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### **Meta-model of servitization: The integrative profiling approach**

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## **META-MODEL OF SERVITIZATION: THE INTEGRATIVE PROFILING APPROACH**

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### **ABSTRACT**

This study develops a profiling framework that allows systematic comparison of different value constellations of industrial, service-based business models. Following the systematic review method, 154 research articles on servitization are analyzed using this profiling approach, producing an integrative meta-model of servitization. Three different approaches to represent servitization in studies are identified: 1) end-state models; 2) gradual transition models, and 3) stepwise progression models. These are systematically compared and eight conceptually different, generic value constellations ranging from low to high levels of servitization are identified: products with limited support; installed and supported products; complementary services; product-oriented solutions; systems leasing; operating services; managed service solutions; and total solutions. These form a pattern of servitization showing increases in complexity of the offering and value for the customer as well as changes in operational responsibilities in the value constellations. This approach resolves the gap of ‘conceptual incommensurability’ in the literature by providing a reference against which the different value constellations of servitization can be compared. The meta-model connects the various perspectives, models and terminology into a base line theory of servitization as a process, and enables a systematic comparison of the different empirical studies.

**Keywords:** industrial service, servitization, transition process, integrated solution, value constellation, systematic review method

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## HIGHLIGHTS

- develops a framework to analyze value constellations in the context of servitization
- produces an integrative meta-model of servitization based on 154 research articles
- the meta-model accommodates all 94 value constellations from the literature
- identifies three types of servitization models: end-state, gradual and stepwise
- identifies eight generic value constellations across the PSS life-cycle

## 1. INTRODUCTION

As a response to changing customer needs and buying practices, established manufacturing firms are increasingly extending ‘downstream’ the industry value chain. Looking for a more stable income during economic turmoil, manufacturers of capital goods are organizing themselves to deliver services and ‘integrated solution offerings’ that combine both physical products and services (Brax & Jonsson, 2009; Davies, 2004; Eggert, Thiesbrummel, & Deutscher; Raddats & Easingwood, 2010). As an extreme example, the US-based company Xerox Corporation accounted over 84% of its 2013’s total revenues as annuity-based and coming from contracted services, equipment maintenance, consumable supplies and financing services, with a 12% increase since 2007 (Xerox Annual Report 2013<sup>1</sup>).

Such extensions downstream are based on building a broad range of services to support the customer function associated with the ‘installed base’ (Storbacka, Windahl, Nenonen, & Salonen, 2013), i.e., the core capital good – hence, following Vandermerwe and Rada (1988), this shift of focus became labeled as *servitization* in the industrial marketing and service operations management research communities (Baines, Lightfoot, Peppard, et al., 2009; Bustinza, Parry, & Vendrell-Herrero, 2013; Lindberg & Nordin, 2008; Matthyssens & Vandenbempt, 2008; Ng, Parry, Smith, Maull, & Briscoe, 2012; Raddats & Easingwood, 2010; Spring & Araujo, 2013). While most studies focus on capital goods industries, the servitization trend influences business-to-consumer and public offerings as well (e.g., Parry, Bustinza, & Vendrell-Herrero, 2012; Rapaccini & Visintin, 2014). As these servitization strategies and ‘servitizing’ activities spread within industries, the research stream focusing on them is growing out of its former niche status and becoming a mainstream research interest.

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<sup>1</sup> Source: <http://news.xerox.com/investors/reports>, released April 7, 2014.

Statistics show that the relevance of servitization in industry is by no means anecdotal:

Neely et al. (2008) studied a worldwide sample of 13,775 firms that were classified as manufacturing in terms of their primary SIC codes and found that 30% of them were adopting a range of servitization strategies; the highest proportion of such companies, 59%, was found in the USA and followed by Finland with 53%.

Most of the of 3376 manufacturing companies in the 2006-2007 European Manufacturing Survey offered services (Lay, Copani, Jäger, & Biege, 2010) and around 16% of their turnover, directly or indirectly invoiced, came from services (Bikfalvi, Lay, Maloca, & Waser, 2012).

The EUROSTAT 2007 data of European manufacturing firms shows great variation across countries and industries. The weighted average for the gain from services was 6% although much higher in some industries and countries: e.g., 11% for the office machinery industry and reaching 59% in the Netherlands (Santamaña, Jesús Nieto, & Miles, 2012).

The trend has been observed in Asia as well. Neely et al. (2011) find that, in comparison to the less than 1% in 2007, the number of Chinese manufacturing firms offering some kind of services has risen to 19% in 2011.

The figures from these surveys provide some idea of the prevalence of the servitization phenomenon. Yet, findings from different studies cannot be directly compared as no standardized way to define and measure servitization activities in survey research exists so far.

Indeed, while research and business activities in this area are rapidly increasing (Baines, Lightfoot, Benedettini, & Kay, 2009; Lightfoot, Baines, & Smart, 2013; Neely et al., 2011), the lack of conceptual clarity has discouraged editors and scholars to publish under the topic, which has led to inventive ways of crafting terminology such as ‘service infusion’ (e.g., Gustafsson, Brax, & Witell, 2010; Kowalkowski, Witell, & Gustafsson, 2013), service addition strategy (Matthyssens & Vandenbempt, 2010) and transition to services (Fang, Palmatier, & Steenkamp, 2008; Oliva & Kallenberg, 2003; Ulaga & Loveland, 2014). A typical approach to circumvent the terms is to focus on the offerings, such as integrated solutions, systems selling or *Product-Service Systems* (PSS). As a result, the research around the servitization phenomenon appears fragmented into separate streams and suffering from an abundance of concepts – some of which appear to be incommensurable. Yet, because the term servitization is at the same time incisive and comprehensive, it has become customary among researchers and practitioners especially in the areas of industrial marketing management and service operations management. This combination of conceptual equivocality and increasing popularity indicates that attempts to clarify and operationalize the servitization concept are in demand.

Servitization has been defined or conceptualized as:

“a wave consciously driving ... companies into services to gain competitive ground” (Vandermerwe & Rada, 1988, p. 315)

“offering fuller market packages or “bundles” of customer-focussed combinations of goods, services, support, self-service, and knowledge... [by which] ...services are beginning to dominate.” (Vandemerwe & Rada, 1988, p. 314)

“the innovation of an organisations [*sic*] capabilities and processes to better create mutual value through a shift from selling product to selling PSS.” (Baines, Lightfoot, Benedettini, et al., 2009, p. 555)

These brief captions already reflect some of the complexities in the body of literature, as the term servitization can be associated with 1) changes in the *positions* that firms' occupy in their industry value stream; 2) changes in the types and scope of firms' market *offerings*; 3) the shifting *orientation* from product-focused towards service-dominant or customer-focused business models; and 4) observed or required *changes* in structures, capabilities and relationships in the organizational and network level. Complexity increases further as different conceptualizations and focal themes are used by different authors to conduct this research. What is common to all perspectives, though, is the sense of transition from traditional product-based business towards increased strategic and operational service emphasis.

The number of descriptive and reflective literature reviews in servitization-related topics is growing, whereas studies that aim to synthesize theory and integrate existing knowledge beyond comparison of the surface-level remain scarce. Although several literature reviews charting this area have been published (Baines, Lightfoot, Benedettini, et al., 2009; Baines et al., 2007; Beuren, Gomes Ferreira, & Cauchick Miguel, 2013; Lightfoot et al., 2013; Sakao, Sandström, & Matzen, 2009; Velamuri, Neyer, & Möslein, 2011), none of these appears to systematically focus on the path or process by which manufacturing companies transition to service business. Specifically, Baines et al. (2007), Beuren et al. (2013) and Sakao et al. (2009) examine how the literature characterizes the concept of PSS in terms of scope and content, what are potential benefits and barriers associated with the adoption of PSS-based business models, provide examples of actual applications, and suggest directions for future research. Baines et al. (2009) and Velamuri et al. (2011), in their turn, classify the studies on servitization and hybrid value creation (respectively) according to the key themes they address. Similarly, Lightfoot et al. (2013), identify the themes that are of greater interest for different research communities involved in servitization-related studies (Services marketing, Service management, Operations management, Product-service systems, Service science) and map the knowledge flows amongst them. Interestingly, the studies of Baines et al. (2007), Baines et al. (2009) and Velamuri et al. (2011), all conclude that the literature lacks systematic assessments of transition paths (despite, as will be pointed out in Section 3, several examples of paths can actually be found). The same conclusion is drawn by Martinez et al. (2010, p. 453) who note that while

there are generic change models available in strategic management, “there are no models specific to the issues of servitization as a change process”.

Aiming to address these gaps, this study creates a grounding theoretical framework for future research by developing a conceptual meta-model to analyze, conceptualize and define forms of servitization. By doing so it integrates existing research on servitization. The framework is developed based on systematic meta-analysis of 154 servitization studies and thus resolves the incommensurability challenge in comparing different value constellations. The meta-model can be used as a generalized framework to study paths of organizational transition when data from different time points is available, and it can also be used to compare the progress of servitization in different companies in case and survey research.

A pragmatic way to define servitization is needed for this initial analysis to clarify when the phenomenon is observed in the reviewed papers, despite the terminology used. For the research purposes in this paper,

*servitization of manufacturing is conceptualized as a change process whereby a manufacturing company deliberately or in an emergent fashion introduces service elements in its business model.*

While this may not fully correspond to all previous definitions, it fulfils the practical requirements of the current study. Servitization studies have developed in the crossing of the scholarly disciplines of industrial marketing, service marketing and operations management. Arising from this cross-disciplinary background, this research perceives services as process-based offerings (Brax, 2013; Sampson, 2012). Similarly, services have been defined as “the application of specialized competences... through deeds, processes, and performances” for the benefit of others (Vargo & Lusch, 2004, p. 2) in marketing research.

The study is structured as follows: first, this section concludes with a working definition of servitization to disclose the starting point for the review. The next section explains the systematic review methodology from the literature searches and screening to coding procedures and analysis. Then, the paper proceeds to findings, first describing how servitization as a transitive process has been captured in the existing literature. This review reveals the key perspectives as well as several gaps in the existing literature. Second, a framework for meta-modeling the extensions down the industry value stream, following the life cycle of the PSS, is developed and the patterns from existing research are investigated and rearranged using this framework. The conclusions and discussion section assesses the contribution and suggests directions for further research.

