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UNDERSTANDING THE IMPACT OF REMOTE SERVICE TECHNOLOGY ON SERVICE BUSINESS MODELS IN MANUFACTURING: FROM IMPROVING AFTER-SALES SERVICES TO BUILDING SERVICE ECOSYSTEMS

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Abstract

We explore the use of remote service technology in manufacturing. The study provides insights into the impact of information technology use on the service business models in German-based manufacturing companies. For these companies, services become increasingly important to compete in global markets. Our study traces how the use of IT, specifically remote service technology, enables innovation in service business models. The study is exploratory, being based on expert interviews with case companies and industry representatives. The study contributes by providing a systematic account of the link between the use of remote service technology and business model innovation.

Keywords: After-Sales Services, IT, Service, E-Service, Remote Service

1 Introduction

Services have become a crucial business segment for the manufacturing industry. Through services, companies secure turnover and especially revenue generation in highly competitive markets (cf. Stolz 2006). This also pertains to globally competitive firms from the German manufacturing industry. While in the past, services were considered self-sellers resulting somewhat automatically from product sales, today, more and more companies try to develop and penetrate this market systematically. Product-related services are at the core of these efforts (cf. Markus 2004). Nevertheless, there is a growing number of companies that differentiate themselves by integrated solution offerings that bundle goods, software, and services (hybrid products) and provide added value to the customer (cf. Geier 1999; Böhmman, Krcmar 2007; Knebel, Leimeister, Krcmar 2007).

Despite all efforts, some years ago the share of turnover generated by services seemed to stagnate in the manufacturing industry (cf. Geier 1999). The reasons for this fact are manifold. More recent studies show that the servitization, the transformation from a pure physical goods manufacturer to a solution provider with individual customer services, is still in progress. In a study by Neely (2008) in 2007 nearly 30% of the considered firms were already servitized. However, traditional field services in manufacturing are under increasing pressure (cf. Böhmman, Taurel, Bremerich 2009). Thus, any further improvement of the service business in manufacturing requires a substantial reengineering of service process (e.g. through IT) and the development of innovative service offerings (cf. Davenport 1993; Lay 2009).

Therefore, it is not surprising that IT plays an important role in the development of services in the manufacturing industry (cf. Leimeister, Glauner 2008). Practitioners increasingly discuss the opportunities that remote services can offer. By the use of technology, especially of IT, remote services allow delivering services independent of geographical location. Remote services are specifically complex because they demand both, additional functionality of the machines manufactured by a company as well as an enhanced IT infrastructure that allows the monitoring and controlling of these machines.

Based on the analysis of our cases of successful remote service implementation, this article aims to uncover the impact of the remote service technology on the service business models of manufacturing firms and thus offer a starting point for further research¹. Firstly, fundamentals regarding definitions and methodological approach are given. On this basis, the cases are shortly introduced and impacts of remote service technology on their business models are described. From these findings, propositions are derived regarding the impact the introduction of remote service technology into a company may have on the different dimensions of its business model, structured according to Osterwalder's (2004) model.

2 Basics

2.1 E-Services

In the following passage, definitions of fundamental terms are given in order to support a deeper understanding of the topic and to outline the basic conceptualization of this article.

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According to Wunderlich et al. (2007), e-services can be described using three different characteristics. The authors define e-services as *web based services*, which deliver a *service over the internet* in an interactive manner, or as purely informational services, which deliver the benefit of *information provision or sharing*.

Buhl et al. (2008), on the other hand, differentiate between an economically and a technologically oriented service concept, which are fundamentally different in the characteristics they consider constitutive of service. From an economic point of view, service is an interaction between customers and providers, in which value is generated. Thus, service is a comprehensive term for the business process, which is composed of a potential, process, and output dimension. It manifests itself as an interaction between a service provider and a service customer.

The technological understanding of service is that of an artifact, which is realized using software and offers a functionality. Web services are a specification of these services, if they are loosely coupled, self-descriptive, independent from platforms, can be composed into more complex forms of services (composition), and are based on standards.

