ABSTRACT

As competition for their products increases, manufacturers have taken a greater interest in servitization. However, they face a difficult challenge when they try to develop service-oriented business models and design service value propositions that require a change in mind-set and new approaches. Thus, the purpose of this exploratory paper is to develop, apply, and evaluate an approach for service value proposition design that manufacturers can use in their transition from a primarily product-oriented business model to a more service-oriented business model. A qualitative research approach - the research through design approach - is taken in a case study of a Spanish machine tool manufacturer engaged in servitization. The findings of this research derive from a service design project at two of the manufacturer's divisions. The empirical data consist of 45 artifacts (prototypes, visualizations, and models) from six workshops and six semi-structured interviews with key company managers. The paper analyzes various service design visualization tools in manufacturing, examines the design of service value propositions, and suggests avenues for additional research on the use of a systematic methodology for service value proposition design.

Keywords:

business models, servitization; service design; value proposition; visualization tools

Highlights:

This visualization tools can be used iteratively to find external and internal fit for new service value propositions.

Service design visualization tools used with cross-functional groups help in acquiring understanding of customer needs.

Service design visualization tools can facilitate structured discussions thanks to a common language and a shared vision.

SERVICE DESIGN VISUALIZATION TOOLS FOR SUPPORTING SERVITIZATION IN A MACHINE TOOL MANUFACTURER

1. INTRODUCTION

Manufacturing companies have to rapidly innovate their value propositions to meet changing customer demands and to stay competitive in increasingly globalized markets. Thus, as research shows, traditional manufacturers have begun to change from "product-only" business models to "service-oriented" and customer-centered business models (Baines, Lightfoot, Benedettini, & Kay, 2009; Cusumano, Kahl, & Suarez, 2015; Raja, Bourne, Goffin, Çakkol, & Martinez, 2013; Visnjic, Wiengarten, & Neely, 2014). For example, even in 2006 the European Manufacturing Survey revealed that most of the 3376 surveyed manufacturers offered services to customers (Lay, Copani, Jäger, & Biege, 2010). Additionally, large manufacturers (e.g., IBM, Otis, Rolls-Royce Aerospace, Xerox, Heidelberg Printing Machines, Lantal Textiles, Tetra Pak, 3M, and MAN Truck & Bus) have developed innovative, service-oriented business models (Björkdahl & Holmén, 2013; Gassmann, Frankenberger, & Csik, 2014). The trend towards servitization is also evident in various industrial sectors such as the machine tool industry[1] (Kamp, Ochoa, & Diaz, 2017; Lee, Kao, & Yang, 2014).

Servitization, a term frequently attributed to Vandermerwe and Rada (1988), is traditionally viewed as the process in the continuum from pure products to pure services with increasing importance given to services in the value proposition (Maglio & Spohrer, 2013; Raja et al., 2013). Servitization aims to increase value delivered in the interaction between manufacturer and customer (Ritter & Andersen, 2014). Manufacturers view servitization and

[1] The European Association of Machine Tool Industry defines the machine tool industry as an industry that focuses on customized and small-scale production of high-precision machines.

its associated service-oriented and customer-centered business model as ways to increase their value, differentiate themselves from competitors, and achieve significant increases in turnover (Doultsinou, Roy, Baxter, Gao, & Mann, 2009; Neely, 2008).

Despite the popularity of servitization as a process aimed at manufacturer diversification, survival, and growth, research reveals mixed results concerning its effectiveness (Cusumano et al., 2015; Raja et al., 2013; Visnijc et al., 2014). Neely (2008) and Ng, Parry, Smith, Maull, and Briscoe (2012) observe that manufacturers face a difficult challenge when they develop service-oriented business models and design service value propositions that require a new mind-set and new approaches. Thus, multiple knowledge communities (e.g., service marketing, service operations, and organizational management) are interested in servitization, particularly with respect to providing assistance to manufacturers engaged in the servitization process (Baines & Lightfoot, 2013).

A recent systematic literature review of servitization as a transitional process of organizational change emphasizes the need for greater understanding of how service value propositions are designed and how appropriate service design visualization tools are used (Baines et al., 2017). Åkesson, Skålén, Edvardsson, and Stålhammar (2016, p. 341) state: “We suffer from limited knowledge of how value propositions themselves are created, developed, and changed.” Additionally, Äyväri and Jyrämä (2017) observe that the existing value proposition tools neglect the networked nature of value co-creation in service systems. Therefore, increasingly, manufacturers interested in, or engaged in, servitization are turning to empirical-based research for guidance on how to make this transition (Ng et al., 2012). Therefore, additional research on service value propositions and related management practices is needed.

From a managerial point of view, manufacturers require new skills, new approaches, and new design tools that focus on capturing the customer value perspective and on designing new value propositions (Aurich, Fusch, & Wagenknecht, 2006; Baines & Lightfoot, 2013; Baines et al., 2009; Ceschin, 2013; Mathieu, 2001; Meier, Roy, & Selinger, 2010; Mont, 2002; Neely, 2008). Manufacturers who lack these skills, approaches, and tools face a significant challenge when they try to servitize their product offerings (Baines et al., 2017). The question raised is then the following: which skills, approaches, and tools are useful for service value proposition design and how can they be combined in an organized process? It is worthwhile addressing this question from both theoretical and managerial perspectives.

To date, more research on service value propositions and service design visualization tools has been conducted in non-manufacturing sectors (Stacey & Tether, 2015; Yu & Sangiorgi, 2017) than in manufacturing sectors (Bhamra, Moultrie, & Thurston, 2014). Nevertheless, various researchers have explored servitization in the manufacturing context (e.g., Calabretta, De Lille, Beck, & Tanghe, 2016; Costa, Patrício, Morelli, Magee, 2017; Iriarte, Justel, Alberdi, & Gonzalez, 2016; Sangiorgi et al., 2012; Thurston, 2013). These researchers have examined the possible benefits from the use of service design visualization tools by manufacturers. They emphasize that effective, customer-centered service design must use the appropriate language, approaches, and tools in support of manufacturers' service value propositions.

Therefore, this exploratory paper further details the academic discourse on approaches and managerial tools that can be used to support servitization and the development of service value propositions in a customer-centered, design-led manner. Thus, in this paper we explore how to develop, apply, and evaluate an approach for service value proposition design that manufacturers can use as they make the transition to servitization. Our research

question is the following: How can manufacturers use service design visualization tools to design service value propositions in the servitization process?

To answer this question, we take a qualitative approach - the research through design approach - (Zimmerman & Forlizzi, 2008) in our case study of a Spanish machine tool manufacturer. Our findings derive from a design project at two of the manufacturer's divisions: the Railways Division and the Sheet Metal Division. We collected our empirical data in six workshops and six semi-structured interviews with company managers.

This paper takes a closer look at the applicability of service design visualization tools for service value proposition design during the servitization process. Additionally, our paper, as a starting point for the analysis of various service design visualization tools in manufacturing, suggests avenues for additional research on the use of a systematic methodology for service value proposition design.

The paper is structured as follows. In Section 2, we discuss service value proposition design and the servitization process. In Section 3, we describe various service design visualization tools. In Section 4, we present our research methodology: approach, process, data collection, and data analysis. In Section 5, we describe the design project at the manufacturer in our research. In Sections 6 and 7, we describe and evaluate our approach for service value proposition design. In Section 8, we summarize our research, discuss managerial implications, and offer suggestions for future research.

2. SERVICE VALUE PROPOSITION DESIGN IN SERVITIZATION

Manufacturers can use service-oriented, customer-centered business models to create, capture, and deliver value when they offer a capability instead of, or in addition to, a tangible product (Baines & Lightfoot, 2013). As Cusumano et al. (2015) and Raja et al. (2013)

explain, servitization typically begins with a product-oriented business model. This model includes the obligatory warranties for repairs and parts replacement. With servitization and its associated business model innovation, the model expands to include more customer-centered services related to product use. The services in the new value proposition are both product-related (e.g., repairs, maintenance, and monitoring) and customer-related (e.g., training, insurance, financing, and leasing (Cusumano et al., 2015; Kindström, 2010; Visnjic et al., 2014).

Generally, the key to business model innovation is a value proposition model that aims to solve problems and meet customer needs and satisfy their wants (Osterwalder, Pigneur, Bernarda, & Smith, 2014). Thus, the service value proposition is the core of service-oriented business models. Kindström (2010) and Keränen and Jalkala (2013) state that service value proposition design is essential in the servitization process.

