# A Capability Model for Equipment-as-a-Service Adoption in Manufacturing Companies


**Jonathan Rösler and Thomas Friedli**

**Abstract** In the light of digital transformation, manufacturing companies are challenged to rethink their business models as technologies, such as the Internet of Things (IoT), that allow innovative product and service offerings. Equipment-as-a-service (EaaS) is a business model that combines both the product and the services needed to maintain and operate the equipment in one offering, whereas the revenue model is based on the actual value (e.g. usage-based, availability-based, outcome-based) provided. Despite high practical relevance, little is known about the required capabilities to introduce and operate such models, as this phenomenon has just started to be explored. Addressing this gap, our study aspires to provide a first understanding of which capabilities are required for introducing and operating the EaaS business model. Based on the insights gathered from interviews with 18 executives from over 14 manufacturing companies that have introduced such offerings, we present a capability model for assessing the maturity needed to introduce and offer EaaS. While bridging the gap between theory and practice, we leveraged state-of-the-art knowledge to help manufacturing companies better understand where they find themselves concerning the capabilities required to introduce and operate the EaaS model.

**Keywords** Servitization · Business model · EaaS

## 1 Introduction

Within the increasingly globalized environment of today, manufacturing companies need to stand up to global rivalry. Low-cost production deriving from less developed countries, as well as the increasing commoditization, place the utmost uncertainty upon manufacturing companies' revenue streams and economic margins (Kindström 2010; Reinartz and Ulaga 2008). The importance of services within manufacturing and product-oriented companies are widely recognized to counter this phenomenon (Baines et al. 2013; Ulaga and Reinartz 2011; VanDerMerwe and Rada 1988). The

J. Rösler (✉) · T. Friedli
Institute of Technology Management, University of St Gallen, Dufourstr. 40a, 9000 St. Gallen, Switzerland
e-mail: jonathan.roesler@unisg.ch



S. West et al. (eds.), *Smart Services Summit*, Progress in IS,
https://doi.org/10.1007/978-3-030-72090-2_6

shift towards service offerings rather than product offerings is referred to as servitization, the transformation of manufacturers into solution providers (Raddats et al. 2019). Switching away from a product centric offering promises interesting paths to implement innovative business models (Baines et al. 2013)

Our research shows how manufacturers increasingly contemplate moving away from transactional relationships and into relationship-based business models, thus, selling customers the ability to use their product without having to purchase them.

In such business models, the providing company is no longer paid for its service activities, such as materials or repairs, but rather upon the outcome of such activities in a continuous setting, e.g., the number of usage hours or the achieved availability of products. Despite widely acknowledged benefits of providing such an offer to customers (Grubic and Jennions 2018), the fundamental question of how companies can introduce and operate EaaS remains widely unanswered to practitioners. In essence, manufacturing companies face difficulties to design and operate such and similar models (Windahl and Lakemond 2006).

As the implementation of Equipment-as-a-Service (EaaS) requires deep changes within and across organizational boundaries of manufacturing companies, the question regarding how manufacturing companies can introduce and operate such models reveals to be of practical importance rather than only theoretical significance. However, existing studies that address this topic are scarce.

Drawing on the resource-based view (RBV) of firms, our study examines the required capabilities to introduce and operate EaaS. We develop a holistic capability-based maturity model to guide manufacturing companies in their endeavor to introduce and operate EaaS. To achieve this purpose, we follow the maturity development process of Becker et al. (2009) to answer the following overarching research questions:

RQ: *What capabilities are required by manufacturers for the introduction and operation of the EaaS business model?*

The remaining of this paper is structured as follows: first, we will present key literature. Secondly, we will outline the methodological approach adopted, including details regarding data collection. Third, we will introduce our proposed maturity model for EaaS. Lastly, we finish by further elaborating on the implication of our findings and present a brief conclusion.

