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Business model innovation: process and tools for service transformation of industrial firms

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Abstract

Nowadays a comprehensive transformation from traditional business models, based on the product sales, to new product-service systems (PSS) can be seen as an opportunity for industrial firms to gain revenues and new competitive advantage. Nevertheless manufacturers frequently fight with this innovation, as it requires fundamental changes in the structure, culture and competencies of the company. Rarely, industrial firms understand how they should reconfigure the elements of their business model (BM) in order to servitize. In addition, literature has only recently started to discuss PSS BM extensively and still gives little support to the decision-making process regarding the service transformation. To provide a first step into closing this gap, this paper proposes a new integrated multi-step methodology for the selection and design of the most appropriate PSS BM. In order to enable the application of the methodology to practical cases, a specific toolkit has been developed. An action research was then performed to illustrate an application of the framework in a capital goods manufacturer and provide research insights.

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1. Introduction

In the current global economy, manufacturers can no longer rely on the traditional product-focused business models with competitive dimensions such as time, cost, quality or flexibility [1]. In this environment, a comprehensive transformation from a traditional business model, based on the product sales, to a product-service systems business model (PSS) can be seen as an opportunity for manufacturers to gain revenues and new competitive advantage [2] [3]. Despite this potential a limited application of PSS business models, especially in the sector of capital goods, has been observed [4]. As a matter of fact, this shift is challenging and companies frequently struggle with this transformation that requires fundamental changes in the structure, culture and competences of the company: rarely industrial firms understand how they should reconfigure the elements of their business models in order to servitized [5]. Moreover, up to date, the literature has not extensively discussed the service transformation adopting

a business model's perspective and therefore it still gives little support to the decision-making process regarding this shift [6][7]. In particular, little attention has been devoted to the description and formalization of new PSS business models and even fewer works are currently offering guidelines, tools or techniques that can be used by companies to servitized [8][9].

Therefore, to provide a first step into closing this gap, this work aims to answer the following research questions: "How industrial companies that undertake the transformation towards PSS business models can be supported? To this end, which tools could be used?" This study is structured as follows: section 2 provides a brief description of the work background and section 3 reports the research methodology adopted and the preliminary results of the literature review. The new model, is presented in section 4, while section 5 provides a summary of the main findings derived from the empirical application and conclusive remarks and directions for future research are drawn in section 6.

2. Service transformation of industrial firms

Faced with the commoditization of goods, declining profitability and customers with complex needs, an increasing number of manufacturing companies are reorienting their value propositions from selling goods to providing solutions [10], in order to gain competitive advantage, increase revenues and margins, achieve higher customer satisfaction and retention [11][12]. Such transition has been addressed by a growing amount of scientific literature from the year 2000s and implies major challenges [13][9][14]. In fact, this transition requires fundamental changes in the way of creating and delivering value and dealing with customers and stakeholders [15][16]. Thus, literature advocate that manufacturers, to be successful in this transformation, should not only shift their value proposition, but need to redesign their business model from a product-centric one to a product-service system [6][10][5]. Although it can be more challenging than product or process innovation, this shift can represent for companies a way to innovate their business model and develop a new successful strategy, such as servitization [17].

However, how to support companies in this transition, remains an issue to be addressed [7]. In fact, the majority of research in the field of business models has taken a rather static view and the question how business model innovations are achieved is thereby widely neglected [18]. Few works have tried to analyze in a comprehensive way the element that could support this transition, pointing out the capabilities, the resources, the tools and the organizational change needed by a company to successfully deploy the new PSS BM [19][5]. As a result, the business model innovation towards PSSs is still complex for both scholars and practitioners [20][21][7][22].

3. Literature overview

3.1. Methodology

To provide a first step into closing this gap, we investigated the literature in order to analyze to what extent the scientific literature provides methods and tools that can help companies in developing new PSS adopting a business model innovation perspective.

