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Agarwal, Girish Kumar; Simonsson, Johan; Magnusson, Mats; Hald, Kim Sundtoft; Johanson, Anders

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# Value-capture in digital servitization

Girish Kumar Agarwal, Johan Simonsson and Mats Magnusson  
KTH, Stockholm, Sweden  
Kim Sundtoft Hald  
Copenhagen Business School, Frederiksberg, Denmark, and  
Anders Johanson  
KTH, Stockholm, Sweden

## Abstract

**Purpose:** Digital Capabilities in operations and delivery through constant data acquisition and future predictions have accelerated digital servitization through reduced uncertainty. New flexibility in value-capture concepts like dynamic and value-based pricing is introduced, which was impossible before. This paper explores two things. Firstly, how embracing contractual flexibility of price-variance and contract lengths influences customer perceived value in artificial intelligence (AI) enabled digital offerings. Secondly, the role transparency plays in the perceived value of such offerings.

**Method:** The paper uses an experiment-based survey and quantitative assessment within a business-to-business setup with 137 respondents across a couple of industrial manufacturers in the Nordic region.

**Findings:** Our observations indicate that value-capture-related flexibilities introduced by digital offerings, namely price fluctuations and longer contract lengths, are perceived to deliver more value to customers than standard offerings with known conditions. Our findings indicate that introduced flexibilities are perceived as opportunities rather than uncertainties leading to higher perceived value by customers. The increased value perception can be explained by the transparency of these offerings provided by data-driven digital technologies<sup>1</sup>.

**Originality:** The paper is an original work to understand the value-capture implication of digital servitization. We discuss the possibilities of different value-capture strategies that companies can adopt within digital business models.

**Keywords:** Digital Servitization, Value-Capture, Artificial Intelligence

## INTRODUCTION

Digital technologies enable new capabilities that can be used to create new business model offerings (Agarwal et al., 2020), e.g., by integrating supply chain partners in ways that were not possible before (Chui and Ng, 2018; Baden-Fuller and Haefliger, 2013). Digital technologies can enable prediction of failure of critical tools before the occurrence and even prevent failure by taking proactive actions to provide value-based services like uptime to customers rather than merely selling a tool as it is (Ng et al., 2009; Grubic and Jennions, 2018; Frank et al., 2019). This change in provided offerings is often referred to as digital servitization and is defined as "the transition toward smart product-service-software systems that enable value-creation and capture through monitoring, control, optimization, and autonomous function" (Kohtamäki et al. 2019).

Digital servitization may bring many benefits to both providers and customers. In terms of the customer organization benefits, technology-based services can: minimize downtime and transfer risk to the provider (Grubic, 2018; Visnjic et al., 2017), increase differentiation, flexibility, and customization (Kowalkowski et al., 2013; Paluch and Wunderlich, 2016; Wan et al., 2017) and improve customer performance in usage processes (Weinman, 2016). Moreover, digitalized servitization may enable dynamic or variable prices and contracts concerning value-capture, thereby influencing the distribution of value between the two parties and potentially leading to an unclear return on investments or value-appropriation from the buyer's perspective. In turn, this may constrain the digitally servitizing firm's capacity to harness competitive advantage effectively (Chahal et al., 2020).

Different price mechanisms and structures have been proposed for digital solution selling in the literature. It involves customized solutions like innovativeness, benchmarking alternatives, measurability, replicability, and operational risk (Frandsen et al., 2019). However, how precisely the servitizing buyers may perceive and manage such an unclear return on investments from digitalized servitization is still little understood. Research has also investigated how customer value-captured can be understood in pursuit of digital servitization and suggests that different value logics exist, more specifically product-based, service-based, virtual-based, and systemic-based ones (Lindhult et al., 2018). In addition, different value-capture strategies like value-added services based on data and information asymmetries have been proposed for digital offering (Zhang et al., 2015). Still, the influence of the information regarding value-capture and price fairness within digital services on customer value is a complex phenomenon requiring further elaboration (Campbell, 2007).

In this paper, we seek to address this gap in a manufacturing context by exploring how a buyer may value a digitalized servitization offering depending on different types of contractual flexibility related to value-capture from the service. We explore two aspects of value-capture design flexibility that arguably affect the value-capture strategy and customer value perception: 'contract length' and 'variance level in prices' paid for the service operationalized as a dynamic pricing model (Hinterhuber, 2008a). We also assess the mediating role of transparency on customers' value-perception of the digital offering when deploying flexible value-capture strategies. Thus, for customer value in servitized digital offerings, which are represented by flexible contractual terms and offered transparently during the service operation with the help of improved availability of data, the following broadly formulated research questions are addressed in this study:

- RQ.1 How does contractual flexibility within the value-capture strategy influence the perceived customer value of digitalized service offerings in a manufacturing context?
- RQ.2 What role does transparency play in the relationship between contractual flexibility and perceived customer value of digitalized service offerings in a manufacturing context?

This study applies an experiment-based survey methodology to address the above research questions. A total of 137 usable responses were retrieved from two industrial manufacturers headquartered in Sweden. The collected data were subsequently analyzed using two-way ANOVA and regression analysis.