## 2 Theoretical Background

Shifting away from transactional and product-oriented approaches to outcome-based contracts (Ng et al. 2013; Visnjic et al. 2017) through EaaS and similar models, such as result-oriented product service systems (Gebauer et al. 2017), or pay-per-use models (Porter and Heppelmann 2015) have been discussed as feasible options for manufacturing companies for decades. Empirical evidence on the successful introduction of such models is, however, mixed at best (Porter and Heppelmann

2015). Whereas examples such as Xerox, Rolls Royce, GE, or Hitachi are often seen as "success stories", the majority of manufacturing companies have yet been unable to offer such models successfully.

In recent times, the most prominent topic within both practice and theory has been how technological possibilities to realize such advanced business models have dramatically increased due to digitalization (Rymaszewska et al. 2020).

The Internet of Things (IoT) is one of the main enablers of these advanced outcome-oriented servitization business models (Becker et al. 2009; Ng and Wakenshaw 2017). The IoT is a system of uniquely identifiable and connected products ('things') generating an internet-like structure that enables a real-time flow of sensing, operation, and location data (Tukker 2004).

Research within this domain has shown that IoT-enabled servitization strategies offer great economic opportunities, closer customer contact, increased sustainability, more stable revenue streams, and improved resource utilization (Kohtamaki et al. 2019; Ng et al. 2012; Reim et al. 2015). Additionally, shifting from product selling to customer problem-solving and outcome provision offers valuable opportunities for customers by mitigating risks and improving operating performance or asset effectiveness (Ng et al. 2012).

However, the shift in processes needed to actuate servitization towards delivering outcomes can be difficult at best, as it requires a significant organization-level change (Benedettini et al. 2015; Story et al. 2017), and many companies lack information to understand the risks associated with such offerings. Moreover, most companies are facing troubles to identify and design suitable EaaS business models and have difficulties in convincing people in the organization to enact such changes towards outcome delivery.

Also, a profound understanding of what and how to organize to achieve an EaaS business model is not always there. There are various further open questions on how value-creating activities are ultimately changing, and which capabilities are required for such changes. In particular, no work on the specific capabilities required for enacting EaaS has been found.

## 3 Research Methodology

To fill the gaps that emerged from previous analyses, we adopted a three-step research process.

First, we carried out a systematic literature search of servitization-related capabilities using the Scopus database. The search was targeted at scholarly or peer-reviewed research papers. We applied a search combination of servitization ("Servitization"), product-service systems ("product (-) service system*", "PSS"), advanced services ("advanced service*"), integrated solutions ("integrated solution*"), performance contracting ("performance contracting", "PBC"), Pay-per-Use ("Pay-per-Use", "PPU", Pay-per-X"), Equipment-as-a-Service, and other related keywords ("Equipment-as-a-Service", "EaaS", "Machine-as-a-Service", "MaaS",

"Product-as-a-Service", "PaaS", "as-a-Service", "XaaS", "aaS", "as a Service"), and capabilities ("capability").

The search conducted between 2000 and 2020 yielded 134 usable articles with review criteria based on the relevance of the abstracts and keywords (first stage) and the content of each publication (second stage). The reviewing procedure included carefully reading, reviewing, and sorting the found articles. These articles were used to derive an initial list of capabilities. Given the employment of a single search engine, no duplicates were found nor excluded.

Secondly, we conducted semi-structured interviews of 90 min with executives from manufacturing companies that were either already experienced in EaaS offerings (12 interviews) or were significantly ahead in piloting these (2 interviews). To refine the model, we asked for their perception of necessitated capabilities for EaaS and validated with them our initial list of capabilities derived from the literature review. We used publicly available information to verify the information given concerning the companies and their offerings.

Third, after formulating the capability-maturity model, we interviewed 15 individuals, academics, and practitioners involved within the topic for their opinions to build support for the model. Each interview was of 60 min. Emails with a questionnaire to guide the open conversations were distributed in advance.

The majority of the responses acknowledged the importance of evaluating manufacturers' capabilities for introducing and operating EaaS and supported the overall structure of the model. Minor adjustments were made regarding the designation of the dimensions. Furthermore, we evaluated the comprehensiveness of the model and validated the results in a self-assessment with the interviewees from steps two and three.

