools' within the Danish firm register (CVR.dk). This provided the study with 1.597 potential SMEs of which 1.194 had approved sharing contact information. Additional mails were sent to 358 SMEs enrolled in the Servitize.dk project, to ensure participants with varying degree of service implementation. The first notification comes with a brief description of the research purpose and the potential managerial contribution to encourage the respondents. A second notification were sent to all non-responders six days later. Following the ten times rule, a minimum of observations is estimated by the highest denominator of eighter the largest number of observable variables for a single latent variable (in this case 8), or the largest number of loadings toward a single latent variable (6) in the model (Hair et al., 2011). Thus, a required number of observations are set to 80 respondents. In total, 163 observations were gathered resulting in a response rate of 22,9% (82) for servitize.dk and 6,7% (81) for the industry. Three control variables were included to ensure the relevance of the observations. The degree of servitization established whether firms are involved in a servitization process assessed upon their service

advancement (none, initial, repeatable, defined, managed or optimised) inspired by Rapaccini et al. (2013). The number of employees states whether they are considered a SME (5 removed).

3.2 Measurement of Constructs

The measures and items used in this investigation are adopted from prior research in servitization maturity modelling. By adopting the item formulations by Coreynen et al. (2018), each item are rephrased to statement-related whereas respondents evaluate recent performance upon each item. This evaluation was scaled on a 7-point Likert scale from 1 (strongly disagree) to 7 (strongly agree). As such, being positively related to the progression of servitization with respect for the adopted item' measures. Each item adopted this framing to ease the reading and interpretation by the respondent. As the study have rephrased and structured new items, a particular focus were made on testing the validity and reliability prior to distribution. To assess the internal validity of measures, items and the survey structure, three academic colleagues were invited to evaluate these aspects leading to smaller phrasing adjustments. Further, by inviting one respondent to conduct the survey while observed, additional linguistic adjustments were made. The survey was distributed in Danish, which potentially creates a misinterpretation due to linguistics. To protect the content validity of the translated items, a back-translation were made by letting an unbiased person translate the Danish version into English and compare the English versions. Finally, a pilot test was conducted for test of the measure' reliability and internal consistency. 200 respondents were invited to participate, providing 11 responses. From here, a Cronbach' Alpha ($\alpha = .976$) proved the reliability and consistency of the measures (Hertzog, 2008, p. 185). The final distribution gathered 104 completed observations and 59 partially completed. All observations exceeding an 85% completion rate were merged into the dataset ($n=125$), and a further missing value analysis proved the values as Missing Completely at Random ($P = .483$). To avoid biased results from imputations, a pair-wise deletion was chosen during the investigation. This, however results in an uncertain effective sample size.

3.3 Common Variance

A preliminary analysis of the model and the dataset were made by evaluating the significance of both outer loadings and weights, controlling for variance inflation factors (VIF) and for outliers. This led to a sequential extraction of two items both insignificant in loadings and weights (SS4 and OG3), while no VIF' were identified at this stage. Additionally, an assessment of the factor scores led to a list-wise removal of 24 outliers, with an absolute value above 1.96 ($\alpha=.05$) (Weston et al., 2006). To evaluate the reliability and validity of the estimated model, a further emphasis is put on the internal reliability, convergent validity and discriminant validity in the following. To test for internal consistency a composite reliability of the models' constructs were applied, which fulfilled the criterion for a confirmatory model ($\geq .70$) with adequate reliability as the scores ranged from .781 to .883 (Hair et al., 2011). Further, all outer loadings obtain significant, although several items attained a weak outer loading beneath the criterion of .70 for good indicators. Following Hair et al. (2011), OG8 were removed as it did not surpass the critical .40 cut-off (.384). The remaining weak outer loadings were obtained as the removal of these might harm the content validity. This indicate that the combination of items is insufficient as they do converge poorly. To ensure the convergent validity on the construct level an assessment of the Average Variance Extracted (AVE) were performed. From here, it was evident that the constructs are capable of explaining more than half of the variance of its indicators by exceeding the .50 limit, hence establishing the convergent validity of the constructs (Hair et al., 2011). Further, the discriminant validity was established, as no cross-loadings exceeded the indented loadings of the associated constructs. Additionally, while the disattenuated correlation establishes the discriminant validity for the majority of the constructs, this is not true for OG (Heterotrait-Monotrait ratio = .962), which emphasises the necessity for remodelling the construct. While OG2 (.512) and OG1 (.557) showed weak loadings, these were previously kept for the sake of content validity. However, as the analysis illuminate how each discriminates the validity, these are removed sequentially. Finally, a