The study highlights that while digital technology enables new capabilities and opportunities to create value (Agarwal et al., 2020), these technologies' adoption is at least partially dependent on the value-capture design of the digital service proposal (Hinterhuber, 2008a; Töytäri et al., 2017). Our study concluded that even though digital capabilities sometimes incorporate uncertainties in terms of flexible contract design with unclear terms like higher contract length and variable pricing, the buyer's value-perception of such digital offerings is still high, and transparency plays a substantial role in this perception. Our study contributes to practice by highlighting the value-capture design strategy that companies can undertake for better adoption of digital offerings. The study contributes to the existing body of literature on value-based pricing (Töytäri et al., 2015), servitized offerings (Bastl et al., 2012), and digital product-service systems (PSS) (e.g., Grubic, 2014; Grubic, 2018; Frank et al., 2019).

The paper is structured as follows. We start by positioning our work in the literature. This is then followed by a presentation of the adopted research methodology. After that, results and analysis are presented, followed by a discussion of the results. Finally, the paper concludes with implications, limitations, and directions for future research.

## **EXPOSITION OF THEORY**

### ***Value-creation in digital servitization***

Traditionally, manufacturing incumbents have predominantly operated with product-driven business models (Oliva and Kallenberg, 2003). Now, manufacturing companies increasingly include more services in their offerings to climb the value-chain, remain competitive, add new revenue streams, and respond to customer demand for more solutions (Noke and Hughes, 2010; Gaiardelli et al., 2015; Baines et al., 2017). This phenomenon is commonly known as servitization (e.g., Vandermerwe and Rada, 1988; Oliva and Kallenberg, 2003). Increasingly, servitization is to a substantial degree enabled by digitalization. Thus, the term "digital

servitization" has emerged to focus on the convergence of servitization and digital technologies in manufacturing (e.g., Vendrell-Herrero et al., 2017; Bustinza et al., 2018; Paschou et al., 2020).

Digital offerings enable the dynamic creation of new types of service value and increase possibilities to deliver such value. Over the years, an increasing literature stream has elaborated on how different digital technologies support business transformation in traditional manufacturing companies (Hsu, 2007; Belvedere et al., 2013; Porter and Heppelmann, 2014; Ardolino et al., 2016). Examples of such digital technologies include ICT solutions embedded into products (Björkdahl, 2009), new types of supporting digital platforms (Cenamora et al., 2017), digital infrastructures (Tilson et al., 2010), and more recently, Artificial Intelligence (AI) (Brynjolfsson and McAfee, 2017). Besides enabling the delivery of new service offerings, digital technologies may also disrupt existing business models and enable entirely new types of value-creation (Porter and Heppelmann, 2014; Brynjolfsson and McAfee, 2017; Corea, 2017). This may happen through, e.g., software-as-a-Service (SaaS), AI-first business models, or by bringing in new capabilities to understand customer needs and interactions through data capture and predicting future features, functionalities, and solutions, ultimately delivering more value to customers (Bostrom, 2014).

### ***Value-capture design in digital servitization***

Besides the ability to create new value, digital servitization also holds many important implications for the ability of suppliers and customers to capture the value-created in the buyer-supplier relationship (Chen et al., 2021). However, there is a knowledge gap concerning the design and implementation of value-capture processes across organizational boundaries (Chesbrough et al., 2018), particularly when it comes to digital servitization (Chen et al., 2021).

We define value-capture as the process of securing profits from value-creation and the distribution of those profits among participating actors such as providers and customers (Chesbrough et al., 2018). Thus, value-capture processes involve the activities that enable providers and customers to determine how the additional value-created should be efficiently distributed between provider and customer (Chesbrough et al., 2018; Sjödin et al., 2020).

Digital servitization holds implications for value-capture precisely because it enables new flexible contractual terms, revenue sharing, outcome-based contracts (OBCs), and value-based pricing (VBP). For example, the offering prices need not be set from the beginning. Instead, they can be determined through captured data and analytics during the delivery based on the actual value delivered and perceived by the customers (Gajen and Gossain, 1998). This approach to the value determined through data can directly affect customers' perceived price fairness, hence influencing the value impact from the digital service offering (Campbell, 2007).

Digital technologies, by offering access to data and remote monitoring combined with advanced analytics to measure, bring us closer to outcomes necessary for OBCs, which in turn can be utilized for new value-capture strategies. Outcome-based contracts (OBCs) have been explored as a new business model well suited for complex value-capture (Batista et al., 2017; Ng et al., 2009) and identified as a highly advanced level of service offering, involving a profound change in value processes (Grubic and Jennions, 2018), which resonates with the transformative value processes in digital servitization (Sjödin et al., 2020). The addition of services has been followed by developing value-capture mechanisms within contracts specifying service performance, instead of inputs and processes such as time and materials, frequently termed performance-based contracting (PBC) (Selviaridis and Norrman, 2014). Pain- and gain-sharing mechanisms inherent to PBCs have also been used to capture value in the servitization of manufacturing (Hou and Neely, 2018; Selviaridis and van der Valk, 2019), and PBCs are specifically useful for risk-sharing and incentive alignment (Datta and Roy, 2011; Kim et al., 2007).