E-service links the economic and the technological service concept. In the following, e-service denotes the provision of services using electronic networks like the internet.

E-services require interconnected information systems. Consequently, services as defined in the technological concept can be employed for the realization of e-services. But this also means that single or composed services from a technological understanding may be offered as e-services.

2.2 Remote Services

The synonyms remote service, tele-controlled service, or teleservice refer to one specific kind of e-service. Wunderlich (2009) describes remotely controlled services as deliverables, which are created and delivered in a technologically supported process, independent of the geographical distance between provider and customer. Also, the geographically distant object on which the service is rendered is changed by a control component with a feedback process.

According to Stolz (2006), most definitions of the term remote service agree on three aspects: The service is an *industrial* one, focusing on machine operations, and is rendered *using ICT* in order to allow *service delivery regardless of geographical location*. The industry association of manufacturing in Germany (VDMA) claims that remote services seek to deliver added value to customer through ensuring and enhancing productivity (availability and quality) (cf. VDMA 2005).

Figure 1 depicts an exemplary customer relationship which may be built with remote services. ICT plays the prominent role of an intermediary and is vital for the realization of an interactive relationship between provider and customer. By using access and controlling technologies the provider is able to remotely access those customer systems which require modification. In the next step, modification technologies make it possible to accomplish the customer's request for changing system specifications. Measuring technologies are employed in order to control for the success of any modifications made and in order to provide status data on the service object as feedback for the customer.

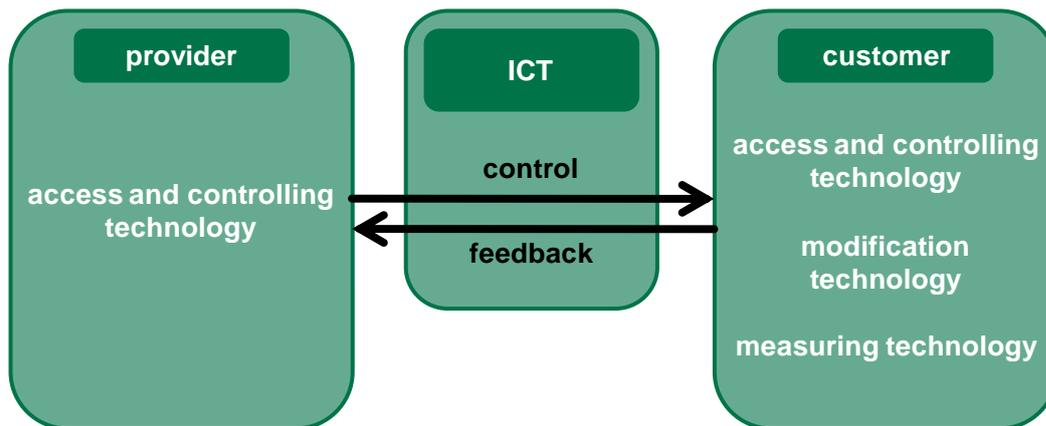


Figure 1. Provider-customer relationship with remote services
(source: based on Wunderlich et al. 2007)

Remote services substitute face-to-face interaction in the service process for technological mediation (cf. Wunderlich et al. 2007). Through integrating IT infrastructure and sharing data, however, remote services may still provide opportunities for an enhanced co-creation of service providers and their customers.

The integration of the external factor into the service provision is also an important part of a remote service. The provider can directly access the geographically distant service creation and is thus able to make changes to the service object. The data connection employed is bidirectional and gives the provider interactive and synchronous access to all resources required (cf. Wunderlich et al. 2007).

It is also characteristic of a remote service that the interaction between the provider and his customer basically stays on the objective level. More precisely, the interaction spans several levels and especially focuses on the objective aspects that are fundamental in the business relationship as well as on the interpersonal level, which underlies the provider-customer relationship throughout its entire lifecycle (cf. Wunderlich et al. 2007).

