Standardizing the service delivery system for repetitive industrial services

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Manufacturers need to develop efficient service deliveries that can be used for multiple customers with different equipment. The service delivery system can support service repetitiveness through standardization. The objective is to increase understanding on features and requirements of standardization in the service delivery system and identify means for efficient service delivery in triadic settings. The qualitative multiple-case study with three manufacturing firms reveals different relevant factors for standardization for reactive and proactive services and highlights certain practices in triadic customer participation. Equipment and remote technologies both challenge and enable standardization and require new competences.

1. Introduction

In order to produce industrial services efficiently for multiple customers with multiple pieces of equipment including different technologies, a manufacturing company has to develop its service delivery system carefully. According to Roth and Menor (2003) different service concepts and markets require different management and service design approaches. They propose a framework for studying service operations management issues (Roth; Menor, 2003). This framework enlightens the critical aspects in service delivery systems. Ponsignon et al. (2011) have used this framework to develop service delivery system design characteristics and contingencies.

The efficiency of a service delivery system requires that the system is standardized at some level. Standardization in service delivery means the use of generalized processes to multiple customers and services with little or no customization. It also refers to the means companies use to systematize their service deliveries. Standardization may imply a tradeoff between customer satisfaction and efficiency. The challenge is to manage service quality and productivity at the same time (Wang et al., 2010).

Competitive performance includes outcomes of cost, quality, flexibility and cycle time (Jacobs et al., 2007), and standardization can be a means to improve these performance measures. Service process designs, service modularization, and e-service systems have been studied both in industrial and knowledge-intensive service contexts already (Carlborg; Kindström, 2014). Even if service repetitiveness for diverse customers is a priority to suppliers, previous research has not covered standardization in service delivery systems sufficiently.

As industrial service business becomes global, the complexity of customers' demands in multiple channels increases and the entry of nontraditional competitors in

markets are possible (Roth; Menor, 2003). For example a supplier may enter into competition with its customers in service business, if it takes increased responsibilities as part of customers' processes. Customers' needs have become more heterogeneous and diversified (Bask et al., 2011). Also the service deliveries are more complex and there are multiple parties involved. Companies have to be able to manage the service delivery system, including various structural, infrastructural and integration choices (Roth; Menor, 2003).

When moving towards service business, the supply chain often changes into a network. A triad, i.e., collaboration of three companies, is the smallest example of this network setting (Choi; Wu, 2009). By examining triads the relationships between different players and their power positions can be researched. The understanding of a supply network phenomenon has been limited by the lack of empirical evidence of managing different triads (Peng et al., 2010). In particular, there is a research gap concerning the service production to end users in service triads. More knowledge is needed on how industrial companies can promote industrial services towards customers in a triadic setting with third parties such as equipment dealers and logistics providers. In this research we are examining how a manufacturing firm acts in a triad and how it can promote service production for end customers.

The purpose of this study is to examine the standardization of service delivery systems when producing industrial services to customers in a multi-equipment environment. The goal is increased understanding on features and requirements of standardization in the service delivery system, and particularly manufacturing firms' roles in service triads in such systems. The research analyzes the need for standardization caused by multiple customers, multiple pieces of equipment and multiple technologies embedded in the equipment. The study focuses on three research questions:

1) What are the critical features requiring standardization in manufacturing firms' service delivery systems?

2) How do manufacturing firms manage customer participation and end-customer information in service production?

3) How do manufacturing firms use technology to promote service delivery system standardization?

The study is focused on manufacturing firms and their service delivery systems towards customers in global, industrial settings. The settings are characterized with complexity: each piece of equipment is unique, the customers are multi-equipment and multi-service users, and various third parties may be involved, including dealers, external service providers, and software firms.

2. Literature review

Service sector grows fast and many manufacturing companies are transforming their business towards service-dominant logic. This means that the nature of value creation transforms. Producers and customers do not have separate roles anymore but they are co-creating value in their interactions (Vargo; Lush, 2008). The customer value does not depend merely on the main product anymore. The relationships be-

tween the supplier and customer in order to ensure the product's effective use are also affecting the customer value. (Grönroos, 2011)

The configuration and design of the service delivery system is the way to provide the target customers the service concept and the value proposition. This part of the service business' competitiveness is contingent (Verma et al., 2002; Johnston; Clark, 2005). To achieve expected levels of performance in overall profitability and customer satisfaction, an alignment has to be found between target market, service concept and service delivery system design (Ponsignon et al., 2011; Roth; Menor 2003).

According to Roth and Menor (2003), companies need to consider their strategic choices in target market, service concept and service delivery system design that are linked with each other through service encounters. The target market is related to selecting the right customer. The service concept consists of two parts: core service and peripheral services. The peripheral services supplement the core service and offer additional benefits that add value for the customer. The service delivery system is the process how the service is delivered to the customer. (Roth; Menor, 2003) It includes for example the technology, equipment, procedures, people and management that are needed in the service delivery (Heskett, 1987). The focus of this study is in service delivery systems.