One of the central concerns in designing an OBC is the pricing model (Hou and Neely 2018), and VBP has been pointed out as a suitable approach for product-service offerings. However, it is also challenging because setting a reasonable price requires that the involved decision-makers, i.e., the buyer and supplier, quantify the exact value from the service and set a price that reflects the customers' willingness to pay (Hinterhuber, 2017). VBP has been pointed out as providing industrial suppliers with many benefits in their pricing models. More specifically, VBP is known to have "the potential to improve differentiation, profitability, and value-creation for industrial firms and their customers" (Töytäri et al., 2017, p237). At the same time, however, there are also

barriers and risks involved in designing a proper VBP model. There might be a lack of access to baseline data upon which to make the VBP model, and about that, to build the necessary trust needed to assess the inherent value of the offering (Töytäri et al., 2015). The ability to quantify the value is an essential aspect of VBP and difficult as customers may have difficulties understanding and recognizing the value in an offering (Hinterhuber 2017). In such cases, the shared access to baseline data becomes essential, as shared data sets can become a foundation upon which VBP can be made. This highlights the critical role of data transparency as a potential mediator in the relationship between perceived customer value outcomes and contractual flexibility in digital servitization.

### ***Transparency through Digital Technologies***

Digital technologies provide capabilities to create transparency and better interactions, efficiency, and operations within digital offerings. These technologies impact existing barriers to openness and attitudes to information rights, leading to data-driven transparency between stakeholders (Rumbul, 2019) and consequently enhancing trust and value exchange. The role of digital technologies has also been investigated as a cost-effective and convenient means to promote openness and transparency, for example, to reduce corruption through e-governance (Bertot et al., 2010). Digital technologies have also enabled the capture of big data sets within individual companies and generic data stores at the industry level, which leads to different data management approaches towards greater accessibility and reusability of this data for an increase in credibility and quality (Hertwich et al., 2018). Apart from others, transparency is another digital technology feature (Bertino et al., 2019) that can be utilized to create, deliver, and capture value within future business models (Chui and Ng, 2018).

As Lamming et al. (2005) proposed, value transparency involves a mutual information exchange between buyers and suppliers, requiring trust as an antecedent and with the potential to enhance trust as an outcome. Building on this, the concept was expanded to include cost transparency, supply transparency, organizational transparency, and technological transparency (Hultman and Axelsson, 2007) in a buyer-supplier relationship. Within digital servitization, data-driven transparency through real-time analytics, predictive forecasting, and proactive configuration of offering design can open a dialogue between buyers and suppliers regarding actual value-creation, delivery, and capture strategies. As highlighted by Tronvoll et al. (2020), transparency afforded by new technologies is one of the main advantages supporting decision-making in the case of digitally servitized offerings. The trust generated by such transparency can effectively disseminate servitized business models (Paschou et al., 2020) within the industry.

The role of data to understand the performance measures of business models has been long discussed (Agrawal et al., 1993). Through the data made available by digital servitization, operational excellence can be achieved within the business models (Belvedere et al., 2013), and customer value can be generated through capabilities like hyper-personalization (Goyal, 2019). While current research highlights value-capture challenges within contracts and pricing and means like OBCs to overcome them, this research addresses transparency as an opportunity enabled by digital technologies, which can be applied within value-capture and pricing strategies.

## **RESEARCH METHODOLOGY**

### ***Experiment Design***

An experimental method was adopted to understand the influence of contractual flexibility on customer perceived value. A VBP based value-capture strategy was presented as a survey case, where value-created and delivered was made transparent to both the supplier and buyer through generated data using an AI-based digital offering. A fictive industrial case that could be easily understood and used across manufacturing companies was described as follows: "Assume that you are the Purchasing Manager for the assembly-line within a manufacturing company. One of the suppliers of an electric motor used in the assembly line has developed a subscription-based service that includes AI-enabled predictive and proactive maintenance and real-time anomaly detection for motor performance monitoring. This subscription contract implies a monthly fee for the duration of 'Yr' years. The supplier delivers promised uptime for the motor and captures and analyses various datasets from the shop floor to maximize the efficiency and productivity of the assembly line. Every quarter, the contract allows you to renegotiate the subscription price based on the actual value delivered with a maximum

increase or decrease of 'Per%' against real data insights generated through AI. If no agreement for the price increase or decrease is reached, the original subscription price prevails for the next quarter."

In total, nine cases were created with three contract duration lengths (two, four, and six years) and three price variance options (0, 5, and 20%), as presented in table 1. As the phenomenon of value is based on perception and arguably rather complex, it cannot just be concluded through direct observations or interviews. The approach to use direct questions to the respondents regarding their evaluation of all the nine scenarios was dismissed to ensure no response bias was introduced if they knew all the scenarios under consideration. As Lodish et al. (2001) pointed out, a common mistake in concept testing is to create a negotiation situation when this does not reflect how the purchasing takes place. By presenting only one offering and one related contract to each respondent, they are more likely to evaluate the offering as they would do in an actual purchasing situation. Hence, an indirect approach relying on a random case presentation to respondents was chosen, where renegotiation moments were fixed in time. For this purpose, an experimental survey was designed to capture information on the willingness to purchase by potential customers and measure their perceived value concerning the contractual flexibility and transparency of the service. This method helps us control a few variables to limit the contractual flexibility, which was the intention during the survey due to the complex phenomenon under consideration. An experimental survey was considered suitable as it is recommended for validation of assumptions rather than truth finding (Diderich, 2020).

