INTERNATIONAL CONFERENCE ON ENGINEERING DESIGN, ICED13
19-22 AUGUST 2013, SUNGKYUNKWAN UNIVERSITY, SEOUL, KOREA

DEVELOPING BUSINESS MODELS FOR EXTENDED PRODUCTS IN MANUFACTURING SERVICE ECOSYSTEMS

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ABSTRACT

The growing demand for integrated solutions forces manufacturers of industrial goods to combine their products with service components to Product-Service Systems, or Extended Products (EP). The new value proposition of the EP also requires an extended network of business partners, which are both not included in the traditional business models of manufacturing companies. The purpose of this paper is to investigate classic business models in manufacturing and create an EP Business Model Framework based on the Business Model Canvas to help manufacturers transform their business models in the servitization process. A special focus is given to value innovation and collaboration in Manufacturing Service Ecosystems (MSE). In an MSE, different organizations and individuals can work together with common or complementary objectives on new value added combinations of manufactured products and product-related services. The approach is exemplified by the evolution of the business model of a machine tool manufacturer.

Keywords: product-service systems, extended product, manufacturing service ecosystem, business model

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1 INTRODUCTION

Although Germany is still successfully exporting goods and services, most of the other European countries see their industries declining. As a result, the European manufacturing industry is still in recession. As a way out of this critical situation, manufacturers question their current business models and try to adapt them to increase their competitiveness (Chesborough, 2012). The underlying paradigm shift is the development towards a service dominant logic: Customers are more and more looking for individual solutions and benefits (Vargo and Lusch, 2004). In an attempt to understand and answer the customers' problems, manufacturers of industrial goods are increasingly required to add services to their products to create holistic and customized solutions. While in the beginning the tangible product has just been extended with some basic services, the value share of services is now increasing to parity with the product and beyond. Such an offering of complementary product and service components can be viewed as a Product-Service System, or more specifically an Extended Product (EP) (Seifert et al., 2011). However, the realization of an EP requires additional competencies and resources, which a traditional manufacturer often cannot provide. Thus, a new collaborative infrastructure of business partners is needed as well.

Consequently, the servitization of manufacturing as described above requires changes to all areas of the manufacturer's business model. Instead of the product functionalities, the value proposition of the Extended Product to the customer has to be described. New key partners, e.g. from the service sector, have to be identified and involved for the realization of the EP as well. New revenue streams have to be defined. Similar considerations have to be made e.g. for changing the cost structure or customer relationship. The paper aims to analyze the necessary changes to a manufacturer's business model required by collaborative servitization and proposes a new business model framework for EP based on the Business Model Canvas representation from Osterwalder and Pigneur (2010). For this purpose, first the two main underlying concepts of value innovation and collaboration are described. Then the methodological background on the chosen business model definition and the Business Model Canvas is given. On this basis, the transformation of the business model from traditional manufacturing to EP realization is described. The necessary changes to the Canvas are derived theoretically. The case of a machine tool manufacturer is used to exemplify the transformation of the business model according to the servitization paradigm.

2 THEORETICAL BACKGROUND

The following sections give a short overview on two main concepts related to servitization, which are value innovation through Extended Products and collaboration in Manufacturing Service Ecosystems.

2.1 Value Innovation through Extended Products

Most manufacturing enterprises choose a position in the continuum between cost leadership and differentiation of their products, according to Porter (1998). However competition is growing, especially from low-cost countries where companies are now able to copy successful products and offer them for a lower price. As a solution, the creation of untapped market space with new demand and profitable growth is proposed by Kim and Mauborgne (2005) in their Blue Ocean Strategy. While there is usually a trade-off between differentiation and low cost to exploit existing demand, the creation of new demand in so called blue oceans aims to break this value-cost trade-off.