## 2. METHODOLOGY: SYSTEMATIC REVIEW

Due to the complexity of the phenomenon and the lack of definitions that allow operationalization of the concept, a large proportion of servitization studies are based on field case research. Such studies provide detailed in-depth knowledge but their scope is often limited to what is going on in the specific cases studied. Only a few surveys and theoretical-conceptual papers exist. Thus, the method best suited to developing an integrative framework is the systematic literature review method that allows the charting of the existing knowledge as a whole, and enables the development of an integrated structure for a body of knowledge (Denyer & Tranfield, 2006; Tranfield, Denyer, Marcos, & Burr, 2004; Tranfield, Denyer, & Smart, 2003).

This method is based on the following main tasks: 1) a profound and structured approach to identify all (or a representative sample of) relevant research in order to generate the data set; 2) a well-designed structured reviewing process that is uniformly applied to all research in the data set; and 3) a systematic way of keeping records of the review results. In essence, the current systematic review method differs from common freeform conceptual or thematic reviews in that *the studied publications are treated as 'data', and the analysis procedures imitate those applied to empirical data*. The nature of the reviewing process depends on the research aim: the current study does not attempt to discover evidence of causes or relationships between the different conditions and servitization outcomes, but to identify ways to conceptualize the organizational change process in servitization.

### 2.1 Literature searches

All major article databases were searched in February 2015: Ebsco, Emerald, ProQuest, Sage, Science Direct, Springer and Taylor&Francis. The search was targeted at scholarly or peer reviewed research papers focusing on servitization. Papers using the search terms in full text only were considered low in relevance, and hence the search was limited to titles, abstracts and keywords where this was possible.

In addition to the main search words addressing servitization, *servitiz\** and *servitis\**, the terms “*service infusion\**”, “*integrated solution\**”, “*service addition\**”, “*service transition\**” and “*product service system\**” were used. The latter search terms were used in combination with “*manufact\**” to reduce the number of irrelevant articles. When identical searches could not be run in the databases for technical reasons the search strings were kept as similar as possible. In broader databases searches were limited to the business and management field, as some search words are also used in other disciplines (e.g. ‘infusion’ in chemistry). For the term “*integrated solution\**” the sample was limited to the 50 most relevant papers in Ebsco due to relevancy issues. In total, 486 articles were identified. The authors recognized that some often-cited original research articles on the subject were not included in the systematically obtained sample and added them

manually. Also, highly relevant articles-in-print were added. Thus, 14 articles were added to the existing data set resulting in 418 articles (added: Eggert et al., 2015; Gebauer, 2008; Gebauer & Fleisch, 2007; Kowalkowski, Windahl, Kindström, & Gebauer, 2015; Mathieu, 2001a, 2001b; Matthyssens & Vandenbempt, 2008; Oliva & Kallenberg, 2003; Parry et al., 2012; Penttinen & Palmer, 2007; Raddats & Kowalkowski, 2014; Tukker, 2004; Ulaga & Reinartz, 2011; Wise & Baumgartner, 1999).

## 2.2 Filtering

Results from different databases were merged to remove 65 duplicate articles. Next, following a systematic procedure the articles were sorted based on relevance and the data set refined (Figure 1). 332 articles were excluded because of being non-articles (e.g., editorials, book reviews), not in the area of business and management studies (e.g. literary science), not concerning manufacturing industries and servitization, or not accessible. During the full text analysis phase, five more articles were excluded as non-articles or irrelevant. Thus the final sample of servitization articles included in the systematic analysis is 154.

The resulting dataset includes publications from 54 journals. The largest numbers of contributions were found in Industrial Marketing Management (23 articles), the *Journal of Manufacturing Technology Management* (13), the International Journal of Operations & Production Management (10), and the Journal of Service Management (8). The year of publication ranges from 1988 to early 2015, with publication numbers rising steeply from 2009 onwards, remaining at the level of about 25 articles per year through 2012-2014.

## 2.3 Content analysis procedures

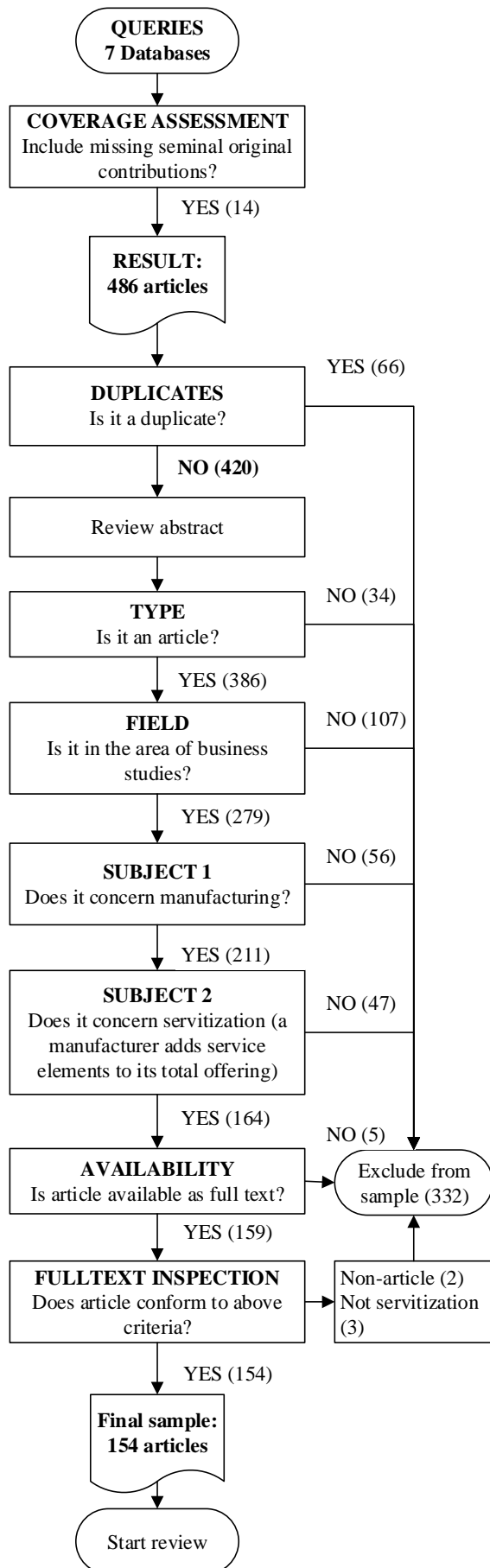
The articles were first carefully read, reviewed and sorted following the screening process captured in Figure 1. Atlas.ti software was used for coding the detailed analysis and an Excel file to record and to compare observations across the dataset. The analysis consists of three major analysis rounds with a different focus, as explained below. The 1) first round sought existing frameworks of servitization in the set of articles; 2) the second round compared the patterns found, and 3) the third round deconstructed the patterns and reconstructed the conceptual meta-model. During the analysis, the authors used separate copies of a single Hermeneutic Unit (i.e., Atlas.ti file) which was synchronized regularly to merge the analyses. This enabled the authors to see, discuss, consult and confirm each other's coding and to develop the coding scheme. The transparent, shared working methods improved consistency and validity of the coding decisions as subjective interpretation effectively translated into collective conclusions.



*Round 1: identifying existing frameworks.* The first coding round focused on identifying servitization related content, possible transition patterns, requirements for servitization and ‘in servitizing’, and different configurations of offerings such as integrated solutions. To structure the analysis, numerous other aspects were coded as well, e.g., research questions, gaps and contributions; company examples and empirical data; and definitions. A focused coding structure was generated at the beginning of the analysis, but new codes and coding strategies were allowed to emerge from the data along the analysis. As an example, the authors first set out to code the stages of the identified transition models, but recognized some models represented a continuum rather than a more precise model, and the codes ‘*continuum start*’ and ‘*continuum end*’ were created. Codes, as such, are not the ultimate goal of the analysis, but their purpose was to label and tag observations and in this manner enable a systematic, thorough comparative analysis across the data. However, codes can serve as simple tags or they may develop into categories and concepts. When a new code was created, the code was described in the notation spaces and memos provided in the software. Further observations and interpretations were collected in this manner. This documentation approach also ensured both researchers used the codes consistently.

Several models and frameworks and their transitive stages were identified in this coding round and the relevant papers were subdivided into theoretical and empirical ones. After the initial round of coding, the analysis progressed gradually and iteratively in parallel with writing: as a developing concept was identified, further exploration and more detailed re-analysis and coding of the data was conducted to support the analysis. Also, in the later stages of analysis the coding was used to derive queries that enabled a thorough but focused analysis across the articles.

As noted, the main goal was to identify original patterns of servitization-related organizational ‘transition’. The authors decided to use original research contributions instead of papers merely citing them. Thus, articles that cited a model or framework published elsewhere were dismissed from further analysis. Following a ‘snowballing’ selection principle these original publications were identified and those missing from the data set were added (as explained in Section 2.1). The articles that provided an original model of servitization as organizational transition were thus identified as the ‘core articles’ in the data set. These models were analyzed to distinguish between 1) frameworks with clearly defined progressive stages and those with less specified approaches; 2) papers that described the starting and ending points only, and 3) those describing the activity or the process of a firm ‘servitizing’. Several papers that proposed alternative servitization strategies were also identified. (The groups of models are reviewed in Section 3.1.)



**Figure 1.** Data screening process for systematic review of articles of servitization.

*Second round: comparison of patterns.* Next, analysis focused on comparing the identified frameworks, aiming at arranging them into a generic pattern of the transition phenomenon based on the forming categories ('before servitization', stage 1, stage 2, etc., 'servitized'). At this point, the incommensurability problem of the different frameworks was discovered; matching the stages of the progressive models was complicated due to differences in focus, perspective, and level of analysis (organization, unit, offering).