**Table 1:** Survey Cases

		Contract Duration		
		2 Years	4 Years	6 Years
Maximum Price Variance	20 %	<i>Survey Case 1</i>	<i>Survey Case 4</i>	<i>Survey Case 7</i>
	5 %	<i>Survey Case 2</i>	<i>Survey Case 5</i>	<i>Survey Case 8</i>
	0 %	<i>Survey Case 3</i>	<i>Survey Case 6</i>	<i>Survey Case 9</i>

### Survey Structure

The survey started with individual background information regarding tenure and role in the current company and overall experience in the industry. After which, one of the nine available cases was randomly chosen and presented, followed by a set of questions referring to various value aspects influencing customers' value-perception. These value aspects included different value-dimensions which impact one's decision to purchase a service, including functional, social, epistemic, and emotional value aspects (Sheth et al., 1991). These questions were derived from a well-established stream of research addressing different values relevant to customers' purchasing decisions (see, e.g., Leblanc and Nguyen, 1999; Sweeney and Soutar, 2001; Cengiz and Kirkbir, 2007), but were modified to fit the specific case used for this study and to be more readily understandable by industrial managers. The questions in the survey were answered on a Likert scale (Forza, 2002) from 1 to 7, where one corresponds to the lowest value foreseen by the respondent and seven corresponds to the highest value foreseen by the respondent. The value being inherently subjective (Zeithaml, 1988), the Likert Scale was chosen for the questions in the survey. The intention was to give respondents a stimulus and support for relational variation in their scores within the various questions (value-dimension) before responding. The total value perceived by the customer for the given case service offer was calculated as the sum of the Likert scale scores provided by the respondent on each value dimension (functional, social, epistemic, and emotional). Finally, respondents were asked two questions on how their willingness to buy the presented service would change if a higher level of transparency (Bertino et al., 2019) were provided in captured data- and AI-driven insights during quarterly negotiation of prices (questionnaire provided in Appendix). For example, buyers could bring actual quarterly performance data showcasing higher or lower output from the assembly line. Suppliers could bring actual connected data from the electric motor showcasing anomaly detection and predictive maintenance to eliminate downtime, thereby enabling transparency in such negotiations. Even though digital enablement can ensure constant data assessment for continuous and even proactive negotiation events, for case simplicity in the survey, industrial respondents were presented with a fixed interval of renegotiation events rather than it being a continuous dynamic process. There were no running contracts for participating survey companies with assembly-line electric-motor suppliers. These assembly-line electric-motors were purchased as a one-time capital good transaction and supported by an in-house maintenance team. Hence, the survey case was decided to propose a fixed quarterly interval negotiation cycle as the following step proposal, which could then be extended to a more continuous and dynamic process based on real-time data-stream as these companies get exposed to and mature in negotiations and usage of such digital offerings.

The nine different cases were created as nine different surveys in SurveyMonkey with the same questions in the same sequence but using different cases (one of the nine) followed by a link splitter for each created equal percentage distribution across all the survey links. Before providing the survey to the actual respondents, it was tested on ten professors, Master's students, and general management members from the two companies used in this study. It took on average 4 to 6 minutes to complete the survey. Some minor adjustments to the questions' sequencing and language were made to have better reliability on received responses based on the feedback received. The sequence of questions was adjusted to ensure that respondents did not follow the most likely response of average or mid-range responses (Forza, 2002) and that the questions followed a logical sequence without hopping from one subject area to another to ensure engagement with the respondents during the entire survey response.

### **Sampling**

The phenomenon of value influence due to transparency is rather perceptual and complex; hence only two Nordic manufacturing companies were selected to control the assessment and report on variance (Klar and Leeper, 2019). The two chosen companies were identified to be at the same stage of the digital offering design for their customers. Moreover, both were relevant to the survey cases as they exhibited similar levels of digital maturity in handling digital technologies and adopting them within their business models. The target respondents were individuals working on digital offerings and departments within the two organizations. Altogether, five sub-organization units were identified, and all the employees in these were provided with the survey. Conducting this survey across more than one company and multiple roles within each company ensured cross-reference and triangulation of value perceptions across organizations and roles (Klar and Leeper, 2019). In total, 137 responses were captured and analyzed. A gist of the type of respondents is provided in Table 2.

**Table 2:** Respondents

<b>Company</b>	<b>Role</b>	<b>Number of Respondents</b>
<b>A</b>	Product / Category Managers	41
	R&D Managers & Engineers	23
	Sales / Marketing & After-Sales	07
	Operations Executives and Personnel	14
	Others	04
<b>B</b>	Product / Category Managers	13
	R&D Managers & Engineers	11
	Sales / Marketing & After-Sales	12
	Operations Executives and Personnel	07
	Others	05

### **Data Analysis**

Assessment of this study was initiated with two-way ANOVA at an overall contractual flexibility level with the two parameters ('Per': variance level in price percentage and 'Yr': duration of the service contract) to understand differences in means and significance of these independent variables as well as their effect on the overall perceived value by respondents (results in table 3). The dataset's normality preceded this step- and homoscedasticity tests followed by post-hoc analysis. Construct validity was tested using Cronbach Alpha assessment of all the value dimensions and related questions asked in the survey. After that, a regression analysis was conducted to understand which specific options (both 'Yr' and 'Per' are categorical variables in our case with three options each) within our independent variables influenced the contribution to overall value. The case with a 2-year contract and 0% price change during the quarterly subscription charge was chosen as the base scenario for 'Yr' and 'Per' against which the regression coefficients were analyzed (our independent variables 'Yr' and 'Per' were categorical).

