Towards usage-oriented business models: an assessment of European capital goods manufacturers

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Abstract:

This paper is part of the T-REX project, funded by the European Commission. An exploratory survey was carried out to analyse the business models of 95 companies, to assess the diffusion of service-oriented business models. We found that business models are in general still product-oriented. Revenue models are dominated by product sales, with a contribution of services close to 20% due to corrective maintenance and spare part sales. Rental or "Pay-per-x" contracts are an almost negligible revenue source. This paper has also defined a set of variables that can be used to describe the business model configuration in servitization contexts.

Keywords: business models, servitization, capital goods

Introduction

In the current global economy, manufacturers are under pressure to adapt to an ever-changing business environment. In response to these drivers, new trends have emerged such as the 'servitization' of manufacturing (Wise and Baumgartner, 1999). The servitization can be also seen as a business model innovation of organizations processes and capabilities wherein manufacturing companies make a shift from selling product to selling integrated products and services, with the aim to satisfy customer needs, enhance the company's performance and achieve competitive advantage (Visjnic, 2010; Neely, 2008). Despite this, a limited application of "service-oriented" business models has been observed in the capital goods sectors, especially within SMEs. This is due also to the lack of business model or model-based approach that guides companies in the servitization process. Therefore, his paper has two objectives: a.) to identify the building

blocks and the relevant variables that can be used to formalize, structure and analyse service-oriented business models; b.) to empirically investigate the way business models of capital goods companies are configured. This paper, in particular, reports the main findings from a survey carried out within T-REX, a research project funded by the European Commission (EC) that aims to develop and implement, through three industrial application cases, a business platform for capital goods companies whose main elements are a new service-oriented business model, an improved design of the products, and a re-engineering of traditional support services.

The paper structure is the following. The next section provides the research background and describes the research framework of this study. The methodology of the empirical research is presented in in section three. Section four describes the main findings from the survey, while conclusive remarks and directions for future research are drawn in section five.

Background and research framework

New frontiers in the capital goods sectors are about selling either the usage of the product (e.g. renting, pay-x-use) or the product performance (e.g. pay-x-performance) rather than the product ownership to the customers. The phenomena concerning the evolution from a "traditional" business model, based on the product sales, to new service-oriented business model, have been discussed in literature since the '90es. The literature conceptualizes the shift from products to solutions through various terms, such as "servitization" (Vandermerwe and Rada, 1988), "transition from products to services" (Oliva and Kallenberg, 2003), "Product-Service Systems (PSS)" (Tukker, 2004), "service infusion in manufacturing" (Kowalkowski et al., 2011), and others. These views converge into the concept of solutions, which can be defined as innovative combinations of products and services leading to high-value unified responses to customers' needs. As pointed out by Neely, Benedettini and Visnjic (2011) although due to economic uncertainties and strong competition there is an increased interest in extending product life-cycle, it seems there is a grey area for companies trying to achieve a successful "transformation to services" and to capture and create value through the provision of services, especially in terms of business models: in fact, the transformation paths from a product-oriented strategy to a combined product-service strategy are still poorly understood (Tukker, 2004; Martinez et al., 2010). To be successful in this transformation, a company should not only adapt its proposition from product-centric to a product-service system, but also needs to redesign its business model (Baines et al., 2009; Slepniov et al., 2010). Business models based on the provision of solutions instead of traditional products change the manufacturer's perspective over the costs and revenues arising during the product lifecycle. In particular, new value propositions that address new customer needs by leveraging on a set of resources, competencies and techniques have to be developed. These new value propositions, moreover, entail also integral changes in how partnerships, channels, customer relationships are configured, and, as mentioned before, about how the revenue model is structured. A business model reasoning is useful to successfully leverage, coordinate and align all these potential disruptive changes, as suggested by Baines et al. (2009). By adopting a business model framework, in fact, it is possible to formalize in a holistic way how companies are creating and transferring value to their customers. Moreover, analysing the new value propositions that could better address customer

needs, it is also possible to define the business model configuration that creates and transfers value more successfully. Therefore, the business model concept can be used as a management method helping to comprehend and analyse the current business logic of a company as well as to plan strategic decisions by designing and simulating new business concepts (Osterwalder and Pigneur 2005). Due to the importance of having a clearly articulated business model as early as possible in the new venture creation process (Barringer and Ireland, 2006), the business model has achieved increasing attention from business scholars as well as practitioners: despite this, a common vision concerning the business model concept and frameworks to formalize them is still missing.