According to Macdonald, Wilson, Martinez, and Toossi (2011), in the literature “value” is commonly described as the profit, various other advantages, and the sense of well-being enjoyed by beneficiaries from the acquisition of a product, service, or relationship. Thus, value is an experiential and contextual concept. While the producer and beneficiary co-create value, the beneficiary alone evaluates it. Lusch and Vargo (2014, p. 57) define value proposition as the “representation of how an actor proposes to positively participate in value creation with a beneficial actor.” Thus, a value proposition is more than the offer of a product, service, or relationship the manufacturer thinks the customer needs or wants (O’Cass & Ngo, 2012).

Customers assess the value of an offer based on a variety of factors. For example, they may evaluate their access to resources enabled by the offer, their role/influence in the relationship, and how the offer differs from that of competitors. In designing service value

propositions in industrial markets, manufacturers must be aware of the value customers seek, especially the value of the offer's intangible values (Baines & Lightfoot, 2013; Kindström, 2010; O'Cass & Ngo, 2012). Therefore, as Kindström observes, manufacturers that design a service value proposition must understand their customers' activities, operations, and needs/wants (e.g., production processes, competences, and functional and emotional needs).

In successful servitization, each service value proposition meets specific customer needs and satisfies specific customer wants (Cohen, Agrawal, & Agrawal, 2006). Recent research supports the idea, particularly in industrial markets, that value is created in customer processes (e.g., Baines & Lightfoot, 2013; Lusch & Vargo, 2014; Macdonald et al., 2011). This means that manufacturers should consider the customer perspective when designing service value propositions. According to Anderson, Narus, and Van Rossum (2006), designing service value propositions that meet customer needs and satisfy their wants requires a clear understanding of customer characteristics.

However, as Maglio and Spohrer (2013) state, in designing service value propositions manufacturers often fail to recognize the importance of various customer characteristics (e.g., skill levels, changes in resources, cost dynamics, and certain intangible values). Furthermore, strategic and management tools such as Osterwalder et al.'s (2014) *Value Proposition Canvas* do not fully consider the importance of customer value perceptions in industrial environments and the special circumstances in B2B and B2C environments (Isaksson, Larsson, & Johansson, 2011). Äyväri and Jyrämä (2017), in an analysis of three tools for value proposition design (*Value Proposition Builder*™, *Value Proposition Canvas,* and *People Value Canvas*), in the context of living labs approach, found that these tools neglect the wider context of the service ecosystem as well as the role of enterprises as

intermediaries in constructing invitations for value co-creation.

Therefore, in designing service value propositions, manufacturers require tools that reflect a mind-set attuned to the construction of solid relationships with customers. Such tools should be used for the identification, visualization, and demonstration of service value to customers (Baines & Lightfoot, 2013; Kindström, 2010).

A key process in the creation of visual artifacts in an experience-centered, design-led manner is visualization. Such artifacts can be used to stimulate collaborative innovation and to facilitate communication of new value propositions. According to Täuscher and Abdelkafi (2017), choosing a visualization tool influences the cognitive processes, creates mental models, and helps establish shared understandings. Eppler and Hoffmann (2012) claim that managers develop and communicate different mental images of their value propositions, depending on the tools they use. This raises the issue of which service design visualization tools are suitable for service value proposition design and how can they be used.

3. SERVICE DESIGN VISUALIZATION TOOLS

According to Patrício and Fisk (2013), service design is a novel, human-centered, creative, and iterative approach that relies on design-led service innovation methodology (see also Brown, 2008). Mager (2008) and Blackmon (2010) conclude that the intent of design-led service innovation methodology is to offer customers services that satisfy their experiential and symbolic needs. Thus, design-led service innovation methodology leads to services that, from the customer perspective, are operationally viable and technologically feasible.

Service design is frequently described as a high research priority (Ostrom et al., 2015). For example, researchers have investigated experience-centered service sectors such as

retailing, traveling, restoration, healthcare and well-being, banking, and insurance (e.g., Andreassen et al., 2016; Iriarte, Alberdi, Urrutia, & Justel, 2017; Yu & Sangiorgi, 2017; Zomerdijk & Voss, 2010). However, research on the servitization process is surprisingly limited (Bhamra et al., 2014). Sangiorgi et al. (2012, p. 261) state that the manufacturers in their study were unaware that "such a thing as service design did exist." It appears that the value of service design in facilitating new strategic business activities and strategies (e.g., servitization) has not yet been fully explored (Prendeville & Bocken, 2017).

Several researchers agree that service design can support the servitization concept because of its customer- and service-centered focus (e.g., Calabretta et al., 2016; Costa et al., 2017; Iriarte et al., 2016; Sangiorgi et al., 2012; Thurston, 2013). Other researchers point to the principal contribution of service design: a series of easy-to-use visualization tools for the co-creation, representation, and prototype construction of customer-centered service (e.g., Blomkvist, 2014; Segelström, 2013; Stickdorn & Schneider, 2010; Viladás, 2011; Yu & Sangiorgi, 2017; Zomerdijk & Voss, 2010). Such visualization tools allow us to understand and share insights about customers' and other stakeholders' behavior in user contexts (Morelli, 2003, 2006; Stickdorn & Schneider, 2010). These tools also encourage external and internal stakeholders' early engagement in the design process (Segelström, 2013). Moreover, these tools can be used to test service ideas and concepts. In such testing, providers acquire a deeper understanding of the importance of service delivery (Blomkvist, 2014).

In general, visualizations support the generation, interpretation, and manipulation of information using spatial images. These images facilitate, for example, problem-solving, communications, and team building (Darren, Amitava, & Gerald, 2001). Zhang (2012) emphasizes that visualizations communicate in two or more dimensions using diverse

elements that include signs, artwork, drawings, graphic designs, illustrations, and colors.

Diana, Pacenti, and Tassi (2009) constructed a framework that classifies service design visualization tools by visualization type. The framework has two scales: iconicity and time. The iconicity scale (abstract or realistic) refers to the realism of the service in the visualization. The time scale refers to the effectiveness of the visualization as an instantaneous and static representation of the service (synchronic), or of the visualization as a sequence of actions and stages in which customers and other participants walk through the service offering (diachronic). The intersection of the two scales leads to four categories of visualization tools: Maps, Flows, Images, and Narratives. Table 1 presents and defines each of the four categories.

Category	Visualization type	Description
Maps	Abstract & synchronic	Maps present a systemic, overall representation of the relational network of the service. *Service Ecologies* (Polaine, Løvlie, & Reason, 2013) and its variations such as *Interaction Maps* (Morelli, 2003, 2006) and *System Maps* (Manzini, Collina, & Evans, 2004; Van Halen, Vezzoli, & Wimmer, 2005) that combine all stakeholders and elements in the service delivery and reveal in an iconic manner how these actors/elements connect.
Flows	Abstract & diachronic	Flows present how the service works chronologically at the emotional levels such as in the different typologies of *Customer Journey Maps* (Curedale, 2013; Koivisto, 2009; Parker & Heapy, 2006; Stickdorn & Schneider, 2010) and at the operational levels such as in the different typologies of *Blueprints* (Bitner, Ostrom, & Morgan, 2008; Geng & Chu, 2011; Geum & Park, 2011; Lee & Kim, 2010; Lelah, Mathieux, Akasaka, & Brissaud, 2011; Shimomura, Hara, & Arai, 2009; Shostack, 1982, 1984; Stacey & Tether, 2015).The combination of *Customer Journey Maps* and *Blueprints* allows us to take an idealized view of both the frontstage processes (areas of the service the customer can see) and the backstage processes (areas of the service invisible to the customer).
Images	Realistic & synchronic	Images play a dual role in service design. Images represent customer profiles and also their functional and emotional requirements such as *Personas* (Cooper, 1999; Pruitt & Adlin, 2006) or *Empathy Maps* (Osterwalder & Pigneur, 2010). Images are also useful for prototyping service touchpoints in their use contexts. Design firms such as Live|Work and IDEO use *Evidencing* techniques (IDEO, 2003; Live|Work, n.d.) that use prototyping approaches based on the creation of a set of images or artifacts that explore and pre-visualize the way the proposed service will be experienced based on its physical or digital touchpoints over time.
Narratives	Realistic & diachronic	Narratives present the value-in-use of the service using a sequence of realistic moments. *Storyboard*s (Goodwin, 2009) in different platforms and accuracy levels of detail are useful for obtaining a better understanding of the customer experience. Service Prototyping techniques are used in *Desktop Walkthroughs* (Stickdorn & Schneider, 2010), *Experience Prototyping* (Buchenau & Fulton Suri, 2000*), Bodystorming* (Oulasvirta, Kurvinen, & Kankainen, 2003), *Pluralistic Walkthroughs* (Lewis, Polson, Wharton, & Rieman, 1990), *Cognitive Walkthroughs* (Wharton, Bradford, Jeffries, & Franzke, 1992), and *Service Walkthroughs* (Blomkvist, 2014). These prototyping techniques, which range from early roleplay to full-scale recreations, are continuing representations of the intended service journey. Their intent is to predict future situations and to prevent failure of service delivery (Blomkvist, 2014).