2.1. Service delivery system design

In the design of service delivery systems, the extant literature emphasizes the role of technology, people, equipment, facilities and layout, location, and processes and procedures (Heskett, 1987). Ramaswamy (1996) discusses the matter in a more general way. He proposes that the service delivery system design choices are related to the service delivery processes and the facilities where the service is produced. Roth and Menor (2003) divide the strategic service delivery system design choices into three aspects: structural, infrastructural and integration choices. The structural choices relate to facilities and layout, equipment and technology, and service product-process interfaces and capacity planning. The infrastructural choices concern such issues as practices, people, performance systems, policies and processes. Finally the integration choices relate to operations coordination and organization, service supply chains, learning and adaptive mechanisms, and integration technologies. (Roth; Menor, 2003)

Ponsignon et al. (2011) have used Roth and Menor's service strategy framework in an empirical study with a market leading electricity supplier in UK. As a result they propose service delivery system design characteristics and contingencies. The nature of the target market and the service concept affect the service delivery system design. Customer requirements can either be heterogeneous or homogeneous. The service concept can be highly customized or standardized. It can be typified by contract with configurable parameters and the nature of customer relationship. For example level of technical and interpersonal skills, potential of automation, level of employee discretion and routineness can be higher or lower depending of the nature of the target market and service concept. Also the delivery process is affected and it can be either decoupled or coupled. (Ponsignon et al., 2011)

An important part of service delivery is the supplier's cooperation with subcontractors and various other parties. The service supply chain is a network of suppliers, service

providers, consumers and other supporting units that performs transaction functions of the resources needed in the service production. It also performs the service deliveries and changes the resources into core and supporting services. (Baltacioglu et al., 2007) According to Ellram et al. (2004) service supply chain management is process, information, service performance, funds and capacity management throughout the whole chain. Service supply chain management is a critical aspect to ensure the efficiency and the profitability of service production. Services also differ from products in such ways that traditional supply chain management has to be revised to meet the requirements services cause.

2.2. Standardization of service processes and supply chains

When a company produces services to multiple customers in a multi-equipment environment, standardization of the service delivery system is needed to some extent. Some important issues in service delivery system standardization can be found from previous research. A summary of relevant previous research is shown in Table 1, and key issues are discussed further.

Formalization vs. flexibility in service processes. Wemmerlöv (1990) and Carlborg and Kindström (2014) divide service processes into rigid and fluid processes. According to Carlborg and Kindström (2014) the rigid processes are standardized and they do not require a high level of information exchange between the customer and the supplier or technical skills. The rigid processes are also highly centralized and formalized. The fluid processes on the other hand are customized and a high level of information exchange and technical skill are required. Also Ostrom et al. (2010) propose same kind of classification. According to them services can be designed to be flexible, dynamic and created together with the customer or rigid, standardized and produced without customer participation. However, in many cases the suppliers customize their services even though they have a modular service portfolio. This kind of behavior complicates the standardization of service delivery system. Nevertheless in order to be efficient, the supplier should aim to standardize its service processes to some extent.

Service concept and process modularity. Earlier research has already shown that service concepts may be highly standardized, whereby the customer-specific delivery of services may be supported through the use of modular service components (Jacobs et al., 2007). Roth and Menor (2003) divide the service concept into core service and peripheral services. The core service has five elements: supporting facilities, facilitating information, facilitating goods, explicit services and implicit services. The peripheral services are supplementary to the core service and they offer additional value-adding benefits for the customer (Roth; Menor, 2003). When a company creates new services in addition to their core product business, they have to balance meeting of the customer needs and acceptable level of service development efficiency (Carlborg; Kindström, 2014). As customer needs are becoming more diversified and heterogeneous, this may hinder the balancing of those aspects (Bask et al., 2011). Modularization can be used to manage the balance between the customer needs and efficiency.

In modularization an object is divided into components. These modules then can be combined differently and thus create customizable offerings (Carlborg; Kindström, 2014). In service business there is often a process point of view into services. When

using this viewpoint, service is a mixture of physical and non-physical elements. Different customer-specific configurations can then be created by integrating these elements. (Davies et al., 2007; Pekkarinen; Ulkuniemi, 2008)

Table 1: Summary of previous research and its gaps concerning standardization in industrial service delivery systems.