bootstrapping procedure were performed with 2000 re-samples with the same number of cases as the original sample (n = 101), to establish the significance of the postulated relations.

Table 1 - Adopted and rephrased Items and constructs

Constructs and Items (all measured in 7-point Likert scale)	Loading
Organizational Governance (1 strongly disagree – 7 strongly agree)	
OG1: We have incorporated a focus on natural work flows within the entire organization – Wikström et al., 2009	-
OG2: We have prioritized business development – Wikström et al., 2009	-
OG3: We encourage employees to manage decision on their own - Coreynen et al., 2018	-
OG4: We have ensured a formal, optimized process for the service delivery - Coreynen et al., 2018	.744***
OG5: We are able to turn service activities into a profitable business - Coreynen et al., 2018	.914***
OG6: We are able to turn service activities into a professional business - Coreynen et al., 2018	.886***
OG7: We have procedures and routines to minimize costs related to new service activities - Coreynen et al., 2018	.848***
OG8: We can overcome internal resistance and conflicts - Coreynen et al., 2018	-
Strategic management (1 strongly disagree – 7 strongly agree)	
SM1: [Our management] consider services as a lasting differentiation strategy – Coreynen et al., 2018	.686***
SM2: ... consider the combination of products and services as a potential way to improve profitability – Coreynen et al., 2018	.782***
SM3: ... aims to exploit the financial potential of services – Coreynen et al., 2018	.836***
SM4: ... considers services to compensate fluctuating product sales – Coreynen et al., 2018	.715***
SM5: ... considers services as highly profitable – Coreynen et al., 2018	.771***
SM6: We are able to formulate clear service-related strategies and objectives – Coreynen et al., 2018	.676***
Value function activities (1 strongly disagree – 7 strongly agree)	
VF1: Are able to provide a performance-based solution that guarantees product's operational performance – Cui et al., 2013	.741***
VF2: We are able to provide customized cost structures for our customers – Cui et al., 2013	.672***
VF3: We evaluate the operating and financial risks and manage uncertainty continuously – Lexutt, 2020	.777***
Market reach (1 strongly disagree – 7 strongly agree)	
MR1: We analyse what we would like to achieve with each customer – Coreynen et al., 2018; Jin et al., 2014	.680***
MR2: We regularly discuss with our customers how we can support one another in our success – Cui et al., 2014	.789***
MR3: We remain informed about the goals, potential and strategies of our customers – Coreynen et al., 2018	.764***
MR4: We analyse what we would like to achieve with each supplier – Coreynen et al., 2018	.787***
MR5: We determine in advance possible suppliers with whom to discuss the building of relationships – Coreynen et al., 2018	.703***
MR6: We remain informed about the goals, potential and strategies of our suppliers – Coreynen et al., 2018	.752***
Digital Integration (1 strongly disagree – 7 strongly agree)	
D1: Our technology allows fully automated and optimized real-time data – Neff et al., 2014	.717***
D2: Our IT systems allows us integrated access to customer-related data – Coreynen et al., 2018	.857***
D3: Our IT systems allows us integrated access to value chain-related data – Coreynen et al., 2018	.830***
D4: Our IT systems allows us integrated access to market-related data – Coreynen et al., 2018	.801***
Service integration (1 strongly disagree – 7 strongly agree)	
SI1: We can easily add significant product-service variety without increasing costs – Coreynen et al., 2018	.915***
SI2: We can add product-service variety without sacrificing quality – Coreynen et al., 2018	.770***
Servitization Success (1 strongly disagree – 7 strongly agree)	
SS1: We were able to increase the service-specific revenue in the previous 24 months (only services)	.851***
SS2: We were able to increase the company-specific profit margin in the previous 24 months (entire firm)	.673***
SS3: Degree of service implementation (service advancement) – Jovanovic et al., 2016	.675***
SS4: Our sales are primarily to established customers with recurring buying patterns (Customer's loyalty) -	-

