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## From ownership to service-oriented business models: a survey in capital goods companies and a PSS typology

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### Abstract

The evolution of capital goods companies towards a “service-oriented” business model is challenging and requires fundamental changes in the company. Main aims of this study, that is a part of a large research project, are to understand how business models of companies that operate in capital goods sector are configured and to identify different PSS types that can help companies to better understand the shifting toward a service-oriented business model. To achieve these results, we developed a framework, based on the Canvas model and carried out an exploratory survey among 95 European companies to understand the relevant issues that characterize business model configuration in servitization context.

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### 1. Introduction

New trends for manufactures push towards not to sell the product (ownership) but rather to sell either the usage of the product (e.g. renting, pay-x-use) or the product performance (e.g. pay-x-performance). The phenomenon concerning the evolution from a “traditional” business model, based on the transfer of ownership, to new usage-oriented business models, has been discussed in literature since the ‘90s and above all from the year 2000s. The literature conceptualizes the shift from products to solutions through various concepts, such as “servitization” [1, 13], “transition from products to services” [2], “going downstream in the value chain” [3], “product-service systems” [4], “moving towards high-value solutions, integrated solutions and system integration” [5,6], “manufacturing/service integration” [8] and “service infusion in manufacturing” [7, 10, 12]. These views converge into the concept of solutions, defined as innovative combinations of products and services leading to high-value and unified responses to customers’ needs .

Strategic realignment toward services should be mirrored in changes in the company’s business model (BM), evolving to a service-based business model [9]. In fact, business models based on the provision of solutions and Product-Service Systems (PSS) instead of traditional products change the manufacturer’s perspective about the costs and revenues arising during the product lifecycle. Even though the strategic importance of services has been highlighted by literature, product-centric firms frequently struggle with service innovation [14,16]. This happens because it is hard to shift from the engineering and product-centred core culture to a more relational and customer-centred attitude [2, 15, 17].

Literature shows a limited application of these new business models, especially in the context of SMEs operating in capital good sectors.

Given this context, the present paper, which stems from a research project (T-REX) funded by the European Commission that addresses the development of service-oriented business models in the domains of machinery, automation and transportation, aims to:

- briefly analyse the current level of adoption of service-oriented business model in capital goods sector;
- design a business model framework that can be suited to analyse the evolving of the offering from product to service in the journey towards servitization;
- review the classical PSS typology, defining different PSS types using building blocks and variables outlined in the new business model framework.

The paper is structured as follows: section 2 provides a brief explanation of the methodology adopted, Section 3 reports a summary of the main findings of a survey that has been carried out in the earliest phase of the project, and used to better understand the actual business models configuration in the target sectors. The new PSS typology is introduced in section 4 while conclusive remarks and directions for future research are drawn in section 5.

## 2. Methodology

In order to analyse the current development and adoption of service-oriented business models, an explorative survey was carried out on European companies operating in the three industry sectors addressed by the T-REX project (machinery, automation, and transportation). In fact, survey research is usual in the early research stages of a phenomenon, when the objective is to gain preliminary insights on a topic [18]. As the literature has not quite scrutinized the issues about adoption of service-oriented business model in SMEs operating in capital goods sectors, in the survey the respondents were allowed to add further items to improve the answers. Aiming at making data collection and analysis of the results more interpretable, the survey has been designed on the base of a business model framework (Fig. 1) grounded on the business model Canvas developed by Osterwalder and Pigneur since the early 2000s [19-21].

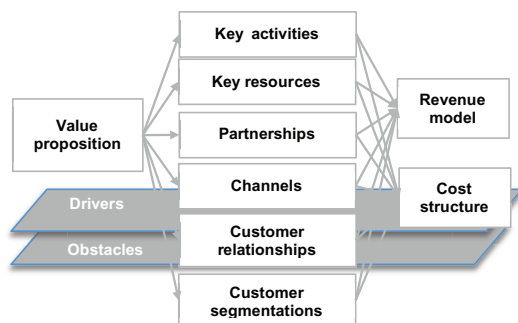


Fig. 1. Business model framework

According to the authors, the business model Canvas is a well-defined concept that allows the company easily to describe and manipulate business models to create new strategic alternatives. The model is constituted by nine elements (building blocks) that are: Customer segments (i.e. groups of people or organizations a company aims to reach and serve), Value propositions (i.e. products and services that create value for a specific customer segment), Channels (i.e. company's interface with its customers), Customer