## 4 Proposed Capability Model

Our model consists of 27 capabilities organized against 8 dimensions (see Table 1) based on the identified requirements and key business activities derived from literature and interviews with field experts: (1) *Organization & Governanc*e, (2) *Value network*, (3) *Data & Analytics*, (4) *Research & Development*, (5) *Marketing & Sales*, (6) *Operations*, (7) *Risk management*, and (8) *Culture.*

For each dimension, the corresponding maturity can be measured on a 5-point scale (ranging from '0 = poorly developed' to '5 = strongly developed') that has been calculated from the average obtained by evaluating the items within each dimension.

To visualize the results, respondents could calculate the average scores for each construct and plot them on a radar chart for their company or business unit. Whenever respondents from the same organization completed the maturity assessment, they could either compare their respective charts or calculate total average scores for each construct to create a shared chart. The tool could therefore be used to compare different business units or companies.

**Table 1** Identified dimensions and capabilities of the EaaS capability model

| Dimension | Capability |
|---|---|
| Organization & governance | (1) Fast decision making, (2) Ability to allocate roles flexibly, (3) Efficient process (re-)design |
| Value network | (1) Identification and analysis of relevant partners, (2) Organizational alignment with network, (3) Ability to co-design processes, (4) Ability to evaluate intermediaries' performance |
| Research & Development | (1) Ability to design products for service, (2) Ability to design for disassembly, (3) Ability to design for recycling, (4) Ability to anticipate potential causes of product failure, (5) Ability to update/upgrade the product |
| Data & analytics | (1) Ability to convince the customer to share data, (2) Ability to translate data into value, (3) Ability to ensure data privacy and security |
| Marketing & sales | (1) Understand the customer's value drivers, (2) Ability to quantify the value provided by the offer, (3) Ability to communicate the individual benefits of the offer, (4) Performance evaluation, (5) Ability to quickly share information among the entire sales force, (6) Ability to design incentives aligned with customer's benefits from the offer, (7) Ability to establish trustworthy relationships with customers |
| Operations | (1) Ability to solve "digital" complaints and incidents, (2) Ability to quickly react to fast-changing situations |
| Risk management | (1) Ability to quantify, control, and monitor risks |
| Culture | (1) Ability to establish a continuous learning culture, (2) Internal communication |

## *4.1 Organization and Governance*

Our data imply that moving towards Equipment-as-a-Service requires a fundamental change in the company's system of making and implementing decisions as well as in its organizational structure.

In particular, our interviewees frequently emphasized that they had to completely rethink their decision-making process and operating guidelines for being able to operate their EaaS model successfully. Overwhelmed by this transformation and the frequently occurring organizational resistance, sometimes, companies decided hence to set up entirely new organizational units.

In this context, the undertaking of *efficient process re-design* without significantly increasing costs was one of the most frequently mentioned capabilities in the interviews. Besides, more than ever, the use of cross-functional teams was highlighted as a proven practice to deal with complex and interdisciplinary problems when moving to this new business model. Also, the ability to *allocate roles flexibly* was therefore considered an essential prerequisite for offering EaaS. Finally, as many firms faced

great operational hurdles when introducing their EaaS model, *fast decision making* was revealed to be of great importance.

## 4.2 Value Network

To develop and operate the EaaS model, often, a new level of cooperation and value co-creation with third parties beyond customers is required. Our data shows that manufacturing firms willing to adopt EaaS, therefore, need to develop more intimate relationships with their customers and partners within their respective ecosystems. Consequently, capabilities that relate to coordinating and integrating with these partners, i.e. for billing or financing, become of high value.

In many interviews, the vast number of potential partners who offer or develop solutions aiming to support manufacturing companies with their EaaS model was addressed. This frequently led to a certain complexity regarding the question of which partner possesses the best offering and who could be a reliable long-term partner for the company. Hence, manufacturers need to further develop capabilities that allow the *identification and analysis of relevant partners* for their EaaS model.