*** $p \leq 0.001$ ** $p \leq 0.01$ * $p \leq 0.05$

4. RESULTS

The reconfigured model obtains a SRMR of .098 (<.10) indicating an acceptable fit (Weston et al., 2006). The inner model obtained no critical collinearities with a max VIF of 2,23. Overall, the validity and reliability of the items and constructs are assessed as acceptable for a preliminary study with reasoning in statistical and theoretical emphasis. Further, the model were capable of explaining 44,2% of servitization success, with an adjusted R² of .442, which emphasis weak strength of the model (Hair et al., 2011). The relations emerged from OG, counts the connections toward SI (H1), VF (H2) and SM (H3), of which the relation between OG to SI ($\beta=.40$; $p \leq .05$) and OG to SM ($\beta=.68$; $p \leq .05$) were significant. In the meantime, the relation from OG to VF ($\beta=-.03$; n.s.) were statistically insignificant. Hypothesis 4 identified a significant relation from SM to VF ($\beta=.31$; $p \leq .05$), similar to the relation from MR to VF ($\beta=.47$; $p \leq .05$). Further, the DI obtained the most postulated relations, and hence the potential strongest emphasis for increasing the servitization effort. The relations emerged from DI included DI to MR (H6; $\beta=.41$; $p \leq .05$), DI to OG (H8; $\beta=.40$; $p \leq .05$) and DI to SI (H9; $\beta=.37$; $p \leq .05$) which all returned significant, while DI to VF (H7) were insignificant. The majority of relations toward servitization success were found to be insignificant except SM to SS ($\beta=.21$; $p \leq .05$) and OG to SS ($\beta=.44$;

$p \leq .05$). This, however, can be explained by a poorly estimation of SS, which the outer loadings did imply and due to the removal of SS4. The evaluation of these relations is illustrated in figure 1.

5. DISCUSSION

The study identified seven statistically significant relations among the servitization dimensions, hence retaining the majority of the postulated hypothesis. The findings demonstrate several relations, impacting several dimensions simultaneously, which strengthen the idea of servitization as a continuous transformation of multiple coexisting dimensions. As interestingly, none of the significant relations articulated a negative consequential effect, although OG to VF possessed a small insignificant negative effect ($\beta = -.033$). This indicates that the dimensions are positively influenced by each other, and it is reasonable to conclude, that an increase in one dimension, leads to an increase in another related dimension. Such findings, allows practitioners to evaluate future plans accordingly to the potential impact of each dimension. This, by acknowledging the relational effect among each other, but in particular by estimating an accurate influence. The composite value calculated through linear weighting process based on the models outer loadings and the respective response of each item (Song et al., 2013), potentially provides the practitioners with such preliminary evaluation tool of own servitization maturity score of each dimension. The standardised outer loadings interpret the impact of each predictors toward the intended construct, while the path coefficients reveal the impact of each relation. As such, these findings potentially can be used to assess the importance of each theoretical element, hence ease the decision-making process, by allocating resources to the elements with the highest impact toward a given goal. For instance, an increase of the manufacturer's organisational governance eventually led to an increase of .683 in the performance of strategic management, which e.g stems from the allocated resources. Furthermore, this weighted importance of each dimension' role in servitization, emphasising important streams for future research. However, as the PLS are most suitable for predicting relations, additional investigations are needed to obtain the explanation of these predictions. Despite the delimitation of the model, due to the remodelling in section 3.3, it is reasonable to believe that these relations provide important insights in the search of fully understanding the field of servitization as a whole.

