Journal of Engineering and Architecture
December 2015, Vol. 3, No. 2, pp. 114-124
ISSN: 2334-2986 (Print), 2334-2994 (Online)

Published by American Research Institute for Policy Development
DOI: 10.15640/jea.v3n2a13
URL: http://dx.doi.org/10.15640/jea.v3n2a13

Product Service System Design: How to Design Humans Application of a methodology in a PSS development with high human involvement

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Abstract

A three-step methodology is proposed to support development teams in product-service system (PSS) development projects. The methodology specifically addresses the problem of designing humans as part of the system. The human presence is a matter of fact when it comes to PSSs. They are the soft system delivering the service part of the PSS, which is also the most value adding for stakeholders. Furthermore many manufacturing companies are moving towards the integration of products and services. There are many structured approaches to support the design of software and tangible objects, i.e. the hard system. However there is a lack of guidance when it comes to the human presence design and integration with the hard system. The methodology aims at filling this gap. It was validated in a PSS development project within a company with a strong focus in product development. Hence it had to fit to an already in place product development framework. The findings were used to further refine the methodology. The methodology was fully applicable within that specific framework. However further validation runs are necessary to ensure its generality. The methodology will support the shift from pure manufacturer to product-service deliverer for those companies willing to change the rules of competition and to deliver more value to their customers.

Keywords: Product Service System development; PSS design and engineering; soft-system design; human sub-system design; design methodology.

1. Introduction

Markets are like adaptive living organism which are constantly evolving and changing. Thus companies and their business models change as well, as well as the side actors of the markets, the customers' needs and requests. In particular customers' needs are becoming more customer-specific and companies are pushed towards the full solution provision rather than just a part of it (Sakao, 2011). Anyhow this trend implies a stronger relation between customer and solution provider, and, from the solution perspective, new ways to deliver it (Oliva and Kallenberg, 2003, Lindhal et al., 2009, Roy and Baxter, 2009).

The overall trend points to services as the formula to cover all these aspects. Obviously, companies willing to stay on the edge need to adapt their organization and internal processes to cope with the change (Oliva and Kallenberg, 2003, Morelli, 2003, Lindhal et al., 2009, Ulaga et al., 2011). Moreover the product portfolio needs to be enriched and integrated with services, while the new product development approaches may require some adaptation to the service development (Isaksson et al., 2009, Maussang et al., 2009, Morelli, 2006).

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The adaptation is required because services differ from classical products. One of the differences is due to the human involvement into the service delivery. It means that product development processes, when dealing with service-products, have to take into account this specific issue (Morelli, 2003, Maussang et al., 2009, Abbot, 2010). This papers aims at describing how the service development was addressed by a company in a real service-product development project, focusing on the design activities dealing with the human factor. The theme is developed after an introduction about the servicization trend of markets and industries, and a brief literature review on the theme of the PSSs. Then, after a comparison between products and services, the case study is introduced and developed together with the methodology explanation. That is to better explain how the human factor can be considered and "designed" in a service product development project with a heavy human component. The case is based on a project developed within an international industrial machines manufacturer. They decided to enrich their product portfolio by adding a service product aiming at supporting in the customers' quality control activities. This service product was meant to be integrated with their machinery.

Finally in the paper, the main commonalities and differences into the design approach are discussed. The comparison is performed considering the case study against a classical hard product development approach.

2. Towards servicization

As already mentioned, the ways of doing business are ever-changing entities, reshaped on the market requests and exploiting the opportunities the changes brings on the table. What is observable now is an increased interest into the customers' needs satisfaction from the companies sided by a more focused approach into the valuables parts of the value chain. On the other hand, customers' needs are changing, requiring a full solution provision rather than just a product while new technologies on the IT side are available, creating hence new business opportunities (Sakao, 2011). Furthermore, raw materials and energy cost is increasing, enhancing thus the competitive pressure both at purchasing and at selling level does so (Tukker, 2004). Since, the customers' needs (explicit or tacit), together with the profit, are the drivers of the companies' operations, firms have to keep the pace with all these input demands. Needs could be considered as problems. As for every problem, there is a solution. Thus customers' needs are an opportunity for those aiming at providing a solution. So, what is the new? The new is that a solution is not necessary a product. For instance, why do people have cars? The possibility to move is the need. If the teleport technology would be available, do people still would own a car? Other types of answer to the same need might be the public transportation or the car sharing services. Still the solutions might not be merely a product. They are a mix of physical enablers (hardware system) and capabilities (soft system) organized to satisfy one or more customers' need (Muller and Sakao, 2010).