Table 1. Service design visualization tools according to Diana et al.'s (2009) framework

As noted above, a mind-set change is a significant challenge for manufacturers that are engaged (or plan to engage) in servitization. Such a change requires understanding that value depends not only on, for example, a product's actual features and functions but also on the customer perception of those features and functions (Johnstone, Dainty, & Wilkinson,

2009). This requires changing the shared mental maps and agreed-on tools that organizations use in decision-making (Prahalad and Bettis, 1986).

The four categories of service design visualization tools presented in Table 1 were adapted, created, and developed in service design research to support a mind-set change. These tools are intended to help organizations as they design service value propositions by taking the customer perspective on their activities and operations (Kindström, 2010) and by mapping “all” the interactions (products, services, and relationships) between the provider and the customer (Morelli, 2009). This perspective is particularly relevant for service value proposition design in the servitization process (Ritter & Andersen, 2014).

The use of these visualization tools can help organizations solicit and create shared understandings among diverse groups (Täuscher and Abdelkafi, 2017). Such shared understandings are very important in situations, such as servitization, when a change of mind-set and a new dominant organizational logic are required (Martín-Peña & Ziaee Bigdeli, 2016).

However, many manufacturers today are unfamiliar with, even unaware of, these visualization tools (Sangiorgi et al., 2012). Furthermore, Adrodegari, Pashoua, and Saccania (2017) charge that insufficient attention has been paid to the description and formalization of specific guidelines that manufacturers can use in service value proposition design. In this paper, then, we seek to fill that gap as we analyze and evaluate service design visualization tools for use by manufacturers in the servitization process. This approach aims to guide manufacturers in a well-structured manner that describes the purpose and expected outcome of each visualization tool during the process.

4. RESEARCH METHOD

4.1. Research approach

We have taken a “research through design” approach. Zimmerman and Forlizzi (2008, p. 42) define research through design as an iterative qualitative research approach that “employs methods and processes from design practice.” They explain that the approach, which is appropriate for exploratory studies, uses design practice to inform research (see also Stappers, 2007). The approach can illustrate researchers’ initial theories as design artifacts (e.g., prototypes, visualizations, and models). Thus, the approach is used to describe a preferred state, to offer a possible solution, or to codify an understanding of a situation. For example, in research on value proposition design, design methods and artifacts from a design project may be used to develop conceptual frameworks and guidelines (e.g., Baldassarre, Calabretta, Bocken, & Jaskiewicz, 2017). In line with that research, in this paper we develop, apply, and evaluate an approach that manufacturers can follow when they engage in the process of service value proposition design.

The research through design approach, in contrast with other qualitative method approaches, not only designs practice that informs research but also helps organizations embrace innovation (e.g., the transition towards servitization) and acquire knowledge (McNiff, 2017; Powell, 2016; Shani & Pasmore, 1985; Zimmerman & Forlizzi, 2008). Horváth (2008) states that research through design is an approach that facilitates scientific exploration and construction of knowledge. The researcher who takes the research through design approach has a participatory role in the intervention, action, and reflection cycles (McNiff, 2017). Through intervention, action, and reflection, knowledge is gradually gathered, integrated, and contextualized. At the same time, a solution develops (Coghlan, 2011; Polaine et al., 2013; Reason & Bradbury, 2001).

Our research is informed both by the knowledge base on value propositions and by the four categories of service design visualization tools. With this background, we took the research through design approach in a design project at the case company to show how manufacturers can use service design visualization tools to design service value propositions.

We use the research through design approach in a combination with a single case study of a large Spanish machine tool manufacturer that had recently begun the servitization process. As Lincoln and Guba (2002, p. 207) state each “case study is a construction, a product of interaction between respondents, site and researcher”. Therefore, the combination of those two research approaches is aligned with the purpose of this study. We selected this company for our case study because of its commitment to servitization and its willingness to participate in a design project. According to Eisenhardt and Graebner (2007), a single case study is appropriate for exploratory research when theory development is limited, empirical evidence is scarce, and specific issues can be addressed. The research on the linkage between the servitization process and service design visualization tools is still at an early stage. Greater use of qualitative data from exploratory, single case study research may lead to additional studies on this linkage (Noda & Bower, 1996).

We conducted a ten-month design project at two of the company’s divisions: the Railways Division and the Sheet Metal Division. Faced with new challenges from changing market conditions, upper management had decided to innovate its business model with an emphasis on service. The company had previously adopted a servitization strategy and was committed to introducing and implementing the servitization process. For this reason, the company offered a particularly interesting empirical setting for our research. Detailed designs of the new service value propositions were required. Thus, our project was

consistent with Täuscher and Abdelkafi's (2017) claim that the application of the selected visualization tools requires an alignment of these tools with the current challenges. Visualization tools are only useful when upper management understands the need for change such as new business models that reflect new service value propositions. Therefore, the case provided a suitable setting for exploring how service design visualization tools can be used for service value proposition design at manufacturing firms in the servitization process.

The objective of the design project at the case company was to develop, apply, and evaluate a new service value proposition for each division. This required identification of customer value, creation of a conceptual design, and development of service activities and touchpoints (machines, facilities, digital platforms, marketing and training materials, etc.).

4.2 Research process

Figure 1 illustrates the three stages in our research process: Problem Identification, Taking Action, and Evaluation. The second stage, Taking Action, has three design phases: Explore, Ideate, and Develop.

In the Problem Identification stage, we made a factual examination of the case company's situation and the challenges it faced. In the Taking Action stage, we conducted six co-creation workshops. In the Evaluation stage, we evaluated the service design visualization tools and the new service value propositions.

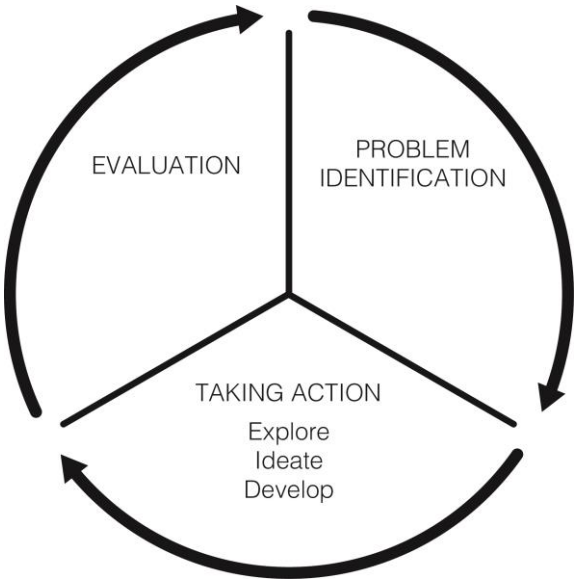

Figure 1. The research process using the research through design approach

4.3. Data collection

Our data consist of 45 artifacts (prototypes, visualizations and models) from 6 workshops, 24 pages of workshop notes, and responses to 6 semi-structured, open-ended interviews with key managers. Table 2 presents our data types and their focus.

Data type	Focus
6 workshops on planning and organization	Problem Identification and Taking Action stages (process organization, tools selection, and application)
45 artifacts from the workshops (e.g., digital platform; commercial reports; offer templates; technical reports templates; blueprints: final customer journey maps; and empathy maps)	Evaluation stage (reflections on the workshops and tools' usability and outcome)
24 pages of notes from the workshops	Evaluation stage (interview data were complemented with in-field participatory observations made in the co-creation workshops)
6 interviews with key managers	Evaluation stage (open questions: 4 main themes – (i) preliminary knowledge about service design, (ii) suitability and novelty of the applied approach and tools, (iii) quality of the results, and (iv) interest in adopting the service design approach and tools.