Viewpoint to standardization and key sources	***Key conclusions; possible gaps***
Formalization vs. flexibility in service processes Wemmerlöv, 1990 Carlborg; Kindström, 2014 Ostrom et al., 2010 Carlborg; Kindström, 2014 Yu; Zhang, 2008	Services can be designed to be flexible, dynamic and co-created with the customer or rigid, standardized and produced by the supplier only. Flexible service processes cause requirements for technical skills and tasks vary highly, rigid service processes are highly formalized and task variety and the level of technical skills are low. Industrial service process is related to the production planning, customer demands and maintenance demands. Because predicting the exact sequence of a service process is often impossible, the process must be flexible in order to be able to answer changes in the three aspects. *Gap: How can co-created service processes be standardized to increase efficiency?*
Service concept and process modularity Johnston; Clark, 2005 Roth; Menor, 2003 Davies et al., 2007 Pekkarinen; Ulkuniemi, 2008 Bask et al., 2011	Service concept includes the way of service delivery, customer's direct service experience, the service outcome and the value of the service. Service concept is based on core service and peripherical services. Service process is a mixture of physical and non-physical elements. Customer-specific configurations can be created by combining these elements. Customization can be achieved on a higher level by breaking down processes into standardized sub-processes. *Gap: How can process modularization be used in effective service deliveries?*
Supply chain reference models Croxton et al., 2001 Croxton et al., 2001 Ellram et al., 2004 Baltacioglu et al., 2007	SCOR model is a tool for charting supply processes and activities. It considers services as process driven. GSCF model is based on a supply chain with three elements: the business processes, the management components and the structure of the chain. Ellram et al.'s model includes five parties: supplier, purchasing, internal user(s)/stakeholders, finance and ultimate customer. Management issues through the chain refer to capacity, demand, customer and supplier relationships, service delivery and cash flow. The IUE-SSCM combines SCOR model and Ellram et al.'s model. It has three main parties: the supplier, the service provider and the consumer. *Gap: How can understanding the service supply chain ease standardization of the delivery related processes?*
Customer participation Carlborg; Kindström, 2014 Xue; Harker, 2002 Tuunanen; Cassab, 2011	There are three different production modes: firm production, customer production and joint production. Customer participation in service production has mainly been viewed as minor and supplementary. In a few existing studies that have usually an internal supplier-oriented point of view, the customer's co-producing role is often neglected. *Gap: How does customer participation affect the service delivery system and how can it be managed?*

Supply chain reference models. Consulting firms and information system providers have developed various modular reference guides to promote the design of standardized product and service processes in companies. Ellram et al. (2004) combine the SCOR (Supply Chain Operations Reference) model and the GSCF (Global Supply

Chain Forum) framework to create a service supply chain model. The SCOR model is a tool for charting supply processes and activities. The GSCF framework conceptualizes supply chain through three features: the structure of the chain, the management components and the business processes. (Croxton et al., 2001) Ellram et al.'s service supply chain consists of five main parties. These are supplier, purchasing, internal user(s)/stakeholders, finance and ultimate customer. The management issues through the chain relate to service delivery, capacity, customer relationship, supplier relationship, demand and cash flow. (Ellram et al., 2004)

Baltacioglu et al. (2007) introduce a framework for service supply chains called the IUE-SSCM (Izmir University of Economics Service Supply Chain Model). The IUE-SSC model is based on the SCOR model and Ellram et al.'s model. It has three main stakeholders in the service supply chain: the supplier, service provider and consumer. In the model, information flow and technology management are important issues through the chain. Service delivery happens between the service provider and the consumer or between the supplier and the consumer. Also this model has several management issues related to demand, capacity and resources, supplier relationship, service performance, order process and customer relationship. All of these management issues have their own sphere of influence in the chain. (Baltacioglu et al., 2007) By using these kinds of models companies can understand better the natures of service supply chains. Also Ellram et al. (2004) highlight that their model can be used to notice red flags of hidden cost sources in the service supply chain. The IUE-SSC model has been implemented to the healthcare industry which is facing notable growth with increasing costs. To be able to manage the growth and the costs, service supply chain management is vital for the industry. In this context the IUE-SSCM was successful tool for identifying important managerial aspects. (Baltacioglu et al., 2007)

2.3. Customer participation in service deliveries and service triads

One distinct feature in service production is customer participation. The dominant understanding is that the supplier and the customer both participate in the joint production of the service (Carlborg; Kindström, 2014). Customer participation increases the variation in the system and makes demands on the facilities, technology and design of staff (Safizadeh et al., 2003). In many cases the supplier cannot avoid customer's participation in the service delivery system (Zomerdijk; de Vries, 2007). This means that one critical aspect in the service delivery system standardization is the customer's role and it has to be considered when the company develops standards and standardized processes.

In the existent literature on industrial services, customer participation in service production has mainly been seen as supplementary and minor (Carlborg; Kindström, 2014). Also the customer's cooperation role in service production is often neglected (Xue; Harker, 2002). Customer participation in service production is, however, a reality and companies have to be able to manage it well to achieve efficiency in the service delivery system.