*Third round: developing the conceptual meta-model.* The researchers recognized that an instrument supporting the comparison of the approaches was needed and explored different possibilities to reanalyze and arrange the models. As a solution to this problem emerged the main idea of the meta-model, which is based on profiling the offering at each stage [of the transition depicted in the stepwise models](#). Since this study is interested in the servitization process of capital goods manufacturers, the researchers focused on the value stream around such offering deliveries. Irrespective of the incommensurable views on transition, the articles typically reported descriptive details about the offered bundle or solution. Therefore, the evolution of the offering was chosen as the focus of the cross-comparison [at a more granular level](#). [This more detailed level of analysis also allows comparison of end-state models](#). (The requirements and the structure of the framework are explained in Section 3.2 and 3.3.)

The third analysis round first analyzed the evolution of the offerings as presented in the identified core articles<sup>2</sup>, and continued to the remaining selection of articles (i.e., end-state models and gradual patterns). [Using the framework that allowed the systematic comparison](#) the identified models were unbundled [into comparable constellation patterns](#). This comparison followed the working principles established in prior rounds of coding; a selection of detailed findings is shown in Table 2.

### **3 META-ANALYSIS OF EXISTING SERVITIZATION MODELS**

#### **3.1 Categorization of approaches to represent servitization**

This section discusses the findings from the first analysis round that sought to identify the frameworks describing value constellations from the studies. The analysis focused on original models. Studies that merely reproduced formerly published models, such as Tukker's (2004), as part of their theory sections were omitted from further analysis. Out of the [154](#) articles in the dataset, [35](#) contained one or more original frameworks. Many of these articles described several different value constellations in their models. The

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<sup>2</sup> The logic was to assume that the information in non-core papers is not precise enough to support model building of the generic framework. These papers were used to supplement the core papers, and in the later analyzes their 'fit' with the developing meta-model was considered as validating support.

models focused on conceptualizing different manifestations of servitization: value stream positions, types of offerings or developmental stages. In addition to ‘explicit frameworks’ (presented as lists and drawings) the analysis sought more implicit patterns.

Three different approaches to represent servitization were identified in the studies: 1) end-state models; 2) gradual transition models, and 3) stepwise progression models. *End-state models* focus on the ‘servitized’ or service-dominant value constellations and organizational settings that follow the transition or transformation process. These studies do not explore the organizational transformation from a process-oriented perspective, hence focusing on an ‘end-state’, an *outcome of servitization*. Such studies focus on the business model (e.g., Barquet, de Oliveira, Amigo, Cunha, & Rozenfeld, 2013) or solution offering of a manufacturer that has undergone an organizational process associated with the service-oriented strategic change. In this group, some studies proposed alternative service strategies, which were considered as alternative forms of possible end-states. *Gradual transition models* represent servitization along a continuum, based on identifying activities that represent or facilitate ‘servitizing’ or making comparisons of pre- and post-servitization conditions. In contrast to end-state models, these studies are process-oriented. *Stepwise models* analyze the continuum further and identify progressive stages of increasing servitization, or distinguish patterns with sequential steps or transformational tasks. In this group, some studies suggested alternative paths. Each of the different frameworks identified was analyzed using the systematic coding approach. However, stepwise models are particularly important for the current analysis, as these models indicate subsequent stages and form the basis for analyzing how the servitization process unfolds. Empirical accounts of servitization “paths” establish the evidence for how servitization advances. Such models therefore validate the conceptual timeline of the meta-model.

End-state models were common in the dataset, as many studies report cross-sectional case research on companies operating in a servitized value constellation (Barquet et al., 2013; Bastl, Johnson, Lightfoot, & Evans, 2012; Brax & Jonsson, 2009; cf. Gebauer, Gustafsson, & Witell, 2011; Kowalkowski et al., 2013; Paiola, Saccani, Perona, & Gebauer, 2013; Rapaccini & Visintin, 2014; Saccani, Visintin, & Rapaccini, 2014; Storbacka, 2011; Ulaga & Reinartz, 2011). Some studies based on the end-state approach suggested several alternative value constellations of resources and capabilities, (Paiola et al., 2013; Storbacka, 2011; Ulaga & Reinartz, 2011) service strategies (Gebauer, 2008), constellation structures (Kowalkowski et al., 2013), value propositions (Rapaccini & Visintin, 2014), and buyer-supplier relationships (Bastl et al., 2012; Saccani et al., 2014). Not all case studies are end-state models, as many utilized a retrospective research design to model the development paths of the companies studied (e.g., Brax & Jonsson, 2009; Gremyr,

Löfberg, & Witell, 2010; Wikhamn, Ljungberg, & Styhre, 2013; Visintin, 2012). [Longitudinal research designs](#) (e.g., Wallin, Parida, & Isaksson, 2015) are less common.

It is important to note that the gradual transition model category has two types of articles: [the explicit-gradual approach](#) and [the implicit-gradual approach](#). Studies representing the explicit-gradual approach *explicate their view of servitization as a gradual process*, whereas studies characterized by the [implicit-gradual approach](#) describe how servitization [gradually](#) ‘unfolds’ but *do not articulate clear stages* or steps. Studies in this latter group do not necessarily argue that the transition is, or should be, incremental. In addition to the more straight-forward basic assumptions<sup>3</sup> of shifting along the servitization continuum, this category includes studies that emphasize a) the incremental or messy aspects of this evolution or b) the experienced complexity in the operational level. As an example of the former, Kowalkowski (2012) suggests that the transition takes place through ‘agile incrementalism’ as opportunities are seized and improvements take place independent of a centralized servitization strategy. Representing the latter type, Brax and Jonsson (2009) recognized systemic characteristics and complexity in their empirical case data; rather than implementing major organizational changes as prescribed sequential steps they suggest that much of this transition takes place through resolving organizational problems along the way.

Criticism of the gradual view is rare. Focusing on the concept of gradual evolution from product-focused to service-focused, Brax (2005) concluded that the literature at that time conveyed a continuum view with incremental transition and suggested that by attempting a more dramatic shift, a ‘revolutionary’ approach, firms could break the product-related organizational rigidities that make their servitization challenging. These findings are consistent with Gebauer and Fleish (2007, p. 346) who warn managers to trade off the potential financial benefits associated with an expansion of the service business with the ‘political’ cost of implementing ambitious service strategies. More generally, the studies by Davies et al. (2004), Finne et al. (2013) and Kowalkowski et al. (2015) criticized the basic assumption of the servitization process as unidirectional.

Stepwise models may be based on empirical research or conceptual work, and their style may vary between normative, descriptive, or prescriptive. The foundational models by Vandermerwe and Rada (1988), Wise and Baumgartner (1999), Oliva and Kallenberg (2003) and Davies (2004) represent this category. In addition, more original contributions are found in later research (Holmström, Brax, & Ala-Risku, 2010; Kinnunen & Turunen, 2012; Visintin, 2012). Most models were unidirectional (cf. Finne et al., 2013),

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<sup>3</sup> In many cases these are, indeed, basic assumptions, as the conceptualization of the nature of this shift is rarely explicated in writing but is traceable in the language used.

whereas some stepwise models suggested alternative paths (Matthyssens & Vandenbempt, 2010; Oliva & Kallenberg, 2003; Penttinen & Palmer, 2007).

Although stepwise models are common, they have been criticized (e.g., Brax & Jonsson, 2009; Kowalkowski et al., 2012; Kowalkowski et al., 2013). Kowalkowski et al. (2013) argue that while they may be appropriate for OEMs, the case with SMEs is more versatile:

“Service infusion differs between SMEs and large multinationals, challenging the findings of previous studies that suggest predefined transition lines for service infusion... These frameworks often propose multiple stages and list certain activities a firm must perform to reach the next stage and ultimately become a service provider. Our study suggests that “any way goes” for SMEs; they can succeed with service provision through different value constellations.” (Kowalkowski et al., 2013, p. 27)

The categorization of the articles in this study is based on the current analysis and may differ from the terminology that authors use in the original study. For instance, a study which labels its servitization framework as a ‘continuum’ (Martinez et al., 2010, p. 451) features a model with clear progressive stages and hence was categorized as a stepwise model. Another example is the framework by Tukker (2004); it visualizes a continuum with value constellations in different positions. Despite their continuum-like figures, these models were interpreted to convey the idea that some positions are more servitized than others. Most studies literally proposed a *model*, whereas some papers conveyed their model implicitly, requiring careful analysis. As an example, Löfberg et al. (based on Gebauer, 2008; 2010) propose five alternative constellations: customer service, after-sales service provider, customer support service provider, development partner, and outsourcing partner. A careful analysis of the full text concludes that these are implicitly arranged along a continuum that ranges from product-dominant to service-dominant.

### **3.2 Rationale and requirements for the profiling framework**

The above comparison of the transition models and patterns in the servitization literature demonstrates abundant variation among the approaches and concepts. The term ‘meta’ refers to something of a higher or second-order kind (Oxford Dictionary): in essence, the attempt to create a meta-model is to create a model of models. Aiming at a robust and generic overview with broad coverage of the phenomenon, the researchers next attempted to align similar steps in different stepwise models using the start and end positions as anchoring points and comparing stages directly. This task was discovered unfeasible due to the incommensurability of the models and their varying levels of detail and units of analysis. A more fine-grained analysis approach was necessary. This failure led to the development of a systematic profiling

approach that allows structured comparison between different servitization business models and offerings. This section explains the main requirements and objectives that were set for framework development.

Despite the differences, the *common logic* observed in all servitization models is that as servitization progresses the offering becomes more complex for the provider (usually decreasing customer perceived complexity), covers the activities around the focal capital goods more broadly, and spans further over the life cycle of the focal capital goods, typically redistributing roles between the parties involved. This logic is taken to indicate guidelines for developing a comparative framework that allows systematic comparison of all forms of servitization addressed in the literature (where the level of description allows making such conclusions).

