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Technical-Business Design Methodology for PSS

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Abstract. Concurrent Design (CD) is a systematic approach to integrated product design that emphasizes the response to customer expectations and the combination of creativity and engineering. Such a concept represents also the basis of Product-Service System (PSS), which represents a valid way for companies to add value to their products, create new value propositions, and easily improve their solution portfolio. Indeed, the fulfilling of the customer needs is fundamental for creating successful industrial PSSs (IPSSs), which aim at combining products and services into a marketable solution. However, the integration of technical and business aspects is crucial to succeed. In this context, this paper proposes an integrated methodology for PSS addressing both technical and business aspects; it adopts a QFD-based approach to structure PSS information along the different process stages, considering four main domains: customer, functional, assets and network. It allows technical feasibility to be carried out and business framework to be defined at the same time to have a robust design concept and a reliable business model from the early design stages. The method is based on the direct involvement of the customer voice according to the CD paradigm. The proposed method also allows to define earlier the network of stakeholders and to dynamically reconfigure the network itself along the process, promoting the creation of the lean enterprise.

Keywords. Product-Service System (PSS); PSS design; Quality Functional Deployment (QFD); Business model (BM); Industrial case study

Introduction

Modern economy is changing from producing material goods to offering functions combining products and services. For instance, IKEA started offering "to create a home" instead of selling furniture, while Rolls Royce offered "total care" and "power by the hour" rather than selling jet engines or spare parts. As a consequence Product-Service Systems (PSSs) are assuming growing importance in industry. They integrate tangible artefacts and intangible services to achieve sustainable, improve enterprise competitiveness, and meet customer needs better [1]. Designing PSS represents a new perspective for traditional manufacturing companies establishing their business on

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producing goods to evolve their business model toward a service-oriented scenario and adopt a new interpretation of the basic design concepts to embrace both product and services [2]. The benefits behind PSS are numerous: for the customer that utilizes the function provided, for the provider that can optimize manufacturing, maintaining, and for the environment and society at large, since less waste is produced [3]. However, creating PS obviously affects the manufacturer's design and development process; for instance, designers have to consider more process variables and merge both tangible and intangible assets, while the development process must be reorganized and activities properly synchronized.

Several methodologies to manage PSS can be found in literature: in particular, the network on Sustainable Product-Service Systems Development (SUSPRONET) identified thirteen most important methodologies for PSS design and development [4]. Most of them focus on technical development stages, while some of them on innovation aspects and sustainability. However, they face PSS in two distinctive ways: from a technical perspective or from a business perspective. In this direction new approaches have been proposed [5] and some prototypal solutions achieved [6]. They demonstrated that important changes affect the company processes in creating PSSs: firstly, traditional product lifecycle has to be enhanced by including also service management; secondly, the product-oriented company model must be extended to realize a service-oriented ecosystem [7]. Also interrelations between physical products and intangible services have to be managed by creating new relationships among the stakeholders [8]. Finally, the role of human factors is fundamental to robustly define the customers' expectations and, consequently, create functions satisfying the customer needs.

This paper promotes the combination of technical-business aspects in defining a design methodology for PSS. In particular it supports PSS design from the earliest lifecycle stages until the definition of the production network by combining technical aspects, User-Centred Design (UCD) principles, and business modelling. Design is structured into steps where technical design activities and business-centred activities run in parallel to effectively supports feasibility analysis and comparison among alternative use scenarios from the early stages.

1. Research background

PSS arises from the idea of Extended Product (EP) [9], according to which services can be used to extend the product feature in order to differentiate the product itself and support its use by the integration of tangible assets (i.e. materials, technologies, processes, and all staff typically related to the product) and intangible assets (i.e. skills, competencies, services, and all information related to human factors). The final result is a complex system able to combine product, services, enabling technologies and the proper infrastructure to realize the desired functions. Due to its complexity, designing PSSs requires not only developing numerous and interrelated activities, but also involving different types of actors in order to compensate for the various resources required [10]. The stakeholders are required also to extend their responsibility in the lifecycle to properly produce, deliver, manage, reuse, remanufacturing, and recycling the PSS [10]. This situation may cause incompatibilities and inevitably induce technical and business conflicts, that can be responsible for falling performance [11].