Thus, a structured keyword search was carried out: the keywords “business model” and “innovation” were combined with terms such as “tool”, “framework”, “step”, “process” and “toolkit”. Moreover, specific keywords that identified the “Servitization/Product-service system/Solution” topics were used. The items obtained from this initial search were 355. These papers were scrutinized by reading the title and abstract: this allowed us to understand if the papers adopted/proposed tools, frameworks, and methods for business model innovation in the analyzed field. Papers considered out of topics (i.e. refer to innovation topic in general or in other fields, focus only on some phases of the business model innovation, do not use a business model perspective to describe innovation, are applied in the ICT sector, start-up business or similar) were excluded: 28 papers were selected, which were read in order to carry out a detailed

content-based selection. At the same time, the database search has been complemented by cross-referencing for further relevant publications: this led to the identification of 6 additional papers. The detailed content-based selection carried out on the sample of 34 papers, allowed to exclude 20 papers, even from title and abstract seemed in target, did not address the servitization of product-centric companies as an innovation of the business model and did not propose process, methods and/or tools that can support this transformation. Thus, it can be argued that, despite the high interest and the acknowledged relevance of the business model innovation phenomenon, it seems to be still under investigate in literature. In particular, in the service transformation field, research has not paid sufficient attention to applicability and availability of different practical tools to support the ideation and implementation of PSS BMs.

3.2. Methods for PSS business model innovation

The 14 selected papers are reported in Table 1. These works were deeply analyzed to derive the new model illustrated in section 4.

Table 1. List of selected papers and model proposed

Paper	Year	Name
Van Halen et al., [23]	2005	MePSS
Maxwell et al. [24]	2006	Sustainable Product and/or Service Development (SPSD)
Copani et al. [25]	2008	Pattern to design new business models
Muller & Stark [26]	2008	PSS requirements generation method
Pawar et al. [27]	2009	PSO framework
Shih et al. [28]	2009	PSS design and evaluation - PSSDAE
Ho et al. [29]	2011	Management consulting framework for designing and implementing service business model innovation
Lee et al. [30]	2011	Business Model Design Procedure
Martinez & Turner [31]	2011	Strategic value creation roadmap
Van Ostaeyen et al. [32]	2011	Generic PSS Design Method.
Ehrenhöfer & Kreuzer [33]	2012	Business model design toolbox
Barquet et al. [34]	2013	Framework to support PSS adoption
Dimache & Roche [1]	2013	TraPSS methodology
Wiesner et al. [35]	2014	Methodology for BM Development

As a representative example of PSS BM innovation process designed for industrial companies, [25] provided a new framework consisting of a multi-step methodology for guiding machine tool companies in to the business model innovation decisions. The proposed methodology represents an operative instrument to drive manufacturers towards the offer of new value added services. The definition of the new service offering is a core element also for the model provided by [31], that includes a series of analyses that need to be carried out so to define the right value proposition that suits better the customers’ value-in-use business model. A more holistic approach has been recently provided by [34]. They developed a specific framework that encompassed all the element of the BM Canvas in order to help companies in the selection of the characteristics that best fit into their business context or that can lead to new business opportunities in servitizing environment.

Similarly, [1] proposed a comprehensive decision support methodology and toolkit that supports decision-making regarding the transition from one position to another along the PSS business model continuum. The TraPSS methodology (transition along the PSS continuum) is systematic and it follows clear steps supported by appropriate tools.

Although the business model innovation's core elements (i.e. steps) presented in the analysed papers are somehow different, we observed that they could be grouped into five main phases that can be tracked back to the general business model innovation literature. These steps are:

1. *Idea generation* (diffusion among the analyzed paper 12/14): finding idea, suggesting steps to generate potential ideas.
2. *Selection of the idea* (14/14): selecting the most promising idea and design.
3. *Requirements analysis* (12/14): evaluation of strengths and weakness, determination of prioritization.
4. *Implementation* (11/14): suggesting steps and influential factors in implementing the business model.
5. *Evaluation step* (3/14): an assessment of economic feasibility and environmental impact of the new business model.

With the only exception of the fifth step, the other phases are presented in the majority of the papers analyzed.

However, in the selected papers, these steps are usually generally described and only in few cases a detailed description/list of sub-steps/activities is provided. In addition, even fewer of them provides specific methods or tools that can support the implementation of the different phases in companies: in many cases the papers list existing methods that can be helpful during the design or development of a business model. In fact, usual creativity techniques [33] such as brainstorming, analysis of stimulus, business models framework and service design tools [8] are applied in the early phase of the business model innovation for servitization. Methods for business analysis (e.g. market, industry, stakeholder analysis, opportunities and risks analysis, visual thinking, etc.) are used in the second step. Methods for quantitative market research (e.g. survey, interviews, group discussions, etc.) and for corporate analysis (e.g. SWOT, customer analysis, gap analysis, customer feedback, etc.) are used in the third step. Evaluation scenario techniques, lifecycle assessment tools and business plan are then used in the last step.