relationships (i.e. types of relationships a company establishes and maintains with specific customer segments), Revenue streams (i.e. revenue a company generates from each customer segment), Key resources (i.e. assets required to offer and deliver the aforementioned elements), Key activities (i.e. activities involved in offering and delivering the aforementioned elements), Key partners (i.e. network of suppliers and partners that support the business model execution) and Cost structure (i.e. costs incurred when operating a business model). This model has been applied and tested in organizations all over the world, such as IBM, Deloitte, Ericsson, and many more. Nowadays the model is increasingly adopted both by practitioners as a conceptual tool that helps companies to identify, understand, design, analyse, and change their business models and by scholars, as a unit of analysis in empirical investigations.

Nevertheless, the Canvas model is not sufficient to understand the transition towards a more service-oriented business model. Therefore, the framework presented in this paper has refined the Business Model Canvas in two ways:

- through the identification, for each building block, of a set of relevant variables that can be used for analysing the configuration of each block and their service orientation. These variables have been derived from existing literature, refined thanks to research experience and validated in preliminary case studies carried out on the industrial project partners;
- with the addition of two new layers: Drivers, namely the elements that drive firms to develop a new product-service offer [22] and Obstacles, that represents the challenges that companies face in the transition “from products to services” [2; 23] (i.e. elements that slow down the adoption of new business model).

## 3. Main results

As mentioned before, in order to give an overall picture of the topic addressed in this paper, this section briefly reports the main findings of the survey carried out within the T-REX project among European companies that operate in the machinery, automation and transportation sectors. In fact, the T-REX project aims to develop and implement a new business platform whose main elements are a new service-oriented business model, an improved design of the products and a re-engineering of traditional support services for companies operating in the above-mentioned sectors.

Therefore, starting from the identification and definition of different variables related to each BM building blocks (see Section 2), 40 questions were elaborated with measurement scale and set of items specifically defined for each variable (the detailed lists of questions and items are available at the T-REX website). Slightly more than 400 firms were contacted: 95 companies, mainly medium and large (Micro 6%, Small 19%, Medium 29%, Large 43%) that operates in Italy (49%) and Germany (32%), responded to the survey. The survey has also received 17 answers from Spain and 1 answer from Finland. Responding companies mainly operate in the Machinery sector (64); the remaining answers are in the Automation (15) (i.e. robot manufacturers and system

integrators), Transportation (8) (i.e. earth-moving machinery and forklifts), and other sectors. Part of the findings emerged from the empirical research are reported in this section: in particular, in order to have an overview on the adoption of service-oriented business models in the three sectors, we describe the findings concerning the revenue models and the value propositions, highlighting also some consideration related to drivers and obstacles.

For the analysis and comparison of revenue models in the three sectors, respondents have been asked to quantify how each of six revenue components contributed in percentage to the company turnover. The six revenue components are: service contracts (preventive/predictive maintenance contracts), technical assistance, spare parts sales, financing/leasing and product sales. Results confirm that despite the fact that service is perceived as an important part of company’s business, service offerings are still mainly anchored to traditional services (Table 1). As expected, product sales still represent the main source of companies’ turnover with an average contribution of 74% (76% for machinery, 82% for automation, 52% for transportation).

Table 1. Survey results – Revenue model analysis

Revenue component	Machinery	Automation	Transportation
Service contracts (preventive/predictive maintenance)	1.98 %	1.90 %	10.83 %
Technical assistance	6.96 %	6.40 %	7.33 %
Spare parts sales	8.17 %	8.40 %	10.33 %
Product usage fee (pay per use or pay per performance contracts)	0.2 %	0.1 %	7.83 %
Product renting	0.59%	0.1 %	7.83 %
Financing/leasing	1.61 %	1.40 %	4.33 %
Products sales	76.09 %	81.70 %	51.50 %