Moreover, once such partnerships were established, the experience with such intermediaries was not always satisfactory. Many of these partners, such as platform operators, were often unable to keep their promises or, as financing partners, turned out to be too expensive when scaling up the model. The ability to *evaluate intermediaries' performance* systematically and suitably was thus mentioned repeatedly.

Also, we found that the EaaS business model led to much closer cooperation with partners as well as a deepening of customer relationships. Consequently, manufacturers build up capabilities that facilitate *organizational alignment with the network*. For instance, the majority of interviewed manufacturers have somehow aligned their organizational structure to leverage the efficiencies within their value creation network. Striving for these efficiency gains, many interviewees noted that they had also re-designed their processes tailored to the needs of all partners. Consequently, many companies had to learn to *co-design processes* with all of the actors found within the EaaS ecosystem.

## 4.3 Research and Development

The EaaS business model is something that cannot be implemented from one day to another. In contrast, manufacturing companies need to optimize their products and services in line with the model and consequently build up the associated capabilities.

For instance, our data indicates that companies have to improve their capabilities to *design products for service*. Namely, to operate the EaaS model efficiently, easy

accessibility of components for maintenance must be ensured or products equipped with sensors.

As at times, the cost of recycling is higher than that of purchasing the equipment, the ability to *design for recycling* at low cost is a factor that will become predominant as the provider takes over the ownership of its assets.

Furthermore, the ability to *design for disassembly* was addressed by some companies. For instance, if an EaaS contract expires, the machine must likewise be dismantled or sold on the aftermarket. Our interviews showed how manufacturers often had a lack of such skills or resources. Consequently, it seemed all the more crucial to enable the simplest possible dismantling system.

With products installed at the customer's facility and getting paid on output or outcome achieved with the equipment, another indispensable capability is the ability to *anticipate potential causes of product failure.* Manufacturers highlighted how they often were forced to further develop within their product innovation organizations as well as begin to apply techniques, such as Failure Mode and Effects Analysis (FMEA). This is because manufacturers needed to improve their products to avoid the downtime of equipment.

Besides these capabilities, our interviewees emphasized the importance of being able to take the customer with them in the development process and receive honest feedback. Often challenged by internal resistance, manufacturing companies should therefore go to customers during the EaaS drafting process.

Finally, many interviewees have pointed out the importance of understanding new trends and technologies that they were able to utilize for their offerings. Market intelligence hence often laid the foundation to develop EaaS models.

## *4.4 Data and Analytics*

To successfully operate and offer EaaS models, companies need to expand their current resource base with digital capabilities. Our data indicate that a necessity for this came not only from being able to operate or design better products but also from many manufacturers selling their EaaS model within their core value proposition of improving the customer's operational efficiency via the model.

This translates into having the equipment readily connected, and the data interpreted and turned into value for either the provider or the customer. Both the ability to *convince the customer to share data* and to *translate data into value* were detected.

As it is not trivial to get access to product status data, product usage data, customer process data, and other sources of data, manufacturers emphasized how customers needed to be sure that their data was well-protected. Hence, we found the ability to *ensure data privacy and security* to be another crucial capability within this dimension.

## *4.5 Marketing and Sales*

Designing, selling, and marketing the EaaS business model turned out to be a key challenge within manufacturing companies. Not least because the skills to identify and demonstrate the value of such a business model have not been heavily developed in typically transaction-driven equipment or service sales organizations of manufacturing companies. Additionally, the ability to design a revenue model that takes into account both the provider and customer perspective is challenging.

Manufacturing firms, therefore, need to be able to assess, and thus identify and then quantify, as well as communicate the total value of their EaaS offer. In detail, we found seven capabilities necessary for offering the EaaS business model in this dimension:

First, we found that EaaS providers need capabilities that allow them to develop an intimate understanding of their customers' needs, processes, requirements, earnings logic, and product use. We characterized this as the ability to "*understand the customer's value drivers"*. This is mainly due to the different usage behavior of customers and their diverse value drivers, be it productivity, quality, or other factors as shown in our interviews. Manufacturing firms need to be able to connect their value propositions with their customer's needs when drafting their EaaS model. In this context, segmenting customers based on such vale drivers was a common practice observed in the interviewed companies.