The same changes are involving the business to business environments. Focusing on the core and most adding value activities, for a firm, means that all the not core activities are not well covered or granted. Thus there is the possibility for other companies to sell their capabilities in those activities (Sakao, 2011, Ulaga et al., 2011). For instance the material handling capability in warehouses, like the warehouse capability in itself may be sold as services. Hence, being a capability (or solution) provider for customers means to strengthen the relationship with them, thus by fulfilling their needs in a customized and integrated way. That is because the service provider has to adapt his capability to every customer's way of working. On the other side of the coin, the empowered relationships may result in a lower service capacity in terms of serviceable customers (Oliva and Kallenberg, 2003). Nonetheless, having stronger relationships allows better observation and study of customers' needs (Sakao, 2011).

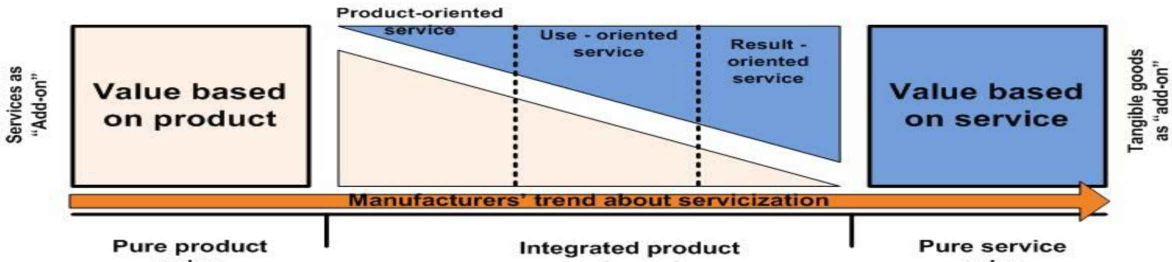

Figure 1: manufacturers' trend about servicization and value continuum (Tukker 2004)

Thus, there is an increasing shift from the product-based business to the servicization of the business model, as it is possible to see in Figure1. What is observable is that non-service based companies are pushing towards an integration of physical products and services, enriching thus their portfolio with hybrid offering i.e. product service systems. The servicization type differs depending on the service content. A classification distinguishes between Product-oriented service, Use-oriented service and Result-oriented service (Oliva and Kallenberg, 2003, Lindhal et al., 2009, Ulaga et al., 2011). An example is the one provided by aeronautical engines producers, which are not selling their engines but uptime with maintenance plan: a ship-owner needs to have his ships moving through the seas, not to own the engines moving them.

From a survey conducted by LiU Institute of Technology among about thirty international firms, it is possible to confirm that the most important forces driving the shift from a product based business to an integrated product-service one are (in order) the stronger relationship with the customer, the customers' needs and the increased competition (Sakao, 2011). Moreover, when it comes to the firms' departments involved into the product-service offering development, the Product Development, the Marketing and the After Sales organizational units result as the most concerned. Furthermore, from the survey it is possible to discover that, mainly, the Product Development department is considered to be responsible for the product-service offering development (Sakao, 2011). The last two answers provide insights about the importance of the product development activities when considering the integration of physical product and services for an effective solution offering. More details from the survey are displayed in Figure 2.