Concerning the value proposition, the survey was structured to investigate the diffusion of different types of services in the three sectors (Fig. 2). From the results, basic services are extensively offered (documentation, repair, spare parts, basic training), while advanced services are only sometimes offered (advanced training, remote monitoring and product remote diagnosis, product upgrade/retrofit, warranty extension and maintenance contracts). The most diffused service among the responding companies is indeed the documentation followed by repair, spare parts provision and basic training, all of them always offered by 66% to 85% of the respondents. Consistently with the revenue model results, transportation companies appear to have a more extended service offering: they offer also more advanced services that are prerequisite to implement service-oriented business models (e.g. sell of second-hand products, rental and financial services as well pay-per-use contracts).

Given these results, we also try to understand which are the drivers and obstacles related to the adoption of service-oriented business model.

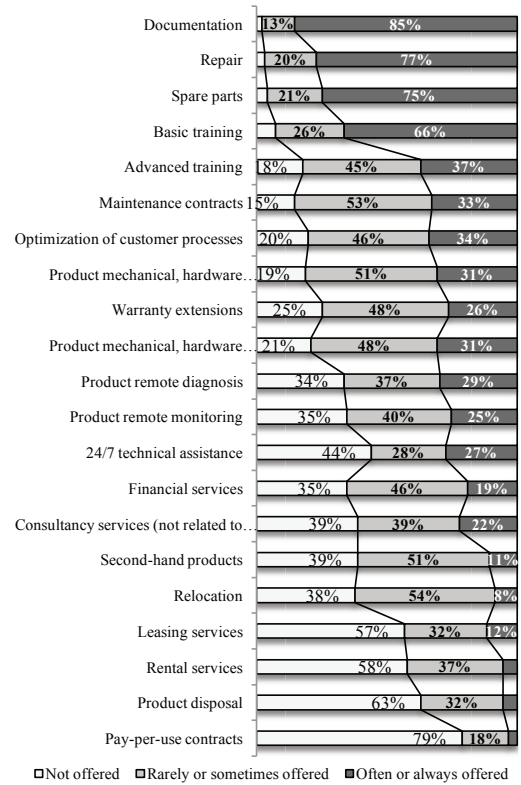


Fig. 2. Survey results - value proposition

The survey shows that the most important driver that pushes manufacturers to evolve their business model towards new usage-oriented ones is the possibility to strengthen relationships with customers (59% of companies sample), hence locking out competitors. Another important driver is the possibility, through these contracts, to make product life-cycle costs tangible for the customers (47%). However, servitization means obstacles to be overcome validated by the fact that 72% of sample companies perceive customers’ culture as an obstacle to develop and offer “pay-per-x” contracts. 56% of sample companies see increasing risks from the offering of “pay-per-x” contracts as important obstacles. Moreover, another obstacle is represented by the difficulty to monitor the product usage conditions and related data (45%). These results seem to confirm the difficulties of capital goods manufacturers to move towards new service-related business model: transformation paths from a product-oriented strategy to a combined product-service strategy remain a complex concept.

One of the first steps required to better understand the shifting toward a service-oriented business model is the identification and classification of key PSS characteristics [24]. Therefore, in the remainder of this paper we propose a refined PSS typology aimed at leading companies operating in the capital goods sector towards the successful adoption of a service oriented business model.

#### 4. Proposal of a revised PSS Typology

The main findings described in previous section, confirms the low adoption of service-related business model in the studied industries. This is due also to the fact that current understanding of the underlying foundations for implementing service-oriented business models is insufficient [25,26]. Because the PSS literature has not discussed business models extensively [9,27], a research gap exists that supports the need to develop a better understanding of how service-oriented business models are implemented [28].

