

# PSS design based on project management concepts

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## Abstract

Customer loyalty can be obtained under the condition that isolated offerings proposed by manufacturers are replaced by integrated value adding solution composed of a product and one or more product-service. The design of such solution requires to take account of four narrowly overlapping dimensions: the product, the product-service, the process and the organization. Objective of this paper is to present a method to support PSS design taking all the dimensions and managerial changes into account; analyzing how they are linked and how they allow to design coherent value adding solution using the most appropriate methodologies and tools whatever their belonging scientific discipline. To reach this objective, we propose to analyze PSS development using a project management centric view as it encompasses the firm's environment, core competence, process, organization, benefits, risks and value concepts. A special focus will be devoted to the definition and characterization of these two latest concepts.

## Keywords

PSS design, service value, service engineering

## 1 INTRODUCTION

Service activities have become since few years a current way to differentiate from competitors and make customers loyal. Manufacturers propose services around the main product they deliver and customer loyalty can be obtained under the condition that isolated offerings are replaced by integrated value adding solutions composed of products and services [1]. Consequently they must be thought and designed together before being sold in a global offer.

Even if currently the way of doing of industrialists is far from a co-design product- service system concept [2], a survey performed during the summer 2008 [3] has shown that most of the services proposed by big manufacturing companies are dedicated to the core product and that they are developed accordingly. For the most part, they are completely integrated in the product offer (for 75% of them) and performed by the manufacturing company (for 95%). Underlying objective of profitability can be reached under the condition that firms manage all the changes that are necessary to deliver a service, as well as the transition allowing to reach the stable condition of product-service high value solution provider.

Changes to control can be split in: (i) Strategic changes due to the necessity to define common organization, management and control principles, (ii) Marketing changes as the analysis and understanding of the customers requirement to provide the good service (high value) is crucial, (iii) Commercial changes to determine the differentiation potential regarding competitors to valorize the offer and make it worth in the eyes of the customer, (iv) Economical changes as the product functionalities centric discourse had to be changed in an integrated value centric one to convince the customer and (v) Cultural modifications of firm employee's skills and focus that must be less technical and back office and more commercial and front office. The design and delivery of the global offer requires to take account of four narrowly overlapping dimensions related to: (i) the product (object that corresponds to the firm core competence, initial object of the selling), (ii) the product-service (service supplied in addition to the product and increasing its value for the customers), (iii) the processes (used to create the

product and/or the product-service) and the organization (the context in which the process unfold is launched). Figure 1 represents the AS-IS and TO-BE situations and the dimensions to manage for each one while mastering the abovementioned changes (Figure 1).

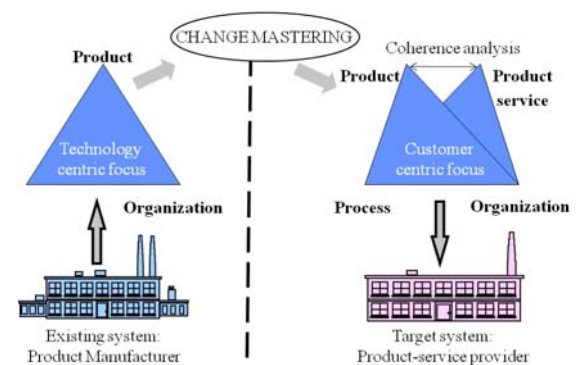


Figure 1: From manufacturing business to product-service solution providers business.

Service research which led to the development of a service theory in the 1970's is wide and integrates different communities who have already responds to some problematic manufacturers are facing today [4], [5], [6], [7] but as Wild et al. mentioned it "each discipline involved in service research appears to have their own dogma and mythology, and all too often end up with minimal interaction with relevant areas" [8]. The service science whose objective is to understand the nature and behaviour of service system, to get deeper level of knowledge integration, optimisation and sustainability by a cross disciplinary approach could be useful to combine the points of views, analysis methodologies and tools to properly cover all the aspects of the complex service to deliver and complex system to set up (from the design to the delivery) and to help characterize the stable abovementioned condition.