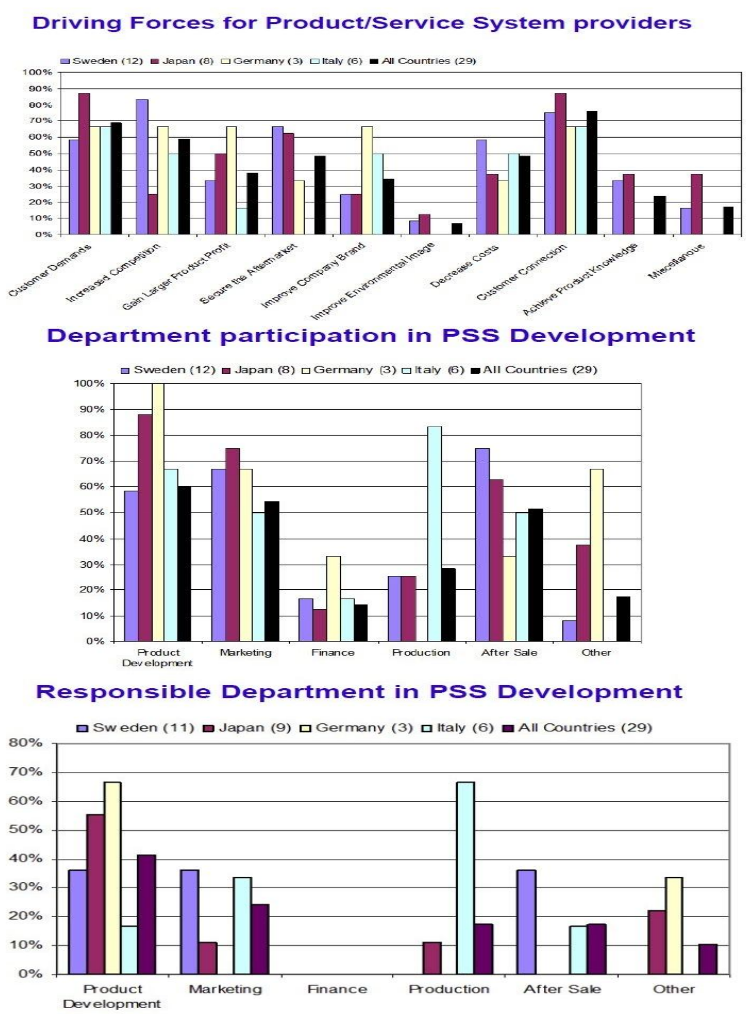

Figure 2: main survey results

3. Literature review

In the past decade the theme of the servicization of the offering, the underlying reasons and the expected benefits were widely explored by researchers and scholars.

Maussang et al. (2009), considers that PSSs are composed by services and technological enablers, i.e. classical products developed and combined to support and allow the service part of the offering, named also soft system by Muller and Sakao (2010). For that reason they propose a methodology supporting the requirements definition for the "product side of the PSS offering". The methodology specifically takes into account the functionalities the products are meant to fulfil for the service delivery and their interactions with the services. Several practitioners stated that the functional centred design is a good methodology for the design of a product-service offering (Sas and Lindstrom, 2014, Isaksson et al. 2009). Then, building on that, they also propose methods to define the actor networks involved in a hybrid offering and their relationships with the PSS (Isaksson et al. 2009, Morelli 2006); that is to support the requirements definition activities. At this point one consideration may spontaneously rises: the focus on the interface and the requirements definition and the functional design sound similar to the Systems Engineering principles. One common point to all the studies is that product-service products (or systems) are different than pure products and pure services (Morelli 2003, Roy and Baxter, 2009, Muller and Sakao, 2010, Lindhal et al. 2009, Sas and Lindstrom, 2014). Since PSSs are considered as a way to establish long term relationships for manufacturing companies, their value must be delivered to the customer during their entire life-cycle. Thus the life-cycle perspective must be taken while designing them (Roy and Baxter, 2009, Lindhal et al. 2009).

The life-cycle perspective, then, may help in designing more environmental and sustainable solutions than a mere product fulfilling the same features. It is given, for instance, that a cleaning service is more efficient in cleaning a floor than a normal person with cleaning products. Anyhow, it is not given that a hybrid solution is environmental friendly (Tukker, 2004).

Another distinguishing factor characterizing the hybrid offering design and successful deployment are the changes at the organizational set-up, to the company culture and to the employees' mindset at the suppliers (Oliva and Kallenberg, 2003, Morelli 2003, Lindhal et al 2009, Ulaga 2011). That is due to the substantial change in the perspective and in the way of doing business required for the successful product-service systems deployment. This difference is so important that it has been pointed as one of the business challenges firms have to cope with to enrich their portfolio with product-service systems (Oliva and Kallenberg, 2003, Ulaga et al. 2011). Furthermore, in many types of hybrid offering the suppliers' employees have a very severe impact on the service supply itself. That is the case, for instance of the suppliers taking charge of customers' processes. Thus employees, representing the soft (or human) system of the offering, their engagement, their behaviours and their skills are a crucial factor for the successful deployment of PSSs (Morelli 2003, Isaksson et al. 2009, Maussang et al. 2009, Abbot 2010). All the above mentioned topics are so well known that the research is widening its scope. For instance Resta et al. (2015) propose a framework to merge the concepts of PSS development and lean thinking pointing at the lean service. Nonetheless, despite this degree of maturity, there is a lack of guidance when it comes to how practically consider the human factor (soft system) into the design activities as part of a solution. The aim of this paper is, thus, to provide small guidance to the human side design within a service product development project.