In a context where companies find themselves in constant changing in order to give new response to the requirements of more and more demanding customers, the concept of business model is gaining importance. For example, a company can use a business model to identify how its value proposition is delivered in a profitable way through its resources and processes. With that understanding, it can be judged how well the same model could be used to fulfil radically different customer needs and related value proposition, and what they would need to do to construct a new one, if need be, to capitalize on that opportunity (Johnson et al., 2008).

In current times several companies are considering to evolve towards new business models in which the use or the function of a product is sold instead of the product itself (Van Ostaeyen et al., 2011). In these models higher value is delivered to the customer by increasing service elements: the company does not sell only a product but a solution, namely a product-service system (PSS) that could be defined as consisting of tangible products and intangible services designed and combined so that they jointly are capable of fulfilling specific customer needs (Tischner et al., 2002). With regards to this evolution towards PSSs, literature reveals various classifications used to characterized and identify the different typologies of PSSs business model (see for example, Wise and Baumgartner, 1999; Michelini and Razzoli, 2004; Tukker 2004; Kujala et al., 2010; Rese et al., 2012; Storbacka et al., 2013). The classification proposed by Tukker (product-oriented, use oriented and result oriented PSSs) remains the most widely accepted classification of PSS, which is used extensively in the literature (Barquet et al., 2013) and refined or extended in successive studies (Tukker and Tischner, 2006; Cook et al., 2006; Azarenko et al, 2009; Copani et al., 2010; Azevedo and Ribeiro, 2013; Barquet et al., 2013). Nevertheless, in the literature there is no business model or model-based approach that guides companies in the transition process to a more service-oriented company and specifically analyses the different configuration of service-business model.

For the present study we used as a reference the Business Model Canvas by Osterwalder and Pigneur (2010), which is clearly structured and diffused among practitioners. It 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).

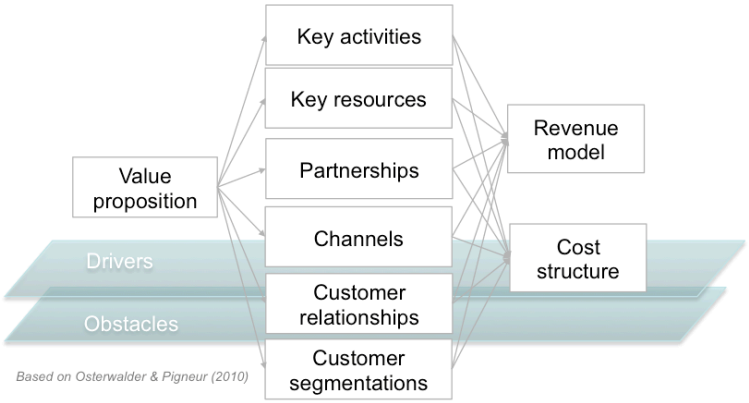

Figure 1 – Research framework.

In the T-REX project, we designed a Research Framework (Figure 1), in which the Business Model Canvas has been enriched with two additional layers: Drivers (e.g. internal or external elements that drive firms to develop new business model) and Obstacles (e.g. internal or external elements that slow down the adoption of new business model). Moreover, we refined and adapted the Business Model Canvas 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 actual service orientation.