Table 2. The data sources in the research

We interviewed six managers at the case company (Table 3). These managers, all of whom had participated in the co-creation workshops, were decision-makers in their divisions. They indicated their commitment to the servitization transition. Two researchers jointly conducted the interviews at the manufacturer's offices. Each interview, which was audio-recorded, lasted from 30 to 45 minutes.

The researchers asked questions about the service value proposition design at the company and the combination of the servitization process and the service design visualization tools. Following a recommendation by Jorgensen (1989), we complemented our interview data with our notes from the co-creation workshops.

Railways Division		**Sheet Metal Division**	
Interviewees	Number of interviews	Interviewees	Number of interviews
Business Manager	1	R&D Manager	1
Project Manager	1	Project Manager	1
Sales Manager	1	Sales Manager	1
Total	3	Total	3

Table 3. Interviewees per Division

4.4. Data analysis

We followed the three steps described by Miles and Huberman (1994) in their data analysis guide: data reduction, data display, and conclusion drawing. We began by discarding irrelevant notes and responses. Then we used post-it notes to display the relevant data on a large sheet of paper. To draw conclusions, we connected the interview responses and observation notes with the resulting artifacts (visualizations, models, and prototypes). We used codes based on Houde and Hill's (1997) three-dimensional model. This model uses three codes: (i) role; (ii) look and feel; and (iii) implementation. Each code corresponds to a group of aspects that relate to an artifact. This developed, applied, and evaluated approach for service value proposition design, with its creation of artifacts, can be used as the basis for further reflection and refinement. Therefore, we think Houde and Hill's (1997) model is

appropriate for our data coding. Table 4 defines each code, supplemented with comments by the interviewees.

Code	Definition	Illustrative quotes from the data
Role	Refers to aspects related to the artifacts' function as expressed by the participants. For example, the interviewees describe how the digital platform, the visualization tools, the new touchpoints, and the workshop outcomes are useful for the participants.	"The maps have helped us move beyond the technological requirements of our customers." "The maps were very useful for defining our new offer."
Look and feel	Refers to aspects related to the concrete sensory experience in using the artifacts. For example, the interviewees describe what they see and feel (as well as believe, say, and hear) while using the approach, the visualization tools, and the prototypes.	"Lots of interesting discussions took place in the workshops." "The terminology used was very unfamiliar to us."
Implementation	Refers to aspects related to the processes and components through which the artifact performs its function. For example, the interviewees describe how process organization and facilitation, visualization tools selection, application sequence, etc. function.	"I think that the visualization tools are easy to understand and use." "It may be difficult to engage our customers in these co-creation workshops."

Table 4.The three codes used in the analysis

5. THE DESIGN PROJECT AT THE MACHINE TOOL MANUFACTURER

The case company designs, manufactures, sells, and services machine tools. Its main customers are in the transportation, energy, aerospace, and capital goods industries. The company, which was founded in 1954, currently has an annual turnover of 220 million Euros and employs more than 1200 people in six divisions. When we conducted our research, the company had business activities in 46 countries. Among other items, the company manufactures/sells band-saw solutions, containers, capital goods, sheet metal, and transmissions. As a medium-size company in its sector, the company differentiates itself from its larger competitors by its focus on the manufacture/sale of customized machine tools.

Upper management at the company recently decided to innovate its business model with a stronger emphasis on service. This change meant moving away from the manufacture/sale of single-operation machine tools (e.g., grinding, milling, drilling, bending, and cutting

machines) supported by basic warranty and maintenance services to the manufacture/sale of complete manufacturing turnkey solutions for specific sectors. The components of the new service value proposition are design, manufacture, assembly, training, monitoring, maintenance, and upgrading of complete manufacturing solutions.

This change was a gradual process that began in two divisions: the Railways Division and the Sheet Metal Division. Although the company had identified its target customers, established new partnerships, and hired more employees, it still had only a first “sketch” of its turnkey offers. Upper management had concerns about its new service value proposition.

Upper management agreed to work with the authors of this paper on achieving three design project aims: (1) to identify customer value; (2) to create a conceptual design for the new service value proposition; and (3) to identify and design the service activities and touchpoints of the new service value proposition. Because the servitization process was already in progress at the two divisions when we began our research, we took the same research through design approach at both divisions.

Target customers were identified for the two divisions. For the Railways Division, the target customers were the private industrial railway operators (specifically, mining industry operators). The company planned to offer turnkey workshops for maintenance and repair of the bogies and wheel-sets for railway wagons. For the Sheet Metal Division, the target customers were the metallic goods manufacturers (specifically, metallic furniture manufacturers). The company planned to offer full processing turnkey solutions in both divisions.

Service design, which is co-creative and participatory (Holmlid, 2009; Sanders & Stappers, 2014), promotes the involvement of various stakeholders in the design process from its very

beginning (Segelström, 2013). Thus, the service design visualization tools were used in the co-creation workshops with groups of experienced company employees (upper and middle managers from the marketing, HR, and engineering departments).

6. THE APPROACH TO SERVICE VALUE PROPOSITION DESIGN

In this section, we describe how we worked with two service value proposition designs that used service design visualization tools. We show how these service value proposition designs developed as servitization processes (West & Di Nardo, 2016).

We were inspired by Sangiorgi et al.'s (2012) study on how service design visualization tools can be developed in co-creation workshops with manufacturers. These authors studied initial attempts at service design in support of servitization; however, they were unable to follow-up on later developments at the companies in their study. Thus, they could not report on how the visualization tools were used or with what success. We were able to build on their research by developing, applying, and evaluating an approach (in co-creation workshops) for service value proposition design.

Three design phases feature in the Taking Action stage of the research process: Explore, Ideate, and Develop (Figure 1). In the Explore design phase, the aim is to identify customer value in both tangible and intangible dimensions. This requires taking the customer perspective in assessing the company's current situation and its challenges. In the Ideate design phase, the aim is to generate ideas useful for the conceptual design of the new service value proposition through mapping and re-mapping the interaction between the customer and the service value proposition. In the Develop design phase, the aim is to develop the new service value proposition by defining and prototyping the new service touchpoints and new service activities.

In Section 3, we described the visualization tools that Segelström (2013) identifies in the service design literature. We classified these tools according to Diana et al.'s (2009) framework in order to determine how the case company managers could use them (Table 1). Segelström reports that design practitioners primarily use Flows (*Customer Journey Maps*) and Images (*Personas* and *Empathy Maps*). Sangiorgi et al. (2012) and Thurston (2013) use *Customer Journey Maps* and *Personas* in their research on manufacturer servitization.

The case company has numerous B2B transactions. For that reason, we substituted the *Empathy Maps* visualization tool for the *Personas* visualization tool because personal customer data have less relevance than business customer data in industrial sectors (Isaksson et al., 2011). We also used operational focus tools (Lim, Kim, Hong, & Park, 2102). We used Flows (*Blueprints*) and Maps (*Interaction Maps*) to determine which organizational changes were needed to implement the new service value propositions. We also used Images (*Evidencing*) to prototype the service touchpoints.

We conducted six co-creation workshops organized around the three design phases (Explore, Ideate, and Develop). Table 5 presents details on the co-creation workshops.

Design Phases	**Workshop series**	**Service design visualizations tools**	**Participants: Railways Division**	**Participants: Sheet Metal Division**
Explore	Workshop 1: identify customer value	*Empathy Maps* *Customer Journey Maps* *Interaction Maps*	5 participants (business manager, quality manager, project manager, sales manager, product engineer)	4 participants (sales manager, project manager, operations manager, R&D manager)
Ideate	Workshop 2: generate ideas to design service value proposition	*Customer Journey Maps* *Interaction Maps*		
Develop	Workshop 3: develop service value proposition	*Blueprints* *Evidencing*		

Table 5. The six workshops in the design project

The researchers and the workshop participants co-created the visualization tools that they

represented on large sheets of paper using post-it notes and marker pens. After each workshop, the researchers formatted the visualization tools digitally. Then the researchers printed and shared the digital representations with the participants in the current and subsequent workshops. Figure 2 illustrates how the tools were sequentially applied in the workshops following the three design phases.