The challenge is then to propose a method to support firm core competence widening taking all the dimensions and changes into account, analyzing how they are linked and

how they allow to design the coherent value adding solution using the most appropriate methodologies and tools whatever the discipline is concerned. To reach this objective, we propose to analyze new product-service development using a project management centric view as it naturally encompasses the management of costs, delays and customers' satisfaction prerequisite for loyalty. Moreover, a project management centric view allows to look after the firm's core competence and knowledge, the process, the risks and the whole organization of the new development.

## 2 PRODUCT-SERVICE DESIGN AS A PROJECT OF NEW DEVELOPMENT

Based on the previous hypothesis, we assume that the project of product-service development can be split as any project in four main steps: (i) a starting sequence, (ii) a definition sequence, (iii) a realisation sequence and, (iv) a closing sequence (Figure 2.) [9].

During each sequence, operational and support activities are performed. Operational activities correspond to the purpose of the sequence.

- The first common step consists in a starting sequence and allows to analyze customer expectations and to explore the positioning of the firm. This rests on a strategic diagnosis and on a marketing analysis. The strategic diagnosis based on the study of environmental factors and on the study of the firm potential and ability to mobilize it allows to determine the strengths, weaknesses, opportunities and threat of the new development. The marketing analysis allows to identify the customers' expectations and value sources using the 4P's of mix marketing. Consequently, at the end at this step, deciders or managers will have an idea about the strategic domains on which they can act. This step is discussed in section 3.
- The second step is a definition sequence that allows to precise the specifications of the product-service to deliver and its value distribution among the functions it might satisfy for both the customer and the manufacturer. Based on a functional analysis and a

value engineering approach, value results can be gathered in a matrix that can be used as a strategic tool to analyze the relevance of a product-service offer integrating the costs of design and delivery as well as the mercantile strategy. This step, developed in section 4, will lead to a strategic choice.

- The third step called realization sequence corresponds to the strategic deployment whose objective is to define: (i) the processes from the design of the product-service chosen in section two to its delivery and, (ii) the organization to support the process according to the core product development. The definition and modelling of the processes and of the organization is out of the scope of that contribution.
- The fourth and final step is the closing sequence. It corresponds to the real service system delivery to the customer and capitalization of project experience. This aspect is also out of the scope of this paper.

Support activities concerning delay, organization, cost, risk, communication and knowledge management specific to any project and mandatory to ensure the new development success must be managed during each phase. Main aspects of their concern are skimmed over in Figure 2

It is to note that as the project must come within the scope of the firm and be coherent with the core product development, existing process and organization, these three dimensions have to be watched not only in step 3 but also in the others. This implies that all the data related to these three dimensions have to be compiled with data coming from the operational and support activities as sort of control.

## 3 STARTING SEQUENCE

The starting sequence objective is to give an idea to manufacturers of the strategic domains on which they can act. To reach this objective, it is necessary to lead two parallel studies. The customers' needs identification by the way of a marketing analysis will determine the customers' demands in term of new development while the second study will analyse the strength weaknesses, opportunities and threats of the firm to respond to some