4. Physical products against service products

Substantially services and products are different items. Examples of products are cars, DVDs, food, drugs and so on. Examples of services are the public transportation, cinemas, restaurants, the healthcare, etc. Though they were not mentioned, both products and services may be B2B and B2C. Anyhow, despite their differences, both products and services are meant to satisfy customer needs. For instance, both cars and the public transportation services aim at satisfying the need of moving, while both DVDs and cinemas want to cover the need of entertainment.

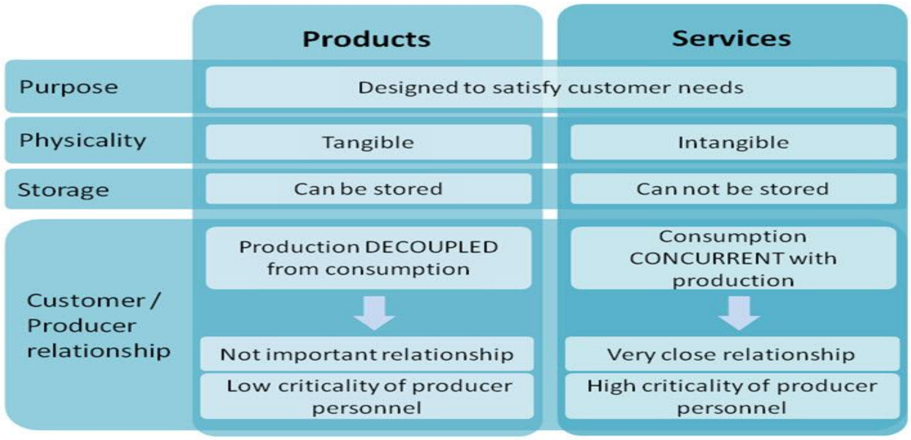

Figure 3: comparison between products and services

However the need satisfaction strategies differ from products to services. This leads to their inner differences. Those differences are displayed in Figure 3. First of all, while products are physically tangible goods, services are intangible, though it may be possible to touch and sense the means that deliver the service (such as the wagons of a train or the electricity cables). For the same reason products can be stored while it is not possible for services (Abbot, 2010).

This implies another substantial difference. A product use and consumption is decoupled from its production. First the drug is produced by a third party and then, after the sale, consumed by the customer. The product stocks achieve the mentioned decoupling. On the other hand, services are consumed in the precise moment they are produced. The healthcare facility produces the health visit in the exact moment it is requested, and the costumer consumes it directly when produced. It is then obvious that it is impossible to store services (Abbot, 2010). Considering the different production-consumption timing, when it is about products the relationship between producer and consumer is not central. It is the opposite for services: the service deliverer and the consumer are very close each other, especially in cases similar to the medical visit. They have to interact each other, thus, if a company wants to deliver a service to customers, its personnel becomes a critical asset for the success. Examples of this are consultancy companies, delivering to their costumers their expertise in the form of consultant teams (Abbot, 2010).

Then, consultant teams may deliver the service using particular tools and may accomplish their tasks relying on particular infrastructures (distance work through the network, shared working platforms, etc) as the urban public transportation relies on roads and buses. Products may be considered as stand-alone instances: they accomplish to their functions by themselves. On the other side, services require a mix of human action supported by tools and infrastructures to be delivered and then consumed. This highlights the importance of the human factor into the service provision, thus of the proper “human factor design” when developing service products. The human factor might be considered as the most characterizing and root of all the other aspects of pure services. As already mentioned above, PSSs are composed by a hard system and a soft system (Muller and Sakao, 2010), thus as for pure services, they can be considered as services enabled by a physical product. Though they might be considered as standing in between pure products and pure services, even in the Product-Service oriented class of the product-services continuum (Tukker, 2004), the characteristics of pure services must be considered as well for the development and operations purposes. That is the human factor has heavy weight and should be taken into account in all the Product-Service Systems development, i.e. it should be designed as well.

5. The case study

The project object of study was undertaken within an international company, market leader into the food packaging machines markets, willing to enrich its offering by integrating services in order to affirm its position as solution provider. The servicization was meant to be started by adding a software module in the machines they develop able to collect and integrate data from various sources. Those data were all about the quality of the machines' outcome. The collected data were meant to be used to deliver a quality control service in terms of KPIs, advanced analysis, benchmarking and quality enhancement. These functionalities resulted to be human dependant, thus soft-system of the whole.