4. The new business model innovation process (BMIP)

Starting from the evidence of the literature analysis, this paper provides a new process methodology that adopts the four common steps as its basis. For the sake of clarity, we have renamed these steps as illustrated in Fig.1.

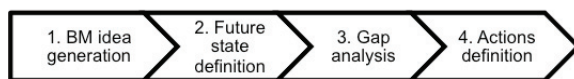


Fig. 1. PSS Business Model Innovation Process

The new methodology, consisting of a four-step process for the selection and design of the most appropriate PSS business models. In order to enable the application of the process model to practical cases, a specific toolkit that supports each step has been created. The tools are generally MS Excel files. The main steps are described extensively and a brief discussion over the tools is given in the rest of the section

4.1. Business model idea generation

The main aim of the first step is to establish a shared language with companies, frame different expectations and to test preliminary ideas, establish the rationale, the scope, and main objectives of the new business model. Each company needs to understand its business situation and to review its BM expectations/ideas. Specific tools have been designed to support this step helping companies to structure and present preliminary ideas more effectively. This step is divided in three main tasks. The first step is the “*BM assessment*”, and it consists of depicting the company with the aid of a business model analysis framework; moreover, a specific analysis of the current portfolio of the offered services is also carried out. In order to support the implementation of this step, we developed a specific tool that provides guidelines for conducting a deeper case study in order to carry out a good understanding of a company's business model configuration. The second task of this step is named “*Expectations*”. It aims to define the project boundaries and collect business idea. This phase still remains a creative stage where new PSS concepts are generated and/or new opportunities are identified. Again, a specific tool has been provided. In particular, a brainstorming tool is used by companies to frame the scope and objectives of their new business model by defining the product/services that will be offered in the new PSS BM. To better support the company's brainstorming, this tool is usually used more than once because the usage process is circular, not linear and this allows reviewing the answers to get a better consistency. Finally, the last task, named “*Context analysis*”, aims to develop an understanding of the context in which the BM will evolve, considering the industry context, the market trends, the role of the company in the supply chain. This step will help the company to identify the role of specific contextual factors for the new BM: inhibitors, obstacles, facilitators or opportunities. To support in practice the above step, a specific tool was developed, aiming to support companies in achieving a perception of three different categories of “contextual factors”, namely: industry context, market and customer and internal environment.

4.2. Future state definition

The ideas provided in the first step are then translated into specific business model characteristics, structuring and mapping the idea in a PSS business model framework. This framework therefore represents the tool used in this step and has been derived from the PSS BM framework proposed by [36]. It consists of a two-level hierarchical framework that encompasses a broad set of components and PSS variables, derived from literature, to be evaluated and characterized when designing the transformation from products to PSSs. In

order to simplify the practical application, the frameworks have been also enriched with a set of questions to support the company's brainstorming on each variable. In this way, the framework can be used as a management method that helps companies to comprehend and formalize in a structured and integrated way a new service oriented business idea. In fact, at the end of this stage, the preliminary idea is selected, translated and formalized in a structured PSS BM.

4.3. Gap analysis

In the third step, the company identifies the gaps with respect to relevant processes/procedures, capabilities and resources of the firm that are needed to successfully deploy the new BM. This serves to understand which are the areas to be strengthened so to successfully implement the new BM. This step consists of two phases: "*Customer need analysis*" and "*Maturity evaluation*". The customer need analysis phase aims to collect information among (current or potential) customers to assess what is the importance given to different potential value sources embedded in the new company offering, assess the interest towards the (new) revenue models and services the company aims to propose in the future. This activity will also allow to fine-tune the BM configuration including additional element and feedback collected from the customer base. To support this task, we designed a specific questionnaire that aims to investigate specific PSS variables (see section 3.2). The second task of this step has been designed in order to assess the service orientation of the company key resources, capabilities and procedures. To support in practice this phase, a specific tool has been provided. The "maturity evaluation tool" is based on existing maturity models in literature but it is specifically designed in order to evaluate through a five-level scale, the service orientation of each variable of the new PSS business model framework. This allow to analyze the current company's gap in terms of resources, capabilities, tools and procedures needed to properly support the new BM, by comparing the actual configuration with the theoretical maturity required by the specific PSS business model chosen by the company.