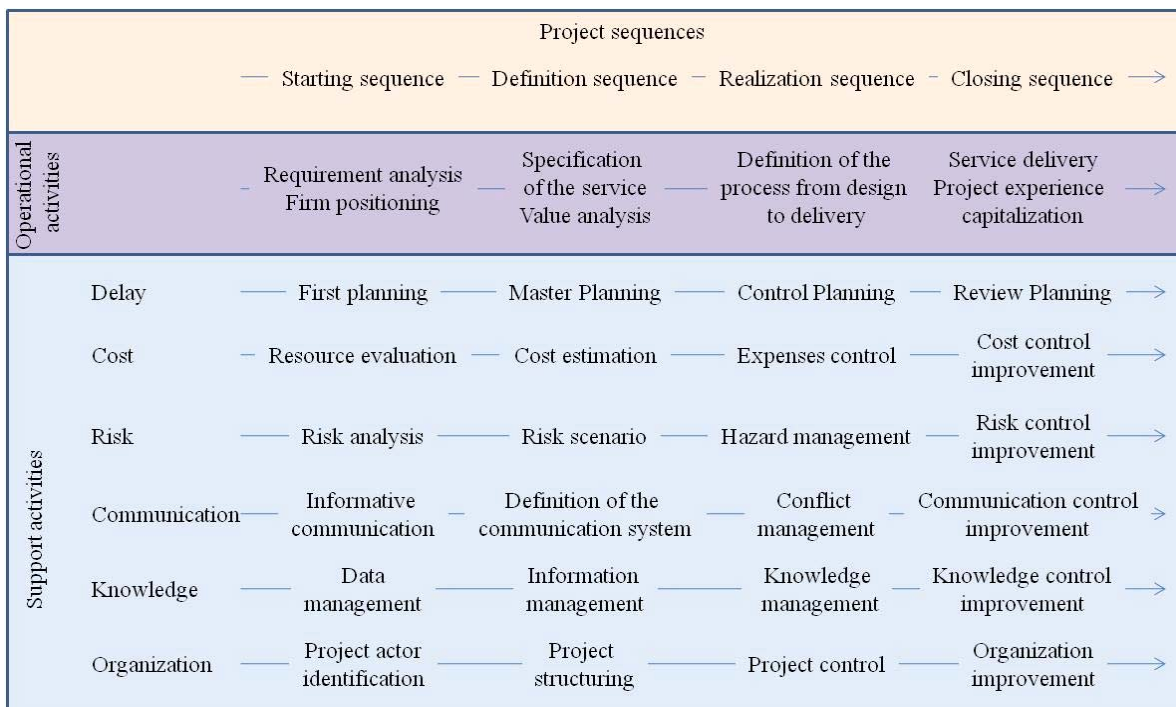


Figure 2: Sequences and activities of a project of new product-service development

needs regarding its internal capacities and its external environment.

### 3.1 The marketing analysis based on the SIVA approach

In a product-service new development, the manufacturing company pursues a special "product" innovation and then tries to develop a market for the product-service. The marketing research is conducted primarily to ensure that profitable market segment(s) exist for the innovation. A successful innovation requires a well understanding of the customers' requirements that can be obtained by a customer-focused marketing. The SIVA (solution, information, value, access) approach ([10]) provides a demand/customer centric version alternative to the well-known 4Ps supply side model (product, price, place, promotion) of marketing management.

Consequently, the characterization of the product-service in term of SIVA items will lead companies to focus their activities and products on consumer demands and then define strategic activity domain on which they can act. Factors to ensure product-service viability and company profitability concern:

- the definition of the product-service system as a solution for a specific need,
- the identification of the value it represents for the customer,
- the conditions of accessibility,
- the information related to the solution.

### 3.2 The strategic diagnosis

The strategic diagnosis makes it possible to position a company and its competitors on a given market. The diagnosis is carried out in two directions: the environment in terms of sector attractiveness (opportunities, threats), and the company in intrinsic terms of potentialities (strengths and weaknesses). Consequently, it rests on the analysis of the macro and micro environment of the company and on the analysis of its human, financial, material and technological capacities and skills to mobilize them to reach the customer demand.

The Strengths, Weaknesses, Opportunities and Threats can be gathered in a SWOT matrix. Initially, the SWOT analysis gathers key pieces of information in two main categories: internal factors and external factors. It is a tool for auditing an organization and its environment and can help managers to determine if their objective -in term of new development for example- is attainable or not by the identification of these key factors useful to achieve them.