Second, our data suggest that the ability to *quantify the value provided by the offer* is of significant importance. Moreover, manufacturing companies should be able to determine the lifecycle costs of the solution as well as to have an intimate understanding of their customer's earnings logic to quantify the total customer lifetime value provided with their EaaS model. Although essential to designing a profitable revenue model for their EaaS offer, usually, we found these capabilities to be not well developed inside the companies in our sample, particularly before moving towards offering EaaS.

Third, when offering the EaaS model to customers, manufacturers need to upgrade their current maturity by being able to *communicate the individual benefits of the offer*, such as compared to the next-best alternative. In particular, the ability to convince customers to decide on the EaaS model, and to agree on the contract duration, the price model, including how to share benefits, emerged as a significant barrier in scaling up this model. Regularly, sales teams of the interviewed manufacturers started to elaborate on the current baseline whenever showing the multiple benefits that the EaaS model offered to their customers. Our interviewees also mentioned that having access to insights about the competitor's offerings and strategies allowed them to better communicate their specific value proposition. Manufacturers should, therefore, develop a profound understanding of their competitor's offering to elaborate on the individual benefits of the EaaS model from a comparative standpoint.

Fourth, manufacturing companies need to develop capabilities that allow them to assess the related costs and contribution margin of their EaaS offer. Our data suggest that many manufacturers had found their initial revenue model to be insufficient,

which often meant that the model could not be operated profitably. The ability to design or adjust the price model based on such an analysis is hence a crucial capability, which we named *"Performance evaluation."*

Fifth, as EaaS requires a reconfiguration of the sales approach, manufacturing companies need to develop capabilities that allow them to *quickly share information among the entire sales force*. Our data suggest that most manufacturing companies are quite diverse in the way they sell their products globally. To sell EaaS on a global scale, companies, therefore, need to train their entire sales force, for which information and documents are needed to be shared smoothly across the whole organization. Furthermore, as selling EaaS was typically considered to be of greater complexity, this capability allowed companies to share "best-practices" within their sales teams.

Sixth, companies need to improve their ability to *design incentives aligned with customer's benefits from the offer* with the EaaS model. Our interviewees often highlighted how they had to adjust their sales incentives to be successful within their EaaS. As EaaS is a completely new business model, salesforce had great benefits from selling EaaS at first. Coupled with the customer's success with the model, many sales roles were, however, re-defined from being one-time sellers to customer success related roles, ensuring that customers were satisfied with the offer.

Seventh and finally, our interviewees also highlighted the ability to *establish trustworthy relationships with customers* across the entire organization to convince customers to opt for the EaaS model. More than before, manufacturing companies should keep their promises and focus on facilitating professional customer account management.

## *4.6 Operations*

By taking on maintenance responsibilities from the customers, providers of EaaS models are more than ever required to deliver comprehensively high quality when it comes to service. Managing the value chain of their EaaS offering, therefore, becomes a key task for manufacturers.

Our data shows that manufacturing companies willing to introduce EaaS should be able to *solve "digital" complaints and incidents* with the same quality and speed as "hardware" related complaints and incidents. For instance, if remote monitoring functions were to go offline, manufacturers would need to be fast at fixing such an error.

Moreover, manufacturing companies need to develop the capability to *quickly react to fast-changing situations*. Our interviewees highlighted the difficulties to operate EaaS on a global scale. For which automated business processes, coordinated salesforce, and field service organization, as well as the use of digital field management software, and access to relevant customer data, were all mentioned as key success factors.

### 4.7 Risk Management

In the past, manufacturing companies only had to take responsibility for the risks associated with the products they sold. However, with the EaaS business model, providing companies take over operational and economical risks from their customers, e.g. by offering a machine for leasing and guaranteeing its availability.