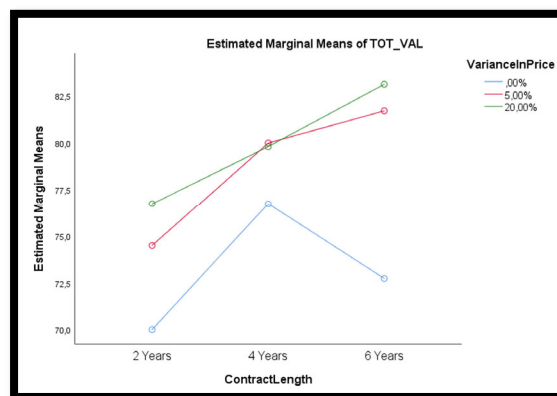
After identifying the impact of contractual flexibility (contract length and possible price variance) on overall customer perceived value, the next step was to assess sensitivity to transparency within the buyer-supplier relationship. The survey's two transparency questions captured changes in the respondents' willingness to subscribe to the service if the negotiations every quarter were based on actual data or controlled by a neutral third party, respectively. The final regression with transparency as an independent variable was analyzed. Conjoint analysis was considered but dismissed as the phenomenon of this study included multiple amorphous value features with many levels of complex relationships between them, which was not the primary focus and could not be collected and controlled as the scope of this study.

## RESULTS

Normality check through Shapiro-Wilk test indicated that data for the use case with no price variance significantly deviated from a normal distribution, but all the other cases had a statistically significant normal distribution. There were two outliers for the case with no price variance and one outlier with 20% price variance and four-year contract length (both being the same respondent number). Levene's test for homoscedasticity yielded a statistically non-significant value of 0.073, thereby not rejecting the null hypothesis. Even though one of the cases yielded non-normalized data and we had three respondents as outliers, since the overall number of respondents was not significant, we kept the obtained dataset without eliminating any responses. The overall significance for the difference in means for the two contractual flexibility measures was statistically significant for the 'price-variance limit' (0.017) but not for 'contract length' (0.055). The estimated marginal means plot (Figure A) shows that the total value perceived by respondents generally increased with overall contractual flexibility. However, there might be a slight decrease in the increasing gradient of total value between five percent and twenty percent, with a slight decrease in value reported for four years between five percent and twenty percent. Since we were interested in the overall effect of the two contractual conditions, namely price variance, and contract length, we did not continue with post hoc analysis to drill into the interaction effect from the combination of price variance and contract lengths. Instead, we continued with a regression analysis of all individual contractual flexibility variables (using a dummy as they were categorical) to understand their impact on total perceived value for the customers.

**Table 3: 2way ANOVA**

Model	Sum of Squares	Degree of freedom	Mean square	F	Sig
Regression	1957.555	4	489.379	3.228	0.015
Residual	20010.690	132	151.596		
Total	21968.204	136			
Dependent Variable	TOT VAL				



**Figure A:** Estimated Marginal Means of total value

### ***Value-perception in flexible contracts***

To answer our first research question, the regression model for understanding the effects of the contractual flexibility independent variables (Contract Lengths of six and four years and Price-variance Limit of twenty and five percent) on total perceived value was found to be statistically significant. The observed p-value was below 0.05 with a fit of around 6.2% (adjusted R2) and VIF (Variance Inflation Factor) values for all the coefficients being less than five, meaning that there is more than 95% chance that these coefficients are not collinear, and thus measuring different effects. All the coefficients in the model turned out to be statistically significant. This showcases that the impact of 'contract duration six years' and 'contract duration four years' on total perceived value was higher than 'contract duration two years'. It also highlights that the impact from 'price-variance limit 20%' and 'price-variance limit 5%' was higher than 'zero price variance for the entire contract duration. Looking further into the coefficients of regression, it was observed that not only the contract length of six and four years but also the price-variance limit per quarter of 20% and 5% gave about 20% more contribution to total customer perceived value as compared to the base scenarios of two-year contract length and a constant price, respectively.



**Role of transparency on perceived value**

The other research question was formulated to understand the role of respondents' sensitivity to transparency on the overall perceived value within AI-driven digital offerings. Adding average transparency as additional independent variables in the previous regression model yielded a substantial increase of our model's explanatory power from earlier six to 42% and the significance level of the overall regression model as indicated in Table 4. Adding average transparency also rendered all the earlier contractual flexibility-related independent variables non-significant, showcasing a strong mediating effect from individuals' sensitivity to transparency on the overall value of digital offerings with flexible contracts. At the same time, the contribution of the contractual flexibility measures price-variance limit 5% and 20% together with contract duration six years was found to be significant on average transparency. All the collinearity coefficients in the updated model were also reported below five, confirming no combining effect of variables in the assessment. Cronbach Alpha for the variable 'total-value' was 0.924, well above the minimum recommended threshold.