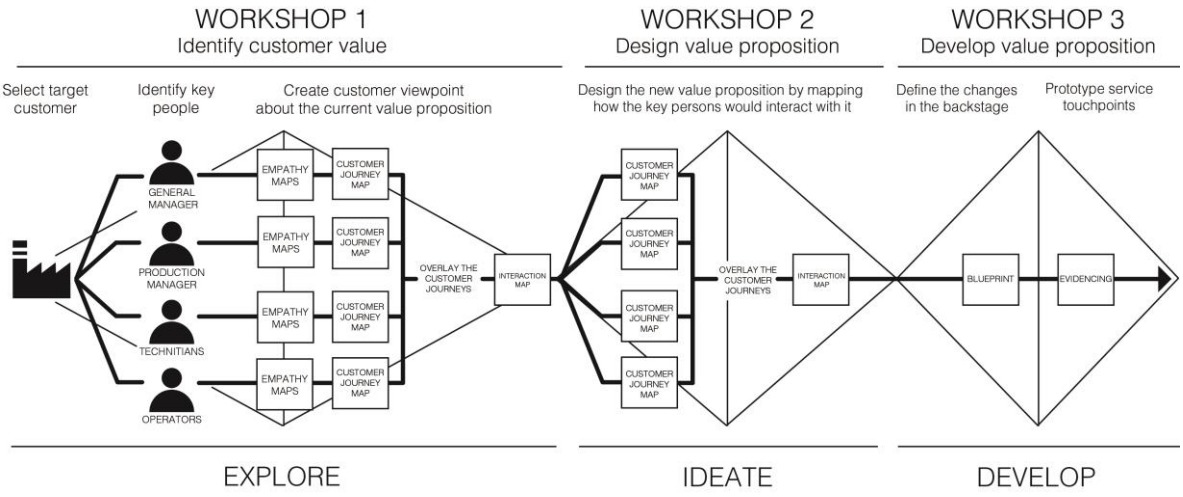

Figure 2. Sequence of the service design visualization tools in the co-creation workshops

6.1 Explore. Workshop 1: Identify customer value

For service value proposition design, Anderson et al. (2006), Ericson (2007), and Kindström (2010) think it is essential to have a holistic understanding of each customer's needs and wants. The goal of Workshop 1 was to give the participants the opportunity to identify and visualize customer value. We asked them to think about the needs and wants of their target customers (O'Cass & Ngo, 2012). Workshop 1 had the following three steps:

1. Select target customer. The facilitators (two of the paper's authors) asked the participants to list the target customers for each market niche. Then the facilitators asked them to select one customer as an example to use in an experiment on the customer's sales potential for

the division.

2. Identify key customer personnel. The facilitators asked participants to identify the key people at the selected customer company who were responsible for the purchase of the solution on offer. These people were categorized by their company position (e.g., top managers, middle managers, technicians, and operations personnel). Next the facilitators asked the participants to assume the customer's value perspective by creating an *Empathy Map* for each key person (Osterwalder & Pigneur, 2010).

3. Map the current value proposition. The facilitators asked the participants to map the current value proposition using a *Customer Journey Map.* This step required the participants to complete each key person's journey in the purchase of the value proposition – the sale of a single-operation machine with the offer of warranty and maintenance services.

Because of the multi-relational nature of the company's B2B activities, several *Customer Journey Maps* were created -- one for each key person. Then the *Customer Journey Maps* were redone. Next, the facilitators asked the participants to describe the existing social network in the current value proposition. The participants used an *Interaction Map* (Morelli, 2003, 2006). This map identifies the relationships between a company's employees and the customer's key people in the current value proposition.

6.2 Ideate. Workshop 2: Design value proposition

In Workshop 2, the participants produced ideas for the design of the new service value proposition. The workshop was framed consistent with Frankenberger, Weiblen, Csik, and Gassmann's (2013, p. 254) comment that a workshop aims "at opening up the solution space and at generating a set of possible alternatives." The design of the service value

proposition reflects the new service journey that the customer's key people (from Workshop 1) experience over time.

The participants created the new service journeys using their understanding of customer value (from Workshop 1). Thus, the service journey focused on the service frontstage in its chronological mapping of the service activities and touchpoints. The facilitators asked the participants to review all customer interactions (e.g., sales activities, service activities, and personal encounters) (O'Cass & Ngo, 2012).

The participants used a *Customer Journey Map* (a model) to ideate the new journey. This journey was framed around a turnkey delivery solution instead of around a machine sale. The model did not take into account the backstage people or the processes. The model's focus was value perception from the customer perspective. In this way, the participants were fully aware of what the customer should see and feel rather than on how the value proposition would function. In the Customer Journey Map (Figure 3), the horizontal row is time, which is divided into three stages in the service period. The six layers in the vertical row represent the customer value perspective.

Again, because of the multi-relational nature of the company's B2B activities, several new *Customer Journey Maps* were created -- one for each key person. After completion of the initial *Customer Journey Map, the* participants modified the next customer maps. They then overlaid (redid) these maps.

Next, the participants re-designed the *Interaction Map* (Morelli, 2003, 2006) by mapping the new relationships among the customers, providers, and partners in the new turnkey value proposition. Colors, circles or boxes, and lines (straight, continuous, and discontinuous) were used to distinguish among the customers' managers, departments, and relationships,