As this is a significant challenge, manufacturers need to build up new risk management capabilities to *quantify, control and monitor risks*. Our data show that these additional risks must first be assessed to determine whether they can be accepted, hedged, and how they need to be priced. For example, if a customer's ability to operate equipment is inadequate, higher operational risks can be a dealbreaker, as availability cannot be guaranteed for a reasonable price. Therefore, the ability to take over risks is based on the company's capability to assess the respective risks of customers in advance. To achieve this, manufacturers also need to utilize gathered information to offer customer-tailored contracts, typically conceived after defined criteria and processes.

### 4.8 Culture

The culture of a company describes its value system. For EaaS offerings, many cultural related aspects focus on the ability to offer EaaS successfully.

Our data shows, in particular, the need to establish a business innovation-friendly *continuous learning culture,* where different approaches can be tried out and failures can be made. The capability to build such an environment, driven by continuous improvement, a seamless feedback loop system and systematic knowledge management, has therefore been identified as a key to offering EaaS.

Furthermore, manufacturing firms need to develop or expand their capacity for *internal communication.* As EaaS is a new business model in which success cannot be guaranteed, best-practice sharing, as well as communicating openly about success and failure, ensures that the whole organization is "on-board", which was frequently considered as very important to be successful. To ensure this, many manufacturing firms made use of dedicated resources to perform internal marketing.

## 5 Conclusions

### 5.1 Implications for Theory

In this study, we investigated the capabilities required for manufacturing companies to successfully introduce and operate Equipment-as-Service (EaaS). In achieving this purpose, we identified these required capabilities, which align to 8 dimensions. In

particular, we highlight those capabilities that are unique and critical. In doing so, the study complements existing academic efforts and makes three leading contributions.

First, while previous studies identified servitization capabilities, this investigation specifically addressed the capabilities required to offer the EaaS business model.

Second, we considered capabilities from both the perspective of introducing and operating such a model. In doing so, this research extended the current knowledge base, as specific capabilities for introducing such a model were typically not well emphasized in existing work. Namely, capabilities that referred to the development and sale of such business models were not widely discussed in previous research.

Third, while this work is focusing on the capabilities required by manufacturing firms wanting to offer EaaS, the data suggests that complementary capabilities relating to intermediaries and customers should be built up for the implementation of EaaS models. In essence, our study highlights the ecosystem perspective of EaaS business models.

## *5.2 Implications for Practice*

Our research sheds more light on how companies can successfully provide EaaS offerings and master the necessary strategic and organizational adaptations needed. The study hence suggests several principal managerial implications for manufacturing companies that are considering to offer EaaS.

Most importantly, manufacturing companies need to invest in building up capabilities that mostly relate to the ability to transform and re-configure the resource-base of companies. By doing so, manufacturers need to balance their traditional business model with the EaaS business model.

Also, it revealed that manufacturers need to expand their current capabilities to succeed in communicating with the customer and selling the EaaS model. The latter is because EaaS models require a much thorough interaction with customers in identifying the EaaS value proposition and the value delivered to customers.

Finally, as most EaaS models are based on digital technologies, manufacturing companies are well-advised to expand their corresponding capabilities in this field.

## *5.3 Limitations and Further Research*

As with all research, this study has some limitations. First of all, the development of the model is based on literature and only a limited number of interviews with executives from manufacturing companies and experts, which makes it conceptual. For that reason, further research could involve more interviewees, divided into academics and practitioners, aiming at improving the model consideration of different perspectives. Moreover, we also acknowledge how even though the maturity model has been carefully developed, based on literature and interviews, a testing and final evaluation of

the tool with cases has not yet been conducted. Besides, at this stage, some dimensions of the model are so far captured insufficiently and should be supplemented.

Nevertheless, the presented maturity model can serve as an essential part of future empirical and theoretical work. As we pursued the ambition to provide a fertile ground for future research, we suggest further research to explore the various dimensions of our model and their internal interdependencies empirically. On the one hand, this exploration could be carried out expediently in a qualitative research design setting where the potential challenges in the conceptualization of each dimension should be clarified along with their causality relation. On the other hand, we also invite quantitative studies of our framework to measure the above in a broader perspective, which could include examining the effects of different capabilities on the performance of companies.