Service delivery in supply networks implies that multiple parties may be involved in service delivery. Service triads engage suppliers, customers and certain third parties into service delivery (e.g. Wu; Choi, 2005). Dubois and Fredriksson (2008) and Wu

and Choi (2005) have studied triadic networks where one buyer interacts with two suppliers. Dubois and Fredriksson (2008) propose a type of sourcing called “triadic sourcing” where the buyer utilizes a joint sourcing strategy for two distinct suppliers, based on a single case study in car industry. Wu and Choi (2005) concentrate on supplier-supplier relationships in their research, using a multiple case study in eight companies from different industries. They define archetypes of these relationships in triadic networks. Rossetti and Choi (2008) have surveyed triadic networks where the supplier interacts with an intermediate player and an end customer in commercial aerospace industry. They focus on a phenomenon where the supply chain disintermediation takes place between the supplier and the customer (Rossetti; Choi, 2008). The third type of triadic network is a chain where one supplier interacts with two buyers. Choi and Kim (2008) have done a literature review of this kind of a network. They highlight the importance of structural embeddedness in a buyer-supplier relationship. This means that the buyer should evaluate its suppliers in the network context and not in isolation.

Peng et al. (2010) have taken a different kind of approach into triads. They identify six types of triads from which they chose three and focus on them, based on their specific research sample. These three triads are as follows:

1) The company has a bridge role in the triad which means that it is connected to two disconnected partner companies.

2) The company has a peripheral role in triad. It is connected only to one of the connected partners.

3) The company has an equal role in the triad. All the companies are connected to each other.

In this research we are especially interested in such a triadic setting where the supplier has a peripheral role. The supplier sells its products to the end customers via distributors or integrators. We are inspecting the means that the supplier has to promote the service sales to these end customers. When using these kinds of sales tactics, the supplier in many cases does not know the end customer. This complicates the supplier’s service production and after sales opportunities.

2.4. The role of technology in service deliveries

In the past decades, the rapid development of information and communication technologies and the internet has had enabled standardization both in service processes and products. Such technological developments for example enable companies to collect data and keep record of their installed base remotely at the customers’ locations efficiently (Jonsson et al., 2009). Remote monitoring is done by adding sensors into the equipment. These sensors produce real-time data about the equipment that can for example be related to signs of breakdown, current status or unusual use of the equipment (Westergren, 2011). The companies can use this kind of data to develop and offer new services to their customers, including preventive maintenance and optimization services.

The sensors are placed on the critical components. When remote monitoring system (RMS) is installed in multiple factories, the manufacturer has an opportunity to collect and analyze data from several components and production systems across organiza-

tional boundaries. (Jonsson et al., 2009) RMS provides also other benefits for the manufacturer. By monitoring the components and equipment the manufacturer is able to track where its pieces of equipment are. Also the knowledge about the products increases, which enables the manufacturer to predict and identify its customers' service needs. (Jonsson et al., 2009) This is a major competitive advantage for the manufacturer as it is essential for the service provider to understand its customers' needs.

To sum up, the above literature review has scanned the key issues relevant to standardizing the service delivery systems. Earlier research has largely focused on the design parameters of service delivery systems inside manufacturing firms and drawn attention to flexible and rigid processes. To complement previous research, we have highlighted the importance of the customer's and network's role as part of standardization efforts, as well as the role of modern remote technologies. Customer participation in service production has been noted in the literature but its effects on the service deliveries have to be studied more, particularly in demanding industrial contexts. Also the ways to manage the customer participation in the service context is an important issue that needs to be enlightened more, particularly when various information and remote technologies are used, to monitor the installed base of equipment.

3. Research methods

3.1. Research design

This research was conducted as a qualitative multiple case study. According to Yin (2009) a case study is a suitable method when the aim is to understand a real-life situation holistically. The case study can also be used to collect knowledge of a group, individual or phenomenon (Yin, 2009). The benefit of a multiple case study is that the results of the first case can be verified in the next cases.

In this research three manufacturing companies were studied. All the case companies are product oriented and active in the engineering industry. In order to maintain the anonymity of the companies, they are called CompanyA, CompanyB and CompanyC. Table 2 offers background information of the case companies.

All the case companies operate in a global environment. They are product-oriented manufacturing companies, with a primary focus on the delivery of fairly complex technology-based systems and recent expansion of offerings into industrial services. At the moment all the companies are showing an interest in remote services. However, only CompanyC is actively selling these kinds of services at the moment and even in their case remote services play a minor part.

The biggest differences between the case companies are their customer bases and service processes. Every company has their own working methods and different technological systems. Also the technology embedded in their equipment causes variation between the companies and their service deliveries.