For conflict management, in traditional product development several approaches have been developed [12]. However, few studies deal with these conflicts from the PSS viewpoint. Recently some researches paid attention to methods and tools to design PSS tailored networks: Krucken and Meroni [13] proposed a pro-active approach based on communication and strategic conversations among the partners; Wang and Durugbo [14] proposed fuzzy technics to evaluate levels of transitions from product-focused operations to service-oriented operations; Watanabe and Shimomura [15] and Nemoto et al. [16] paid attention to describe interactions among the ecosystem partners. In the last years, also business aspects assumed more and more attention. Although the existing literature indicates that defining a Business Model (BM) can be useful to implement PSS: although the paucity of guidelines, the definition of a proper BM is crucial for successful PSS [17]. BM refers to the logic of the firm, the way it operates and how it creates value for its stakeholders; since PSS is a new proposal based on added value, a good BM definition is fundamental for PSS. Morris at al. [18] analysed the most recent works about BM frameworks and provided an appreciated overview. A plethora of elements has been defined: nomenclature and arrangement vary depending on the research perspective, but some common aspects can be distinguished such as Value Proposition or Customer Value Proposition. The CANVAS model presented by Osterwalder [19] is probably one of the most robust model, able to describe the business organization through 9 basic building blocks, covering four main areas: product, customer interface, infrastructure management, and financial aspects. Barquet et al. [17] pushed to use BM to support PSS definition, while Guidat et al. [20] gave a set of guidelines to define innovative BM for remanufacturing to convert products into PSSs. However, finding out guidelines about how to use such models for PSS concretely in the design process is difficult and a general-purpose model is still missing.

Finally, another important aspect of PSS is sustainability. Tan et al. [21] stated that PSS approaches are sustainable innovation strategies in a total lifecycle perspective. The concept of lifecycle has traditionally been applied to physical products, so to manufacturing companies. A recent study proposed a review of such approaches from different viewpoints: from value to cost, functions, qualities, or performances [22].

In this context Concurrent Design (CD) approach can be used to integrated product or project design by emphasizing the response to customer expectations and the combination of creativity and engineering [23]. CD focuses mainly on the early phases of a project or product and aims at translating multidisciplinary design meetings into concrete parameters, supported by experts representing all perspectives of the product/project lifecycle (e.g. technical, cost, risk, schedule), using a common reference model to exchange information. This approach brings traceability and enables a faster, more efficient and reliable project execution. It could be validly applied to PSS to model its complexity, to move from customer expectations to technical issue. Indeed, PSSs require a strong activity integration and concurrency by definition, and to systematically represent PSS lifecycle. A lifecycle for PSS has been proposed by Kimita et al. [24]: it consists of four phases (value analysis, design, execution and evaluation). The value analysis is crucial as the goals are extracted to start the design phase. There are few studies about how to structure this phase for PSS, from axiomatic design [25] to service-engineering modelling methods [26]. Axiomatic design aims at mapping processes in respect with 4 domains: customer needs, functional requirements, design parameters, and process variables. Firstly, the customer needs are converted into functional requirements as the minimum set of independent requirements that completely characterize the functional needs of the design solution. Than, functional requirements are embodied into design parameters and design parameters to determine process variables. Kimita et al. [24] proposed a design method to address conflicts in PSS development by adopting an axiomatic design and map the PSS entities.

Furthermore, other techniques can be used to detail the design stage, such as Quality Function Deployment (QFD), Analytic Hierarchy Process (AHP) and Hierarchical Task Analysis (HTA). QFD aims at bringing a new product model to market [27] and consists of several activities supported by various matrices able to translate the customers' requirements into the appropriate technical requirements [28]. QFD can also address sustainability by incorporating environmental aspects [29]. Differently, AHP decomposes a complex system into a hierarchy to capture the basic elements of the problem in order to solve multi-solution problems affected by various factors (i.e. functions, aesthetics, safety, cost, operation, reliability, lifecycle variable) [30]. Similarly, HTA [31] addresses functional requirements as well as the specific actions that are required to satisfy these requirements. Recently it has been demonstrated the effectiveness of QFD and Hierarchical modelling for analysing the relations between customer need and technical requirements in PSS design [32, 33]. Evidences of QFD adoption to incorporate the voice of customers at the early stages of PSS design and develop PSS are presented in [34, 35].