2.3 Business Models

In order to analyze the impact of remote services on a business model it is necessary to first define the term “business model”. This step is very important because of the huge variety of possible understandings in the literature (cf. Osterwalder 2004; Al-Debei 2010).

Based on a literature review Al-Debai (2010) summarizes a business model as “[...] an abstract representation of an organization, be it conceptual, textual, and/or graphical, of all core interrelated architectural, co-operational, and financial arrangements designed and developed by an organization, as well as all core products and/or services the organization offers based on these arrangements that are needed to achieve its strategic goals and objectives.” (Al-Debai 2010). Similarly Osterwalder (2004) defines a business model as a “[...] conceptual tool that contains a set of elements and their relationships and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams.” (Osterwalder 2004). Osterwalder (2009) also developed the business model canvas (Figure 2.), which represents a visualisation of the business model dimensions. Because of the systematic and easy use of the canvas, we selected this approach for the analysis of the impact of remote service technology on the service business model.

Osterwalder (2004) posit that a business model can help to describe and to understand an underlying business logic so that we can analyze the impact of a remote service on a business model of a

company based on the structure provided by the nine dimensions of this model. These are Value Propositions, Customer Segments, Channels, Customer Relationships, Key Activities, Key Resources, Key Partners, Cost Structure, and Revenue Streams (cf. Osterwalder, Pigneur 2009). In order to reduce complexity we combine Distribution Channel with Customer Relationship and Key Activities with Key Resources. This does not impact the usefulness of the model for structuring our cases but helps to classify the existing information.

Value Proposition provides an overall description of a product or service. It contains a detailed description of the product and the value it can deliver to the customer. Customer Segment contains a specification of the target customer segment and, if possible, further information about the client needs. Distribution Channel describes the way a customer is reached by the company and how effectively this channel can be used. Combining this dimension with Customer Relationship makes it possible to look at how the customer is reached and what type of relationship the company has with the customer. Key Activities in interaction with Key Resources describe all activities and resources needed to realize the offer. If any activities cannot be executed or resources are not available Key Partners are needed. They provide activities or supply resources that are required render the service or product. The Cost Structure offers a list of the most important and most expansive cost positions. The last dimension in the Osterwalder model is Revenue Stream, which gives an overview of possible revenue streams (cf. Osterwalder, Pigneur 2009).

3 Remote Services in the Manufacturing Industry

Data Collection and Analysis

This research is based on expert interviews that were conducted in the context of a research project on business opportunities for e-service on the Internet of Services. The interviews focused on the mechanical engineering and automotive industries. In total, we conducted 13 interviews lasting 60-120 minutes. The experts are selected for their broad industry knowledge of the application of remote services (5 industry experts) or for their in-depth knowledge of the use of remote services in a particular company (8 company experts). Of the five industry experts, two hold academic position with a research focus on IT applications in the selected industries. The other industry experts represented an industry association, a specialized consultancy, and a vendor of remote service software solutions.

To prepare the interviews, detailed research was undertaken on the current topics and challenges of the respective industries as discussed in scientific research and on the web sites of trade associations. Based on these data, thematic guidelines were developed, which helped to structure the expert interviews. These guidelines for company experts comprised closed questions with regard to basic information on the company and its general offerings of e-services. All guidelines contained open questions that investigated the status quo and the future for remote service and complementary e-services either in the specific company or in the focal industry. In order to gain a deeper insight into the topic, questions about opportunities or challenges of e-services and remote technology and related technological developments and industry trends were also included in the questionnaire.

The subsequent analysis focused on identifying the impact the use of remote service technology might have on the various aspects of a company's business model. For this purpose, the information provided by the industry experts was clustered and examples were extracted. On this basis, propositions were derived regarding the influence of remote technology on a company's value proposition, customer segment, customer relationship and channel, key activities and resources, key partners, cost structure, and revenue streams.