Table 2: Information of the case companies

	CompanyA	***CompanyB***	***CompanyC***
The nature of the industry	Mostly project deliveries but also transactional deliveries. Focus area is component manufacturing.	Mostly project deliveries but also transactional deliveries. Focus area is assembly manufacturing.	Mostly project deliveries. Focus area is both component and assembly manufacturing.
Typical customers	Customers vary from company clients to consumers	Customers vary from small to big companies	Customers vary from small to big companies
Service offering	Traditional product related services, consulting	Traditional product related services, process integration and optimization	Traditional product related services, process improvement
Net Sales (million euros)	>30000	<5000	<5000
Number of employees	>100000	>10000	>10000

3.2. Data collection

The data collection was done using multiple methods. In this research semi-structured interviews were used as the primary data collection method. The interview outline development was based on the literature review and the general information of the case companies. The interview outline included similar questions for all the case companies. However some modifications were made depending on the case companies. The main themes of the interviews were: service delivery processes, the company's customers and their role in service deliveries, service delivery system standardization, sales processes, customer interaction, remote data collection and background information. The service delivery process theme included questions for example about the structure of the process, its level of standardization and the participants involved in the process. The customer's role theme had topics such as communication between the supplier and the customer, customer's participation in the service delivery and customer satisfaction. Questions about sales processes on the other hand were related to the order-delivery process, cooperation of product and service sales teams and sales tools.

In total, 19 interviews were performed. Five interviews were carried out in CompanyB and seven interviews in both CompanyA and CompanyC. They lasted between 25 to 111 minutes (53 min on average). The persons that were interviewed were working mostly in middle management in service business related operations. All the interviews were audio recorded and transcribed. Most of the interviews were conducted at the case companies' premises and some at the university premises. This offered also an opportunity to learn about the interviewees' working environment and to observe the premises and working habits.

Observation and documentation provided by the company were used as secondary data collection methods in the CompanyA. The company's repair shop's operations - the repair process, personnel's working habits and the facilities - were observed.

They also offered some documentation about their service processes and information systems. These documents were mainly presentations and the documents were used to acquire a complete understanding about the company's services and service processes. This was analyzed and used in the research for purposes of validation.

3.3. Data analysis

Data analysis included several steps. The audio-recorded interviews were transcribed by an external service provider. The first author reviewed the transcripts to find and correct mistakes and gaps. After this, the data was categorized. The categorization was thematic and based on the interview structure.

Each company's data was initially analyzed separately before a cross-case comparison. The aim was to develop case-specific results as well as to find the similarities and differences between the case companies. Workshops were held with all the case companies to discuss the case-specific results and get feedback from them. The aim of these workshops was also to ensure the correctness and validity of the results. Additionally, the case-specific narratives were sent to the company contact persons, for validation and potential corrections. After the feedback of the companies, a cross-case analysis was made to compare and combine the results. The analysis was inductive within the core themes, enabling the emergence of key issues unique to the case contexts. Excerpts from the interviews and cross-tabulation are used in the Results chapter to demonstrate the key findings.

4. Results

4.1. The case companies' service delivery processes and their standardization

There are similarities and differences between the case companies regarding their service delivery processes and how well they are standardized. All the case companies use ERP systems to standardize the steps in their service deliveries. However, the interviewees have identified various needs for improvement, and a need for further standardization can be noted. According to the interviewees, particularly the reactive service deliveries and communication with the customer include good potential for enhanced standardization.

All the case companies have both reactive and proactive services in their service portfolio. The service delivery systems vary between these service types. In case of reactive services, interviewees in all the case companies noted several domains in which standardization could be enhanced. The issue most commonly mentioned by interviewees is problem solving concerning the equipment in the customer's use. It can take a long time and it requires sufficient background information from the customer. A manager at one of the case companies highlighted: "*We have to know so much about the situation that we can send that kind of maintenance technician there who can audit the right piece of equipment.*" This means that communication with the customer is important for the service delivery. Another manager noted that when a maintenance technician faces a piece of equipment that is not familiar to him, the

problem solving is challenging and it can take a long time. In general, allocating the right resources for the right tasks is a relevant resource management issue that requires planning and anticipation.

In the proactive services, interviewees reported good experiences with managing the service delivery systems. A manager explained: "*We know at least two months before the time of the delivery, how long it will take and what is the size of the team we are going to send to the customer's premises.*" When the service deliveries are planned and scheduled beforehand, the uncertainty of the service delivery system decreases. For example spare and wear parts can be ordered straight to the customer's premises depending on the service and the expected time the delivery requires decreases. Yet, the case companies have also different challenges regarding the proactive services. The identified factors relevant to standardization in the case companies' delivery of reactive and proactive services are summarized in Table 4.

Table 4: Factors to be taken into account in standardization in different service type deliveries, as identified in the interviews

Challenges in reactive services	*Challenges in proactive services*
• Service delivery system variation case-by-case • Resource management • The costs increase • The delivery time increases • Defining the problem and its cause • Unexpected changes in the service specifications	• Unique challenges, depending on the service, customer, context and other factors • Customer participation in information collection • Unexpected changes in the customer's premises or the environment where the delivery takes place • Spare parts are not at the right time at the customer's premises even though ordered in time

Particularly in proactive services, the pursuit of standardization faces different factors in the manufacturing firm's delivery system, varying between the customer requests and the companies much more than the challenges in reactive services. Overall, the interviewees felt that the management of proactive service deliveries is at a relatively good level in the case companies and the challenges emerge from such unique aspects as the customer base, the service concept or organization structure. The interviews highlighted challenges in customer participation, the importance of locations and environment in service deliveries, and timely spare part deliveries from the subcontractors. These were the issues that were most important according to interviewees own experience in proactive service deliveries.