**Table 4: Regression Model Assessment**

Overall Model Significance		Adjusted R2 (Model Fit)	
Model 1	0.015	Model 1	0.062
Model 2	0.000	Model 2	0.424
	Standardized Coefficients Beta	Statistical Significance	Collinearity Coefficient
<b>Model 1</b>			
SixYr	0.202	0.047	1.469
FourYr	0.200	0.049	1.468
TwentyPer	0.242	0.012	1.304
FivePer	0.201	0.036	1.302
<b>Model 2</b>			
SixYr	0.080	0.326	1.534
FourYr	0.063	0.431	1.522
TwentyPer	-0.023	0.782	1.601
FivePer	0.001	0.986	1.520
Trans	0.283	0.001	1.570

**ANALYSIS AND DISCUSSION**

Digital servitization introduces new opportunities for traditional manufacturing suppliers and buyers who desire to create more value by increasing their offerings' share of digital services. However, digital servitization may also bring value challenges through increased exchange complexity and risk (Bastl et al., 2012). There are two types of value uncertainties in an offering: uncertainty in value-creation and value-appropriation. While traditional contracts ensure reduction of uncertainty in value-appropriation by clarifying agreement terms like price and duration, they do not contribute to our understanding of value-creation to a similar extent. Digital offerings can provide actual usage and execution data, which can quantify value-created, which can establish a sharing of created value that is perceived as fair by both suppliers and buyers. As perceived fairness has been found to constitute a key factor for the acceptance of pricing models (Campbell, 2007), this would arguably facilitate better value perception for buyers. Our study contributes to the understanding of value-capture design in digital servitization, not the least, embracing uncertainty introduced by allowing changing terms through flexible contract design may be an attractive approach if we exploit digital capabilities to generate transparency. Below we discuss our main contributions, which hold relevance to the general understanding of value-capture in digital servitization and transparency through digital servitization. We further highlight implications for theory and practices, limitations, and directions for future research.

**Value-capture design strategy in digital servitization**

Analyzing the results obtained from the first regression model responds to our first research question by suggesting that even though the digital offering arguably introduces more uncertainty and risk (Reim et al., 2016) in the form of flexible contract design, they are perceived to deliver more value (Smith et al., 2014; Teece, 2010; Settanni et al., 2017). This observation has implications for the traditional handling of value-capture design alternatives within servitization. Contracts have primarily been designed to reduce uncertainty and risk (Durugbo, 2013; Grubic and Jennions, 2018). Therefore, it is a surprising finding that total customer perceived value increases despite varying contract terms like longer duration and non-fixed prices as firms and their customers typically agree upon contract terms beforehand. Customers are still willing to opt for such a flexible

offering with the supplier despite a higher uncertainty of value-appropriation. This implies that digital technology-enabled services may be perceived differently by customers and thereby needs to be understood at greater depth with the potential to contribute to the theory on the service paradox (Gebauer et al., 2005). The findings from this study indicate that digital capabilities within services contribute towards better value-capture, as the offering with flexible pricing is preferred despite the uncertainty in value-capture due to the improved value-creation offered by the increase in transparency. Despite more uncertainties, functionalities like transparency can be vital in organizational capabilities (Barney, 1991; Teece, 2007) to retain existing customers and attract new customers.

The observations illude that this higher value opportunity is available for companies that can manage a digital product-service platform needed for advanced service offerings (Cenamora et al., 2017; Simonsson et al., 2020). This infrastructure can generate the necessary data insights needed to deliver upon the promises of supplying continual performance monitoring as is set out as a prerequisite for the contract. Access to baseline data is necessary for the parties to have a fruitful ongoing value discussion. Earlier research lacks examples of data and AI capabilities-based servitization initiatives, which we cover in this paper. The present case of an advanced AI-based servitized offering reflects a technologically turbulent industry, wherein more benefits are perceived despite the risks of adopting contracts based on financial results (Böhm et al., 2016).

### ***Transparency through digital servitization***

Our findings suggest that one of the significant reasons for great value-perception within more flexible and uncertain digital offerings can be attributed to individuals' sensitivity to the transparency enabled by digital technologies. The offering case in the survey states that: "... every quarter, the contract allows you to renegotiate the subscription price based on the value-delivered ...", which while introducing more uncertainty (Lerch and Gotsch, 2015; Hald and Mouritsen, 2018; Kreye, 2019), gives a transparent view of the services delivered and value-added. Arguably, this brings about an increased sense of control and commitment and thereby is seen as delivering higher value (Eggert and Helm, 2003). This alludes to new business model innovation designs (Porter and Heppelmann, 2014; Brynjolfsson and McAfee, 2017; Cenamor et al., 2017; Corea, 2017). Flexible pricing introduces uncertainty concerning value-appropriation (Kreye, 2019; Durugbo and Erkoyuncu, 2016). This should primarily be seen as unfavorable as we do not know the exact future price of the service. However, as a buyer, we could also see this as an opportunity to lower the price over time, had the transparency given us a more correct view of the actual value-created and thereby avoid the uncertainty that buyer pays for a value that they do not get. Arguably, avoiding this later uncertainty is more fundamental, and reducing this uncertainty is more important. Hence, when we increase transparency (Hultman and Axelsson, 2007) and contractual flexibility, the overall effect on perceived value is positive.