An analysis of strategic moves has shown that blue oceans are formed by creating a leap in value for the company and their customers. This process is termed value innovation, in contrast to value creation, which is incremental, and purely technological innovation. Value innovation means to pursue differentiation and low cost at the same time: *"Value innovation is created in the region where a company's actions favorably affect both its cost structure and its value proposition to buyers. Cost savings are made by eliminating and reducing the factors an industry competes on. Buyer value is lifted by raising and creating elements the industry has never offered. Over time, costs are reduced further as scale economies kick in due to the high sales volumes that superior value generates."* (Kim and Mauborgne, 2005)

Value innovation thus concentrates on the value proposition to potential buyers. For manufacturing enterprises, this means to concentrate their strategy on innovating new value propositions for their customers to make competition of other companies irrelevant. The leap in value has to be achieved by breaking the boundaries of the manufacturing industry and creating a new offering that is hard to copy.

At the same time, the key factors of manufacturing have to be improved and complemented with non-manufacturing factors from other industries. The bundling of physical products with intangible components like services to an Extended Product creates new options for value innovation, giving more value to the customer (Seifert et al., 2011). The evolution of the Extended Product concept is illustrated in Fig. 1.

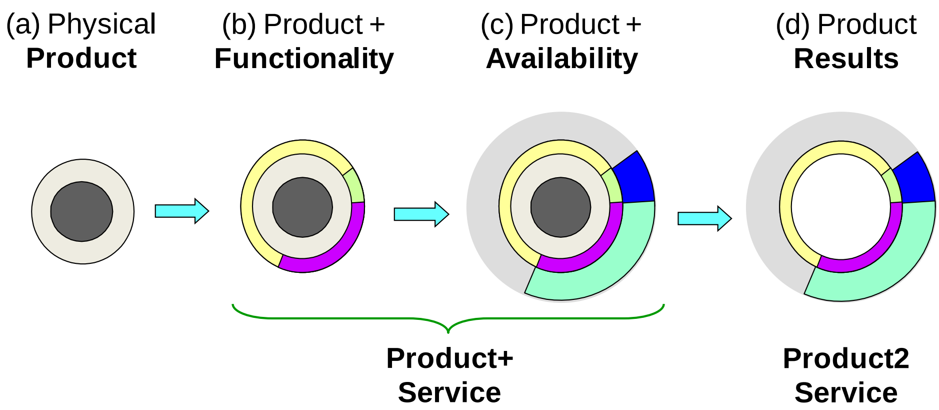

Fig. 1. Evolution of the Extended Product concept

The above figure shows the logic of the Extended Product concept, where the physical product in the center is surrounded by its shell (innermost ring) and different kinds of services (outer rings). While the product shell denotes tangible aspects like packaging, design etc., the services describe intangible additions to the product. The different options to configure Extended Products do also create a number of possibilities for value innovation. While in the past value has been generated from selling the product (a), now it is extended by services (Product+Service): In a function-oriented business model, the functionality of the solution is secured, e.g. through maintenance services (b). Availability-oriented business models additionally guarantee the usability of the solution (c). In a final step (Product2Service), result-oriented business models sell only the benefits of the solution to the customer, while the responsibility for its operation remains with the provider (d) (Meier et al., 2010).

2.2 Collaboration in Manufacturing Service Ecosystems

As value innovation typically requires breaking the boundaries of the industry, value itself has to be defined beyond the boundary of a particular company. It rather extends to other stakeholders involved and is not an isolated issue for individual companies. The innovation of Extended Products also requires additional competencies. New combinations of products and services require looking into branches which are not yet related to the product to discover opportunities. The development of services requires competencies in service engineering and in all cases it could be necessary to have competencies in developing product-service and service-product interfaces. These competencies could come from collaboration with service providers.

Therefore, collaboration is an important factor to be considered when defining new business models for Extended Products. To support collaboration for value innovation, companies and customers have to be enabled to "work together". A solution might be the creation and operation of service ecosystems as an extension to the existing industrial districts. In previous papers, the Manufacturing Service Ecosystem (MSE) has been described as a suitable model to support the innovation of Extended Products: *"The MSE is a non-hierarchical form of collaboration where various different organizations and individuals work together with common or complementary objectives on new value added combinations of manufactured products and product-related services. This includes the promotion, the development and the provision of new ideas, new products, new processes or new markets. Future Internet architectures and platforms enable the active participation of all stakeholders in all the phases of the product and service life cycle."* (Wiesner et al., 2012)