Since the company compete to keep its position as market leader, it is mature and it heavily invests in product development. Considering the importance of such activities for the service-physical product integration as well, the firm's development paradigm was applied to this kind of project too. The design approach is based on the System Engineering principles and the V-model (Buede, 2009). Thus, the Stakeholder Requirements were collected and analysed first as main project inputs. Afterwards, the whole bundle of high level requirements was translated into System Requirements, reformulating the stakeholders' needs in a technical language suitable for the design activities. In parallel a Reference System was individuated among the company products. The matching with the System Requirements allowed the individuation of the already uncovered features (in this case, most of them were so). Thus, starting from the Reference System's architecture and the System Requirements, the whole Product Service System Architecture was defined (Buede, 2009). Though the object of the development is fundamentally different from a classical physical or software product, the activities did not differ in the approach and outcomes. Then, considering the functional architecture and the System Requirements, the Sub-Systems were individuated and the System Requirements were cascaded into Sub-System Requirements accordingly. It is possible to note that, at this point, the Systems Engineering methodologies and the functional product development have a lot in common (Morelli, 2006, Buede, 2009, Isaksson et al., 2009, Sas and Lindstrom, 2014).

The first and most important difference with a classical product stepped out already at sub-system level. In particular, they were all due to the human presence: when individuating the Sub-System by considering the wanted features, most of them resulted top be "human sub-systems", or soft sub-systems (Muller and Sakao, 2010), indeed. A human sub-system, like the classical sub-system, provides a specific capability to the whole system but they consists of people with their competences, demeanours and behaviours, defined processes to deliver that capability and tools to support the process accomplishment.

As already mentioned, from a functional point of view there is no difference between a soft sub-system and a classical one, i.e. hard system (Isaksson et al., 2009, Sas and Lindstrom, 2014). Nonetheless, while there is plenty of approaches and methodologies supporting the design of hard systems (or sub-systems) (Maussang et al., 2009), it seems there is a lack of guidance when it comes to the soft system (or sub-system) design. The following paragraphs describe the proposed human sub-system design methodology showing its application to the above described case study.

6. How to design human sub-systems

Humans have been walking the planet for thousands of years. Thus they are a pretty mature sub-system for a product. When it comes to them, they cannot be designed, but there is still a lot to deal with: behaviours, feelings, interactions, competences, demeanours and so on compose the design space though. Within that space it is possible to act in order to organize the desired sub-system capability. In this paragraph the steps leading to the human sub-systems design achievement are illustrated.

6.1. Architecture design activities

As already mentioned previously, a capability is composed by people, processes and tools, geared together to perform some specific tasks with certain performance. In a sort of sense, both a system and its sub-systems have to provide one or more functionalities with certain performances. Thus the idea of a sub-system which is a capability is not that far from the usual thought. The design steps for human sub-systems, considering the system engineering principles, were spread at system and sub-system level. The used approach consisted of:

- Sub-system roles and responsibilities definition, started already at system level while identifying the different sub-systems, it aimed at specifying and detailing what every sub-system consists of and for what purposes (roles, responsibilities and competences);
- Behavioural schema design, performed entirely at sub-systems level, defined how each sub-system's responsibilities interact each other in terms of activities undertaken to deliver the service functions;
- Tool definition and design, performed at sub-system level, aimed at defining and, if required, at designing the tools to be used for the service functions delivery.

These three main steps, which are going to be better detailed below, were reiterated several times in order to reach an acceptable level of knowledge and agreement on the matter.

6.1.1. Roles and responsibilities: who has to perform what

The first undertaken step was to better define the sub-systems identified already at System level. Considering the functions each of them was involved with and the functional interactions (input from the System Architecture), the picture of who has to perform what was refined. In particular, many sub-systems resulted to match with a role that was meant to be covered by a single person or an organization within the company. The matching was performed in a matrix having the required functions and the sub-systems as dimensions, already at system level. The resulting matrix is shown in Figure 4. The blue coloured cells identified the functions that were meant to be enabled by the hard sub-system (i.e. the software), while the orange ones identified the functions that were meant to be enabled by human sub-systems. It also resulted that to satisfy many functions it would have been necessary to involve more than one sub-system. It pointed out that there would have been the need of internal interfaces between soft sub-systems.

		SUB-SYSTEMS				
		Software	Vendor	Software expert	Analyst	Support
FUNCTIONS	Data Collection	×				
	Data Storage	×				
	Installation & Training		×	×		
	Customization		×	×		×
	Data Analysis		×		×	
	KPIs Provision	×			×	
	Suggestions				×	
	Internal Support					×
	External Support		×	×	×	
	Service Termination		×	×		

Figure 4: System Functions v.s Sub-System matrix

For confidentiality purposes the data are shown in a simplified and different way than the original one. Then, the information was better refined and cleared by considering the competence availability and competence gaps within sub-systems. Internally available trainings were identified in order to fulfil those gaps. The so created competence map resulted to be very useful to determine the sub-systems involvement into the service delivery activities through all the service product life cycle. Thus all the phases from the service sale to the end of contract were considered. Several repetition of this step led to further refinements of the roles and responsibilities of each of them (Figure 5). In this way the "human ingredient" of the capability was covered.