Methodology

To understand the level of service orientation of business models, an exploratory survey has been carried out on European companies that operate in three main sectors: Machinery, Automation, Transportation. Given the paucity of previous studies with similar goals and background, we opted for an exploratory survey. Exploratory survey research, in fact, is usual in the early research stages of a phenomenon, when the objective is to gain preliminary insights on a topic (Forza, 2002). The survey can help to determine the concepts to be measured in relation to the phenomenon of interest and how to discover new facets of the phenomenon under study. Although exploratory surveys usually do not rely on models and concepts (Forza, 2002), in this project we have developed the research framework aiming to make survey data collection and analysis interpretable. Starting from the definition of building blocks (constructs) and related variables we have made an operationalization by defining a measurement scale and item for each variable. The unit of analysis of the survey is therefore the business model of the investigated companies.

Based on the identification of the three main domains addressed by the project, we have defined the target population as a set of companies from three broad industry sectors: Machinery, Transportation and Automation – these industries include the sectors object of the projects. The research centres involved in the project (IK4-Tekniker, Fraunhofer IAO, University of Brescia) have hence submitted the survey to all the companies in the three sectires with which they have had previous relationships

or interactions. The survey has been first designed and validated on a MS word document by the three research centres involved in the project. The English version of the survey has been replicated in an on-line survey editor and then submitted to project industrial partners to assess comprehensibility and wording. The pilot testing of the survey has provided three answers that have led to revise aspects such as terminology and length of the survey. Once validated, the survey has been translated into Spanish, Italian and German languages by creating new versions in the on-line editor. Once translated, the survey has been submitted to selected companies in their mother languages by email (in Italy and Spain), and also as a paper version in Germany.

Answers collected from the three mother languages survey versions have been coded using a "coding map" in order to assure the consistence and the readability of data collected and then gathered into a comprehensive database in order to perform the analysis. Each answer has been analysed in order to assess its validity and to find out imputation errors. Finally, descriptive analyses have been performed both considering the whole set of answers and segmentations, following criteria derived from contextual variables such as the industry sector in which a company operates.

Main findings

The survey was completed by 95 companies. According to "New SME definition" (provided by the EC - 1/1/2005), we classify respondents based on companies size: sample companies are mainly medium and large (Micro 6%, Small 19%, Medium 29%, Large 43%). In general, the sample is characterized by a much greater share of medium and large companies compared with the EU population, where SMEs are predominant. This may be due to two aspects: a.) a strong presence of large companies in Germany, one of the countries targeted by this study; b.) a greater awareness and interest about the topics dealt with in this study by medium and large companies, while SMEs have a lower degree of maturity on service-related aspects. From a geographical point of view, the responding companies operate mainly in Italy (49%) and Germany (32%). The survey has also received 17 answers from Spain and one answer from Finland. The responding companies mainly operate in the Machinery sector (64), either as Original Equipment Manufacturer (OEM) or dealer / integrator of machine tools, packaging machines, textile machines, etc., or manufacturing components such as tools, spindles, pneumatic components, etc. 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.

The main findings emerged from the empirical research are reported and summarized for each building blocks (BB) in Table 1. In particular we identify the configuration of most relevant variables for the sample by taking into account communalities among the three target sectors (General findings). Moreover, for each sector the main deviations from the general findings are highlighted.

Table 1 – Business model configuration across industry sectors (M: machinery; A: Automation; T: Transportation)