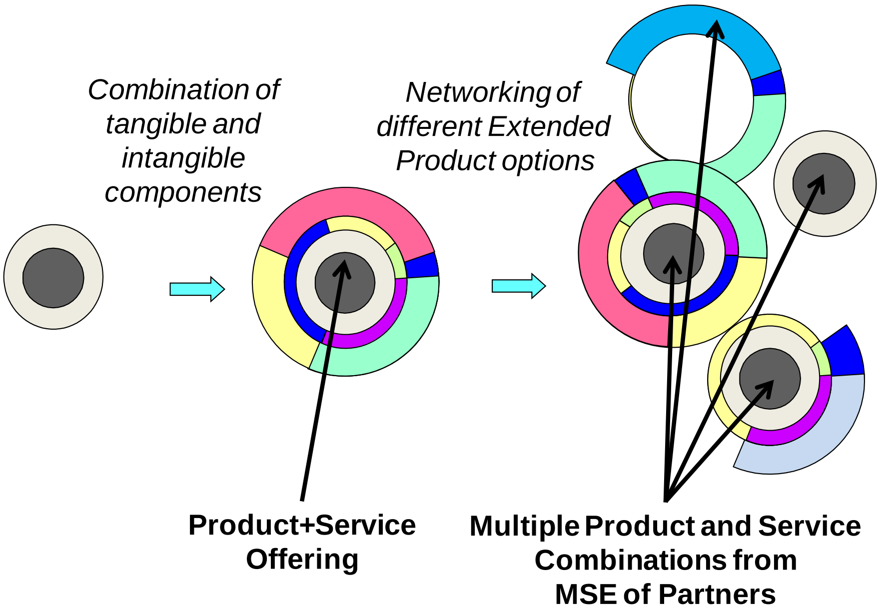

Fig. 2. EP realization in Manufacturing Service Ecosystems

Fig.2 shows the logic of value innovation in MSE. Going beyond the configuration of a fixed Product+Service offering, multiple product and service combinations can be flexibly configured by the partners in the ecosystem. The broad variety of an ecosystem and the inclusion of the customer supports the “look beyond the own backyard”. Thus, EPs of interoperable products and services can be configured on the fly through the MSE members.

Being based on Future Internet architecture and platforms, MSE business models are heavily depending on drivers from this area. The FInES Cluster has recognized four major drivers for new business models (FInES, 2010):

- Web 2.0 developments
- ICT market trends towards commoditization and utility
- New Key Enabling Technologies (KET)
- Globalization

Web 2.0 encompasses a range of services that are Internet based and involve the direct participation of end-users. As such, they capture new demand and create an ecosystem of relationships between business partners from different domains and the customer. Also, revenue is disconnected from selling a product towards service provision. Therefore Web 2.0 is an important enabler for value innovation.

Commoditization of ICT and interoperability as a utility support more high value added capabilities through online and real-time services. Standard basic tools from different platforms can be combined for co-creation of value based on the needs of the end-user. The relationship between suppliers and customers becomes more important than mere production. New business models have to balance the value between the provider and the customer.

As commoditization of existing technologies is on its way, the development of new Key Enabling Technologies for Enterprise Interoperability is critical for the success of new business models. Important aspects are e.g. Service oriented Architecture, business relations or enterprise modelling. A bottom-up approach of open, modular building blocks enables dynamic service creation, execution, discovery, composition and orchestration.

Finally, the broadly used term of globalization is also relevant for the development of new business models. Production is internationally distributed among specialized partners. This increasingly affects also the service business, enabled by ICT. This leads to new opportunities, but also to challenges for innovation. Dynamic business models are essential to respond quickly to changes. However, evolving value networks and ecosystems need new enterprise systems to manage them.