This reflects that even though there is 'objective uncertainty', it seems what influences customers' view of value in digital business model design (Hsu, 2007; Belvedere et al., 2013; Ardolino et al., 2016) is the 'perceived uncertainty'. This means that the overall total value perceived in uncertain digital offerings is dependent on individuals' sensitivity to the perception of transparency (Eggert and Helm, 2003; Hultman and Axelsson, 2007). Effectively, the mediating nature of transparency suggests that uncertainty (Hinterhuber, 2008b) does not play any significant role when put together with transparency (Lamming et al., 2005). On the one hand, we see a reluctance to adopt digital offerings and new business models such as value-based revenue models (Hinterhuber, 2017). However, on the other hand, we observe that digital technologies (specifically AI-based) can enable digital offering functionalities (Brynjolfsson and McAfee, 2017), contract designs (Durugbo and Erkoyuncu, 2016), and capabilities (Grubic and Jennions, 2018; Frank et al., 2019).

The above concludes several findings concerning customer appreciation of 'uncertainty' (Reim et al., 2016) in contracts, relating to contract terms and contract length and the role of transparency for value assessment of new types of offerings. This has several implications. One is value-based pricing, which requires that companies understand the full spectrum of values provided and convert all the value aspects into one fixed figure (Hinterhuber, 2017). Also, some critical barriers to successfully implementing such an approach are access to essential data needed for value assessment and a lack of transparency between parties (Töytäri et al., 2015). However, through a value-based pricing approach, the flexibility in pricing provides trust and transparency as default parameters in the surveyed case relationship. Hence, although decision-makers feel personal familiarity and comfort in trusting value-based pricing, digital technologies and the business model in different scenarios

will likely impact the pace of adoption, with a move towards more extended contracts with frequent negotiations based on AI-supported maintenance techniques. Thus, our findings suggest value-capture design strategies and approaches, which can affect greater buyer value-creation, thereby scaling the adoption of technology-enabled service offerings in the long term. The findings suggest that value increases when uncertainties in varying conditions are introduced into the contract. This positive angle of uncertainty mechanisms may facilitate understanding and the adoption of new service offerings.

### ***Implications for theory***

Prior literature has suggested that a lack of baseline data for value assessment is a crucial barrier for accepting value-based pricing (Töytäri et al., 2015). This study supports that an approach that can provide transparency and trust in a service contract setting would make value-based pricing a viable option in practice. The findings further suggest that customers value some uncertainties in contracts which is in addition to what has been earlier stated that contracts are a way to generate defined outcomes (Batista et al., 2017).

A customer's decision to purchase digital offerings with transforming value has been less understood as current literature has few instances of exploring buyer-supplier relationships in a servitized context (Bastl et al., 2012), which this study contributes. Our findings on specific aspects of contract length and price variations also extend current decision-making theory (Kreye et al., 2014) by empirically demonstrating the management of specific uncertainties in purchase decisions of servitized offerings.

This study further adds to PSS literature by providing new knowledge concerning the service paradox, which states that investment in new service offers does not yield sufficient returns (Gebauer et al., 2005) and even risks bankruptcy (Benedettini et al., 2013). Earlier work has further identified that even when a new digital service has been co-created by supplier and customer, the realization of the value opportunity could be challenging as it may require a new business model, on which the parties could have different views (Simonsson and Magnusson, 2018).

### ***Implications for practice***

Lessons for practitioners from this study lie on both sides of the dyadic business model relationship, i.e., the manufacturing buyers and the suppliers. The finding suggests that manufacturing suppliers should not avoid embracing certain uncertainties in value-capture and contractual governance of new service offerings to generate more value. On the contrary, they should embrace it. Shorter contracts regarding renegotiation frequency gradually increase accuracy in outcome versus prediction as the AI models are learning, though with a potential service price variance, are likely good for enhanced stability, plannability, and predictability in the assembly line for a manufacturing company. Such service offerings and setups hold many use cases, though this one is likely an attractive one for executives. For small or medium-sized enterprises or enterprises in business segments with high competition and small profit margins, a service contract with a subscription model and a small or neglectable upfront investment for critical components in an assembly line can also be very attractive from a strictly financial perspective. The study highlights the role of digital technologies within value-capture strategies that the suppliers can undertake. As exemplified above, organizations can use these technologies to generate transparent solutions to win buyers' trust and create profitable long-term relationships. As it is sometimes a difficult task to initially set a price (Hinterhuber, 2017), when both parties are unsure of the value-created, speed to market for new service offerings can be substantially improved by new transparent value-capture strategies where price adjustments are allowed overtime, based on the actual value-created. A solid financial model comparing the new business model to the old one with rigid contracts, limited transparency, and flexibility with high up-front investment from the customer side is a good starting point combined with market and customer analysis to set the initial market price of such offering and expected value to deliver. Such a baseline could serve as a parameter setting the initial contract terms. Working with customers a bit more tech-savvy early on could also benefit the learning curve from new technology and service contracts. The same approach could allow companies to bring new offers to market more rapidly without great inhibitions and risk about correct pricing, as there would be a mechanism to adjust to reality over time as the offering-value knowledge grows.