BB	Variable	Level of analysis	Configuration (M: Machinery; A: Automation; T: Transportation)
Value proposition	Customer value sources	General findings	Sample companies attribute moderate importance to value generated through minimization of customer maintenance efforts. Moderate to relevant importance of product expected lifetime, customer image enhancement, customer minimization of operational risks, brand reliability. Relevant to high importance of product performance, and product productivity.
		Industry findings	**A:** Low importance of minimization of customer maintenance efforts **T:** High importance of brand reliability and relevant importance of minimization of customer maintenance efforts
	Service offering	General findings	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).
		Industry findings	**A:** In some cases also advanced services related to optimization of customer processes are offered **T:** Offers some advanced services as financial services, leasing, second-hand services and rental
	Customization and Modularization	General findings	Varying degrees of customization across industries. Modularization is medium to low.
		Industry findings	**M:** Average degree of customization (around 35% of typical product); Average degree of modularization (around 30%) **A:** Quite high degree of customization (around 45%); Low degree of modularization (around 20%) **T:** Low degree of customization (around 25% of typical product); Low degree of modularization: (around 25%)
Key resources	Importance of organizational function	General findings	Production/Assembly, product components purchasing and product design are perceived as quite important.
		Industry findings	**M:** High importance of R&D on product and product design activities. Moderate importance of R&D on services **A:** High importance of R&D on product and moderate importance of R&D on services **T:** High importance of R&D on services, marketing and pre-sales commercial activities; extremely important are After-sales service activities
	Adoption level of different Information Systems	General findings	ERP, PDM and CRM systems are quite used. Non-integrated database systems (such as MS Excel, Access, FileMaker, …) are widely implemented (adopted by 95% of the sample companies).
		Industry findings	**M:** Low diffusion of PDM systems (adopted by 34% of the sample companies) **A:** High diffusion of PDM (73%), ERP (73%) and CRM systems (around 67%) **T:** Low diffusion of CRM systems (38%)
Key activities	Adoption level of TCO practices	General findings	Sample companies have low experience in the adoption/development of models to simulate the TCO of their products, and a medium awareness about the actual TCO of their products.
		Industry findings	**T:** High experience in the adoption/development in model to simulate TCO of their products and in the evaluation of TCO.

BB	Variable	Level of analysis	Configuration (M: Machinery; A: Automation; T: Transportation)
	Adoption level of service engineering practices	General findings	68% of sample companies consider service as an important part of their business and also think that importance of service will increase in future (86%). Anyway they have not defined yet explicit strategy, responsibilities, budget, formal processes and methods for the development of new services.
		Industry findings	**T:** Companies have defined an explicit strategy for existing and new services. Moreover they have also defined responsibilities for the development of new services.
	Experience on design for X techniques	General findings	Sample companies have high experience in design for reliability and medium in design for maintainability/serviceability, durability and life-cycle techniques. They have low experience in the design for reuse/recoverability.
		Industry findings	**T:** High experience in the design for maintainability/serviceability and medium experience in the design for reuse.
	Adoption level of fleet operation and maintenance practices	General findings	Sample companies perform fleet operation and maintenance practices on less than 50% of their installed base. In particular remote diagnostics, product condition analysis, preventive and corrective maintenance activities are carried out on less than 30% of the installed base.
		Industry findings	**M:** Companies perform predictive maintenance activities on less than 20% of their installed base **A:** Companies perform remote diagnostics and predictive maintenance activities on less than 20% of their installed base **T:** Companies perform preventive and corrective maintenance activities (under contracts or warranty) in average on 60% of their installed base and product condition analysis on 50% of their products.
	Installed base condition monitoring	General findings	Sample companies collect and manage data on health conditions and product performances on less than 30% of their installed base. Companies collect and manage failure modes, maintenance activities reports and product usage information in average on 50% of their installed base.
		Industry findings	**T:** Companies collect and manage data on health condition and on performances in average on 50% of their installed base. Failure modes, maintenance activities reports and product usage data are collected in average on 70% of installed base.
Partner-ships	Relationships with suppliers	General findings	Companies usually have long-term relationships with their suppliers (around 85% of the sample companies) Companies usually collaborate with several suppliers (only 24% of the sample companies declare that usually collaborate with few suppliers)
		Industry findings	No particular deviations from the general findings
Channel	Offering evaluation and Configuration of after-sales channels	General findings	Sample companies attach moderate importance to total cost of ownership assessment, service level agreement and open house visits for the evaluation of their offer in the pre-sale phase. Companies perceive as quite important use cases, reliability assessment and comparison of technical performance and on-site visits to best-in-class customers. 68% of sample companies provide support after the sales mainly with internal resources.
		Industry findings	**A:** Companies provide preventive/predictive maintenance and technical assistance planning both with internal and external resources. **T:** Companies consider as quite important also service level agreements and total cost of ownership assessment.