To be useful, the profiling approach must 1) *structurally accommodate the broadest coverage and complexity* of these models of ‘servitizing’ or ‘servitized’ offerings, and 2) *identify the distribution of the roles* between the main actors. To allow this coverage, the supply process of a complex product-service-system is taken as the basis on which the integrative servitization framework is developed. Therefore, a generic PSS life cycle was identified using previous literature. The definition of ‘system’ is not crucial here; the term is used to refer to any demanding delivery that has some kind of functional life cycle. This choice is linked to the popular conceptualizations of servitization as the shift of activities downstream in a supply chain (Angelis, Lima, & Širaliova, 2010; Davies, 2004; Holmström et al., 2010; Wise & Baumgartner, 1999).

In addition, whilst a complex system may be a purely physical good without service-based value elements, this value chain is rarely limited to the physical offering in practice. Broader solutions can address expressed or latent customer needs around the physical system more effectively (Nordin & Kowalkowski, 2010). Also in the literature the descriptions of ‘solution offerings’ are typically associated with the supply processes of complex systems (Brax & Jonsson, 2009). These ‘solution offerings’ are systemic hybrid offerings that combine capital goods and supporting services that enable or improve the performance of the good in a particular use context. More ambitiously positioned solutions set out to ‘optimize’ customer activities around a certain function. The spectrum of concepts and configurations to characterize such offerings is broad, as concepts have developed from intensive case field research in ‘servitizing’ companies rather than from pre-existing theory. For example, popular terms are ‘complex products and systems’ (Gann & Salter, 2000), ‘integrated solutions’ (Brady, Davies, & Gann, 2005b; Brax & Jonsson, 2009; Davies, 2004), ‘product service systems’ (Baines et al., 2007), ‘hybrid offering’ (Ulaga & Reinartz, 2011) and ‘turnkey solutions’ (Windahl & Lakemond, 2010). In certain cases companies organize themselves as project-based

firms (PBFs) and use projects as specific organizational forms to deliver these complex systems (Artto, Valtakoski, & Kärki, 2015; Kujala, Artto, Aaltonen, & Turkulainen, 2010). Regardless of the terminology used, B2B solution offerings are addressed to enable and support a customer's productive process that is linked to a specific resource structure. In the case of servitizing manufacturers this resource structure typically includes a complex tangible PSS, and the life cycle of this system can be perceived as a conceptual platform for attempts to resolve the theoretical incommensurability in servitization studies.

To resolve the problem of alignment and incommensurability, [the analysis was brought to a more detailed level, allowing comparison of the stages \*within\* the models of transition \(i.e., models that represent change towards increased servitization\)](#). Thus, the researchers chose the *value constellation* as their focal unit of analysis and developed a framework through focused reading and crosschecking of literature to analyze each servitization model in detail against the generic PSS life cycle in the third round of analysis. Moving away from the original terminology of each study in the dataset, [the detailed](#) approach allows a more objective analysis of the key dimensions of complexity, responsibility, ownership and payment model.

[Using value constellations as the units analyzed enables the](#) end-state models to be included in the analysis, which [makes the analysis more comprehensive](#). It also allows analyzing the different parallel alternatives separately. Furthermore, as each study may include multiple value constellations, the resulting larger set of different configurations improves the likelihood of saturation of the observations. [The smaller set of studies that provide stepwise servitization patterns is then used to explore the meta-level pattern](#). The next subsection describes the generic stages and value elements identified in re-analyzing the literature and used to construct the profiling framework.

### **3.3 Development of the profiling framework**

The meta-modeling framework relies on a generic conceptualization of the PSS life cycle as the base logic of modeling. In order to establish such a model, the *typical stages and value elements in the operational delivery chain* for PSSs and integrated solutions were identified from literature. This section explains these stages and value elements. As the study focuses on the servitization of manufacturers, the basic assumption of the context is the presence of a complex physical offering (a capital good). In the case of industrial solution offerings this physical good is typically part of the platform for service provision. [Thus, the literature perceives production of such goods as the starting position of servitizing solution delivery chains](#) (Angelis et al., 2010; Baines, Lightfoot, Benedettini, Whitney, & Kay, 2010; Brax, 2005; Davies, 2004; Windahl & Lakemond, 2006; Wise & Baumgartner, 1999).



Delivering solutions requires taking part in a complex supply process characterized by different stages (cf. Table 1). Tuli et al. (2007) identify four consecutive stages: 1) customer requirements definition, 2) customization and integration of goods and/or services, 3) deployment, and 4) post-deployment customer support. Whilst marketing models have a tendency to start from the customer requirements, solutions are created by integrating and customizing common subsystems, modules and components of hardware, software and service that have been - internally or externally - developed *prior* to the definition of individual customer requirements (Visintin 2012). The development of these elements as well as the actual delivery of solutions based on them requires manufacturers to access and coordinate a network of external suppliers throughout the system's life cycle (Davies, 2003; Gaiardelli, Resta, Martinez, Pinto, & Albores, 2014; Gao, Yao, Zhu, Sun, & Lin, 2011; Pawar, Beltagui, & Riedel, 2009). [For global organizations, the design of the supply network also entails the definition of the role of the central focal company and of the local agents and/or subsidiaries \(Kucza & Gebauer, 2011\).](#) The design of the supply network, thus, can be considered as stage of the solution delivery process on its own (Saccani & Perona, 2014; Saccani et al., 2014).

Based on these considerations the profiling framework identifies eight subsequent stages in the supply process for a complex solution based on a PSS:

- 1) production,
- 2) business analysis,
- 3) solution design,
- 4) supply network design,
- 5) implementation,
- 6) operation,
- 7) support and
- 8) disposal.

The assumption of the profiling structure is *not* that these stages would occur in every *offering* but that they comprehensively represent the *range* of possible generic stages or tasks in the PSS life cycle. Clearly, some of these stages can overlap (e.g. operation and support stages). In general, the responsibility of each stage can be taken by the customer (**C**), the servitizing supplier (**S**) or a third party (**T**). However, no matter who is responsible for it, each stage involves the interaction between supplier(s) resources and customer resources (Tuli et al., 2007). The combination of these value elements and roles may be used to categorize a broad range of solution offerings in the servitization context.

**Table 1.** Detailed overview of the stages of the generic solution offering delivery process used as the basis for the profiling framework.

Stages in value delivery chain	Typical value elements (processes)	Responsible party
<b>1</b> <i>Production</i>	Product design Hardware production Software production	Customer (C), Supplier (S), or Third party (T)
<b>2</b> <i>Business analysis</i>	Business consulting	
<b>3</b> <i>Solution design</i>	Technical environment analysis System requirement specification Maintenance plan Customer training requirement definition Functional design Technical design SLA definition	
<b>4</b> <i>Supply network design</i>	Supply Network design	
<b>5</b> <i>Implementation</i>	Installation services System engineering services Field engineering services Training	
<b>6</b> <i>Operation</i>	System operation System-enabled process management	
<b>7</b> <i>Support</i>	Maintenance On-field support Spare and consumables provision Remote support	
<b>8</b> <i>Disposal</i>	Collecting and transportation Brokering for re-sales Recycling	
<b>Other value elements</b>		
<b>a</b> <i>Financing</i>	Financing of the solution investment	
<b>b</b> <i>Ownership</i>	Ownership of the capital goods and systems	
<b>c</b> <i>Payment model</i>	Pricing and payments	Input/output/outcome-based

Each value constellation identified in the dataset was analyzed as a configuration of sub-offerings that address the client's needs associated with the stages of the generic PSS life cycle. When a sub-offering was associated with a PSS life cycle stage, the analysis procedure further analyzed which party was responsible for its production. Thus, two guiding questions summarize the approach: 1) What generic value-adding stages constitute the supply chains for complex, industrial systems offerings? 2) How are roles distributed in each value stage?

In addition to the stages, three further value elements are identified: **a)** financing of the capital good investment, **b)** system ownership, and **c)** payment model. In the framework, system ownership and payment model are considered as revenue models elements, whereas financing is considered a supplementary value element. In the profiling framework the options available in these elements allow distinguishing between business models that are similar in the operational stages of the delivery but are based on different revenue

models. Next, these stages and contractual elements, summarized in Table 1, are explained briefly and connected with the reviewed literature.

The first stage of the profiling framework includes, under the generic label of *production*, the processes through which servitizing companies design, engineer and manufacture the hardware, software and service elements characterizing their solutions. This stage usually requires R&D, marketing, production, finance and service functions to jointly work on developing elements that can be combined to address the needs of a wide audience of potential customers (Visintin, 2012). The production stage is characterized by ‘non-service processes’ (cf. Sampson & Froehle, 2006), i.e., by processes not necessitating customer-specific inputs to be instantiated and performed. Such inputs are processed in the following stages that integrate and customize the designed elements to address customer-specific needs (Brady et al., 2005b; Tuli et al., 2007).

*Business analysis.* In this stage the supplier analyzes customer-specific business processes and figures out how these processes could be optimized through the implementation of a new system. This stage typically requires analyzing the customer’s broader business needs, its business model, operations and labor situation (Tuli et al., 2007). When the problems are well-structured (cf. Nordin & Kowalkowski, 2010) customers can perform such analyses independently without the supplier’s support. In certain situations, however, customers are not fully aware of their own needs or cannot translate these needs into functional requirements (Selviaridis, Spring, & Araujo, 2013). In these situations, the supplier needs to master business consulting capabilities to deliver effective solutions (Davies, 2004; Davis, Spohrer, & Maglio, 2011; Oliva & Kallenberg, 2003; Windahl, Andersson, Berggren, & Nehler, 2004).

*Solution design.* In the solution design stage, the system behavior (i.e., functional design) and its architecture (technical design) are outlined (Holmström et al., 2010; Visintin, 2012). In complex cases, a further *technical analysis* precede solution design because customer’s other systems set boundary conditions and requirements for the new system and its infrastructure and implementation (Visintin, 2012). In the traditional ‘goods only’ model the customers are responsible for such technical analysis, but as complexity increases, they are less likely to be able to perform this assessment themselves. The solution design stage actually *defines the elements* included in the system and their requirements for integration and support (Brady, Davies, & Gann, 2005a; Tuli et al., 2007).