2. The T-B design methodology for PSS

From the previous literary review, a set of important findings has been defined for the development of a new methodology:

- a lifecycle approach is needed when talking about PSS;
- a technical and systematic design approach is necessary to face PSS design issues;
- a business approach is necessary to map the relationship between the company and the customer, that is fundamental to make a PSS run effectively;
- a business ecosystem must be defined to consider relations among stakeholders.

In this way the research defines a new methodology combining technical and business aspects (T-B) along four domains characterizing PSS: customer, functional, asset, and network. The reference design process is adapted from Pahl et al. [36] and the different design stages are organized into a set of inputs and outputs according to the QFD philosophy. Indeed, the method is structured according to a set of correlation matrices to map the correlations among the most significant aspects at the different design stages, where the output of one matrix becomes the input of the following one. Four matrices referring to the four considered domains are identified.

2.1. The T-B methodology steps

The T-B methodology starts from the consumer domain and moves through the other ones (functional, asset and network). The method can be synthetized in six main steps:

Step 1. Definition of the customer needs and demands: it is based on the adoption of UCD techniques depending on the specific sector and the market typology (i.e. focus group, interviews, desk research, ethnography, personas) and is generally carried out by the marketing staff. It allows defining a set of needs and their relative weights, expressed according to a 5-point Likert scale. Similarly, demands are elicited: they are extremely important for PSS since they represent the key features to achieve a high perceive value. Data are collected in Matrix 1 that matches needs and demands by expressing the inner correlation between them, according to a 0-3-9 scale (0 represents no correlation, 9 means the higher correlation). Ethnography and surveys [37] are used for eliciting such correlations. Ethnography consists of providing a qualitative description of the human social condition based on fieldwork and users' observation in their natural setting. Survey is added to make the user study more interactive and also collect directly the users' feedback. In this way it is possible to find out the most relevant needs by summing all the correlation values along each specific matrix column and considering the highest results. Similarly, the most significant demands are obtained by applying the sum-product function along each row, where the need weight is the multiplayer for each value, and considering the highest results. Contemporarily from a business viewpoint, two areas of the BM can be defined according to CANVAS (i.e. customer needs and value proposition as a synthesis of the demands).

Step 2. Definition of the user tasks: it adopts a specific UCD technique (i.e. role-playing) to highlight the tasks to be executed to satisfy the selected needs and it moves from the customer to the functional domain. Role-playing is performed by experts who play as characters into the real context of use simulating the actions and moods of the consumers. It allows a vivid and focused exploration of situations and generation of ideas in order to "be in the moment" and share with the customers their experiences [38]. From a technical viewpoint, tasks are necessary to deal with PSS functions; from a business viewpoint, tasks are connected to PSS customer relationship since they express how the users interact with PSS, how they communicate with PSS providers, under which circumstances and how frequently, how they access to both product and services, and so on.

Step 3. Requirements elicitation and functions definition: it moves entirely into the functional domain and translates well-know activities in traditional design but moving into the PSS context. The most significant demands from step 1 are organized into a list of basic, technical and attractive requirements by HTA technique [31]. HTA allows addressing the underlying mental processes that give rise to errors during task execution, and being connected with the higher-level mental functions as well as the specific actions required to satisfy these requirements. After that, the definition of the PSS functions is based on the correlation between requirements and tasks, which is carried out by the Functional Analysis System Technique (FAST) method according to the Kano's model [39]. In this step the combined contributions of the marketing staff as well as the technical staff and the service personnel is fundamental. From a business perspective, the defined functions allow eliciting BM key activities.

Step 4. Assets definition: it focuses on the definition of the T/I assets needed to realize the PSS to satisfy the value proposition and the customer needs. It starts from the ecosystem analysis and maps all the potential partners and their features (e.g. skills, competences, services, products, response time, cost, regulation respect). Once partners are fully described, functional modelling is used to relate functions and T/I assets. Unified Modelling Language (UML) is used to model the detailed PSS functional structure and identify the necessary assets. From a technical viewpoint, the result is the list and description of the T/I assets needed. From a business viewpoint, the assets represents the key resources and the distributing channels.