6. CONCLUSION

This research illuminated new insight into the hierarchical structure of the six servitization dimensions, by theorising and statistically identifying seven significant (DI>OG, DI>MR, DI>SI, OG>SI, OG>SM, SM>VF, MR>VF) and two insignificant (DI>VF, OG>VF) relations. These findings add to the stream of a multi-dimensional perspective of servitization maturity, by establishing the coexistence of the six dimensions. Further, these findings provide practitioners with a preliminary foundation for decision-making through weighted importance of each dimension, their relations and underlying parameters. Importantly, none of the relations had a significant negative consequential effect. Due to the limitations of the model, additional studies into statistical predictors of the dimensions are needed. In particular, this study calls for further investigation into predictors of organisational governance and servitization success to enable a better prediction of the dimensions impact. Finally, additional research into usability of the weights, and the identified relations are welcome. Overall, it is believed that these findings are an important first step toward a unique maturing combination approach.

7. LIMITATIONS

The study is lacking under the need for a clear definition of servitization success, which hindered the ability to construct or adopt predictors of this dimension.

REFERENCES

- Adrodegari, F., , & Sacconi, N. (2020). A maturity model for the servitization of product-centric companies. *Journal of Manufacturing Technology Management*, 31(4), 775-797.
doi:10.1108/jmtm-07-2019-0255

- Andersen, T. C. K., Madsen, M. E. E., & Goduscheit, R. C. (2020). *Key Dimensions of Assessing Servitization Towards a conceptual maturity model*. Paper presented at the CINet Conference 2020, Milan.
- Baines, T., Bigdeli, A. Z., Bustinza, O. F., . . . Ridgway, K. (2017). Servitization: revisiting the state-of-the-art and research priorities. *International Journal of Operations & Production Management*, *37*(2), 256-278. doi:10.1108/ijopm-06-2015-0312
- Baines, T., & Lightfoot, H. W. (2014). Servitization of the manufacturing firm Exploring the operations practices and technologies that deliver advanced services. *International Journal of Operations & Production Management*, *34*(1), 2-35. doi:10.1108/ijopm-02-2012-0086
- Baines, T. S., Lightfoot, H. W., Benedettini, O., & Kay, J. M. (2009). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management*, *20*(5), 547-567. doi:10.1108/17410380910960984
- Brax, S. A., & Visintin, F. (2017). Meta-model of servitization: The integrative profiling approach. *Industrial Marketing Management*, *60*, 17-32. doi:10.1016/j.indmarman.2016.04.014
- Bustinza, O. F., Gomes, E., Vendrell-Herrero, F., & Baines, T. (2019). Product-service innovation and performance: the role of collaborative partnerships and R&D intensity. *R & D Management*, *49*(1, SI), 33-45. doi:10.1111/radm.12269
- Coreynen, W., Matthyssens, P., & Gebauer, H. (2018). Are You Ready for Servitization? A Tool to Measure Servitization Capacity. In M. Kohtamäki, T. Baines, R. Rabetino, & A. Z. Bigdeli (Eds.), *Practices and Tools for Servitization: Managing Service Transition* (pp. 25-39). Cham: Springer International Publishing.
- Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management*, *60*, 42-53. doi:10.1016/j.indmarman.2016.04.012
- Cui, L. G., Su, S. I. I., Feng, Y. C., & Hertz, S. (2019). Causal or effectual? Dynamics of decision making logics in servitization. *Industrial Marketing Management*, *82*, 15-26. doi:10.1016/j.indmarman.2019.03.013
- Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139-152. doi:10.2753/MTP1069-6679190202
- Hertzog, M. A. (2008). Considerations in Determining Sample Size for Pilot Studies. *Research in Nursing & Health*, *31*, 180-191. doi:10.1002/nur
- Huikkola, T., Kohtamäki, M., & Rabetino, R. (2016). Resource Realignment in Servitization: A study of successful service providers explores how manufacturers modify their resource bases in transitioning to service-oriented offerings. *Research-Technology Management*, *59*(4), 30-39.
- Jin, D., Chai, K.-H., & Tan, K.-C. (2014). New service development maturity model. *Managing Service Quality: An International Journal*, *24*(1), 86-116. doi:10.1108/msq-10-2012-0134
- Jöreskog, K. G., & Sörbom, D. (1982). Recent developments in structural equation modeling. *Journal of Marketing Research*, *19*(4), 404-416.
- Kindstrom, D., & Kowalkowski, C. (2014). Service innovation in product-centric firms: a multidimensional business model perspective. *Journal of Business & Industrial Marketing*, *29*(2), 96-111. doi:10.1108/jbim-08-2013-0165
- Kohtamäki, M., Partanen, J., & Möller, K. (2013). Making a profit with R&D services — The critical role of relational capital. *Industrial Marketing Management*, *42*(1), 71-81. doi:10.1016/j.indmarman.2012.11.001
- Kowalkowski, C., Kindstrom, D., & Gebauer, H. (2013). ICT as a catalyst for service business orientation. *Journal of Business & Industrial Marketing*, *28*(6), 506-513. doi:10.1108/JBIM-04-2013-0096
- Kuula, S., Haapasalo, H., & Tolonen, A. (2018). Cost-efficient co-creation of knowledge intensive business services. *Service Business*, *12*(4), 779-808. doi:10.1007/s11628-018-0380-y
- Lenka, S., Parida, V., & Wincent, J. (2017). Digitalization capabilities as enablers of value co-creation in servitizing firms. *Psychology & marketing*, *34*(1), 92-100.