*Supply network design.* The actual implementation and support of the system could require access to a network of suppliers. Delivering solutions creates the need to identify and access a broader set of capabilities through a collaborative network of external specialized component suppliers, subcontractors

and service providers (Davies, 2004; Pawar et al., 2009; Windahl & Lakemond, 2006). Thus, in *supply network design* the partners that need to be involved in the solution delivery and post-deployment phases are identified and/or contracted. Such networked and relationship-based collaboration models require strong partnering competence (Shepherd & Ahmed, 2000; Windahl et al., 2004), but this set of operational and dynamic capabilities has been found to be particularly challenging for manufacturers to develop (Brax & Jonsson, 2009; Davies, 2004; Gebauer, Paiola, & Edvardsson, 2012).

External suppliers are often used especially in the post-deployment phases (Gebauer et al., 2012). There is not a single best way to shape buyer–supplier relationships in servitized environments, as the type of service being outsourced influences how upstream relationship should be crafted (Kowalkowski et al., 2013; Saccani et al., 2014). Activities in the supply network design stage depend on the distribution of roles and responsibilities in the latter stages (Johnson & Mena, 2008). For the traditional product-based approach the design of supply network focuses on upstream suppliers of the integrator firm, whereas in a servitized value constellation the supply network design also covers the supply chain serving the use process (Holmström et al., 2010; Johnson & Mena, 2008).

*Implementation.* The system is implemented and installed in the customer’s socio-technical environment. Implementation services are typically provided on a project basis (Artto et al., 2015), whereas the further stages need a continuous service relationship (Brax & Jonsson, 2009). Generally, this stage involves system engineering activities (e.g. software development and system integration), field engineering activities (systems installation and configuration) as well as training activities. Especially when systems are complex the implementation may be carried out by several suppliers (Saccani et al., 2014). Indeed, implementation services are the typical ‘after sales services’ mentioned in many product-services classifications. For example, in Mathieu’s (2001a) categorization services supporting the product are those that “facilitate the client’s access to the product”. The basic installed base services identified by Oliva and Kallenberg (2003) include transport, installation and commissioning services – all product supporting services of the implementation stage.

*Operation.* In this stage, the system is operated and the processes that the system enables or support are managed. In certain case, processes are managed by a supplier on behalf of customer. In these cases, the supplier assumes the responsibility of the output produced by these processes and takes on the operational risk associated with them (Nordin, Kindström, Kowalkowski, & Rehme, 2011). These services are referred to as operational services (Davies, 2004; Gebauer, 2008; Nordin et al., 2011; Oliva & Kallenberg, 2003; Paiola, Gebauer, & Edvardsson, 2012), managed services (Raddats & Easingwood, 2010; Visintin, 2014),

or process delegation services (Ulaga & Reinartz, 2011). According to Davies (2004), the provision of operational services is the second set of core capabilities required for integrated solutions. Also, the company that has designed the system has a competitive advantage over its competitors to provide operational services due to its intimate knowledge about both the customer's needs and the implemented systems (Davies, Brady, & Hobday, 2006).

*Support stage.* The support stage is parallel to the operations stage. The system is maintained and monitored to prevent breakdowns and fix failures when they occur, and end-users are supported in the daily interaction with the installed base product. In the literature there is unanimous consensus that going downstream to provide, for example, break-fix and help-desk services represents the most basic form of servitization (Neely, 2008). Mathieu (2001a) distinguishes between service supporting the product, i.e. those services that ensure a product's functionality over time, and service supporting customer, i.e., those services facilitating the end-users' daily interaction with the product. Many later studies have adopted this categorization (Baines, Lightfoot, Benedettini, et al., 2009; Rapaccini & Visintin, 2014; Saccani et al., 2014; Turunen & Toivonen, 2011). The support stage provides broader opportunities for service business models depending on the utilization of software and additional hardware such as condition-based monitors, availability of accurate information about customer's processes and the system, and distribution of roles and responsibilities (Holmström et al., 2010). Development of more effective support solutions is typical in situations where unexpected downtime is particularly expensive or generates risks of hazards.

*Disposal.* The disposal stage includes the end-of-life (or end-of-contract) activities targeted at replacing, recycling, disassembling and or disposing the system (Becker, Beverungen, & Knackstedt, 2010; Gaiardelli et al., 2014).

In addition to operational aspects (i.e., what is offered and how it is delivered) servitization involves other value elements that define the business model of the value constellation. In particular, the literature frequently addresses the transfer of ownership (Baines et al., 2007; Lay et al., 2010; Neely, 2008; Rapaccini, 2015) and the pricing model (Holmström et al., 2010; Kohtamäki, Partanen, & Möller, 2013; Kowalkowski et al., 2013; Raddats & Easingwood, 2010; Steiner, Eggert, Ulaga, & Backhaus, 2014). As key revenue model elements these define the *solution business model* (Barquet et al., 2013). Albeit crucial for the customer, financial services are considered as supplementary services instead of a defining characteristic.

*Transfer of ownership.* Mont (2002) introduced the concept of ownerless consumption to describe cases in which the supplier(s) do not transfer the system ownership but just sell the system's functions. The service-based offering enables a new revenue model:

“For the outsourcing customer, a capital good no longer represents a fixed cost incurred on an intermittent basis, but a variable cost paid for in regular instalments for the duration of a service-based contract. A supplier of capital goods can achieve efficiency gains by spreading the costs of providing solutions over a larger number of customers.” (Davies, 2004, p. 740)

In the literature, re-definition of ownership characterizes the more advanced servitized offerings such as use-oriented and solution-oriented PSSs (Baines, Lightfoot, Peppard, et al., 2009; Neely, 2008; Tukker, 2004). However, Van Ostayen et al. (2013) warn that, despite allowing to separate between product- and use-oriented PSS, allocation of property rights cannot be used to distinguish between use and solution oriented PSSs. In fact, examples of PSS, that are characterized by a use-oriented logic but do not involve transfer of ownership to the provider, can be found (e.g. the Roll Royce's Power-by-the-hour).

*Payment model.* Three main approaches can be identified: *input-based*, *output-based* and *outcome-based* pricing (Ulaga & Reinartz, 2011; Visintin, 2012). According to the first approach, service elements are charged on a pay-per-deed basis (i.e. suppliers are paid for the actions they perform for their customers) and spares and consumables are charged by applying a mark-up on costs. With the output-based approach, the supplier is paid based on the output of its service activities, i.e. based on its capability to respect agreed upon timing and SLA. Finally, with the outcome-based pricing, the supplier is contracted to deliver outcomes rather than merely assets or activities. Sometimes, different pricing approaches are used in different stages (Visintin, 2012). In the early stages of servitization, input-based pricing is common, as hardware/software are usually charged ‘by unit sold’, consulting activities ‘by the hour’, and field service activities ‘by the instance’. Output- and outcome-based pricing schemes are more likely to emerge in the operation and support stage.

*Financial services.* Availability of financial services is a crucial advantage for the supplier in the negotiation phases of contracting (Davies, 2004). For instance, General Electric provides financial solutions through GE Capital as part of its integrated solutions (see Davies, 2004). Through asset management services the whole service infrastructure can be offered as a service based on long-term contracts (Brady et al., 2005b).

This section concludes that the specific types of business model emerges from the three aspects explained here. The combination of operational and contracting choices may be detected by comparing the main stages of the integrated solutions delivery life cycle, the roles of the parties, and contracting related value

elements, together cover the main aspects defining a value constellation in the context of servitization. This analytical framework, visualized in Figure 2, is robust enough to allow comparison of the broad range of business models systematically.

Servitization model	Product-service system life cycle stages								Other value elements		
	1 Production	2 Business analysis	3 Solution design	4 Supply network design	5 Implementation	6 Operation	7 Support	8 Disposal	a Ownership	b Payment model	c Financing
Value configuration X	C/S/T	C/S/T	C/S/T	C/S/T	C/S/T	C/S/T	C/S/T	C/S/T	C/S/T	Input / output / outcome	C/S/T

Figure 2. Analytical profiling framework for systematic cross-comparison of value constellations in servitization (operational responsibility: C = customer; S = supplier; T = third party).

### 3.4 Systematic meta-analysis: generic value constellations in servitization

The next step in the study is the cross-comparison of the value constellations found in the data-set of servitization literature. Each model identified was analyzed separately using the framework explained in the previous section. Thus, if a research paper reported several alternatives or stages of servitization, each of them was analyzed independently from the others. As an example, the study by Oliva and Kallenberg (2003, p. 162) is diagnosed to embody five value constellations (1, 2, 3a, 3b, 4). Total of 144 constellations were identified in the data set. Out of these, 50 were too obscure to allow reliable analysis or represented a situation not in the focus of this study (i.e., services provided by non-manufacturers), thus 94 constellation models remain that both fit the scope and provide a sufficient level of details to allow analysis.

The analysis proceeded as follows; each model was analyzed against the framework and results were marked to a spreadsheet. The steps were modeled from the ‘least servitized’ (as indicated in the original study) on top to the ‘most servitized’ on the bottom. This provided researchers a clear visual representation of the progress of servitization in the transition model within each study. Next, the constellations were re-grouped with similar ones to identify aggregate level patterns in the data-set. A simplified version of the results is presented in Table 2. In Table 2, the stages of business analysis and supply network design have

been combined with the solution design stage due to lack of detail in many studies and to decrease the complexity in presenting findings.

The different value constellations were arranged in a spreadsheet ranging from least complex (from supplier's point of view) to most complex: the least complex had the minimum level of operational responsibilities for the provider and highest level of operational responsibilities for the customers, whereas the most complex was the opposite. In the aggregate level, the coded markings form a pattern with increasing operational responsibilities from minimum-service configuration to maximum-service configuration. This range of constellations was carefully examined to identify how the offering changes across the range of servitization models. Eight conceptually different categories of value constellations were identified, which here become the generic constellations of the meta-model (see Figure 3 for a visual representation of the generic constellations):

- A. Products with limited support
- B. Installed and supported products
- C. Complementary services
- D. Product-oriented solutions
- E. Systems leasing
- F. Operating services
- G. Managed service solutions
- H. Total solutions.