4.4. Actions definition

The fourth step aims to support the company in the definition of a list of actions in order to fill the gaps and/or to implement the new BM and to prioritize them according to the expected impact. In this step the company evaluates and selects the most appropriate actions by prioritizing them according to the expected impact and feasibility. To support its implementation, a specific tool ("importance-effect matrix") was developed and aims to help the company to evaluate and select the most appropriate actions needed to build the required resources, capabilities, tools and procedures so to support the new PSS business model. The tool, provides a list of predefined actions that can be enriched and adapted by the company. It first supports the company to analyze the expected impact of each actions in the specific case. Then, thanks to an automatic calculation, the tool computes an overall score for each action that represents an indicator of the

effectiveness of the lever. Moreover, within this tool, a preliminary levers' cost can be evaluated.

5. Empirical application

The developed processes and methods have been applied in three companies operating in the machinery, automation and transportation sectors, through the action research methodology, allowing to test the comprehensiveness of the proposed process and refine the toolkit thanks to companies' feedbacks. The Action Research (AR) approach was carried out over a period of 18 months within a project funded by the European Commission under the 7th Framework Programme. During this period, we had at least, 3 interactions (meetings and call conferences) with each company for each activity of the BMIP and 4 plenary workshops with all the companies and experts from other research centers to discuss the main results and criticalities at the end of each main phase.

In the remainder of this section we present the main evidences of the application of the BMIP in an Italian company that designs and delivers high speed milling machines. High customization and flexibility are the most important success factors of the company, that claims to provide high quality and customizable machines and equipment that can fulfill the most sophisticated needs in precision and productivity. Thus, today the driving force behind company's growth is the constant product and technological innovation, while services are still seen as a necessary evil. The company offers some standard services (e.g.: repair, spare parts, documentation) while advanced services are almost never offered. However, consistently with the new economic scenario where customers are more and more looking for quick and collaborative solutions to their problem, the company has started thinking about advanced services, such as monitoring and remote diagnostic.

Given this context, the application of the BMIP allows management to develop a clear understanding of the business model concept and of the transformation needed. First the preliminary idea, was refined and shared within the company (*Step1*) and then translated into specific business model characteristics, structuring and mapping the idea in a new PSS business model framework using the tools provided in the *Step2*. Thus, a new business model for Gantry Type High Speed Milling machines in aerospace industry were defined. The company decided to redesign the spindles of this product line, implementing additional sensors, in order to enable the development of a new Capability based Monitoring (CbM) tool. Since the electrospindle is the most crucial component of the machine, achieving a series of data and information about some parameters of this component is very important to understand its status and if it needs to be maintained or not. Through the application of sensors to capture data such as stator temperature, bearings temperature, axial and radial acceleration, in the new BM therefore, a new CbM service will be introduced. This service will allow Company B to ensure a better control on customer's processes, helping customer to maximize the use of the machine and to propose specific maintenance contract. In fact, the new CbM features will be exploited introducing a new contract based on a

monitoring SW dedicated to the spindle. The new maintenance contracts' portfolio is thought to be offered to company's customers covering all running machines worldwide old and new ones. The contracts will cover the cost of related materials, manpower and travel expenses and accommodation. In this way, with the new PSS BM, the company aims to support customers with additional maintenance tools, an enriched service portfolio and improved design of critical machine components, such as the spindle. This will add value to the product delivered and will allow customers to achieve their goals. Main tangible results of the new business perspective will be related to the Overall Equipment Effectiveness that measures how close manufacturers are to perfect production (manufacturing only good parts, as fast as possible, with no down time) and to the Total Cost of Ownership that is an estimate intended to help owners determine the direct and indirect costs of a product or system.

During the *Step3* of the BMIP, the "maturity evaluation tool" has been applied to analyze the current configuration of the business model element in the Company. Overall the current configuration of these elements seems to be ready to support the new business model idea, as it doesn't represent a disruptive innovation for the company (see Fig. 2).