3 METHODOLOGY

The effects of the concepts described in chapter 2 on a manufacturer’s business model have to be analyzed in order to develop EP business models. In order to do that, the elements of the business model have to be described. There is however no commonly agreed definition of a business model in literature. Sometimes it is just described as the way *"how to create money"* with the company (Baatz, 1996). A more suitable definition for the scope of this paper comes from Timmers (1998): *"An architecture for the product, service and information flows, including a description of the various business actors and their roles; and a description of the potential benefits for the various business actors; and a description of the sources of revenues."*

However, the above definition is too vague in its description of the business model elements and how to visualize them. To analyze the impact of servitization to a business model, a more concrete description of its elements is needed, together with a simple way of visualization. Such an approach is offered by the Business Model Canvas as a method for illustrating the building blocks of a business model (Osterwalder and Pigneur, 2010). The Business Model Canvas is a template that is often used within strategic management and offers the idea to describe how an organization creates, delivers and captures value. It divides a business model into four pillars with altogether nine building blocks that are intended to realize that claim. The pillars and building blocks of the Business Model Canvas are depicted in Fig. 3 below.

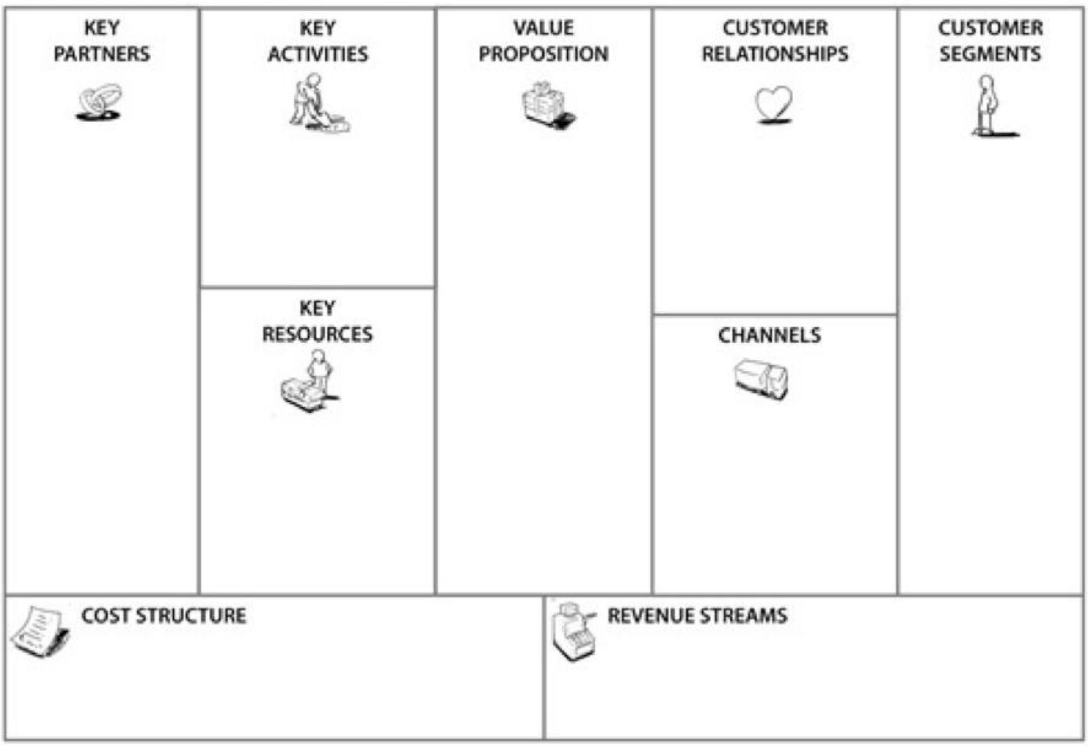

Fig. 3. Elements of the Business Model Canvas (Osterwalder and Pigneur, 2010).

The Canvas is used by analyzing and visualizing the existing business model of a manufacturer in the nine areas. In the further course of the paper, the Business Model Canvas will be evolved to a holistic business model framework to be able to visualize EP business models in MSE. Its structure and elements will be adapted accordingly and used in a case study of a machine tool manufacturer to describe a possible new EP business model.

4 EXTENDED PRODUCT BUSINESS MODEL FRAMEWORK

In this chapter, the Business Model Canvas is developed into a business model framework for Extended Products according to the concepts identified in chapter 2. The Canvas is adapted to support representation of value innovation in MSE. Table 1 gives an overview of the evolution from the Business Model Canvas towards an integrated EP Business Model Framework.