The standardization of service processes differs between the case companies. Some processes are well standardized but others vary depending on the customer and the piece of equipment. For example a manager at one of the case companies noted that their wear part service deliveries are well standardized but their field maintenance service deliveries vary a lot and the manager compares them to a car repair. Every piece of equipment requires a bit different maintenance tasks and the processes are different. Some main challenges related to the lack of standardization were expressed as part of the interviews. A manager at one of the case companies noted: "*Because the service processes are not standardized and the services are not productized enough, the pricing and the offering of the services is much more difficult than products.*" Another manager explained that they have had cases where spare parts have delayed and the service delivery has failed. They are now trying to ensure that these kinds of situations will not happen again. Also, the interviews revealed that

certain parts of service processes may be better standardized whereas other parts may still be quite customized.

4.2. Customer participation in service deliveries

Customer's participation in service deliveries was experienced as crucial particularly in case companies A and C, and important also in CompanyB. In CompanyA and CompanyC the most important thing emphasized in the interviews is the information the customers offer. Customers have to give certain information for the companies so that they are able to properly plan and schedule the service deliveries. This information includes for example knowledge of the piece of equipment in question, details of the problem or need and possible information about planned stoppages. A manager noted: "*In my opinion we could give more responsibility to the customer regarding the validity of background information. There could be some kind of automatic procedures because there often are quality errors.*" In CompanyB's case the importance of customer participation varies. In some service deliveries the customer participates highly in the service delivery and for example does some maintenance tasks by itself. In other cases the customer may participate only to necessary extent.

In all case companies the customer participation highlights the importance of communication. The means the case companies use to communicate with the customers are both formal and informal. Most important means of communication for the case companies are email and meetings. However, even though in many service deliveries the information is a crucial aspect, the case companies have standardized the communication models only little or not at all. For example, a manager at one of the case companies explained that they have certain information that they ask from the customer every time, but still in many cases there is a lack of information and they have to contact the customer several times. This leads to delays in the service deliveries.

Particularly in one of the case companies the need to promote end-customers' service use through sales intermediaries was highlighted in the interviews, and it deserves further attention as it illustrates the triadic setting in service delivery. The company uses several sales channels and in some cases they are facing challenges to know who the end-customers of their products are. This issue originates from the supply chain management and the fact that the chain is not transparent enough.

The company has tried to promote the end users to inform about the pieces of equipment by offering additional guarantees. However the guarantees have not been successful incentives for the end users. A sales manager noted: "Typically our products are such that if they have a two year guarantee, they break right away or last 15 years. Half a year additional guarantee is not a very big benefit." At the moment the company is developing a software system to ease the registration of the equipment. The end user would just scan the serial number of the piece of equipment with a mobile phone or tablet and the registration would go through the software system.

The company also considered incentives for their distributor partners and integrator customers to inform them who their customers are. In case of distributors the company could develop into repetitive concepts such services that would be easy to sell and they could offer some kind of compensation for the distributors to sell their services with the products. Integrators are more complex case because some of them

compete with the company in the service area. If the integrator is a competitor, they have no means to promote the integrator to inform them of the end-customers.

Also the organization structure of the company has been considered as a relevant issue. Their product and service departments are separate and it hinders their service sales because the cooperation between the departments is not sufficient. According to a manager they do not offer the customers services at the same time as products. This is a sales problem and it could be solved by adding cooperation between the departments. At the moment the company is trying to integrate the departments at some level in order to ease the sales process.

Furthermore, the company example demonstrates increased complexity due to the use of several different information systems and even the different departments' use of different systems. Due to the complexity in such support systems, cooperation between the service and product departments is not always easy. If the sales departments had common systems, it would be easier for them for example to inform the other department of leads.

4.3. Use of remote technology and its requirements on the service deliveries

All the case companies can produce some services for multiple customers at the same time. The technologies in the customer's use and remote technologies to monitor equipment generate unique requirements toward the manufacturer. Interviewees had experienced that both core equipment technologies and remote technologies to monitor them are relevant in service delivery, and the development toward technology-related services is currently ongoing.

The different technologies embedded in the equipment causes requirements for the service deliveries. Interviewees in all the case companies highlighted that the technologies require different competencies and resource management becomes more complex. In all the companies, supervisors in each team or unit are in charge of resource and competence management. Also the technology embedded in the customer's premises can cause requirements for the case companies. A manager explained: "*In some customer premises the maintenance technicians working in there have to have security certificates. This means that all our maintenance men cannot work in all locations.*" This adds the complexity of the resource management.