SS type	SS name	Brief descriprtion
Hard System	Software	Module software in charge of collecting quality data
Soft System	Vendor	Capabilty interfacing with customers to develop the most suitable solution. It also works as main interface with the company.
	Software expert	Capability in charge of managing the module software, its installation, customization and delivering training to users
	Analyst	Capaibilty in charge of performing adcandced analysis on data and in providing suggestions on how to enhance the product
	Support function	Capability in charge of supporting all the other ones in their tasks

Figure 5: simplified Sub-Systems roles and responsibility table

Again the displayed information is shown in a simplified way for confidentiality issues. For instance, the service Life-Cycle phases are not displayed into Figure 5. The results of this first step affected the whole product architecture and performances. Moreover it also impacted on the company internal structure in terms of involved units, people and roles within them and iterations between organizational units. As already mentioned, the service products have the characteristic of the heavy human importance in terms of service delivery (Abbot, 2010). That means that the human factor within the service has a crucial importance on the product itself. Moreover it signals that the shift from product to service provider is more than just an enrichment of the product portfolio, but an overall organizational and cultural change (Sakao, 2011).

6.1.2. Behavioural design: what has to happen when

Once defined the roles and, afterwards the responsibilities, behavioural schemas were drawn for every functions. Sub-Systems' roles and responsibilities were the main inputs for this step accomplishment, sided by the sub-system functions matrix. Hence all the information regarding "who is involved with what" were used. Each schema represented, for each function, the activity sequence to be undertaken to deliver it to the customer and/or user. Moreover they clearly depicted which sub-system was responsible for which activity and in which moment of the function delivery. Meaning that the interactions between sub-systems, and with the external environment were explicated as well (i.e. internal and external interfaces). Behavioural descriptions were provided as well in order to enhance the schemas' readability.