The most important change to the original Canvas is the integration of customers and business partners into the MSE. Therefore, the *Customer Segments* and *Key Partners* areas are blended into a *Manufacturing Service Ecosystem* frame, which surrounds all other areas. This in fact means that all stakeholders towards the Extended Products are collaborating in one strategic network and customers can become partners and partners can become customers.

Table 1. EP Business Model Elements

Osterwalder Business Model Canvas	EP Business Model Framework
Customer Segments	Manufacturing Service Ecosystem
Key Partners	
Value Proposition	Extended Product combinations
Key Activities	Virtual Manufacturing Enterprise configuration
Key Resources	Product and Service competencies
Customer Relationship	Customer co-creation
Channels	Web 2.0
Cost Structure	Cost of Ecosystem
Revenue Streams	Revenue from Ecosystem

The *Value Proposition* as central pillar of the business model is concretized as *Extended Product combinations*, providing the customer with tangible and intangible components according to his needs for functionality, availability or results. The *Key Activities* for the realization of the value proposition are related to the *VME configuration* of an operational network that supports the necessary processes for provision of the EP. Likewise, the *Key Resources* required are the *Product and Service competencies* of the network partners.

On the other hand, *Customer Relationship* evolves into *Customer co-creation*, where the customer is involved into the specification of the EP (e.g. in Living Labs) as an individual solution tailored to his problem. This also affects the *Channels*, which have to transform from a one directional path towards the customer to a bi-directional interface to the ecosystem in the sense of a *Web 2.0* platform. The *Cost Structure* and *Revenue Streams* are directly connected to the MSE, where the *Cost of Ecosystem* for one partner is *Revenue from Ecosystem* for another partner. The complete framework is visualized below in Fig. 4.

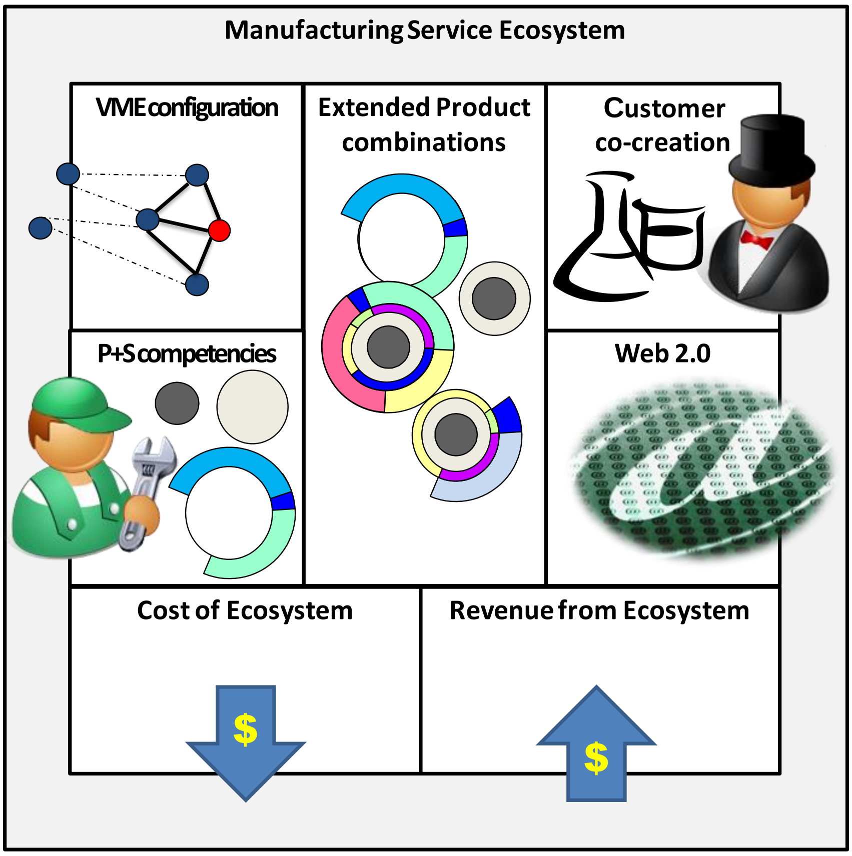

Fig. 4. EP Business Model Framework

5 MACHINE TOOL MANUFACTURER CASE STUDY

In order to complement the theoretical approach presented in chapter 4, a survey under four manufacturing enterprises has been conducted, taking up a Business Model Canvas of the companies and developing a new EP Business Model on this basis. The business model of one of the enterprises, a machine tool manufacturing SME, is presented in this chapter as an example of the approach.