Table 1 shortly introduces five exemplary companies and their remote service portfolio with its specific characteristics that we conducted interviews at in the course of the study.

Company	Basic information	Examples for the use of remote service technology
1	<ul style="list-style-type: none"> • automotive industry • OEM • several brands • >50,000 employees (2009) • >50 bn. Euros turnover (2009) 	<ul style="list-style-type: none"> • data collected in vehicles and analyzed for vehicle-related after-sales services, to enhance internal knowledge, and improve performance / design • remote services give manufacturer direct access to vehicle and allow repairs or modifications without geographical constraints e.g., vehicle automatically requests service if maintenance is required • remote services help optimize internal processes (via automation and parallelization), efficiency (cost reduction), and quality
2	<ul style="list-style-type: none"> • manufacturing industry • internationally leading solution provider in print media sector • >10,000 employees (2008/09) • >1 bn. Euros turnover (2008/09) 	<ul style="list-style-type: none"> • services for all lifecycle stages of printing machines • remote services also allow offering added-value services e.g., for process optimization based on data collected and analyzed from customer's machines • remote services help cutting costs, facilitate competitive differentiation, and allow tapping new revenue potentials
3	<ul style="list-style-type: none"> • manufacturing industry • systems for continuous production processes • >10,000 employees (2009) • >1 bn. Euros turnover (2009) 	<ul style="list-style-type: none"> • collection and analysis of customer data are automated and help to enhance customer knowledge and develop (new) products and services tailored exactly at the customer's needs • remote services and individualized offers facilitate direct contact and put competitors at a disadvantage • remote services decrease maintenance costs and time requirements
4	<ul style="list-style-type: none"> • manufacturing industry • broad range of technologies and markets • globally operating • >100,000 employees (2009) • >50 bn. Euros turnover (2009) 	<ul style="list-style-type: none"> • remote services used for a variety of different models e.g., simple problem solving via remote connection; fostering knowledge exchange and solving availability problem of a small number of geographically dispersed experts; comprehensive concept for operating and servicing a plant/solution (i.e. build-own-operate-transfer-model)
5	<ul style="list-style-type: none"> • manufacturing industry • specialized provider of intralogistics systems • <500 employees (2008) • <200 bn. Euros turnover (2008) 	<ul style="list-style-type: none"> • portfolio comprises entire chain, including plant layout, construction as general contractor, integration of inventory software, and after-sales services • after-sales services based on remote services e.g. plant monitoring, operator support, and software management • remote services allow for the development and provision of innovative services

Table 1. *Brief description of exemplary companies and their use of remote service technology*

4 The Impact of Remote Services on the Business Model

4.1 Impact on Value Proposition

The introduction of the remote service technology can have substantial effects on the products and services a company offers. For example, it may help to develop new offers or to extend the existing portfolio.

The development of new products and services can be supported by the usage of remote service technology. Our cases provided a lot of different examples for the potential for supporting innovation.

Company 2 uses the technology to establish new product extensions for their old printing machines. An application store offers the customer the possibility to download new extensions for their existing products. The company is able to design new software products for the support during product lifecycle of its printing machines and to install them via remote connection.

Another example can show us a different impact of remote services on an existing business model. Company 3 collects information via remote services and analyzes it with the aim of developing some new offers to the customer. The company can detect gaps in the service process of the client. Having identified such a gap, the company then helps its client to close it by restructuring or optimizing the client's processes. Especially for clients in the food industry, for instance, a small process improvement in their production line could result in high savings. Additionally, the company in our case offers its customers access to its knowledge database. In view of these aspects, we propose:

- P1a: The use of remote services facilitates the offering of process-related services in addition to product-related services.
- P1b: The use of remote service technology delivers the information needed to offer business process optimization services.

A second impact remote service technology can have on the value proposition of a company is that it can be employed to extend or support an existing product. Being able to offer expert input even in remote locations can increase the perceived value of products considerably. Therefore, company 4 established remote technology to increase expert availability and to simplify knowledge exchange among its experts. Overall, these improvements help to raise service quality. Examples for this application of remote technology can be found in any of our cases.