respectively. Figure 4 presents a simplified example of an *Interaction Map.*

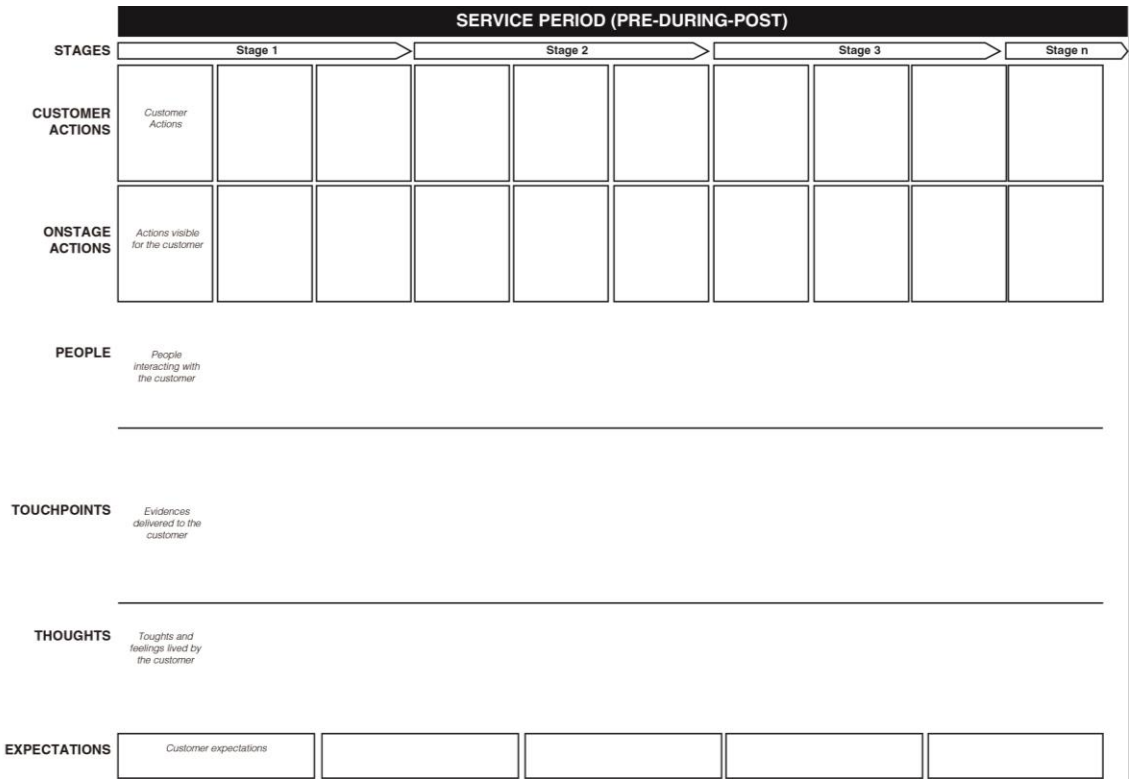

Figure 3. The *Customer Journey Map* model

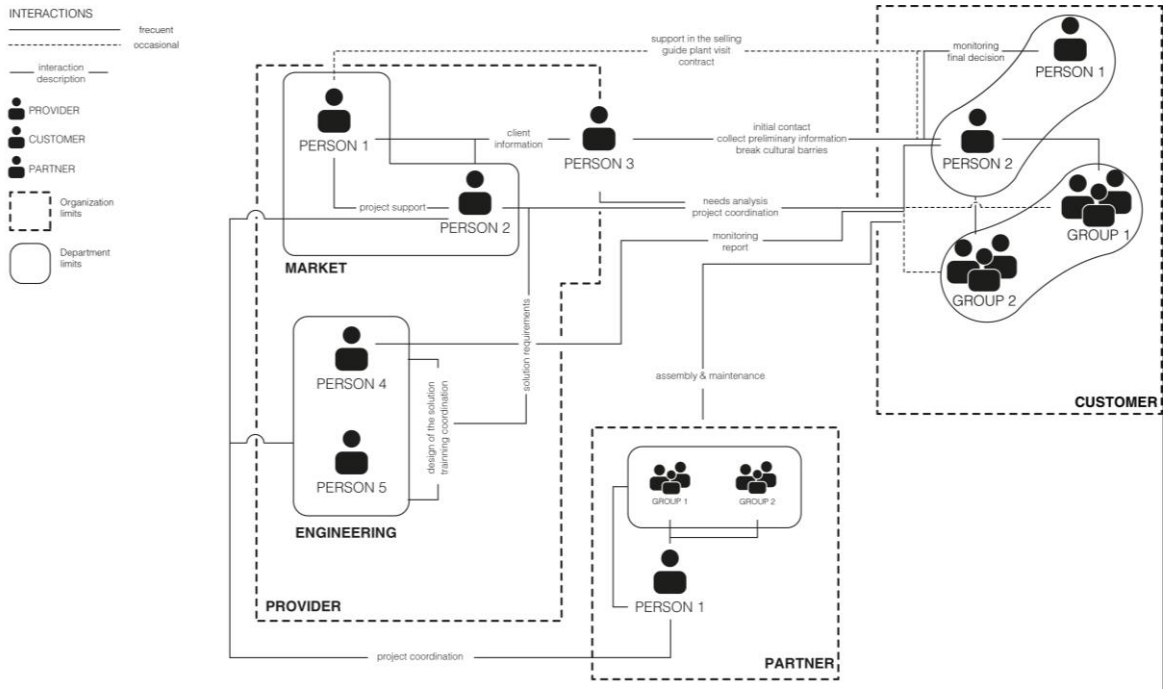

Figure 4. Simplified version of the *Interaction Map*: The network at the Sheet Metal Division

6.3 Develop. Workshop 3: Develop value proposition

In Workshop 3, the participants identified the modifications in the current backstage processes that were needed for the new service frontstage processes (designed in Workshop 2). They also prototyped the new service touchpoints. Whereas in Workshop 2 the participants focused on the customer experience, in Workshop 3 they focused on the operations needed to deliver the new service value proposition.

Workshop 3 had two steps. In the first step, the backstage processes were defined. The participants created a *Five Sections Blueprint* model (Bitner et al., 2008). In this model the new backstage processes are added to existing workflow processes. In the second step, the participants prototyped the new service touchpoints (physical and digital) using *Evidencing* prototyping (Table 1). Here the participants sketched images of commercial presentations,

catalogues, wireframes for software platforms, training materials, technical and monitoring reports, etc.

7. EVALUATION OF THE APPROACH TO SERVICE VALUE PROPOSITION DESIGN

The use of visualization tools in the design process guided the case company in the development of the service value propositions. Table 6 summarizes the outcome of each visualization tool in terms of the service value proposition design and its relationship to the servitization literature.

Members of the company's upper management team agreed to implement the design project. However, the company's business manager admitted that the company initially lacked the internal competence to manage the project although the evaluation revealed the company's managers thought they had acquired the procedural skills needed to manage the project in a "well-structured manner." As the design project continued, they found the process and the visualization tools "easy-to-use" and "beneficial." A project manager said:

> The visualization tools are easy to understand and use (…) lots of interesting discussions took place in the workshops and afterwards when we shared the visualizations among the different departments at the company.

The project shows that the use of service design visualization tools can support both an external fit and an internal fit (Eskelinen, Rajahonka, Villman, & Santti, 2017; Frankenberger et al., 2013). External fit refers to the alignment between the customer needs, wants, and characteristics and the ideas behind a new service value proposition. Internal fit refers to the alignment between these ideas and the processes required to offer customers a new service value proposition.

Design phase	Visualization tool	Outcome of each tool related to the service value proposition design	Servitization literature that this approach aligns with
Explore (Workshop 1)	*Empathy Map*	Identify customer's value perspective, including intangible values Acquire a more customer-oriented viewpoint Support external fit	Investing time and effort to understand customers' voice more profoundly than merely obtaining product requirements (e.g., Anderson et al., 2006; Ericson, 2007). Need to develop abilities to visualize the intangible value of the service offers (Kindström, 2010). Need to design a service offer able to attract persons from different levels at the customer's organization (Kindström, 2010; Täuscher & Abdelkafi, 2017). Need to develop skills to empathize with customer's situation (Baines & Lightfoot, 2013).
	Customer Journey Map	Visualize the current value position from the customer's value perspective Acquire a more customer-oriented viewpoint Support external fit	Emphasis on the customer's processes in designing the value proposition (e.g., Baines & Lightfoot, 2013; Kindström, 2010; Lusch & Vargo, 2014). Need for holistic understanding of customer's value perspective (performance, co-creation, relationship) (O'Cass & Ngo, 2012).
	Interaction Map	Visualize how the relationships between provider's and customer's employees in the current value proposition	Analysis of the relationships and delivery processes in order to take advantage of the customer's inputs and roles (e.g., Isaksson et al., 2011; Kindström, 2010).
Ideate (Workshop 2)	*Customer Journey Map*	Generate ideas and visualize the way in which the company must interact with the customer in the new service value proposition Generate ideas that identify new service activities and touchpoints for demonstrating intangible value to customers Abandon product-centered mind-sets Support external fit	Creation of specific service value propositions for each customer (Cohen et al., 2006). Design of service value propositions based on customer processes with a focus on, for example, co-production (e.g., Baines and Lightfoot, 2013; Kindström, 2010). Identification of new customer contacts points based on customers' needs and wants (Kindström, 2010).
	Interaction Map	Visualize optimal relationships between provider's and customer's employees in the new service value proposition Support external fit	Need for frameworks that can facilitate common understandings of the roles and responsibilities for the various stakeholders in service offerings (e.g., Isaksson et al., 2011; Morelli, 2009). Need to design the value proposition that enables achievement of deeper

			relationships with customers (Kindström, 2010).
	Evidencing	Visualize how the new value proposition feels and looks to the customer through the new touchpoints Understand how the service value proposition is "made tangible" through the new touchpoints Prototype how Intangible value is demonstrated to customers Support external fit	Need to demonstrate value by carefully presenting service activities to the customer (Baines & Lightfoot, 2013). Find new customer contact points based on customers' needs and wants (Kindström, 2010). Create tools for communicating value in-use to customers (e.g., Macdonald et al., 2011; Morelli, 2009). Establish the company in the customer perspective as a service provider (e.g., Baines & Lightfoot, 2003; Kindström, 2010).
	Blueprint	Identify which backstage operations must be modified because of the new onstage service activities and touchpoints Support internal fit	Need for methods for progressive definition of the service systems, from a general level to the details of single operations (Baines et al., 2009; Morelli, 2009). Need to focus service delivery operations on customer value creation (Kindström, 2010). Match of internal resources to customer's organization and needs (Kindström, 2010).

Table 5. Outcomes of the workshop visualization tools and their relationship to the servitization literature

The service design project shows that realistic-synchronic Images (*Empathy Maps*) have a useful role in identifying customers' intangible values. This is an important finding because it is a response to the challenge of visualizing the intangible values of service offerings (e.g., Baines & Lightfoot, 2013; Kindström, 2010; O'Cass & Ngo, 2012). In the same way, developing an *Empathy Map* for each key person in the customer's organization adds to the knowledge on how the design of service value propositions can appeal to persons at various customer organizational levels (Kindström, 2010; Täuscher & Abdelkafi, 2017).