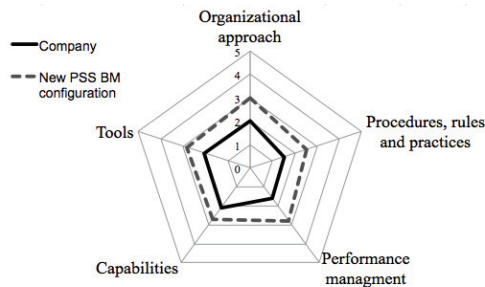


Fig. 2. Gap analysis results – Overall maturity evaluation

As expected, we found a lack of procedures and practices to align product and service importance within the company. Especially for development of new services many practices and rules can be applied (e.g. assessment of customer's preferences and feedbacks, deals with key service partners/suppliers, practices for data collection, interpretation, analysis and processing of product/service data from the field, etc.). In fact, no procedures and practices for managing customers' feedbacks on product/service experience are established in the company. At operational level, procedures for managing service delivery processes (e.g. technical support, repairs, help desk, etc.) are still missing. Moreover, also the capability to communicate and make tangible the service value to the customer is not adequate.

Starting from the highlighted gap, the *Step4* allows identifying several actions needed by the company to achieve the defined PSS BM configuration (*Step 2*).

For the sake of simplicity, the main levers identified are summarized in Table 2.

Table 2. Action list derived from the analysis

	Description
Organizational approach	Change of mental models to view service as a business opportunity and as a potential source of value creation. It has to support actively a service culture focused on providing a specific training course for a new incentive system.
	Define a specific team for the new service development & service engineering.
	Define a specific team for analysis and interpretation of data.
	Development of Service Business: the creation of the role for sales of service is crucial for the development of the new BM. A dedicated direct sale-channel for service will be established to increase the customers' awareness of the new offering/value.
Procedure and practices	Creation of new commercial roles with service attitude: "sales support & customer service profile" is also crucial for the development of the new BM. In the organizational chart new roles will be defined with an associated list of key activities to be performed.
	Define procedures that formalize the product and service design phase, ensuring the participation of different business function and defining their role.
	Define procedure that formalize and standardize back-office processes (while maintaining front-office customization) and service delivery.
	Marketing initiative for new full service contracts / new monitoring services (publicity and communication) Marketing and commercial specific approach to customers. Company has started developing a dedicated page on the website to new services that will be offered to customers
Tool	The creation of the new diagnostic tool (HW/SW) will be the key element for the implementation of the new BM. The new diagnostic tool will provide the service technician the capability of understanding the health state of the critical electro spindle component
	Define the list of data and protocol: list of failures we want to recognize, validate the defined test protocol and add predictive capabilities to the SW.
	New additional sensors will be added in order to improve spindle diagnostics: an analogical sensor for drawbar positioning; part contact sensor that prevents start rotation when there is contact; temperature sensors on the upper and lower bearings; a temperature sensor on the motor; a 3 axial accelerometer to monitor vibrations on the spindle

6. Conclusions

This work has developed an integrative framework that can link service strategy and concrete operation practices. In particular, we provide a new contribution to theory by developing a process framework for business model innovation that integrates the quite dispersed literature on the subject. Moreover, the proposed toolkit can support practitioners in service design, organizational design and transformation. In fact, this work can help managers providing a useful framework to structure their new business model idea and manage the relevant element and critical requirements that have to be taken into account in the servitization journey. In fact, as the case application shows, the proposed methodology and tools can be used by companies to understand the transformation needed towards servitization, guiding new PSS initiatives. Moving through different steps of the proposed business model innovation process, companies can better understand where their current business model stands, identifies where they want to go and points out and address the relevant gaps needed to successfully deploy the new BM configuration.

This paper presents some limitations that suggest future research developments. In particular, this research is based on the analysis of specific industry sector, more empirical tests

are needed to come out with a generalization of the contributions (both theoretical and practical). The extension of the empirical research to different sectors can overcome current limits of the proposed business model innovation process and tools and lead to a general fine-tuning of the contributions developed in this work. Moreover, future researches should focus on the “Evaluation steps”, providing methods for evaluating PSS business models implementation process.

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