*Products with limited support.* In this value constellation the supplier manufactures the equipment and sells it to the customer. The dominant payment model is based on inputs, and customer is responsible for all planning and analysis as well as implementation. The basic level support needed (break-fix services, maintenance services) is provided by the customer, the supplier or a third party. Holmström et al. (2010) consider this 'arms length after-sales service' as the default constellation – a starting position for servitization. This category includes Mathieu's (2001b) 'customer service' and 'product service' constellations. Very basic 'add-on services' like user training (Parida, Sjödin, Wincent, & Kohtamäki, 2014) and other 'base services' (Baines, Lightfoot, Smart, & Fletcher, 2013) are also included in this category. Please refer to Table 2 for full details of this analysis.



Table 2. Constellation patterns in the data-set: simplified results.

	Production	Solution Design	Implementation	Operation Support	Ownership	Payment Model
<b>Products with limited support</b>	S			C/S/T		input
Basic product (Matthyssens and Vandenbempt, 2008)	S					
Add-on services (Parida et al., 2014)	S		S			
Base services (Baines et al. 2013); Maintenance and financial services, Product related products and services (Wickhamn et al., 2013); Product-Oriented t-PSS (Arzarenko et al., 2009)	S			S		
Customer services, Product services (Mathieu, 2001b)	S			S/T		
Default constellation: Arms length after-sales service (Holmstrom et al., 2010); After-sales service providers (Gebauer 2008)	S			S		input
<b>Installed and supported products</b>	S	S	S	S		input
After sales Service (Matthyssens and Vandenbempt, 2010); intermediate services (Baines et al. 2013); Introvert Bulk Producers (Kinnunen and Turunen, 2012); Product attached service on own products (Raddats and Easingwood, 2010); Product oriented-Customer Owned (Windhal et al., 2004; Windhal and Lackemond, 2010); Product related (Tukker, 2004); Satisfying Product Providers (Kinnunen and Turunen, 2012); Selling after sales services (Paiola et al., 2013); Service supporting the product (Mathieu, 2001a)	S					
Consolidating product-related services (Oliva and Kallenberg, 2003); Equipment supplier (Kowalkoski et al., 2015); Product LifeCycle Services (Ulaga and Reinartz, 2011); Service supporting the product (Turunen and Toivonen, 2011); <a href="#">Segregated Input-based PSS (Van Ostaeyen et al., 2013)</a>	S		S	S		input
Customer support providers (Gebauer 2008)	S	S	S	S		input
Product approach, Bundle Approach (Visintin, 2012)	S		S	S		input/output
Entering the installed-base service market (Oliva and Kallenberg, 2003); Expanding to process-centered services (Oliva and Kallenberg, 2003)	S/T	S	S	S		input
Product attached service on own and third party products (Raddats and Easingwood, 2010); Product-attached services (Raddats and Kowalkowski, 2014 )	S/T	S	S	S		
Enterprise System Support (Kapletia and Probert, 2010)	S/T	S		S/T		
<b>Complementary services</b>	S	S		S		input
Services as a product (Mathieu, 2001b)	S/T	S	S/T	S	S/T	
Professional solutions and services (Wickhamn et al., 2013)	S	S		S		
Advice and consultancy (Tukker, 2004); R&D oriented services (Parida et al., 2014);	S	S	S	S		
<b>Product-oriented solutions</b>	S	S	S	S		output
Integral solutions (Wise and Baumgartner, 1999); Maintenance and product support services (Parida et al., 2014); Service supporting the client's action in relation with the supplier's products (Mathieu, 2001a); Tailored Systems (Matthyssens and Vandenbempt, 2008); Traditional product focus (cases Alstom, Ericsson,Thales) (Davies et al., 2004; Brady et al., 2005a; Davies et al., 2006)	S	S	S	S		
Asset Efficiency Services (Ulaga and Reinartz, 2011); Constellation I: Collaborative service supply chain (Holmstrom et al., 2010); Service supporting the customer processes (Turunen and Toivonen, 2011); <a href="#">Semi-integrated usage-based PSS (Van Ostaeyen et al., 2013)</a>	S		S	S		output
Process Re-engineering approach, System integrator approach (Visintin, 2012)	S	S	S	S		input/output
Availability provider (Kowalkoski et al., 2015); Expanding to relationship-based services (Oliva and Kallenberg, 2003)	S/T	S	S	S		output
<a href="#">Semi-integrated availability based PSS (Van Ostaeyen et al., 2013)</a>	S	S	S	S		output
Constellation II: Condition based maintenance as a service, Constellation III: Visibility based asset management (Holmstrom et al., 2010); Service supporting the customer business (Turunen and Toivonen, 2011)	S	S	S	S		outcome
Solution Partner (Matthyssens and Vandenbempt, 2010); Systems integration (Kowalkowski et al., 2013)	S/T	S	S	S		

Table 2. Constellation patterns in the data-set: simplified results (Part 2).

	Production	Solution Design	Implementation	Operation	Support	Ownership	Payment Model
<b>Systems leasing</b>	S	S	S		S	S	input
Product Renting/Sharing, Product Pooling (Tukker, 2004);	S		S		S	S	
Product leasing (Tukker, 2004); Use-Oriented t-PSS (Arzarenko et al., 2009);	S	S	S		S	S	
<i>Integrated availability-based PSS (Van Ostaeyen et al., 2013)</i>	S	S	S		S	S	input
Service Partner (Matthyssens and Vandenbempt, 2010)	S		S		S	S/C	
<b>Operating services</b>	S	S	S	S	S		input
Activity management (Tukker, 2004)	X			S	X		
Functional system support (Kapletia and Probert, 2010); Process management (Matthyssens and Vandenbempt, 2008); Product related services (Lay et al 2010)	S	S	S	S	S		
Operational service on own products (Raddats and Easingwood, 2010)	S	S	S	S/C	S		
Functional and operational services (Parida et al., 2014)	S	S	S	S	S/T		
Operational offering Process oriented-Customer Owned (Power Case) (Windhal et al., 2004; Windahl and Lackemond, 2010)	S	S	S	S/T	S		
Operational service on own and third party products (Raddats and Easingwood, 2010); Operational offering Process oriented-Customer Owned (Alfa laval case ) (Windhal et al., 2004; Windahl and Lackemond, 2010)	S/T	S	S	S/C	S		
<b>Managed service solutions</b>	S/T	S	S	S	S		output/ outcome
Process Delegation Services (Ulaga and Reinartz, 2011); advanced services (Baines et al. 2013);	S	S		S	S		output
System integrator (Matthyssens and Vandenbempt, 2008)	S	S	S	S	S		
<i>Semi integrated performance-based effect oriented PSS (Van Ostaeyen et al., 2013)</i>	S	S	S	S	S		output
Operations services on own products (Raddats and Kowalkowski, 2014 )	S	S	S	S	S		outcome
Integrated solutions -external and internal system integration (cases Alstom Transport, Ericsson) (Davies 2004; Brady et al., 2005a; Davies et al., 2006);	S/T	S	S	S	S		
<b>Total solutions</b>	S/T	S	S	S	S	S	outcome
Outsourcing partners (Gebauer 2008)	S		S	S	S	S	
Integrated solutions -internal system integration (Case TT&S) (Davies et al., 2004; Brady et al., 2005a; Davies et al., 2006); Operational services (Wickhamn et al., 2013); Pay per service unit (Tukker, 2004); Pure System Seller (Davies et al., 2007); Rental offering Product oriented-Supplier Owned (Windahl et al., 2004); Result-Oriented t-PSS (Azarenko et al., 2009);	S/T	S	S	S	S	S	
Functional results (Tukker, 2004); Performance offering ,Process oriented-Supplier Owned (cases Air , ABB service division)(Windhal et al., 2004; Windahl and Lackemond, 2010); Value Partner (Matthyssens and Vandenbempt, 2010)	S	S	S	S	S	S	outcome
<i>Integrated performance based effect-/demand-/solution-oriented PSS (Van Ostaeyen et al., 2013)</i>	S	S	S	S	S	S	outcome
Performance provider (Kowalkoski et al., 2015); Taking over the end-user's operations (Oliva and Kallenberg, 2003);	S/T	S	S	S	S	S	outcome
Vendor independent operations services (Raddats and Kowalkowski, 2014 )	S/T	S	S	S/C	S	S	

Note: X= original source has not specified this stage but logically it must be included for the constellation to be feasible

*Installed and supported products.* The manufacturer delivers the solution system installed and provides support service. The scope of services may vary, but the dominant payment model is input-based and the key difference to basic industrial products is the addition of installation services. Solution design is not included as systems in this group are pre-designed as part of the providers' product development process, although some solution design tasks are needed when third party systems are included in the delivery. The

most common configuration of this constellation is a service package that includes implementation and support. A broad set of different terminology were used to conceptualize the constellations, e.g. ‘service supporting the product’ (Mathieu, 2001a; Turunen & Toivonen, 2011), ‘consolidating product-related services’ (Oliva & Kallenberg, 2003), ‘product oriented-customer owned’ (Windahl et al., 2004; Windahl & Lakemond, 2010), ‘after-sales service’ (Matthyssens & Vandembemt, 2010), ‘product lifecycle services’ (Ulaga & Reinartz, 2011); intermediate services (Baines et al., 2013) and ‘equipment supplier’ (Kowalkowski et al., 2015). Some configurations in this category addressed third party systems and included a solution design step: ‘entering the installed-base service market’ and ‘expanding to process-centered services’ (Oliva & Kallenberg, 2003), ‘enterprise system support’ (Kapletia & Probert, 2010), ‘product-attached services’ on own and third party products (Raddats & Easingwood, 2010; Raddats & Kowalkowski, 2014). Whilst services in this category may have a relational basis, the payment model for these solutions is based on inputs.

*Complementary services* are other services that the OEM provides separately from the main solution system delivery. Examples of these are ‘professional solutions and services’ (Wikhamn et al., 2013) and ‘R&D oriented services’ (Parida et al., 2014) that can include design services, diagnostic services, consultation, logistics, managed inventories and training. In addition, Mathieu’s concept ‘services as a product’ is a complementary service based on varying collaborative constellations. These services are based on input.