#### *List of internal factors: strengths and weaknesses*

The definition of a relevant strategy for a company consists in measuring its present and future capacities which will thereafter be implemented within the framework of the adopted strategic plan. It is necessary to take account of a double aspect: an analysis of the entrepreneurial resources on the one hand, and on the other hand, an analysis of the ability of the company to

mobilize these resources (resources can indeed be identified without any possibility for the company to mobilize them. An audit performed by the company will give a progress report on its current and potential resources making it possible to support the adopted strategic process. One distinguishes in term of resources the following elements:

- The human resources (human capital) that must be analysed from a qualitative and quantitative point of view. From a quantitative point of view, one can obviously measure the number of employees present in the company taking account of the halftime employees, of the number of employees really present each day... From a qualitative point of view, it is essential in a strategic approach to insist on the employees' competences and know-how so as to identify the competing main strengths of the company. The human capital enhancement goes through the set up of training plan to increase the potential of the employees present. Others factors can concern the motivation, involvement, project team, project manager, top management commitment, contact personnel training, contact personnel quality, sales team, etc.
- The financial resources as a strategic process often requires financial resources whose availability depends on several factors. The company internal proper resources represented by the capacity of self-financing measure the financial flows generated by the company present or anticipated activity which could be reinvested by itself during its activity. The company external proper resources provided either by shareholders or by financial establishments for which the company can measure its ability to gather them. Then factors can deal with results, benefits, possibilities of investment and investors
- The technological resources that can be defined as a set of knowledge and techniques used to design and manufacture a product. The knowledge of the technological inheritance of the company is essential as it is a key element of its present and future competitiveness and as it often conditions the use of other available resources. Then factors coming from design (technological innovation potential, R&D opportunities) and production (Capacity/load ratio; Delay; Partners relationship; Resource competencies, stock level Production, service definition, process definition identified procedures) are relevant to analyze product-service development.
- The material resources that correspond to the set of capital assets held by the company and registered in its active assessment. Most of the time, a strategic process results in an increase of the needs in fixed assets (ground, materials, machines...). The company must thus give a progress report on its production capacities and on their real rate of use.

Factor	Factor classification	Relevance profitability	Strategic impact
	Significant benefit=5 Benefit=3 Minor benefit=1 Neutral=0 Minor risk=-1 Risk=-3 Significant risk= -5	S/W highly relevance=5 S/W medium relevance=3 S/W low relevance=1 Neutral=0 O/T high probability=-5 O/T medium probability=-3 O/ T low probability=-1	High = 5 Medium = 3 Low = 1 Undetermined = 0
Product to integrate	Neutral	S/W highly relevance	High impact
Project team	Minor benefit	S/W medium relevance	Medium impact
Manufacturing resources	Benefit	S/W low relevance	Low impact
Technological potentiality	Significant benefit	S/W medium relevance	High impact
Operations/ process	Benefit	S/W highly relevance	Medium impact
Partners relationship	Minor benefit	O/ T low probability	Low impact
Brand image	Significant benefit	O/T high probability	High impact
Cost base	Risk	O/T medium probability	Medium impact
Cash flow	Minor risk	O/ T low probability	Low impact
Sales team	Significant risk	O/T high probability	High impact
Distribution	Risk	O/T medium probability	Medium impact
Political environment	Minor risk	O/T low probability	Low impact
Economic outlook	Significant risk	S/W highly relevance	High impact
Cultural changes	Neutral	O/T medium probability	Low impact
Technical context	Benefit	O/T high probability	High impact
Customers position	Benefit	O/T high probability	High impact
Suppliers position	Neutral	O/T high probability	High impact
Competitors position	Neutral	O/T high probability	High impact
Substitute	Neutral	O/T high probability	High impact