Step 5. Partners' selection: this step moves into the network domain and aims at selecting the most appropriate partners on the basis of the correlation between the assets and the specific partners' resources and availability that takes into account risk assessment. Risk assessment focuses on the supply chain and Supply Chain Risk Management (SCRM) methods are used: they consider risks within the supply chain in terms of supply costs, delivery time, supplier reliability, supply quality, and risks external to the supply chain according to a coordinated approach amongst the chain members to reduce the supply chain vulnerability as a whole [40]. In this second case, the so-called Social, Technological, Economical, Environmental and Political (STEEP) analysis is applied. At this stage the main actors are marketing, technical and purchasing staff. This step is mainly business-oriented since it aims at defining the key partners in the BM.

Step 6. Service modelling: this step uses blueprinting technique [41] to model service processes specifically starting from the defined CANVAS BM. Blueprinting is a customer-focused approach widely used in service innovation that allows to visualize PSS processes and connect the underlying support processes throughout the organization, and to help defining channels (both information flow channels, and distribution and delivery channels).

Figure 1 shows the method matrices and the information defined as inputs and outputs in the four domains considered. Information in red represents the main outputs from each step, while blue labels refer to the business aspects.

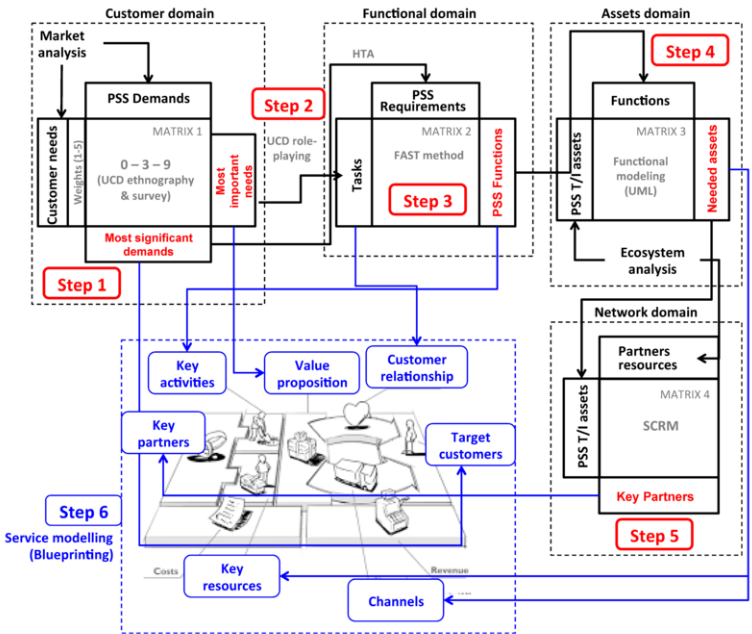

Figure 1. T-B design methodology for PSS

3. The industrial use case

3.1. The industrial context and issues

The industrial case study is represented by the design of an innovative PSS solution for Washer Dryers (WD). Actually the traditional product is designed and produced by an Italian company, leader in household appliances, which has also a worldwide network made up of numerous suppliers and commercial branches. The company is interested in innovating its actual business through services. Recently, it worked on connectivity issues and proposed a set of connected devices (e.g. washing machines, dryers, fridges, ovens) addressing the smart home concept. However, they are still producing and selling products while services are almost commercial add-ons, so that the real benefits for final users are still hidden due to the lack of analysis of business aspects. Actually technical aspects are faced at the beginning of the design activity, while business aspects are defined later on during the implementation stage. The goal is to innovate the PSS offer by creating an appealing PSS solution by integrating technical and business design. The main challenge is satisfying the real market needs and identifying the right business model able to satisfy the customers' expectations.

3.2. Method application to design a new PSS

This section summarized the method application by presenting the results obtained in form of matrices. Figure 1 shows the results obtained in Matrix 1 and Matrix 2. In Matrix 1 needs and demands are elicited, and the rank reveals the most important ones (highlighted in light blue). Then, the most important needs are used to define the tasks and requirements by respectively role-playing and HTA. From the beginning of the design stage, the related BM starts to be filled by value proposition (derived considering the most significant demand) and the customer segments from the analysis of the needs, while key activities and customer relationship are defined from functional analysis. Figure 2 presents the results from Matrix 3 and Matrix 4. In Matrix 3 PSS assets are derived from the ecosystem analysis on the basis of the above-mentioned functions, while Matrix 4 correlates assets and specific partners' resources. 2. At a business level key resources and key partners are identified. Last steps relate to the definition of the BM (Figure 4) and service modelling by blueprinting (Figure 5).