As the study highlights the increase of buyer's value-perception through digital technology-enabled transparency, this has implications for better visibility of value, thereby less reluctance to increased cost while adopting servitization and thereby avoiding the service paradox where the cost for service production exceeds related revenues (Gebauer et al., 2005). The study also demonstrates an avenue for buyer value impact through a digital approach that stretches from products to customers and responds to earlier research calling for further clarity on digitalization and platforms in a service context (de Reuver, 2018; Thomas et al. 2014). One apparent limitation to this value-capture approach is that it is a very rational view and most likely requires a sound and open relationship between the buyer and supplier. Under such conditions, the proposed approach ensures keeping opportunistic behavior at bay.

### ***Limitations***

Even though the survey respondents in the study were operations and product managers who deal with business-to-business purchasing on a day-to-day basis and can be considered a good proxy for customers, we recognize that the case was fictive. The study was confined to a business-to-business (B2B) setting with no direct involvement with end-consumers to understand their value-perception and hence limits the applicability of the findings vis-à-vis real customers. Since the study uses only one case variation in the survey and that is somewhat simplified, full-service contracts are much more complex and elaborate, including performance levels, maintenance process, and other aspects that should be further elaborated.

Another limitation is that the survey is based on data from only two organizations and did not include more companies of different sizes from several industries. Since the current study investigates major industrial manufacturers in the Nordic region, a possible bias within the survey concerning the authority and power asserted by these industrial manufacturers over their suppliers could have been introduced.

Even though two aspects of transparency were covered in the questionnaire (third party mediation and actual service provider data), the survey design did not cover detailed aspects within the two transparency mechanisms. Hence, different transparency aspects' contribution to the total value-perception is not highlighted.

### ***Future research***

While this paper focuses on the main effect of the uncertainty in contract conditions on the customer perceived value, the interaction effect between the uncertain contract conditions is an area to be further explored. Current research findings have the potential to open a new area of research on the centrality of transparency as a capability being enabled by digital technologies, which can then be used not only within value-capture design strategies but also within value-create and value-deliver aspects of business models. Future research may also include investigating uncertain aspects of customer perceived value for other digital technologies like Blockchain and Cloud.

The generalizability of the findings can be improved by examining how the case might turn out if a start-up were to offer such a service, especially to understand the renegotiation dynamics concerning transparency offered by digital technologies—for example, not keeping the renegotiation frequency fixed but rather dynamic. It also needs to be studied if either the suppliers or the customers always expect to prove the value. Hence, it calls for future research on how the negotiation spectrum is defined and the methods and processes for realigning such contract terms.

Another avenue for future research could be to investigate whether the approach presented in this paper tends to push pricing into the lower spectrum of the defined negotiation spectrum. This would pressure supplier margins for the offered (possibly managed as goodwill or sunk costs by suppliers).

## **CONCLUSIONS**

We observe that digital servitization adoption brings opportunities and value-capture uncertainties and risks for manufacturing buyers. This study concludes that manufacturing buyers perceive more value in digital offerings than traditional ones that are less uncertain despite added uncertainties and risks. We further conclude that manufacturing buyers perceive introduced uncertainties as positive opportunities due to the transparency provided by digital technologies through data sharing.

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## APPENDIX

### Survey Questionnaire

Question Code	Question
Tenure_C	How many years have you worked in the company where you are currently employed?
Tenure_R	How many years have you worked in your present role?
Tenure_Ind	How many total years of experience do you have in the industry?
Epistemic_1	To what extent does the use of this service enable experimentation with new ways of doing business?
Epistemic_2	To what extent does the use of this service enable you to learn new things?
Epistemic_3	To what extent does the use of this service enable you to engage in collaboration activities with your supplier?
Functional_1	To what extent do you feel that this service will improve your assembly-line performance?
Functional_2	To what extent do you consider the predictive maintenance on the motor included in the offer to be valuable?
Functional_3	To what extent do you consider the motor performance monitoring included in the offer to be valuable?
Functional_4	To what extent do you consider the promised uptime for the motor included in the offer to be valuable?
Functional_5	To what extent do you feel comfortable with the overall pricing model of the service?
Functional_6	How would the purchasing of this service be as compared to your current way of purchasing the motor?
Emotional_1	To what extent would you be comfortable with establishing this type of business relationship with the supplier?
Emotional_2	How would day-to-day assembly-line operations become with the adoption of this service?
Emotional_3	How would the use of this service change your current stress situation at work (thanks to product performance monitoring and/or predictive maintenance)?
Social_1	To what extent will the use of this service improve the way your company is perceived by your suppliers?
Social_2	To what extent will the use of this service improve the way your company is perceived by your competitors?
Social_3	To what extent will the use of this service improve the way your company is perceived by your customers?
Transparency_1	Would your perception of the offering be different if the basis for renegotiation was clearly supported by actual service performance data?
Transparency_2	Would your perception of the offering be different if the analysis used as input for the renegotiation was provided by a neutral third-party?