Figure 6: example of diagram schema: "Customization" functionality

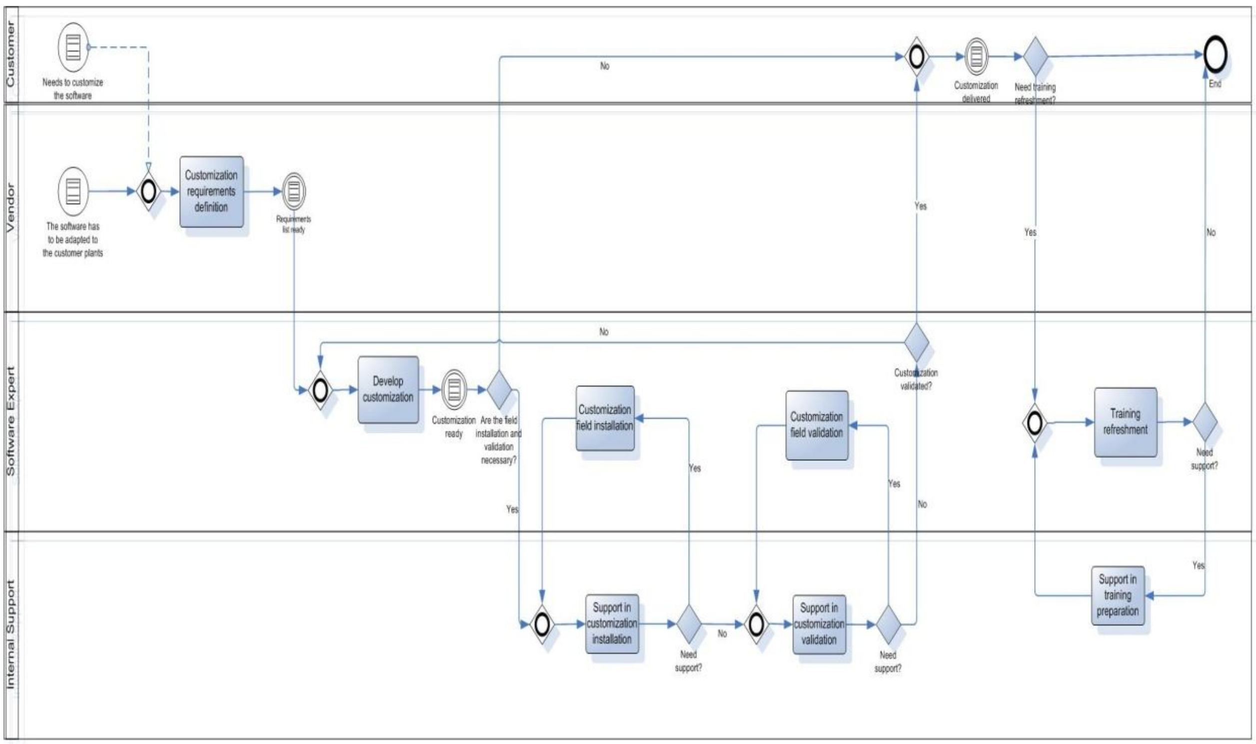

Figure 6 provides an example of behavioural schema by showing, in a simplified manner, how the Customization function was meant to be delivered to customer. This function encompassed the software customization on customer request and to adapt it to the customers' installed base. The Vendor, as interface with Customers, was meant to capture the customization needs. Software Experts and Internal Support (if needed) were meant to adapt the software, validate it and to deliver the proper training to customer personnel.

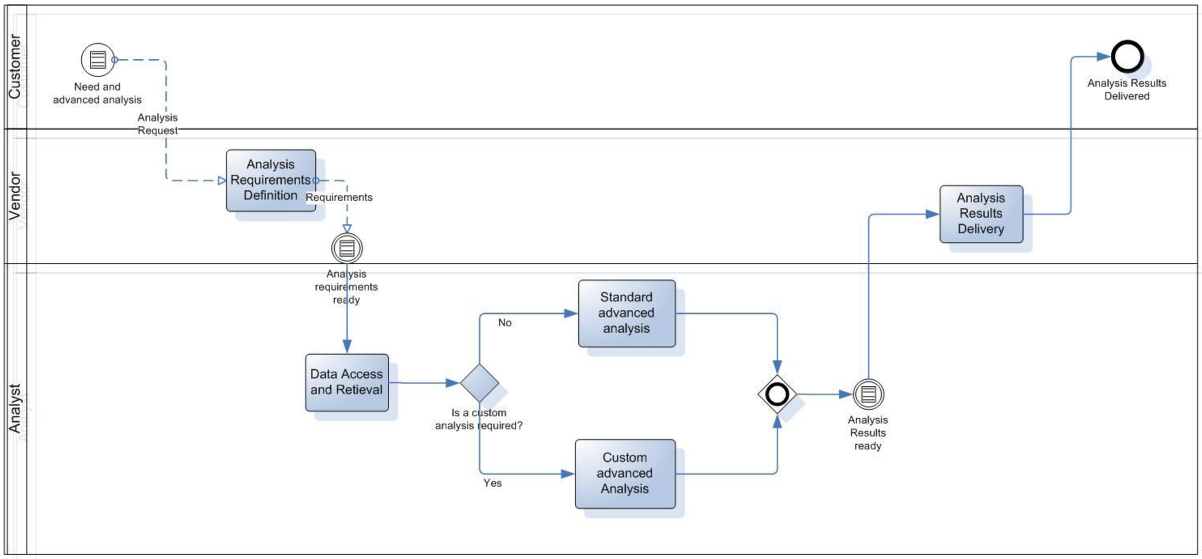

Figure 7: example of diagram schema: "Analysis" functionality

Figure 7 displays another simplified example of a behavioural schema. It is about the Analysis functionality. On Customer request, the Vendor provides to Analyst information about the type of analysis required. The Analyst, then, access and retrieves data from the Customer's systems. Then he performs the advanced analysis (being it standard or advanced) and returns the results to the Vendor. Finally the Vendor gives the results to the Customer.

The value of these schemas was double because they represented, on one side, the processes of the service product features delivery, and, on the other side, the roles and responsibilities defined in the previous step were translated into a set of activities and tasks.

Thus, with this step, the "process ingredient" for the capability creation was covered. As for the first step, this one was repeated several times, with the inputs coming from the previous one. This allowed the knowledge building about the sub-system behaviour, a better definition of each process activities according to the defined roles and responsibilities and it also pushed towards more precise roles and responsibilities descriptions. Moreover, it also allowed a better definition of the interfaces between sub-systems, clearly showing what they have to exchange each other in order to delivery to the customers/users the service's features.

6.1.3. Tools definition/design: how it has to happen

Once defined the activities every human sub-system has to accomplish, the tools they have to use for that purpose were defined. That was to allow the proper interactions between sub-systems and with the external environment, in accordance with the defined interfaces. Example of tools may be the data exchange and collection infrastructure, the calculation tools and so on.