For the new PSS for WDs, target consumers are "house managers" (people very active at home and full of attentions for the home management in general) and "efficiency seekers" (usually young people who like to be efficient and smart, and are attracted by new technological solutions). Customer relationship is mainly based on the use of a mobile-web application and a 24-7 call centre for assistance. Key partners and key activities are directly related to the previous analyses. The costs consider WD production, service architecture and End-of-Life management. Finally the revenue streams are created according to a Pay per Service model.

A)

CONSUMER NEEDS	Weight	PSS DEMANDS: Autodose technology	WD provided of professional cycles	WD provided of led technology	New technology for treating coloured clothes	WD provided new technology for sweet wash/drying	New patented high temp. tech. for clothes anti-allergy	WD connected and monitoring	Smart maintenance	Pay service and WD for free	Appliance with smart interface	Detergents supply	Appliance with remote control	MOST IMPORTANT NEEDS	Rank
Clean clothes	5	9	3	4	3	3	3	1	1	1	0	9	0	185	4
Dry clothes	5	0	9	0	0	9	3	1	1	1	0	0	0	120	10
Care for fibres	4	0	3	0	3	9	3	0	0	0	0	1	0	76	11
Care for colours	1	1	3	0	9	0	3	0	0	0	0	1	0	17	14
Appliance cycles tailored on customer	4	0	3	0	3	3	3	9	3	3	0	9	3	156	7
WD able to load detergents	3	9	1	0	0	0	0	9	0	3	3	9	9	129	8
Wash at home clothes require dry-cleaning	1	1	9	0	1	3	1	0	0	0	0	1	0	16	14
High washing performance	5	9	9	1	9	9	9	1	1	0	3	1	3	275	1
High dryer performance	5	0	9	1	1	9	3	1	1	0	3	0	3	155	7
High machine performance	4	9	1	3	1	1	1	9	9	3	9	0	9	220	2
New easier interface	3	0	0	9	0	0	0	3	0	0	9	0	0	63	12
Easier selection of programs	2	0	0	3	0	0	0	1	0	0	9	0	0	26	13
Information abot energy consumption	4	0	0	0	0	0	0	9	0	3	0	0	9	84	10
Information about each cycle	5	1	0	0	0	0	0	9	9	3	0	0	3	125	9
Energy and other resources efficiency	4	9	0	0	0	0	0	9	1	3	0	9	9	160	6
Balance between quality and price	4	3	3	3	3	3	3	3	3	9	3	3	3	168	5
Reliability and Durability	5	1	1	0	0	0	0	9	9	9	9	0	3	205	3
MOST SIGNIFICANT DEMANDS		213	120	82	110	127	104	294	164	158	162	167	204		
Rank		2	9	12	10	8	11	1	5	7	6	4	3		

B)

TASKS	PSS REQUIREMENTS: New sensors to provide autodose	WD redesign to provide detergent boxes for autodose	New sensors to monitor WD	Development of an infrastructure to connect WD	SW system development	Improve the main board	Improve the WD interface	New app development to monitor WD by external devices	Rules definition to apply preventive maintenance	WD check	Consumer habits monitoring	Detergent suppliers involvment	HW infrastructure development	PSS FUNCTIONS	Rank
Insert clothes into WD	0	0	0	0	0	0	1	0	0	0	0	0	1	2	12
Load detergent	3	0	3	0	3	3	0	9	0	0	9	9	9	48	4
Select programs	1	0	3	0	0	0	9	9	3	9	9	0	1	44	5
Choose the correct program according to clothing label	3	0	1	1	0	0	3	3	0	0	0	0	0	11	10
Choose the program according to customer habits	3	0	1	3	0	0	3	3	0	0	9	0	0	22	9
Control the program starting	0	0	9	3	9	9	9	9	1	9	3	0	3	64	2
Use the right detergent amount per each cycle	9	9	1	3	1	9	0	1	0	0	9	9	9	60	3
Use the short cycle for half load	0	0	1	3	0	0	1	0	0	0	1	0	0	6	11
Control the program temperature	0	0	9	3	9	9	9	9	3	9	9	0	9	78	1
Avoid the uncorrect stop of WD	0	0	0	1	0	0	9	1	9	9	0	0	9	38	6
Use the antilimestone per each cycle	9	9	0	1	0	0	0	0	0	0	0	9	0	28	8
Avoid more cycle with high speed	0	0	1	1	3	1	0	1	9	9	3	0	9	37	7
Clean the detergent box	1	0	0	0	0	0	0	0	0	0	0	1	0	2	12
Clean the WD after 20 cycles	9	1	1	0	0	0	0	0	1	3	3	3	1	22	9
	38	19	30	19	25	31	44	45	26	48	55	31	51		
Rank	6	11	8	11	10	7	5	4	9	3	1	7	2		