5.1 Manufacturer Business Model

The business model of the machine tool manufacturer is shown below (see Fig. 5):

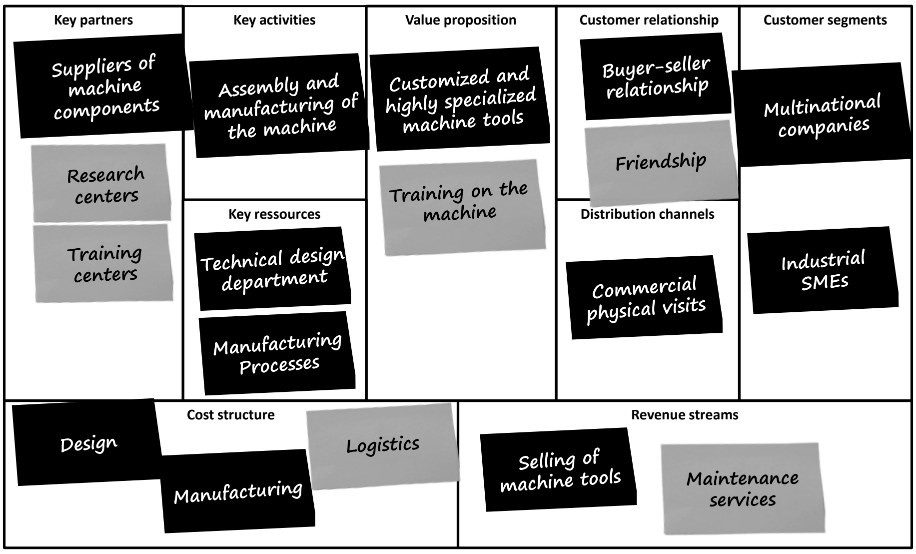

Fig. 5. Traditional Business Model of the Machine Tool Manufacturer

The machine tool manufacturer is following a differentiation strategy. The high-price products are customized individually for each offer. In the figure above, the effects of this classic manufacturing strategy are marked black, while first attempts to break the boundaries of the manufacturing industry by adding services to the product are marked in dark grey. The separate building blocks characterizing a “classic” business model are described in Table 2:

Table 2. Traditional Business Model Areas

Business Model Canvas Area	Characteristics
Customer Segments	Individual companies as customers in different size categories.
Key Partners	Suppliers of machine parts as well as training and research centers.
Value Proposition	The value proposition to the customer are the functionalities the customized machine tool and to a certain extent training on its operation.
Key Activities	Manufacturing and assembly of the machine.
Key Resources	Design and manufacturing departments.
Customer Relationship	Typically a buyer-seller relationship, sometimes long-term “friendship”.
Channels	Physical visits of the selling department.
Cost Structure	Cost-driven for design, manufacturing and logistics.
Revenue Streams	Most of the revenue comes from the sale of the product and basic maintenance.

5.2 Extended Product Business Model

By evolving the traditional business models through value innovation through EP by collaboration in MSE into the developed EP Business Model Framework, ideas for new business models can be derived. Taking the recorded business model of the case study as a basis, a transformation of the models towards EP and MSE has been conducted. In the following, the results are described in the EP Business Model Framework according to the example from the machine tool manufacturer (see Fig. 6):