*Product-oriented solutions* are comprehensive packages that include solution design, implementation and support. Support services in this category are relational (contract-based), and conceptually this category differs from the previous ones in that the dominant payment model is output-based. Examples of this group are ‘integral solutions’ (Wise & Baumgartner, 1999), ‘service supporting the client’s action in relation with the supplier’s products’ (Mathieu, 2001a), ‘traditional product focus’ with the cases of Ericsson, Alstom Transport and Thales (Brady et al., 2005b; Davies, 2004; Davies et al., 2006), ‘tailored systems’ (Matthyssens & Vandembemt, 2008), ‘Process Re-engineering approach’ and ‘system integration approach’ (Kowalkowski et al., 2013; Visintin, 2012), ‘solution partner’ (Matthyssens & Vandembemt, 2010) and ‘maintenance and product support services’ (Parida et al., 2014). Constellations that were identified as output-focused include ‘expanding to relationship-based services’ (Oliva & Kallenberg, 2003), ‘constellation I: collaborative service supply chain’ (Holmström et al., 2010), ‘asset efficiency services’ (Ulaga & Reinartz, 2011), ‘service supporting the customer processes’ (Turunen & Toivonen, 2011) and ‘availability provider’ (Kowalkowski et al., 2015). Outcome-based constellations were labelled as ‘constellation II: condition-based maintenance as a service’ and ‘constellation III: visibility-based asset

management' (Holmström et al., 2010), and 'service supporting the customer business' (Turunen & Toivonen, 2011).

*Systems leasing.* In this value constellation the supplier provides the customer a fully implemented system and provides the support services needed. Ownership is not transferred, and the payments are input-based. Customer has operational responsibility over system operations. 'Product renting/sharing and 'product pooling' (Tukker, 2004) and 'use-oriented t-PSS' (Azarenko, Roy, Shehab, & Tiwari, 2009) belong to this group.

*Operating services.* In this configuration, the customer receives a fully integrated solution and supporting services, and the provider takes care of operating it. Customer invests on the tangible system, and payments are input-based. Examples of this category are 'activity management' (Tukker, 2004), 'process management' (Matthyssens & Vandenbempt, 2008), 'functional system support' (Kapletia & Probert, 2010), 'product related services' (Lay et al., 2010), 'operational offering' (Windahl et al., 2004; Windahl & Lakemond, 2010), operational service on own and/or third party products (Raddats & Easingwood, 2010) and 'functional and operational services' (Parida et al., 2014).

*Managed service solutions* are output- or outcome-based solutions in which the customer owns the system. Some studies indicate that the systems can be produced in collaboration with third parties or completely sourced from them. The provider operates the system and is responsible for the systems functionality. In earlier literature such value constellations are called 'pay per service unit' (Tukker, 2004), 'integrated solutions' with the cases of Ericsson, Alstom Transport and Thales (Brady et al., 2005b; Davies, 2004; Davies et al., 2006), 'system integrator' (Matthyssens & Vandenbempt, 2008), 'process delegation services' (Ulaga & Reinartz, 2011), 'advanced services' (Baines et al., 2013), and 'operations services on own products' (Raddats & Kowalkowski, 2014).

*Total solutions.* Again, the system delivery and service solution is comprehensive; the main difference to managed service solutions is that the solution provider owns the systems and typically the contract period for the solutions is very long. The dominant revenue model is designed as outcome-based. This constellation is the most complex for the provider and includes; 'taking over the end-user's operations' (Oliva & Kallenberg, 2003), 'functional results' (Tukker, 2004), process oriented-supplier owned performance offering with the case of ABB service division, product oriented-supplier owned rental offering (Windahl et al., 2004; Windahl & Lakemond, 2010), 'pure system seller' (Davies, Brady, & Hobday, 2007), 'value partner' (Matthyssens & Vandenbempt, 2010), 'operational services' (Wikhamn et al., 2013), 'vendor-

independent operations services' (Raddats & Kowalkowski, 2014), and 'performance provider' (Kowalkowski et al., 2015).

Figure 3 summarizes the results of the analysis and shows the visual representation approach developed to support mapping of concepts and case data both in literature as well as directly with empirical material. To add visual clarity the steps performed by the customer are left white while others were marked dark; in this manner the increasing density of dark cells in the mapping indicates greater degrees of servitization in the relationship in the sense that customers purchase the activities as a service from the OEM ('S') or another provider ('T'). The generic value constellations identified in the meta-analysis are listed in the left column each on their own row. The revenue model (two columns on the right side of Fig. 3) forms another dimension that reflects the advancing of servitization. In value constellations characterized by product-dominance the payment models are input-based. Inputs units may be products, working hours, and fixed periods of service. As the service-dominance increases in the value constellations, the payment models become output and outcome focused using combinations of key performance indicators, and systems become available as full service, i.e. the customer does not invest and become owner of the solution systems.

Several studies in the data set focus on systems integration (e.g., Davies et al., 2007). This value constellation is not included in this list of generic value constellations of servitization, because the systematic profiling discovered that systems integration has a unique configuration profile only when the supplier is a non-manufacturer (1/T-2/S-3/S/T-4/C-5/C-a/C-b/input) and the systems integration is provided as a service. As Spring and Araujo (2013) point out, in some cases systems integrators are service firms (e.g. consulting firms) with no roots in manufacturing. This study focused on servitization of manufacturing companies; when a manufacturer extends to systems integration, production and implementation of their own systems is the basis of this expansion. This pattern can be recognized in the case studies on Alstom Transport, Ericsson and Thales Training & Simulation (Davies, 2004). This profile corresponds to product-oriented solution (1/S-2/S-3/S-4/S-5/C-a/C-b/input), making systems integration provided by OEMs a subcategory of product-oriented solutions.

Generic Value Configuration	PSS life-cycle stages						Revenue model elements		
	1 Production	3 Solution design	5 Implementation	6 Operation	7 Support	8 Disposal	a Ownership	b Payment model	c Financing
A) Products with limited support	S	C	C	C	S/T	-	C	input	-
B) Installed and supported products	S	C	S	C	S	-	C	input	-
C) Complementary services	S	S	C	C	S	-	C	input	-
D) Product-oriented solution	S	S	S	C	S	-	C	output	-
E) Systems leasing	S	S	S	C	S	S/T	S	input	N/A
F) Operating services	S	S	S	S	S	-	C	input	-
G) Managed service solution	S/T	S	S	S	S	-	C	output / outcome	-
H) Total solution	S/T	S	S	S	S	S/T	S	outcome	N/A

Figure 3. Generic configurations for value constellations in servitization.

In addition to those stages reported in Table 2, the analysis framework (Figures 2 and 3; Table 1) includes the life cycle stage of system disposal (Azarenko et al., 2009; Kapletia & Probert, 2010; Oliva & Kallenberg, 2003; Parida et al., 2014; Raddats & Easingwood, 2010; Tukker, 2004; Ulaga & Reinartz, 2011) and the additional value element of financial services (Davies, 2004; Lay et al., 2010; Mathieu, 2001a; Wikhamn et al., 2013). The analysis covered these aspects but the existing literature rarely mentions disposal, and it appears from the analysis that disposal services are normally available as ‘order qualifiers’. Figure 3 includes a mark-up for disposal with the value constellations of systems leasing and total solution, because in these cases the supplier owns the systems. For this reason, studies did not report financial services in association with these two categories. In the literature dataset, instances of the disposal and financial services were occasional and therefore observations concerning them are inconclusive, and for clarity have been omitted from the tables.

## 4 CONCLUSIONS AND DISCUSSION

### 4.1 The contribution

This study contributes to servitization research by developing the first comprehensive meta-model capable of arranging the pre-existing transition models and frameworks in a cross-comparison framework and explaining the key differences between these different value constellations. Aiming at a representative analysis, this study analyzed 154 research articles investigating the increasing service-dominance in manufacturing companies. The study followed the systematic review method for which the researchers designed a detailed, software-assisted thematic coding procedure. Three rounds of analysis were conducted to identify models and frameworks in the literature, to compare the 94 models found in 35 studies, and to develop the conceptual meta-model (presented in Figure 3) through a fine-grained examination of the models (Table 2) against a common profiling framework using the PSS life cycle as the base logic (Figure 2). Processed in this manner, the findings are well grounded in the literature stream, i.e., multiple observations for each generic value constellation pattern were identified in previous studies.

The analysis first recognized three kinds of framework approaches representing servitization; end-state, gradual transition and stepwise progression models. Presumably, these representations mimic the researchers' point of access to field, and the availability of data is reflected in the produced models; when researchers approach a company ex-post 'transition' they cannot make direct observations of the process and concentrate on the outcomes, value constellations or offerings, whereas researchers participating in industry-academia R&D-projects see the development efforts. Being more comprehensive, *stepwise models call for data that captures both the process and the outcome aspects of servitization.*

Further analysis led to the development of the profiling framework, consisting of the generic PSS life cycle stages and value elements, which made systematic comparison possible in the level of the value constellations (i.e. the offerings). Thus, eight generic value constellations of servitization were identified and this conceptual system fully saturated in the analysis.