BB	Variable	Level of analysis	Configuration (M: Machinery; A: Automation; T: Transportation)
Customers	Adoption level of customer segmentation criteria	General findings	Customer segmentation criteria have an average diffusion among companies. In particular, criteria based on industrial sectors, customer status and reputation, and revenue generated by customers from product sales are widely diffused.
		Industry findings	**A:** Revenue generated by customer from services purchasing is extremely diffused (adopted by 93% of company sample) **T:** Geographical location, revenue generated by customer both from services and product purchasing (100%), customer status and reputation (88%) and profit generated by customer from services purchasing are highly diffused (88%).
	Adoption level of web-based systems to automate relationship	General findings	Web-based applications to automate customer relationships during the after-sales phase are rarely offered. In particular, around 55% of the company don't offer yet web-based applications to monitor product systems or health state, to place spare parts orders, to open and manage tickets for service requests and activities. On average, only 20% of companies sample have been offering these applications for more than 5 years.
		Industry findings	No particular deviations from the general findings
Revenue & Costs	Revenue model	General findings	Product sales represent the main source of revenues.
		Industry findings	**M and A:** Services represent only 20% of companies' turnover. In particular service contracts and financing/leasing represent less than 2% each. Renting and pay-per-x contracts don't generate revenue. **T:** Services represent about 50% of companies' turnover. In particular service contracts represent the main sources of service-related revenues (about 11%). Financing/leasing contribute to the total turnover for around 5%, renting and pay-per-x contracts for around 8% each.
	Cost structure	General findings	89% of sample companies perceive production as the main source of cost, followed by purchases costs (75%)
		Industry findings	**T:** According to companies view, Service, Sales/marketing and purchase represent the most expensive activities.
Drivers & Obstacles	Drivers	General findings	The most important driver that pushes manufacturers to design and offer "pay-per-x" contracts, therefore evolving 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%).
		Industry findings	No particular deviations from the general findings
	Obstacles	General findings	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 an important obstacles. Another obstacle is represented by the difficulty to monitor the product usage conditions and related data (45%).
		Industry findings	**T:** Companies perceived as important obstacles also service orientation attitude of service personnel and service engineering capabilities.

Conclusion

This paper is part of a larger research project, funded by the European Commission that addresses the development of service-oriented business models in the domains of Machinery, Automation and Transportation. In this paper through an exploratory survey we tried to define the state of the art of business model configuration of companies that operate in these three sectors. Summarizing findings described in the previous section, we can observe that:

- the adoption of service-oriented business models is low in the studied industries, in particular with regards to the machine tools and robotics sectors; revenue models are dominated by product sales, with a contribution of services close to 20% dominated
- by corrective maintenance and spare part sales. Rental or "Pay-per-x" contracts are an almost negligible revenue source.
- Service offerings are still mainly anchored to traditional services.
- The transportation industry is a step ahead the machinery and automation one in the journey towards new usage-oriented business models.
- Service is an important part of company's business and its importance will increase in future. However, most companies have not yet formalized the service development activities, with no explicit strategy, responsibilities, budget, formal processes and methods in place.
- Product design practices aimed at modularity and reliability are in place in a number of companies, while products/components reuse, recoverability and serviceability are rarely supported since the product design phase by formal techniques.
- Fleet operation and maintenance practices are carried out by companies on less than 50% of the installed base, generally through direct field engineers.
- Information systems and automation have a great unexploited potential.
- Customer relationships are still dominated by a traditional approach. They are transaction-based, and customers' culture is perceived as an obstacle to develop and offer "Pay-per-x" contracts.

Finally this paper contributes both to practice and to academic discussion related with business model by having established a set of variables that can be used to describe the business model configuration in a servitization context.

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