As the company's managers became more aware of these intangible values, they gained a greater understanding of their customers' situations and more empathy for their customers. They also developed what Baines and Lightfoot (2013) call "service centricity" – a more

service-oriented attitude towards customers (Åkesson et al., 2016; Äyväri & Jyrämä, 2017; Eskelinen et al., 2017; Frankenberger et al., 2013). Thus, the managers thought they could deal with two main challenges in the early phase of service value proposition design: the reluctance to change business logic and the inability to think imaginatively about the customer perspective. A sales manager said:

> The maps [Empathy Maps] have helped us move beyond the technological requirements of our customers (…) we were clear about the functional requirements that our customers demand with our solutions, but sometimes "trust" seems to be more important than technology.

The design project shows the usefulness of abstract visualizations (both synchronic and diachronic) such as Maps (*Interaction Maps*) and Flows (*Customer Journey Maps*). Using these maps, the managers were able to map the current service value proposition and their customer relationships (Kindström, 2010). They were also able to come up with ideas on how to improve their customer interactions using, for example, marketing efforts, service activities (Isaksson et al., 2011; O'Cass & Ngo, 2012), and new customer contacts points (Kindström, 2010). The business manager said:

> The maps were very useful for defining our new offer (…) now we have systematized the touchpoints we must deliver, who must deliver them, and when we must deliver them.

These visualization tools were especially helpful given the lack of systematic tools available to produce new business model ideas and service value propositions (e.g., Åkesson et al., 2016; Äyväri & Jyrämä, 2017; Baines et al., 2017; Frankenberger et al., 2013). The managers agreed that using the *Interaction Maps* and the *Customer Journey Maps* in

combination revealed the need to show customers that, in addition to selling a product, they were also selling a service (e.g., Baines & Lightfoot, 2013; Kindström, 2010; Lusch & Vargo, 2014; Macdonald et al., 2011). A sales manager said:

> We do a lot of invisible engineering work before, during, and after the installation of the solution for our customers (…) Our commercial delegates are always asking for "bullets" for our customers to show that we are actually doing things (...) Somehow we must demonstrate this to our customers.

The digital platform prepared for the Sheet Metal Division illustrates the outcomes from the Develop design phase (Figure 5). The platform, which a workshop participant proposed in the Ideate phase, was prototyped using *Evidencing* techniques (sets of realistic-synchronic Images) in the Develop design phase. The platform allowed customers to monitor and follow-up on the design and installation of the turnkey solution and to evaluate its effect.

By prototyping the platform using realistic Images, the managers could predict how customers would evaluate it before its installation (Baines & Lightfoot, 2013). Thus, *Evidencing* the new touchpoints gave the participants greater confidence in the new service value propositions (Täuscher & Abdelkafi, 2017).

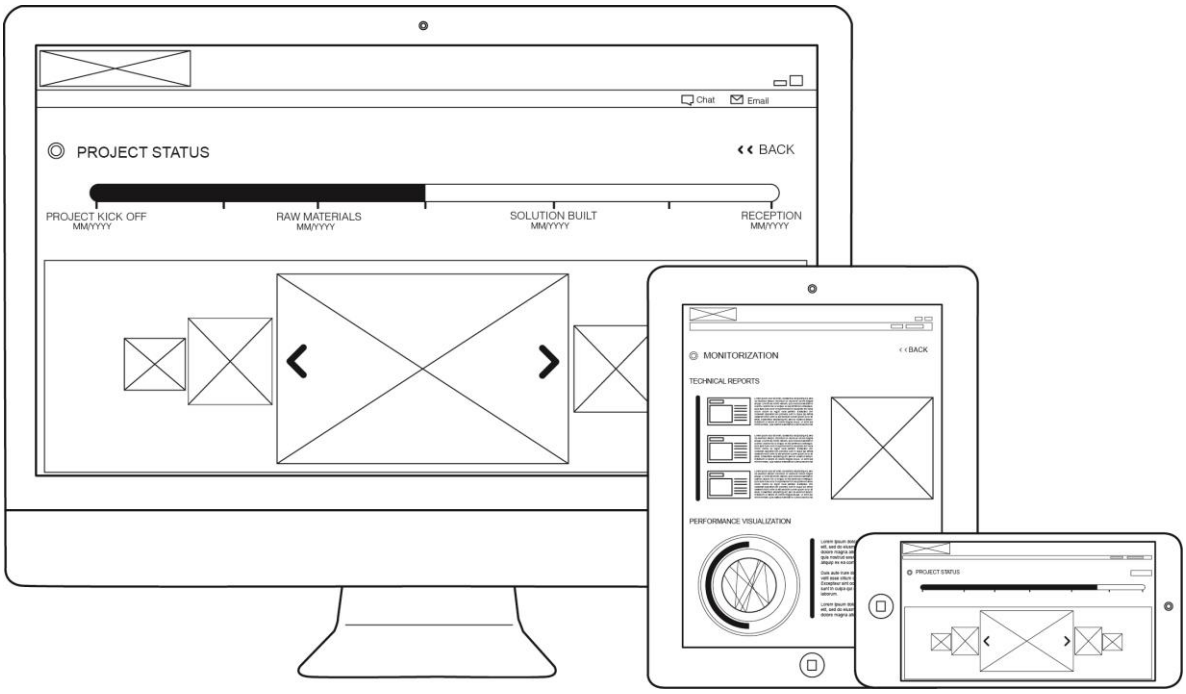

Figure 5. The digital platform at the Sheet Metal Division

The Railways Division managers also had a mind-set change as they gradually moved away from the purely product-centered “embedded culture” to a more service-centered culture (Galbraith, 2002; Martinez, Basti, Kingston, & Evans, 2010). Figure 6 illustrates this change via an abstract-diachronic visualization. The new service value proposition reflects the managers’ greater customer orientation and greater interest in establishing long-term customer relationships centered on multiple interactions versus single machine transactions.

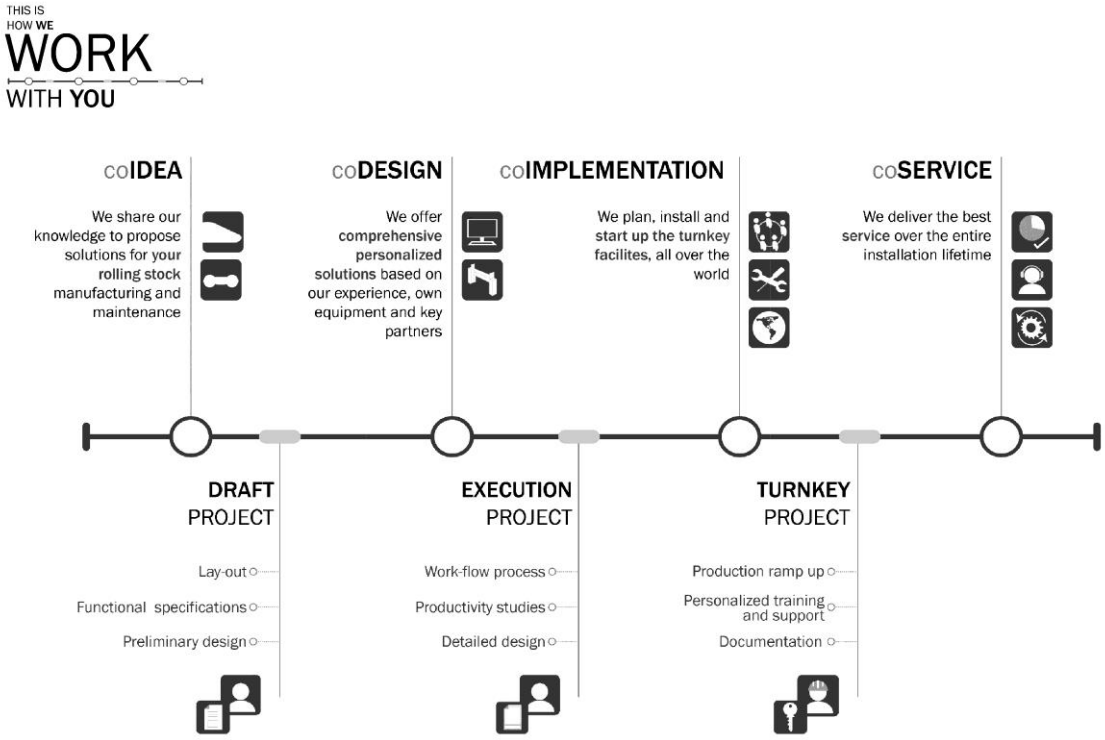

Figure 6. The new service value proposition representation at the Railways Division

However, while generally supportive of the new service value proposition, some Railways Division managers were hesitant about the terminology the facilitators used. A project manager said:

> The terminology used was very unfamiliar to us (...) we are not used to concepts such as customer experience, co-creation, touchpoints, etc.