Also, an automation of service processes can be realized via remote services. For example, this is achieved by automated monitoring of product conditions, like in company 2 and 5. Condition and process monitoring can provide important information, which may prove useful for other processes as well. This way, company 2 is able to offer special services throughout the complete lifecycle of its printing products. All of these services can increase individualisation of products and, thus customer satisfaction. Furthermore, information collected can be used to improve product properties, as is the case in companies 2 and 3. Consequently, we posit the following proposition:

- P1c: Remote services strengthen existing customer service (effect on service quality) through extending the access to expert knowledge and enabling proactive services.

4.2 Impact on Customer Segment

The companies studied focus the use of remote service technology predominately on existing customers. By reducing the overall reaction time and automating many processes the use of remote services can increase customer satisfaction and loyalty.

However, a few companies also try to leverage remote services to expand the existing customer base. A customer of company 1 has to sign a service contract for the whole lifecycle of the product, in this case the automobile. The contract ends with the car being sold or taken out of service. If it is sold company 1 has the opportunity to contact the buyer and to offer him a new service contract. If the buyer is interested in using all features his new car offers he will sign the contract and company 1 will get a new client.

Another example can be found at company 4. This company uses the remote service technology for internal purposes and, in addition, it sells this technology to its customers. Especially the selling helps to finance the remote service technology and to get additional revenues from new customers. According to the shown examples, we propose:

- P2a: The use of remote service technology can help to increase satisfaction and loyalty among existing service customers.
- P2b: The use of the remote service technology can help to acquire later generations of product owners as service customers.
- P2c: The development of remote services competence can help to acquire new customers for remote service technology and infrastructure.

4.3 Impact on Customer Relationship and Channel

A review of possible impacts of remote services on the dimensions Customer Relationship and Channel shows that this technology can be a way of establishing direct customer contact. This contact may in turn offer the chance to sell new special products or services to the customer. In cases 1 and 2, the companies have developed an application-store where the customer can buy new services or features for existing products, e.g. support systems for the car driver. Another example for a direct customer contact can be found within company 2 as well. Via an E-Call-Interface (emergency button) on their installed printing machines employees of the customer can establish a direct connection to the company. However, in order to be able to use these features, an internet connection must be available at the company's site. Therefore, we propose:

- P3a: The use of the remote service technology helps to intensify the direct contact to the customer.
- P3b: The use of remote service technology provides a platform for the simple acquisition and delivery of software-based services.

4.4 Impact on Key Activities and Resources

Another area of the business model of a company that may be affected by the introduction of remote services is subsumed under Osterwalder's dimension Key Activities and Resources. Using this technology, a company is able to gain data on the current status of its installed base. An example for this effect can be observed in case 2, where information is collected and analyzed continually in order to speed up and simplify internal processes and service delivery. Similarly, company 2 also parallelizes parts processes on the basis of the status data it has analyzed. This way, the structure of the processes as well as the processes themselves can be improved. Thus, we propose:

- P4a: The use of the remote service technology increases process automation of a company.
- P4b: The use of the remote service technology fosters parallelization of the processes of a company.

Furthermore, the collection and analysis of remote data enlarge the information a company has about its customers. For instance, Company 3 acquires knowledge on its clients and uses these insights offer

support, training, and consulting that is specifically tailored to the individual needs of each customer. Consequently, we posit the following propositions:

- P4c: The use of remote service technology for data collection increases the knowledge a company has about its own and its customers' processes.
- P4d: The use of remote service technology fosters process optimization within the company itself as well as within its customers' organization.
- P4e: The data collected through remote services improves the product development process.

A fifth impact that the introduction of remote service technology was found to have with regard to Key Activities and Resources can be seen in company 1. In order to fully make use of the possibilities offered by remote services, the company needs to enlarge its resources by adding further technology for connecting to its installed base and – across that – to its customers. An example of this kind of technology is the Bluetooth or wireless communication this company uses in its automobiles.