The interviewees in the different companies had somewhat different experiences related to technology and its role in standardization. For example the long lifecycles of the equipment are a central issue when pursuing standardization as there are multiple generations of the same equipment category in use all the time. A manager at one of the case companies explained: "*Some of the customer's pieces of equipment can be several decades old when others are new. Challenges arise when we have to compare substitutive products to these pieces of equipment.*" Also the size of the piece of equipment can affect the service deliveries. One manager had experience of spare part deliveries and he noted: "*It is a logistic nightmare to replace thousand parts that weight 400 kilos.*" The technology embedded in the equipment can have traditional and surprising effects on the service deliveries and its role has to be remembered when managing a service delivery system. Some of the interviewees emphasized the competences needed for handling technologies in customer's use and

the need for internal knowledge of these competences. To achieve customer satisfaction, it is quite crucial to find the right experts for service delivery when equipment lifecycles are long and generations of equipment differ from each other.

All the case companies showed interest in the interviews for monitoring the equipment and using the gathered data for predicting customers' service needs. A manager at one of the case companies told: "*There are lots of opportunities to exploit the data. -- The idea behind it has to be the willingness to help the customer.*" All the case companies gather installed base data from their customers. The most highlighted issue in the case companies at the moment is the management of the data. Different information systems across units cause challenges and in many cases the data has to be added into several systems. At the moment CompanyC has the most developed remote service offering. They are actively gathering remote data and use it in their service production. Their biggest challenge is that in theory remote services are enabled but in practice development in the processes is still ongoing.

5. Discussion

5.1. Standardization of delivery systems in industrial services

The first research question relates to the features that need standardization when developing a manufacturing company's service delivery system. This study reveals that the important features in standardization can be divided into reactive service factors and proactive service factors. The identified reactive service factors include resource management, cost and time management, problem solving and information management regarding service specifications. In reactive services, therefore, standardization appears to require actions on a very operative level in the processes and practices governed by the manufacturing firm. The proactive service factors, in turn, consist of customer participation management, facility management and spare part delivery time management. Therefore, in proactive services, standardization is considered in terms of how the customer interface is managed and how customer requirements are fulfilled in the service delivery. In all, these factors agree with earlier literature relatively well, but point out the necessity to consider standardization at multiple levels: customer interaction, service delivery system, and micro-level operations of the manufacturing firm.

Many of the factors found in this study have been noted in Roth and Menor's (2003) study of service delivery systems. For example resource management, information management in service specifications and customer participation management can be considered as infrastructural design choices. Facility management and spare part delivery time management on the other hand are related to structural design choices. Cost and time management and problem solving have not been covered in Roth and Menor's framework because they can be considered as more specific than the framework. Our findings, thereby, contribute by highlighting some of the micro-level operations that complement the general framework on service delivery systems, particularly in the reactive services of engineering firms.

Some of the factors relevant to service delivery system standardization can be related to the service supply chain models of Ellram et al. (2004) and Baltacioglu et al.

(2007). For example customer participation management has been considered in both of the previous models. Information management regarding service specifications and resource management can be related to Baltacioglu et al.'s model. The other factors have not been covered in the supply chain models because the models are made on a more general level. Therefore, our findings on the industrial services of engineering firms contribute by highlighting the focus on proactive services, when seeking standardization at the customer interface activities.

Both in reactive and proactive services, the results showed unique challenges, depending on the service type, customer, context and other factors. Variation occurred in the service delivery systems, as well as situation-specific service delivery. The findings, therefore, promote the idea that different service delivery systems are needed for different situations even within the same manufacturing firm.

5.2. Customer participation and end-customer information in service production

The second research question inquired the manufacturing firms' means to manage customer participation and end customer information in service delivery. The interviews showed that even in the case of proactive services, customers have an important role in enabling and even driving standardization possibilities. Customer participation and information provided by customers may either advance or challenge the standardization of services. If customers are willing to provide information that suppliers need for service standardization, they can be enablers of the standardization process. However, in the opposite case suppliers may be powerless regarding their standardization objectives.

The results lend support to Safizadeh et al.'s (2003) claim that customer participation increases the variation in the system and causes requirements on many aspects. The study also reveals that in many cases the customer participation is an essential part of the service delivery, thereby agreeing with Zomerdijk and de Vries' (2007) research. However, customer participation was experienced as somewhat more central in the standardization of service delivery than what is proposed in some earlier research. For example Carlborg and Kindström (2014) claim that customer participation has mainly been seen as minor and supplementary. Also Xue and Harker (2002) explain that the customer's cooperative role in service production is often neglected. In this study, engineering firms considered customer information and customer participation as quite relevant in the pursuit for standardization.

In particular, one of the case companies demonstrated a clear triadic setting where the cooperation through sales intermediaries with customers made the access to customer information and participation especially challenging. Such intermediaries have been identified in earlier research particularly in terms of service providers between the equipment manufacturer and customers (Finne & Holmström, 2013). The findings in this study complement earlier research in revealing the importance of the transparency of the service supply chain, organizational structure and partner management in a multiple sales channels situation.