Therefore, we propose that future service value proposition design projects begin with a "Workshop 0" that precedes Workshop 1. In this introductory workshop, facilitators would explain the design-led approach, with its specialized terminology and tools, and describe the benefits the design project could achieve.

Other managers doubted whether the design project could produce specific benefits. They expressed concern about customer reactions to such co-creation projects. The R&D manager said:

> It may be difficult to engage our customers in these co-creation workshops. I don't think that they are used to such approaches (…) our customers could misunderstand our intentions (…) they may think we are going to use information with their competitors.

These concerns indicated the importance of understanding the settings in which new service value propositions are designed. In B2B manufacturing contexts, unlike B2C service sectors (Yu & Sangiorgi, 2017), extra care must be taken when introducing co-creation approaches. A careful analysis of the setting, with its possibilities for misunderstandings and other problems, is needed before the project is undertaken.

Our research reveals that the existence of a previous and well-formulated servitization strategy supports a generally positive attitude to a service value proposition design project. The manufacturer in our study had worked with the product-service continuum transition before the design project began. Upper management had identified target customers, the technologies needed, and the new partners required. Given this background, upper management was positive about the use of the visualization tools and the new approach. A sales manager said:

> I think that this project has worked in such a short time because we have been working on this transformation for a long time.

Therefore, the operational focus on the abstract-diachronic visualizations tools (e.g., the *Blueprint)* had a minimal role in the new service value proposition at the company. Most of

the major operational changes had already been implemented when we began our work. A project manager said:

> The new actions proposed in the *Blueprint* don't significantly affect our current operations (…) although it has helped us define the role of our new partners in the installation, training, and maintenance of the solution.

However, if a company lacks a well-formulated servitization strategy, the use of properly adapted *Blueprints* (e.g., Geng & Chu, 2011; Geum & Park, 2011; Lee & Kim, 2010) may play a significant role. *Blueprints* may address the gap between the intended service value proposition based on the customer perspective and the required production operations (Morelli, 2009). For the manufacturer in our study, the design project nevertheless demonstrated that service design visualizations tools are useful for identifying factors not previously considered.

It may be a longer and more complex endeavor to take the suggested approach using visualization tools with manufacturers that lack a well-formulated servitization strategy. In that case, to overcome the normal human tendency to resist change, more iterations might be required. Additionally, we suggest that the visualization tools should be used with, or after, a change initiative. According to Powell (2016) and Täuscher and Abdelkafi (2017), the commitment to a design process – evidenced in questions, prototypes, and iterations – promotes a common vision for, and acceptance of, an envisioned change. Additionally, the design process might support a process of organizational learning aimed at developing a new service-dominant logic (Garratt, 1987; Prahalad & Bettis, 1986; Täuscher & Abdelkafi, 2017).

8. CONCLUSIONS, IMPLICATIONS, AND SUGGESTIONS FOR FUTURE RESEARCH

This paper responds to the call for more research on guidance and visualization tools for manufacturers who are developing, or wish to develop, new service value propositions (Äyväri and Jyrämä, 2017; Baines et al., 2017; Bhamra et al., 2014; Martín-Peña & Ziaee Bigdeli, 2016). Adrodegari et al. (2017) observe that very few studies offer such guidance. Martín-Peña and Ziaee Bigdeli (2016) charge that the lack of a common language is still a significant challenge to servitization.

Our paper develops, applies, and evaluates an approach that aims to illustrate how manufacturers can use service design visualization tools for service value proposition design in the servitization process. This approach is an example of an operationalization of service value proposition design characterized by a number of stages, activities, and tools that can be adopted and integrated with manufacturers' everyday practices. The approach – in its empirical setting -- contributes to knowledge with its practical guidance on the use of service design visualization tools. These tools can facilitate structured, effective discussions on servitization when participants share a common vision and a common language.

When such service design visualization tools are introduced at product-centered companies, the result can be a change in business logic as the companies become more customer-centered (Galbraith, 2002; Martinez et al., 2010; Prahalad and Bettis, 1986; Täuscher and Abdelkafi, 2017). Furthermore, service design visualization tools, when used with cross-functional groups, can lead to a deeper understanding of, and commitment to, the customer perspective (Frankenberger et al., 2013) and to "service centricity" (Baines & Lightfoot, 2013). In our study, the manufacturer's two divisions adopted the new service value propositions that were natural developments of their previous work with servitization.

Our research shows that if service design is adopted during the process of servitization transition, managers at manufacturers can gain a better understanding of key customer personnel at different levels. In particular, they may gain a better understanding of the intangible values that customers respect (Anderson et al., 2006; Ericson, 2007; Kindström, 2010). This understanding allows manufacturers to design service offers that appeal to various people in the customer's organization (Kindström, 2010; Täuscher & Abdelkafi, 2017).

With this understanding, manufacturers can also better explain their new service value propositions, both internally and externally. With the use of visualization tools manufacturers can show they understand their customers' situations and can empathize with them. In this way, manufacturers can demonstrate the value of their offers to customers by thoughtful presentations of their service activities (Baines & Lightfoot, 2013; Lusch & Vargo, 2014). These presentations reveal new customer contact points based on customer needs and wants (Isaksson et al., 2011; Kindström, 2010).

This paper makes two main contributions to the literature. First, we describe a design-led approach that focuses on service design visualization tools previously neglected by many servitization scholars. As Stappers (2007) emphasizes, it is important to expose researchers to alternative approaches to similar topics. Second, we illustrate the role of service design visualization tools in service value proposition design for servitization. However, more research is needed into how managers in practice select and use tools for service value proposition design and how established practices are changed as a result.

This paper has several practical implications. In addition to explaining the use of service design visualization tools, we show how various groups can cooperate in the servitization process around new service value proposition design. Furthermore, we illustrate how

managers at manufacturers can use visualization tools iteratively as they seek an external fit and an internal fit for new service value propositions (Eskelinen et al., 2017; Frankenberger et al., 2013).

Our research derives from a single design project at two divisions of a manufacturer that had adopted a turnkey servitization strategy prior to the start of our project. We recognize, therefore, the limitations on the generalizability of our findings. This approach is also highly context dependent (Horvath, 2008). Therefore, more discussion and dissemination of the results of exploratory studies using research through design are needed (Manzini, 2009). However, we propose that our study is a starting point for further analysis on the use of service design visualization tools by manufacturers. Other researchers can examine, test, and develop empirically the suggested approach in other manufacturing settings. Our research shows how the use of the design-led approach in a new domain helps people learn to use service design visualization tools that support servitization (Morelli, 2009; Costa et al., 2017). The approach can also be used to match internal resources to customer needs and wants (Anderson et al., 2006; Ericson, 2007; Kindström, 2010; O'Cass & Ngo, 2012).

We propose three research avenues. First, researchers might conduct empirical studies of service design projects that do not depend on the participation of facilitators (i.e., in facilitator-free projects). Such research, which would place the researcher more in the "observer" role than the "participant" role, would examine the ability of a case company to act more independently in the servitization process. Therefore, a promising avenue for future research is an investigation of how manufacturers can be encouraged to proactively adopt such approaches in order to change their established practices.

Second, researchers might take a different approach to the use-sequence of service design visualization tools than the approach used in our study. Alternative approaches, using

different tools and sequences, could advance our understanding of the optimal way to develop, apply, and evaluate a service value proposition. Therefore, the comparison of service value proposition design processes, through iterations with different sets of visualization tools in different sequences, will increase our understanding of the usefulness and applicability of those tools. These comparisons can highlight both similarities and differences in the processes.

Third, we note that the research approach taken in our study, research through design, is a relatively new way of generating scientific knowledge and of observing human design processes (Brown, 2008; Manzini, 2009) which does not aim at generalizability. The suggested approach, however, meets both the empowerment and applicability criteria for judging the quality of case studies reports suggested by Lincoln and Guba (2002). The detailed description of both the tools and the design process creates the needed prerequisites to empower, activate and stimulate action. It also stimulates re-examination and reconstruction of manufacturers' believes.

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