- P4f: The use of remote service technology causes a need for new resources in a company.
- P4g: The use of remote service technology requires IT integration into the customer production technology

4.5 Impact on Key Partners

The next dimension of Osterwalder's business model refers to Key Partners. By using remote service technologies a company can establish direct contact to its customers. Consequently, some of the company's partners may become unnecessary. In all our cases, number of service orders placed with partners could be downsized when remote service technology was introduced. However, a physical malfunction cannot always be solved remotely. In these cases, a company should be able to retreat to a working partner network or to its own branches. Thus, we propose:

- P5a: The use of remote service technology may help reducing the number of service orders placed with the partners of a company.

Additionally, the use of remote technology may also require a company to find new partners that help it to establish or strengthen the link between the company and its customers. Thus, there are new types of partners, which must again be integrated, like telecommunication providers or mobile phone manufacturers (as with company 1).

- P5b: The use of remote service technology requires the integration of new partners.

4.6 Impact on Cost Structure

Studying our cases, we could also observe that the introduction of remote services into a company influences the level and the structure of its costs. Cost savings are mainly the result of a substantial part of the relevant installed base being covered by remote service technology. In order to achieve this, however, remote service technology must be added to most new and as much as possible to existing products. This way, product costs, product development costs and retrofit costs are increased. For instance, Company 4 was able to cut its costs for on-site service firstly, by decreasing the number of cases, which required actual physical presence of a service technician and secondly, by increasing the efficiency of those on-site service calls that still proved to be necessary. Furthermore, the company was able to realize cost cuttings through a decrease in the number of dissatisfied customers, i.e. service costs in the area of service recovery, customer retention etc.. Nevertheless, these savings in service costs have only become possible through investments into the connectivity of the installed base the company serves. Consequently, we propose:

- P6: The use of remote service technology reduces the service costs of a company.

4.7 Impact on Revenue Streams

The seventh dimension of the Osterwalder business model underlying our analysis is Revenue Streams. With regard to this area, we have found that the companies examined for this article could add new revenue streams from innovative products or services. The ways for this were manifold, e.g., company 3 designed new services on the basis of information gained from its remote service contacts. On the other hand, Company 5 devised much more comprehensive service contracts for its intralogistics systems, while company 4 even developed entire build-own-operate models including many different services and products from its portfolio. Thus, one may say that remote services can also serve as an enabler for new pricing models like pay-for-performance, which is behind build-own-operate-transfer models. Also, in some cases the remote channel is employed as a new distribution channel, especially for selling after sales services, e.g., applications for existing machines or automobiles.

Moreover, in the case of company 4, an increase in customer satisfaction could be realized which in turn impacts the sales volume of the company positively. One important factor for this is the fact that remote services have helped the company to provide its customers with the services they expect more quickly and to better fit its offers to each customer's individual needs. Therefore, we propose:

P7a: The use of remote service technology increases revenues from new products or services.

P7b: The use of remote service technology serves as an enabler for new pricing models.

P7c: The use of remote service technology positively influences the revenue generated by existing contracts.

5 Conclusion and Outlook

The exploratory analysis shows that the use of remote services has a wide range of impacts on the service business models in the case companies. Using remote services supports manufacturing firms to improve traditional after-sales services and enables these firms to move into new services-led business models. A key enabling factor for business model innovation is the ongoing access to the installed base of machines and systems as well as the ability to collect and analyze machine data when in use. Figure 2 summarizes the findings.