Certain practices were emphasized in the results, in attracting customer participation in service delivery. For example, the incentives for the end-customers have to be significant enough so that they are willing to register their pieces of equipment. The

case company has offered additional guarantees but these have not been significant enough for the end-customers' business. Organizational structure was considered as relevant to the end-customer service promotion. If the service and product sales departments are separate, the communication between the departments is crucial. The literature regarding triadic settings mainly concentrates on the structure of the triad, and this study has revealed practical ways in which the transparency and cooperation in the triad can be enhanced.

5.3. The role of technology in service delivery system standardization

The third research question dealt with the role of both equipment technologies in the customers' use, and remote monitoring solutions as prospective means of service delivery system standardization. According to the results, the low or limited degree of standardization may hinder offering of services and the efficiency of service delivery, which in turn make the pricing and marketing of services complex. Thus, standardization of services can be considered as a necessity for large-scale service provision.

The technology embedded in the equipment causes requirements for the service delivery system. The most important requirement is resource management. According to the results, different technologies require the availability of different competencies. This has been noted also in the previous studies. For example Roth and Menor's (2003) service delivery system framework highlights the importance of resource management. This study was focused on engineering firms with multiple different complex systems, with different generations of equipment in use globally at the customers' locations. This complex setting and its requirements to resource and competence management draw attention to the organizational arrangements in service delivery systems. Further research is needed, to map and analyse with more detail how resource and competence management should be configured, to meet the needs of global engineering firms in their industrial services.

One promising means for service standardization seems to be the use of remote technologies even though it also requires investments into development, as the results show. As the interviewees commonly noted, in particular, in the case of reactive services they are reliant on the information given by the customers. Use of remote technologies would decrease this dependency, and reliable information about the equipment and its malfunctions and repair needs would be readily available for the supplier. Moreover, it would shift the focus more toward the direction of proactive services. Remote technologies would also establish a connection between the supplier and the end-customer even though the supplier would be a peripheral partner due to the intermediary retailer. This way the supplier could promote better the use of services among end-customers.

Even if the remote technology can provide a means to promote standardization of services the diversity of the equipment poses still challenges for this process. Hence, a question remains whether the data obtained from divergent equipment is uniform enough to be useful for service standardization.

6. Conclusions

6.1. Contributions and managerial implications

This paper contributes to the research of service delivery systems by discussing the standardization of delivering repetitive industrial services and promotion of service use in triads; topics only bypassed in the previous research. The topic was approached through a qualitative case study in three manufacturing companies offering industrial services.

Based on the results, two main points regarding the standardization of service delivery systems were highlighted. First, even though the case companies are already experienced in industrial service business and can be considered as unique in their settings, standardization in the service delivery systems was perceived as relevant, necessary and feasible. Standardization possibilities were identified both in reactive and proactive services and on three levels: micro-level operations of the firm, customer interaction and the service delivery system. Second, proceeding in the standardization process is problematic and some aspects require special attention. Differences in standardization practice exist across service types, contexts and organizational structures. In addition, the results showed that wide-ranging technologies and multiple customers set requirements for wide-ranging competencies and resource management. This study contributes to the topic particularly by considering complex settings in which all equipment are unique and multiple customers are serviced in cooperation with various third parties.

This study has featured some factors that need standardization in manufacturing companies, potentially to be taken into account in managerial practice. The importance of customer participation in service production was highlighted and the results can be used to understand the relevance of customers in the service delivery system. Furthermore, technology has various roles as a means to promote service delivery system standardization. This study has explored how equipment technologies drive changes in the service delivery system, and how remote monitoring services can ease the development.

6.2. Limitations and ideas for further research

The main limitation of this study relates to the research design choice of a case study in three manufacturing companies. The results cannot be generalized as such to cover all other manufacturers offering services even though the results were validated in workshops in the case companies. Detailed analysis would require more extensive data collection among a larger group of manufacturing companies offering industrial services.

Further research is needed particularly on: 1) the details of remote technology use in complex and global service contexts; 2) triadic customer cooperation in alternative partner configurations; 3) implications of the lifecycle of equipment technologies on service delivery, and 4) the practice of resource and competence management in industrial services in global engineering firms, particularly when equipment lifecycles are long. As this study was focused on the manufacturers' operations only, it would

be interesting to expand the study to 5) cover also the customers' and third parties' viewpoints, to provide a more comprehensive outlook of the subject.

7. Acknowledgements

This research has been conducted as part of the Service Solutions for Fleet Management (S4Fleet) research program funded by the Finnish Technology and Innovation Agency Tekes, companies and research institutes, and coordinated by FIMECC (Finnish Metals and Engineering Competence Cluster). We gratefully acknowledge the support of the financiers and the companies that participated in this study.

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