## References

Baines, T., Lightfoot, H., Benedettini, O., & Kay, J. (2009). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management, 20*(5), 547–567.

Baines, T., Lightfoot, H., Smart, P., & Fletcher. S. (2013). Servitization of manufacture: Exploring the deployment and skills of people critical to the delivery of advanced services. *Journal of Manufacturing Technology Management, 24*(4), 637–646.

Becker, J., Knackstedt, R., & Pöppelbuß, J. (2009). Developing maturity models for IT management: A procedure model and its application. *Business & Information Systems Engineering: Business & Information Systems Engineering, 1*(3), 213.

Benedettini, O., Neely, A., & Swink, M. (2015). Why do servitized firms fail? A risk-based explanation. *International Journal of Operations & Production Management, 35*, 946–979.

Briscoe, G., Maull, R., Ng, I., Parry, G., & Smith, L. (2012). Transitioning from a goods-dominant to a service-dominant logic: Visualising the value proposition of Rolls-Royce. *Journal of Service Management, 23,* 416–439.

Gebauer, H., Saul, C. J., Haldimann, M., & Gustafsson, A. (2017). Organizational capabilities for pay-per-use services in product-oriented companies. *International Journal of Production Economics, 192,* 157–168.

Grubic, T., & Jennions, I. K. (2018). Do outcome-based contracts exist? The investigation of Power-by-the-hour and similar result-oriented cases. *International Journal of Production Economics, 206*, 209–219.

Kindström, D. (2010). Towards a service-based business model—Key aspects for future competitive advantage. *European Management Journal, 28*(6), 479–490.

Kohtamaki, M., Parida, V., Oghazi, P., Gebauer, H., & Baines, T. (2019). Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research, 104,* 380–392.

Ng, I. C. L., Ding, D. X., & Yip, N. (2013). Outcome-based contracts as new business model: The role of partnership and value-driven relational assets. *Industrial Marketing Management, 42*(5), 730–743.

Ng, I. C. L., & Wakenshaw, S. Y. L. (2017). The Internet-of-Things: Review and research directions. *International Journal of Research in Marketing, 34*(1), 3–21.

Parida, V., Sjödin, D. R., Wincent, J., & Kohtamäki, M. (2014). Mastering the transition to product-service provision: Insights into business models, learning activities, and capabilities. *Research Technology Management, 57*(3), 44–52.

Porter, M. E., & Heppelmann, J. E. (2015). How smart, connected products are transforming companies. *Harvard Business Review, 93*(10), 96–16.

Raddats, C., Benedettini, O., & Burton, J. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management, 83*, 207–223.

Reim, W., Parida, V., & Örtqvist, D. (2015). Product–Service Systems (PSS) business models and tactics—a systematic literature review. *Journal of Cleaner Production, 97*,61–75.

Reinartz, W., & Ulaga, W. (2008). How to sell services more profitably. *Harvard Business Review, 86*, 90–6, 129.

Rymaszewska, A., Helo, P., & Gunasekaran, A. (2020). IoT powered servitization of manufacturing—An exploratory case study. *International Journal of Production Economics.*

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.

Tukker, A. (2004). Eight types of product–service system: eight ways to sustainability? Experiences from SusProNet. *Business Strategy & the Environment (John Wiley & Sons, Inc), 13*(4), 246–260.

Ulaga, W., & Reinartz, W. J. (2011). Hybrid offerings: How manufacturing firms combine goods and services successfully. *journal of marketing, 75*(6), 5–23.

VanDerMerwe, S., & Rada, J. F. (1988). Servitization of business: adding value by adding services. *European Management Journal, 6*(4), 314–324.

Visnjic, I., Jovanovic, M., Neely, A., & Engwall, M. (2017). What brings the value to outcome-based contract providers? Value drivers in outcome business models. *International Journal of Production Economics, 192,* 169–181.

Windahl, C., & Lakemond, N. (2006). Developing integrated solutions: The importance of relationships within the network. *Industrial Marketing Management, 35,* 806–818.