##### 4.1. PSS typologies in literature

The usefulness of a PSS typology in particular depends on its ability to explain the essence of the PSS concept. The PSS typology is often applied to describe a variety of PSS options within a particular industry or for a particular manufacturer [32,33]. Although, many academic papers on PSS use the well known Tukker's classification [4] for this purpose [e.g. 29-31], literature reveals various PSSs typologies that could identify the different types of business model. For example, Wise and Baumgartner identify four types of PSSs [3]: embedded services, comprehensive services, integrated solutions and distribution control. This classification is based on service content but product ownership is not considered. The concept of product ownership is instead presented in Michellini and Razzoli [34] that distinguish between: provision of tangibles with included life cycle services, provision of tangibles under leasing arrangements, provision of shared products and function delivery. Tukker [4] proposes a classification making a distinction between three categories, namely: product-oriented, service oriented and result-oriented. This classification of PSSs is agreed by several authors, which themselves refined it and added further elements describing the type of business cooperation between customers and suppliers [25, 30, 33, 35-37]. Other authors proposed different classification based on specific PSS elements [38-40] but Tukker's classification remains the most widely accepted classification of PSS, which is used extensively in the literature [37]. Nevertheless, the classical PSS typology is affected by some problems that prevent it to capture the complexity of PSS examples found in practice [41]: these categories therefore, may be explored further to facilitate the most appropriate categorization of companies [42].

##### 4.2. A new PSS typology

Starting from the above-mentioned literature and from the survey results, a new PSS typology is presented in the remainder of the paper. In fact, the analysis of the literature and a qualitative evaluation of the results deriving from the survey, allow us to define five PSS types (see Fig.3), that present different revenue mechanisms for different value propositions, and to select the relevant BM variables that have to be considered in order to define a structured PSS typology. Differently from other PSS typologies proposed in literature [3, 34, 4], our PSS typology rely to the building block of the business model framework (Fig. 1): each PSS types therefore,

is characterized by a specific configuration of the each building block and related variables.

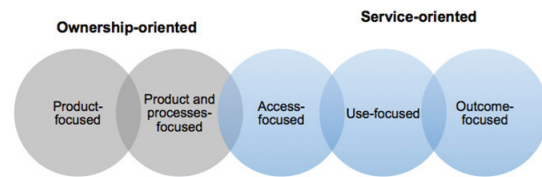


Fig. 1. PSS types

The identified five PSS configurations have been classified in two different groups: Ownership-oriented and Service-Oriented (Group A and Group B). In the following sections the identified PSS types are presented highlighting main differences in the configurations. Only a brief description of the five PSS types is presented in the present paper as the work of describing the complete configuration of all the variables for each PSS type is ongoing.

##### 4.3. Group A – Ownership oriented

In these PSS types, product sales are the main source of revenue and services are sold as an add-on to the product. Services can be sold both with a transactional (e.g. corrective technical assistance without any contractual agreement) or relational approach (e.g. maintenance contracts).

###### 4.3.1. Product-focused PSS type

The provider sells the product or the system and separately it sells services customer needs during the use phase of the product (e.g. break-fix repair, maintenance contract). Many basic and traditional industrial sectors are product oriented, so their purpose is to deliver tangible value to the customer. The company can sell a combination of single standard products and industrial services, which are usually not customized, with the aim of improving or restoring the functionality of the product, such as through maintenance and repair (basic field services and inspection). Companies have traditional 'tangible' production costs (e.g. resources, time input and cost of capital used) and the revenue is mainly generated from the product sale ("one-off payments").

###### 4.3.2. Product and processes focused PSS type

This PSS type is similar to the product-focused one. The main difference here is that the company offers services, both in the pre- and after-sale phases that aim to optimize customer processes. In the product and processes focused business model, the company promotes services that in the end can lead to increase efficiency and effectiveness of customer's operations. Often, service operations are managed through a separate functional unit that is configured as a profit centre. After-sales channel may be involved by the sales channel in the provision of consultancy services related with customer maintenance activities. Similarly to the product-focused model, products and services provision are usually both transactional and generate two separated revenue streams. In particular the main revenue stream still consists of product

sales: in the product price is often included a pre-sales service component (customization or configuration of the product).

#### 4.4. Group B: Service-oriented

In these PSS types, services strictly linked to the usage of a product are the main source of revenue. The ownership of the product is not transferred to the customer.