Table1: Risks and benefits of a new product/product service development

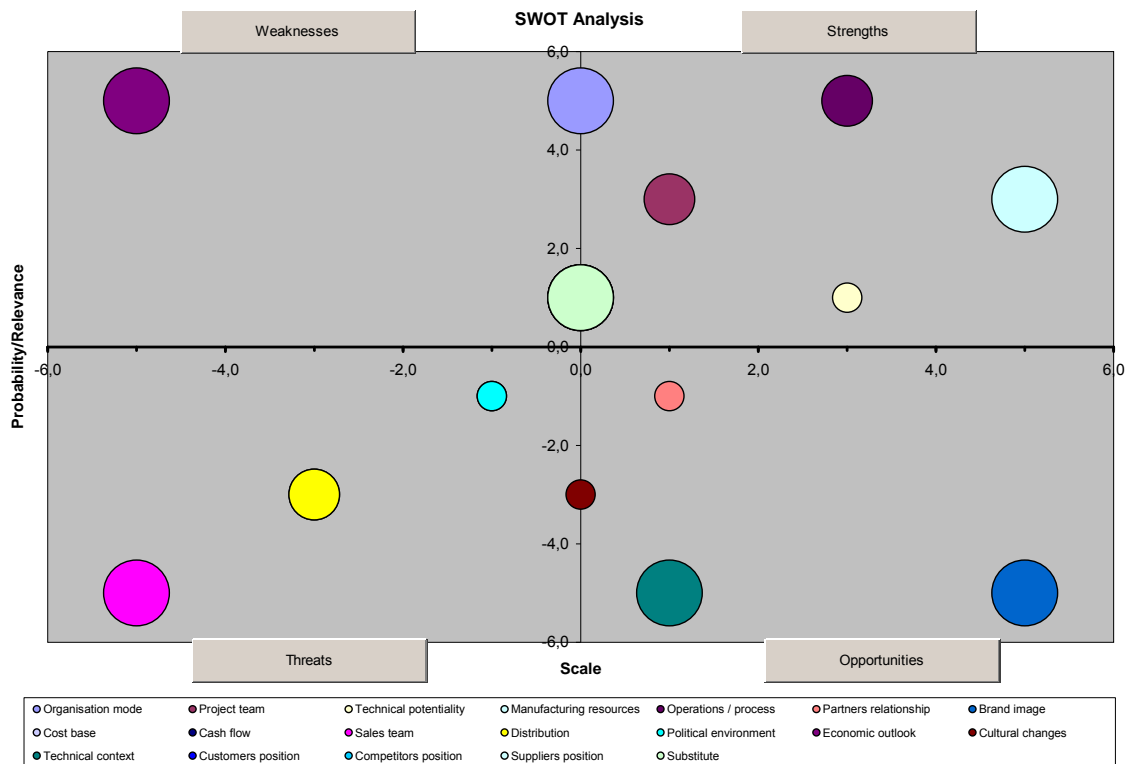


Figure 3: Example of a chart

The analysis of the inheritance of the company (human, financial, material or technological) is essential to any relevant strategic process. It remains that this analysis is not enough sufficient if it is not accompanied by a deep study of the ability of the company to mobilize those resources regarding a strategic project. From this point of view, an analysis of the organisation of the company is essential to evaluate its ability to change regarding a new

strategy. Then internal factors may stem from firm culture and organization: enterprise identity, brand image, organization structure mode; industry specialization; project experience, membership, sales office, etc. The justification of each factor and sub factor is given in [11].

*List of external factors: opportunities and threats*

External factors stem from the study of the micro-, macro- and meso-environment of the firm. The Macro-

environment picture can be obtained by the way of a PESTEL analysis where each letter stands for Political, Economic, Social, Technological, Ecological and Legal. The PEST factors can be used to assess the market for a business or organisational unit strategic plan.

The micro-environment picture can be obtained by analysing the firm' strength on its sector of activity regarding the relationship with its customers, with its suppliers, the threat of new competitors and the substitute products [12]. The company has then to weigh the terms and conditions of trade within its market and select its customers and its suppliers on strategic criteria otherwise it can increase its vulnerability.

The Meso-environment focuses on person that could influence the economical relations in a market. The list of external factors and sub factors of interest is detailed in [10].

### 3.3 Definite list of factors

The factors abovementioned can be gathered by aggregation and according to their relevance in the following set: Project team, Manufacturing resources, Technological potentiality, Operations/ process, Partners relationship, Brand image, Cost base, Cash flow, Sales team, Distribution, Political environment, Economic outlook, Cultural changes, Technical context, Customers position, Suppliers position, Competitors position, Substitute, Product to integrate.