<p>Key Partners </p> <ul style="list-style-type: none"> • P5a: helps reducing the number of service orders placed with the partners of a company • P5b: requires the integration of new partners 	<p>Key Activities  Key Resources</p> <ul style="list-style-type: none"> • P4a: increases process automation of a company • P4b: fosters parallelization of the processes of a company • P4c: the data collection increases the knowledge a company has about its own and its customers' processes • P4d: fosters process optimization within the company itself as well as within its customers' organization • P4e: improves the product development process • P4f: causes a need for new resources in a company • P4g: requires IT integration into the customer production technology 	<p>Value Propositions </p> <ul style="list-style-type: none"> • P1a: facilitates the offering of process-related services in addition to product-related services • P1b: delivers the information needed to offer business process optimization services • P1c: strengthen existing customer service through extending the access to expert knowledge and enabling proactive services 	<p>Customer Relationships  Channels </p> <ul style="list-style-type: none"> • P3a: helps to intensify the direct contact to the customer • P3b: provides a platform for the simple acquisition and delivery of software-based services 	<p>Customer Segments </p> <ul style="list-style-type: none"> • P2a: helps to increase satisfaction and loyalty among existing service customers • P2b: helps to acquire later generations of product owners as service customers • P2c: development of remote services competence can help to acquire new customers for remote service technology and infrastructure
<p>Cost Structure</p> <ul style="list-style-type: none"> • P6: reduces the service costs of a company 		<p>Revenue Streams </p> <ul style="list-style-type: none"> • P7a: increases revenues from new products or services • P7b: serves as an enabler for new pricing models • P7c: positively influences the revenue generated by existing contracts 		

Figure 2. Impact of remote service technology on service business models in manufacturing (source of business model canvas: Osterwalder 2004)

In terms of this transformational impact of the use of remote services on business models, the cases point to three different foci. Each of these foci is linked to a set of effects of the use of remote services on the business model. These foci are: (1) improving traditional after-sales-services, (2) enabling solutions, and (3) building service ecosystems. Each of these foci is shortly discussed:

- (1) *Improving after-sales-services* summarizes effects that improve efficiency (P4a, P4b, P5a, P6), international reach (P1c) as well as quality and customer satisfaction (P3a, P2a) of established product-related services. Remote services provide the technology to reengineer or automate after-sales services for better quality and lower cost. The result of this is incremental innovation that enables firms to better penetrate their established markets (P7a, P7c).
- (2) *Enabling solutions* is a second focus of the effects of using remote services. Here, remote service provides the technology and, more importantly, the data to extend the service portfolio to process-related services (P1a, P1b, P4c, P4d). Together with a manufacturer's products, process-related services are required for building solutions with measurable impact on key performance indicators of the customer's business processes (Tuli et al. 2007). Remote services thus enable business models based on the integration of products and services for which revenues are based on the actual performance of processes and/or systems (P7b, pay-for-performance).
- (3) *Building service ecosystems*, in contrast, focuses on using remote services as a platform to deliver packaged software-based services (P3b). In this case, customers can easily acquire and tailor additional value-added services for products and processes through remote service links. As indicated by our case research, manufacturers could potentially open these platforms to external partners in the same way as companies such as Salesforce.com or Apple have done in the software industry (P5b, P4f). Such open platforms would effectively turn products into foundations for a service ecosystem (Barros/Dumas 2006; Riedl et al. 2009).

Our exploratory research thus indicates that remote services could become a transformational force in the manufacturing sector over and above incremental innovation in traditional after-sales-services business models. Nevertheless, this research provides only a starting point for further research. The

next step includes the development of our propositions to empirically examinable hypotheses followed by an empirical survey. Such a study could also further investigate the changing nature of customer relationships through remote services. One of the conditions for the use of remote services is the readiness of customers to share some data on the use of machines with the vendor of the machine. This raises concerns for security and privacy. Studies on the privacy policies and reputations could yield data on how providers of remote service address customer concerns and how exchanging data evolves customer relationships.

This research contributes by exploring the impact of IT-enabled innovations on service business models of manufacturing firms. We provide a systematic account of these impacts and derive propositions from this analysis that can guide future research in this area. Moreover, we summarize these effects into three potential foci of business model innovation in manufacturing firms enabled through the use of remote services.

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