##### 4.4.1. Access-focused PSS type

The customer does not buy the product but pays a fixed regular fee to gain access to it. The fee is not related to the product actual usage and may include additional services (e.g. maintenance and assurance costs). In fact, the company usually keeps the property rights of the product and has the responsibility for its utilization conditions (timely installation, maintenance, upgrade, etc.) during a given period of time. Therefore, services that guarantee the functionality and extend the product lifecycle are offered, such as preventive maintenance, product upgrade, retrofit and revamping. In access-focused business model the business relation between customer and provider shifts from a transaction-based interaction to a relational one, that covers a long period of time. In fact, generally, payment are based on a monthly or yearly fixed rate, which would cover both the product and services that would be made available throughout the product's lifecycle.

##### 4.4.2. Use-focused PSS type

The customer does not buy the product or system but pays a variable fee that depends on the usage of the product (pay-per-usage time, pay-per-usage unit). As the company is responsible for all life cycle costs, there is a powerful incentive to optimize the product in terms of costs. Here customers focus on the value-in-use that is created (and determined) during the consumption, rather than on the value-in-exchange that is added to goods during the production process. For this reason, the company has to be able to predict the behaviour of the user, since otherwise no clear cost calculation can be made. The adoption of service-oriented business models implies a new revenue model, where the focus is on the definition of new selling parameters driven by customer perceived value instead of internal cost. Often a risk premium has to be included into pricing mechanisms. The payback period of the value delivered is often longer than the payback period of traditional product sales (as in ownership-based revenue models): therefore the provider must have the financial resources or receive support from financial partners to bridge this period.

##### 4.4.3. Outcome-focused business PSS type

The customer does not buy the product or system but pays a fee that depends on the achievement of a contractually set result in terms of product/system performance or outcome of its usage (for instance the final output volume). This PSS is similar to the Use focused one, but here the value for the customer is generated by the reduction of initial investment, the minimization of operational costs and risks to achieve an expected outcome with the product usage. This business

model requires usually a "Case-by-case design": definition of the "right" outcome, the "right" services and the "right" cost/fees is crucial. An outcome-based contract could be contracted on a fixed payment basis tied to performance measures (e.g. based on Service Level Agreement) of the identifiable outcome, with pain and gain sharing mechanisms in place. Moreover, compared to the other PSS, here the provider's risk assumption changes: non-conformity costs of product output are in fact borne by the provider.

## 5. Conclusions

In recent years companies operating in capital goods sectors have developed a growing interest in the provision of services in order to respond to the increasing challenges from competition. Despite this, a limited implementation of new service-oriented business models has been observed. The main findings reported in the first part of this paper, seem to empirically confirm this tendency. In fact:

- The adoption of service-oriented business models is low in particular in the sectors addressed by the project, namely: machinery, transportation and automation;
- The main sources of value for customers still lie in product-related aspects (e.g. performance, product productivity, minimization of purchase cost, etc.)
- Service offerings are still mainly anchored to traditional services. The importance of the service business is increasing among companies, but most of them still have only weak capabilities in new service development.

Given this context, scholars have tried to develop different PSS typologies that can help companies in the adoption of service-oriented business model. Nevertheless, PSS design methodologies are still scarce and this limitation may explain the restricted adoption of PSS; literature shows the lack of specific methodologies providing practical guidelines for PSS implementation.

For this reason, this paper has presented a PSS typology grounded on a specific framework that is the result of a refinement of the business model Canvas [19] and that can be used as a practical guideline to help companies in the journey towards a new service-oriented business model. The identified PSS types will be used in the next steps of the T-REX project to define a new business model innovation framework that will support the companies in this transition through the development of a specific methodology toolkit that have the PSS Typology as a landmark. Using the detailed PSS types as reference point, companies would be able to assess where their current business model stands and then define the appropriate actions to move towards the desired PSS type.

As with any research, our study is not without limitations. First, the study is based on the analysis of specific industry sectors, namely transportation, automation and machinery and this could limit the generalizability of the findings and the proposed PSS typology. Second, the defined five PSS types, although comprehensive and detailed, are still merely static representation of a business model and further research is needed to refine this typology: identifying the complete configuration of all the identified relevant variables of the business model framework is the objective of the next steps of

this research. Finally, the survey results have been used only qualitatively to develop the presented PSS typology. For this reason, future works will be addressed towards the rigorous adoption of quantitative methods in order to identify particular clusters to support our PSS typology.

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