Figure 2. Matrix 2 (correlation between tasks and PSS requirements) (A) and Matrix 3 (correlation between T/I assets and PSS functions) (B)

A)

PSS T/I ASSETS	Rank	PSS FUNCTIONS: Autodose	WD connected	WD monitored	Smart maintenance	Best practices proposals	Marketing offers proposal	Smart interface	Temperature monitoring	Water used monitoring	Detergent used monitoring	Energy used monitoring	Total costs per cycle	NEEDED ASSETS	Rank
Sensors inside WD basket	3	9	0	3	0	1	1	0	3	3	9	0	1	90	6
Sensors to monitoring WD running	3	1	0	9	1	0	0	0	9	9	9	3	1	126	4
Sensors to identify detergent amount	3	9	0	0	0	1	1	0	0	0	9	0	1	63	8
Sensors to monitoring cycle's temperature	3	0	0	3	0	1	1	0	9	0	0	0	1	45	9
Detergent boxes	2	9	0	0	0	3	0	0	0	0	1	0	3	32	10
WD interface	4	0	1	1	0	1	1	9	0	0	0	3	3	76	7
SW system	2	9	3	9	9	3	3	1	0	0	0	0	0	74	7
ICT infrastructure to connect the WD	2	1	9	9	3	3	3	0	0	0	0	0	0	56	8
Knowledge in autodose technology	3	9	3	3	0	0	0	0	0	0	9	0	0	72	7
Knowledge in machine connection and monitoring	4	1	9	9	3	1	1	1	0	0	0	0	0	100	5
Delivery application	4	0	0	0	9	9	9	9	0	0	0	0	0	144	3
Rules to check the WD status	4	0	3	9	9	1	0	0	0	0	0	0	0	88	6
Rules to manage the smart maintenance	2	0	3	9	9	0	0	0	0	0	0	0	0	42	9
Rules to manage data collected	5	0	3	9	0	1	1	0	3	3	3	3	3	145	3
Rules to deliver different fuctionalities	4	0	1	1	9	9	9	1	3	3	3	3	3	180	1
WD components	5	1	3	3	9	1	1	9	1	1	1	1	3	170	2
KEY FUNCTIONALITIES		131	125	248	210	121	111	127	95	68	142	53	72		
Rank		3	4	1	2	4	5	4	6	7	3	8	7		

B)

PSS T/I ASSETS	Rank	PARTNERS RESOURCES: Partners in research (electronics, informatics, etc.)	Universities	Design partners	Detergent producers	Detergent providers	Energy utilities	Technological partners	Gyms and sport facilities	House builders	Smart Home providers	Software developers
Sensors inside WD basket	3	9	3	0	0	0	0	1	0	0	0	1
Sensors to monitoring WD running	3	9	3	0	0	0	0	1	0	0	0	1
Sensors to identify detergent amount	3	9	3	0	0	0	0	1	0	0	0	1
Sensors to monitoring cycle's temperature	3	9	3	0	0	0	0	1	0	0	0	1
Detergent boxes	2	0	0	9	3	3	0	0	0	0	0	0
WD interface	4	1	0	9	0	0	0	3	1	1	1	3
SW system	2	3	3	1	0	0	0	0	0	0	0	9
ICT infrastructure to connect WD	2	9	9	1	0	0	0	3	0	0	0	0
Knowledge in autodose technology	3	3	3	1	0	1	0	0	0	0	0	0
Knowledge in machine connection and monitoring	4	9	9	1	0	0	0	3	0	0	3	1
Delivery application	4	9	3	1	0	0	0	9	0	0	0	0
Rules to check WD status	4	1	9	0	0	0	0	9	0	0	0	1
Rules to manage smart maintenance	2	1	9	0	0	0	0	9	0	0	0	1
Rules to manage data collected	5	1	1	0	0	0	9	9	9	9	9	3
Rules to deliver different fuctionalities	4	1	1	0	0	0	9	9	9	9	9	3
WD components	5	0	0	9	0	0	0	0	0	0	0	0
KEY PARTNERS		232	180	114	6	9	81	213	85	85	97	79
Rank		1	3	4	10	9	7	2	6	6	5	8