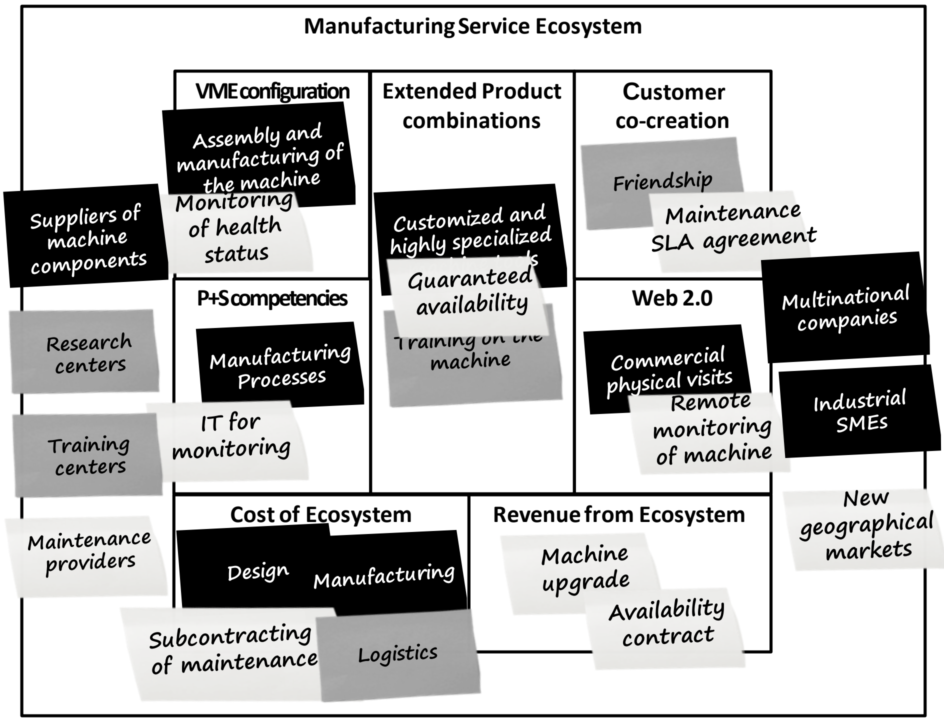

Fig. 6. EP Business Model of the Machine Tool Manufacturer

In the figure above, the similarities to the classic business model are marked black and dark grey, while changes based on the EP and MSE strategy are marked in light gray. The changes in the separate building blocks can be described as follows:

Table 3. EP Business Model Areas

EP Business Model Framework Area	Characteristics
Manufacturing Service Ecosystem	The MSE is created involving network of local maintenance partners, who are able to repair a broken machine in a minimum of time. As a result, customer segments in new geographical areas can be targeted thanks to new partners in the ecosystem.
Extended Product combinations	The value proposition of the machine tool is complemented by intelligent maintenance services to an Extended Product guaranteeing the availability of the machine tool.
Virtual Manufacturing Enterprise configuration	Besides the production of the machine, a VME network is created for remote monitoring of its health status and the provision of intelligent maintenance.
Product and Service competencies	To develop and implement the maintenance services, mainly IT competencies are required in addition to manufacturing.
Customer co-creation	The new business model focuses on permanent interaction with the customer to define and adapt the maintenance SLA according to the user requirements.
Web 2.0	The new maintenance services will be handled in real-time, providing the customer with an interface to report maintenance requests online.
Cost of Ecosystem	The maintenance activities are subcontracted to the local maintenance partners, which creates additional costs towards the ecosystem.
Revenue from Ecosystem	The availability contract and possible machine upgrades create a constant revenue stream coming from the ecosystem.

6 DISCUSSION AND CONCLUSION

This paper has analyzed the necessary changes to manufacturers' business models required by collaborative servitization. Innovation of the value proposition through the offering of Extended Products is suggested as an approach to escape the competition, especially from low-cost countries. Value innovation however cannot be implemented as a standalone concept. It has been shown that it implies changes to other areas of the business model, i.e. requiring new competencies and thus new networks of partners. As another approach, it is therefore suggested to include all stakeholders for the realization of the EP in a strategic Manufacturing Service Ecosystem network, allowing for multiple Product-Service combinations. This implies however new organizational and IT support to manage the ecosystem.