- Lexutt, E. (2020). Different roads to servitization success – A configurational analysis of financial and non-financial service performance. *Industrial Marketing Management*, 84, 105-125. doi:10.1016/j.indmarman.2019.06.004
- Liu, F. H., Chen, L. J., & Tsou, H. T. (2019). Suppliers' local network embeddedness and buyers' joint innovation. *International Marketing Review*, 36(3), 342-364. doi:10.1108/imr-05-2018-0164
- Neff, A. A., Hamel, F., Herz, T. P., Uebernickel, F., Brenner, W., & vom Brocke, J. (2014). Developing a maturity model for service systems in heavy equipment manufacturing enterprises. *Information & Management*, 51(7), 895-911. doi:10.1016/j.im.2014.05.001
- Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172. doi:10.1108/09564230310474138
- Rapaccini, M., Saccani, N., Pezzotta, G., Burger, T., & Ganz, W. (2013). Service development in product-service systems: a maturity model. *The Service Industries Journal*, 33(3-4), 300-319. doi:10.1080/02642069.2013.747513
- Reim, W., Sjödin, D. R., & Parida, V. (2019). Servitization of global service network actors—A contingency framework for matching challenges and strategies in service transition. *Journal of Business Research*, 104, 461-471.
- Sjödin, D., Parida, V., Kohtamäki, M., & Wincent, J. (2020). An agile co-creation process for digital servitization: A micro-service innovation approach. *Journal of Business Research*, 112, 478-491.
- Song, M. K., Lin, F. C., Ward, S. E., & Fine, J. P. (2013). Composite variables: when and how. *Nurs Res*, 62(1), 45-49. doi:10.1097/NNR.0b013e3182741948
- Spring, M., & Araujo, L. (2013). Beyond the service factory: Service innovation in manufacturing supply networks. *Industrial Marketing Management*, 42(1), 59-70. doi:10.1016/j.indmarman.2012.11.006
- Tukker, A., & Tischner, U. (2006). Product-services as a research field: past, present and future. Reflections from a decade of research. *Journal of Cleaner Production*, 14(17), 1552-1556. doi:10.1016/j.jclepro.2006.01.022
- Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, 60, 69-81. doi:10.1016/j.indmarman.2016.06.013
- Vilares, M. J., Almeida, M. H., & Coelho, P. S. (2010). Comparison of Likelihood and PLS Estimators for Structural Equation Modeling: A Simulation with Customer Satisfaction Data. In V. Esposito Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Handbook of Partial Least Squares: Concepts, Methods and Applications* (pp. 289-305). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Weston, R., & Gore, P. A. (2006). A Brief Guide to Structural Equation Modeling. *The Counseling Psychologist*, 34(5), 719-751. doi:10.1177/0011000006286345
- Wikström, K., Hellström, M., Artto, K., Kujala, J., & Kujala, S. (2009). Services in project-based firms – Four types of business logic. *International Journal of Project Management*, 27(2), 113-122. doi:10.1016/j.ijproman.2008.09.008

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