Each constellation accommodates several different constellations with different names that are similar regarding their essential elements. The generic types were distinguished based on a change in one of the following dimensions which we analyzed: 1) structural coverage of the product-service system life cycle (whether an offering element is provided or not), 2) who is the party responsible for the stage (customer, provider, or third party), 3) ownership (same as for responsibility), and 4) the payment model (input/output/outcome based). Thus, the dimension of structural coverage corresponds with complexity (increases to provider, decreases to customer). Based upon the findings, *this study argues that the developed*

*profiling framework is a valid meta-model for servitization – a model of models – since it successfully mapped and accommodated all 94 models found in the literature.*

In other words, instead of producing ‘yet another model’, the developed framework accommodates the pre-existing models within one and arranges them from less to more servitized or service-dominant. In the set of articles, 15 articles presented a clear stepwise model (Baines et al., 2013; Davies, 2004; Holmström et al., 2010; Kapletia & Probert, 2010; Kinnunen & Turunen, 2012; Kowalkowski et al., 2015; Kujala et al., 2010; Mathieu, 2001b; Matthyssens & Vandenbempt, 2008, 2010; Oliva & Kallenberg, 2003; Penttinen & Palmer, 2007; Raddats & Easingwood, 2010; Turunen & Toivonen, 2011; Vandermerwe & Rada, 1988). Table 2 spreads these stepwise models across the profiling framework and illustrates that none of the previous models address all of the structurally different generic constellations identified in this study. Furthermore, the extent to which the contractual value elements are included in analyses varies in existing research (the often-cited framework by Tukker, 2004, does not consider the payment model). Also, bound to their empirical contexts, pre-existing frameworks have focused on certain types of companies (e.g., Kujala et al., 2010, on project-based businesses), specific industries (e.g., Kapletia & Probert, 2010, on the UK defense industry), and/or certain phases of the servitization journey (e.g., Kinnunen & Turunen, 2012, on the beginning on the servitization process).

Having noted the lack of reviews focusing on the transition towards service dominance (Baines, Lightfoot, Benedettini, et al., 2009; Baines et al., 2007; Martinez et al., 2010; Velamuri et al., 2011), the next section explains how the current analysis contributes to this discussion.

#### **4.2 The plausibility of the servitization concept**

Recently, increasing debate has revolved around the commonly used concepts of servitization as transition, infusion, expansion and transformation (Finne et al., 2013; Kowalkowski et al., 2012; Kowalkowski et al., 2015; Kowalkowski et al., 2013). Finne et al. (2013) perceived the literature representing servitization as a forward-unidirectional process and contrasted this against two case studies showcasing reversed servitization paths. According to Kowalkowski et al.,

“the service transition concept, as established in Oliva and Kallenberg's (2003) pathdefining study, assumes that firms undertake a unidirectional repositioning along a product-service continuum: from basic, product oriented services towards more customized, process-oriented ones, ultimately leading to the provision of solutions. As a result of this assumption, the further firms move along the transition continuum, (a) the greater relative importance of services increase and the less the relative importance of tangible products, and (b) the customer relationships become long-term and more intimate.” (Kowalkowski et al., 2015, p. 1)



Both studies argue that firms expand the portfolio of their offerings to include different product-service configurations rather than ‘shift in a goods-dominant/service-dominant continuum’ (Finne et al., 2013; Kowalkowski et al., 2015). Furthermore, other studies demonstrate that no single recipe to servitization exists (Brax & Jonsson, 2009; Kowalkowski et al., 2012; Kowalkowski et al., 2013) and that the path of a servitizing company may proceed via different constellations (Matthyssens & Vandenbempt, 2008, 2010; Oliva & Kallenberg, 2003). What can the current meta-analysis contribute to this discussion?

The evidence gathered from the studies shows a gradually increasing pattern towards more complex, service-based offerings. The mapping graphically illustrates how the operational responsibilities associated with the steps are transformed from the customer to the provider as servitization proceeds further. The figure shows a vertical continuum that characterizes *expansion* from product-focus to service-based models. In pure expansion, an OEM spreads its total offering to include several constellations while continuing selling basic industrial products. Evidence of *transition* may be traced in two ways. First, when OEMs begin to provide solution offerings not manufactured by themselves, they are moving away from their original home base of manufacturing. As OEMs servitize further, third parties and component suppliers may take production responsibilities from them if some production tasks (e.g., spare parts and components) are no longer considered as core capabilities of the OEMs. As an example, a component manufacturer may move to systems integration business (Davies, 2003; Hobday, Davies, & Prencipe, 2005). The addition of third parties in the production stage, observed in the meta-analysis, signals such a change. Second, transition beyond expansion takes place when the firm moves away from its early product-dominant value constellation, i.e. stops selling the ‘industrial product only’. Whilst producing data to examine this is beyond the scope of the current study, [clearly being its main limitation](#), studies that analyze the transition hypothesis [empirically](#) across larger samples of companies are needed.

The analysis reveals that the terminology describing the different value constellations has proliferated across the years: structurally similar solutions have different names, and the same names are used for structurally different constellations. The meta-model shown in Figure 3 resulted from a systematic, inductive process that ignored the original labels researchers have given to the models and compared them structurally. In this manner, unlike any previous research, the framework, built bottom-up, resolves the problem of incommensurability and allows comparison of the concepts side by side. The different constellations included in the stepwise models were each analyzed separately, breaking down the original structure. In the resulting meta-model, *all stepwise models were located across the eight constellations in the same order as presented in the original research* without exceptions (see Table 2 for details). This is a strong sign of the internal validity of the framework and the meta-model. This also serves as a validity test

for the original studies: despite the variation in terminology, the studies are internally consistent in how they represent the advancement of servitization. The findings thus provide support for the general concept of servitization as the OEMs' journey towards service-dominant business models.

### **4.3 Research implications**

The contributions of this study point to the following implications for further research. The analysis of the literature shows that the boundary between theoretical and empirical has not been clear (cf. Hadjikhani & LaPlaca, 2013); each empirical constellation has the potential to become a model on its own. This has led to the proliferation of servitization models and concepts in industrial marketing management and service operations management. The cross-comparison of different models shows that a robust framework to label and compare different solution offerings is needed in order to systematically compare the evidence from different studies. Due to the lack of a common scale to assess servitization, many quantitative studies have focused on measures such as turnover from services (Bikfalvi et al., 2012; Kohtamäki et al., 2013; Lay et al., 2010; Neely, 2008). Whilst these measures give important information about the volume of services, they do not describe how advanced and/or complex the service business is. Quite often spare parts sales are included in the figures and the volume of services would measure high in an industry where parts wear out quickly, e.g. quarrying. The meta-model provides a structured approach to investigate the degree of servitization across larger samples of companies and should be utilized in designing surveys and producing new empirical data. To investigate hypotheses of the impact of servitization on company performance, new quantitative studies should obtain data from the companies' portfolio of offerings to assess their level of servitization more precisely. Each of the eight generic constellations are conceptually different, making the categorization of the meta-model robust and straightforward to implement. Such research could test the alleged benefits as well as drivers of servitization.

Future research about the process and path of servitization should address the positioning of companies along the range of eight generic constellations using longitudinal research designs. The current study provides an organized framework and shows the direction in the aggregate level. However, it does not provide information on particular patterns of how companies servitize. For instance, further research is needed to assess whether servitization is gradual and/or incremental (Brax, 2005; Kowalkowski et al., 2012) or 'linear-unidirectional' (Finne et al., 2013; Kowalkowski et al., 2015) and which configurations dominate different industries and settings. [Especially, studies that combine process and outcome related data and thus could be capable of producing stepwise or other possible transition models are needed. In addition, the proposed framework builds a reference for further research on relational aspects and network structures as](#)

the value constellations evolve from ‘arms-length’ relationships towards service-dominance and co-creation of value (cf. Möller, 2013).

Performing meta-analysis with existing research has certain obvious shortcomings. The data consists of the published findings instead of original empirical data. The analysis is based on other authors’ conclusions and interpretation. Yet, as empirical work is spread across a large community of researchers, bias based on researcher subjectivity is evened out in the aggregate levels of analysis. Meta-analysis enables covering larger streams of research, allowing easier identification of patterns and making generalizations. Cumulative support for findings accrues as categories saturate. As can be identified from Table 2, all identified configurations were strongly saturated. Also, models in literature that lacked sufficient detail to be reliably categorized were omitted from the third analysis round.

A further limitation for the study is its scope of analysis; in essence, the decision to limit the literature review to management/business related journals. This led to the exclusion of contributions coming from some engineering and design related journals. A closer examination of articles indicated that such journals unlikely publish studies addressing servitization at the level of business model transition/change process but abound of contributions presenting methodologies to design and deliver PSS. Potentially, some of these more technical studies may present new PSS frameworks that could have been considered here as ‘end-state models’ and classified accordingly. Yet, the set of 486 articles covers the most important and widely recognized value constellations as no other frameworks than the ones mapped in Table 2 were found in further test searches.

Finally, the meta-model cannot escape the challenge of pluralism in the servitization terminology: whilst the framework translates between the multiplicity of concepts, the generic value constellations needed to be labeled. Terms that appear neutral, common in both industry and academia, and intuitively understandable at least to those familiar with the servitization concept were chosen, but other labels could serve equally well.

#### **4.4 Practical implications**

Despite being primarily aimed at developing an analytical tool to support future research on servitization, this study offers important contributions to practice as well.

Most importantly, it provides a framework to represent synoptically the company’s offering and value proposition. This, in turn, can help managers in several important tasks. A systematic framework enables

managers to communicate the offering of their company better to customers and to the different actors and stakeholders in the company's supply network. Analyzing the offerings using the framework should help companies to identify possible gaps in the firm's portfolio and/or in the market. The meta-model facilitates the benchmarking or comparison of different offerings – often formulated using different and inconsistent terminology – within and across industries, and thus to identify possible avenues to develop solutions and business models. The meta-model is also a useful construct from the perspective of strategic and organization design, supporting managers in mapping and planning the servitization journey of the company over time and compare it with those benchmarked, thereby identifying longitudinal trends. The 'modular' design structure characteristic for the meta-model also makes the different possible choices visible to managers. Moreover, buyers in customer organizations can use the profiling approach as they begin to design their solution purchasing strategy. Such comparison frame should support companies, in the role of customer, to develop their own internal assessment tools used in making purchasing decisions.

In addition to providing a theoretical framework that helps to understand servitization, this study provides a useful reference for practitioners, scholars and students alike who need to approach the vast and ever-increasing servitization literature in a systematic and effective way. The framework maps (Table 2) most of the models and examples that have appeared in the scientific literature, which can facilitate practitioners in identifying and interpreting the more detailed studies relevant for them and to take advantage of the examples and findings reported in these studies across industry boundaries. Similarly, instructors teaching the servitization phenomenon in industrial marketing and operations management courses can use the framework both in the graduate level class and in doctoral seminars.

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