In order to show the effects of the above approaches to the elements of a manufacturer's business model, the Osterwalder Canvas has been chosen as a graphical representation of the business model areas. A first analysis has shown how the building blocks of the Business Model Canvas for the machine tool example could be adapted to this new strategy. EP business models have some specific aspects, which require the adaption of the Canvas towards an integrated EP Business Model Framework. For example, the deeper involvement of customers leads to a disappearing delimitation from other key partners. Both areas are thus included in the MSE.

Using the EP Business Model Framework, the effects of servitization to the building blocks of a business model example from the machine tool sector have been illustrated. Some conclusions can be derived from the results achieved:

- All areas of the EP Business Model have to be linked to the MSE
    - The EP combination is specified using customer co-creation by Web 2.0
    - The VME for EP realization is created from ecosystem partners, and has to provide the required P+S competencies
    - Costs and Revenues are shared in the MSE, where costs for one partner is revenue for another partner, which has to be balanced
- Changes to the business model can be made in an iterative approach, where emerging needs from the ecosystem are fulfilled by other ecosystem partners, or new ecosystem partners allow the realization of new EP combinations
- New technologies and developments from the ICT sector are required for the management of the MSE, as well as the realization of the EP combinations.

The preliminary analysis in this paper will be detailed in subsequent work, specifying the Framework areas and their links in depth. The results will be evaluated through implementation in the business cases of the end-users from the MSEE project.

ACKNOWLEDGMENTS

This work has been partly funded by the European Commission through the FoF-ICT Project MSEE: Manufacturing SErvice Ecosystem (No. 284860), which is fostering the research in this area and will develop the final MSE concept and several practical implementations in the manufacturing industry until 2014. The authors wish to acknowledge the Commission and all the MSEE project partners for their contribution.

REFERENCES

Baatz, E.B. (2002) Will your business model float? *WebMaster Magazine*, (10) 1996, http://www.cio.com/archive/webbusiness/100196_float.html, accessed 02.09.2002.

Bieger, T., Bickhoff, N., Caspers, R.; Knyphausen-Aufseß, D. z., Reding, K. (2002) Zukünftige Geschäftsmodelle – Konzepte und Anwendungen in der Netzökonomie. Springer: Berlin, Heidelberg, pp. 4-5.

Chesborough, H. (2012) Open Service Innovation: Rethinking your Business to Grow and Compete in a New Era. John Wiley & Sons: San Francisco.

European Commission: Service Innovation Yearbook 2010–2011 (2012). http://itemsweb.esade.edu/research/iik/files/service_innovation_20102011.pdf, accessed 22.05.2012.

FInES (2010) Future Internet Enterprise Systems Cluster: Cluster Book ICT2010, EVENT VERSION.

Kim, W.C. and Mauborgne, R. (2005) Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant. Harvard Business School Press.

Meier, H., Roy, R., Seliger, G. (2010) Industrial Product-Service Systems—IPS2. *CIRP Annals – Manufacturing Technology* 59, pp. 607-627.

Osterwalder A., Pigneur Y. (2010) Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. OSF: Switzerland.

Porter, M.E. (1998) On competition. *The Harvard Business Review Book Series*.

Seifert, M., Thoben, K-D., Eschenbaecher, J. (2011): Mechanisms to conduct Life Cycles of Extended Products. In Hesselbach, J. and Herrmann, C. (Eds.) *Functional Thinking for Value Creation, Proceedings of the 3rd CIRP International Conference on Industrial Product Service Systems*. Springer: Berlin, Heidelberg, pp. 39 – 43.

Timmers, P. (1998) Business Models for Electronic Markets. *EM - Electronic Commerce in Europe, EM - Electronic Markets* 8, 2, pp. 3-8.

Vargo, S. L., Lusch, R. F. (2004) Evolving to a New Dominant Logic for Marketing. *Journal of Marketing* 68(1), pp. 1–17.

Wiesner, S., Westphal, I., Hirsch, M., Thoben, K-D. (2013) Manufacturing Service Ecosystems - Towards a new model to support service innovation based on Extended Products. In Emmanouilidis, C., Taisch, M., Kiritsis, D. (Eds.) *Competitive Manufacturing for Innovative Products and Services: Proceedings of the APMS 2012 Conference,* Advances in Production Management Systems. Springer: Berlin, Heidelberg.