Figure 3. Matrix 4 (correlation between T/I assets and PSS functions) (A) and Matrix 5 (correlation between T/I assets and partner resources) (B)

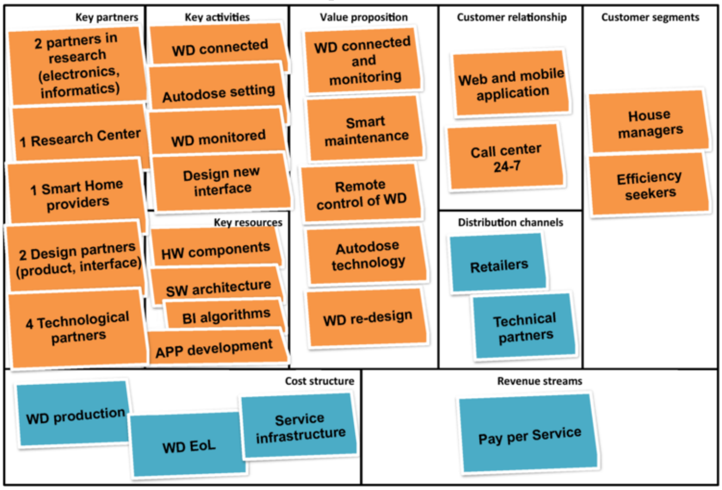

Figure 4. CANVAS BM for the designed PSS

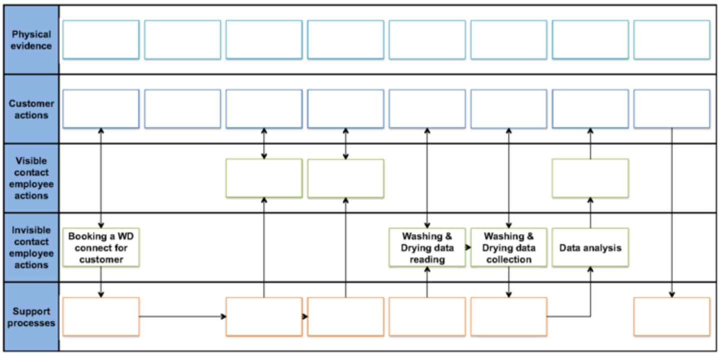

Figure 5. Service modelling for the designed PSS (blueprinting)

The case study demonstrated the method validity in organizing and structuring the design knowledge as well as guiding designers and managers into a complete PSS model definition. Method application overcomes the main limitation of previous design supported by traditional tools (brainstorming and focus groups), which generated confused PSS concepts, absence of priority among functions, difficult service process mapping, and critical partners' selection. Monitoring the design team, we found that method application allows avoiding confusion and reducing time to market.

4. Conclusions

The research proposed a new design methodology for PSS to overcome the main limitations of traditional product-centred process, which obstacle manufacturing companies moving to PSS. The new method integrates technical and business aspects according to a strategic approach. It provides structured guidelines from designers and managers to define both technical requirements and business model according to a QFD-based procedure. In this way technical aspects are considered more consciously and the evaluation of business aspects is anticipated providing some advantages also on technical area. An industrial case study is then presented to demonstrate how the proposed method can be adopted to successfully integrate technical and business aspects. The method has been proved to validly guide designers and managers to define the new PSS value proposition, the PSS network and the main service processes. The main limitations concern manual execution, which can be heavy for complex PSS. Future works will be oriented to provide a software tool supporting such methodology.

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