The required tool list was defined considering their purpose (the activities to be performed) and, of course, the human part. This led to the tools requirements definition to drive their choice or design. Depending on their criticality for the whole service product system, on their internal and external availability and on the required competences for their design, some resulted to be easily provided by suppliers, while others required their own development process. Among the first ones, for example, there was the main data storage management system.

Examples of developed tool were the benchmarking one, the calculation methodologies for Analysts and the communication tools instead.

In the case of the human sub-systems design, the tools should be considered as enablers for the sub-systems' activities. Moreover, it is important to notice that, at the highest detail level, no "design of the human part" occurred. Only the tools for their activities were object of detailed design activities in the classical meaning of the term. To express it with an example, it is like the woods cutting capability is required and, rather than "designing" the lumberjack, the chainsaw is designed instead.

The definition of the tools requirements allowed further discussions and iterations about the behavioural schemas and the specific sub-systems roles.

6.2. Verification activities

Another peculiarity of the human sub-system design process comes with their verification activities. The design activities provided a list of sub-systems with their responsibilities, a series of processes and a set of tools they have to use to fulfil the functionalities they are involved with. The highest detail level activity was reached with the tool design. Thus they required verifications activities as well. Those tools did not differ from other classical products. Hence verification activities were carried on as usual through testing on their functionalities and performances. The matter of the human verification still remained anyhow.

Object of the design were mainly the interfaces and interaction they should have each other and their role coverage. It is clear that it was not possible to verify them in the usual way as separated systems. The result was that they were verified after their integration as a system, while piloting the service product on equipment. That is because it was necessary to check if the chosen competences were proper, to fulfil eventual gaps, to verify the suitability of the internal interfaces and the use of the tools.

7. Comparison with classical design activities

The general development approach remains unchanged from the system level to all the following ones: requirements have to be studied, defined and challenged per every sub-system and, according to them, sub-system architectures have to be designed. Anyhow, when people are active part of the (sub) system, they have to be considered as a full capability consisting of competences, processes and tools. Thus, they require those three elements to properly deliver their function. It means that the design should point at defining the required competence profile to cover the specific roles, the processes (i.e. the activities, the interactions and interfaces) they are involved with in order to allow their capability and the tools and infrastructures they should rely on.

Anyhow the detail level is not high as it may be reachable when digging from sub-system to module to component to single part design. Nonetheless there might be room for the design of the above mentioned tools if not already available. This activity may be considered even as a product development indeed, with requirements coming from the sub-system and its specific solution architecture.

Accordingly to these facts, while it is possible to run verification activities on the developed tools, the approach should be different for human sub-systems. The way chosen by the PSS project was to verify all the sub-systems together while running the whole service-product in a pilot. That was due also to the defined behavioural architectures: in many cases the function delivery involved more than one human sub-system, thus their interactions were fundamental for the verification. Without those interactions, it would have been impossible to verify the features.

8. Conclusions

In a market environment with an ever growing competition, the shift from a product value based business model towards a product-service integrated value based represents a juicy business opportunity (Lindhal et al., 2009). Considering the substantial differences occurring between the classical products and service products, the servicization of the offering is not trivial. The service business implies several organizational changes, from the culture to the way of doing things (Oliva and Kallenberg, 2003, Ulaga et al., 2011). For instance, given the importance of the human component (i.e. the soft system (Muller and Sakao, 2010)) for the successful service delivery, already existing new product development processes (as well as all the other internal processes) have to be adapted in order to cope with that factor (Oliva and Kallenberg, 2003).

This is what the paper addresses, i.e. an approach guiding the design activities for soft sub-systems within a structured framework such as the Systems Engineering principles applied in a manufacturing company. The proposed methodology was tested in a case study, a product-service system product development project aiming at enriching and integrating the company portfolio with a quality control and enhancement service.

The in place product development approach resulted to be fully applicable to the product-service case, with some small tuning though. They were necessary to consider the human factor within sub-systems. The adaptation implies that sub-systems have to be considered as capabilities providing some features and composed by people with their competences, processes to guide the people activities and interrelations, and tools and infrastructure to support them.

Moreover the maximum detail level for the design activities was reached during the tools and infrastructure design ones. Due to the human factor, other than defining roles, responsibilities and detailing what they have to do it, the detail level of the design activities is low. To conclude, it is necessary to test the methodology in other projects and in different environment, in order to validate, refine and make it as more general as possible.

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