Note that we do not mention if an internal factor is a strength or a weakness as there is a continuum between both; id. for the threats and opportunities. The project team leader will first have to determine the consequences of a factor: whether it is a benefit (strength or opportunity) or a risk (weakness or threat).

Subsequently, the relevance of each internal factor as well as the probability of occurring of each external factor will be defined. Finally the impact of each factor on the organisation could be discussed and results plotted in a chart (see © Copyright MarketWare International 2001-2004). An example is given in Figure 3.

- The X-axis measures the scale or magnitude of each SWOT factor,
- The Y-axis is used to plot the relevance of strengths or weaknesses and the probability of threats or opportunities,
- The Z-axis is used to plot the strategic impact of the factor.

Factors scale, relevance and impact are valued according to predetermined quotations (see table 1).

- This chart can be interpreted via the following keys:
- Items plotted close to the (0,0) are the least significant, either because they are not rated as important or the relevance or probability is very low.
- Those that are at the extremes of the chart are rated as most important and are rated as highly relevant or a high probability of occurring.
- The size of the bubble indicates the strategic impact of the SWOT factor.

A visual representation of the risks and benefits of a new product-service development could be obtained and compared to other ones. The position of the firm will result from the comparison that takes parameters relative to the product, organisation and processes into account by the way of the factors.

## 4 DEFINITION SEQUENCE

The definition sequence consists, once the development direction is chosen, in defining the solution that will be

profitable for both new manufacturer and customers; to determine its position in the portfolio of the firm and its legitimacy to be proposed and enhance firm competitiveness and profitability.

This second stage rests on the use of the value analysis methodology and compares the value of the offer for the manufacturer taking account of its expected benefits and the value of the same offer for the customers defined by the way of expected quality criteria. All these developments are based on the assumption that the value can be defined by the ratio between the performance of some functions and their cost [13].

Currently two functions are defined:

- "basic function" which correspond to anything that makes the product work or sell and,
- "secondary functions" or "supporting functions" that describe the manner in which the basic function(s) are implemented

### 4.1 Product-service value analysis: from the manufacturer point of view

We assume that the functions which participate to the definition of the value for the provider focus on the expected benefits of a product-service proposal. Based on [14] and a literature review in the management area, benefits usually mentioned concern:

- the construction of a customer loyalty by the building of dependency relationships between a consumer and a provider that can lead toward profitability,
- the search for differentiation that allows retaining and attracting consumers,
- the increase and stabilizing of firms' turnover due to the possibility to generate regular income and to have cash flow disposal,
- the corporate image reinforcement linked to technological advanced, product quality...
- the occupation of an existing or new market to participate to market share division,
- the possibility to create alliance with service providers and to share risks,
- the possibility to increase the quickness of a design or production process using product-service based on information and communication technologies,
- the possibility to shorten sales delay or negotiation phase using financial services and,
- the search for a product-service system that is designed to have a lower environmental impact than traditional business models [15].

Each benefit can be defined as expected performances that stem from a strategy and have priorities one to the other. Quantifiable criteria can be associated to each one whose level also stem from the strategy. The level really measured, that reflect the performance of the function, compared to the global cost of the service allows to determine the value of the service for the firm.

Costs to take into account can be divided in direct and indirect costs. Regarding product-service characteristics, several costs can be addressed that depends:

- on its degree of tangibility,
- on the degree of interaction that is necessary between the firm contact personnel and the customer to deliver it and,
- on the degree of standardization of the product-service delivery process. They can encompass component costs, cost of labour, and overheads.

The description of the functions from the manufacturer point of view and the consciousness of the product-service costs allow to build a value analysis matrix (see Table 2).

#### 4.2 Product-service value analysis: from the customer point of view

According to [16], customers challenge the overall value of an offer to its complete cost. The overall value refers to the different advantages obtained, supported by the firm brand image. Advantages may gather both benefits expected on technical functionalities and subjective criteria as lots of studies have shown that customers are waiting for something from the exchange with the firm. [17] has proposed a list of criteria and dimensions allowing to evaluate the quality of a standard service. These criteria can be associated to implicit functions whose fulfilment can lead to customer loyalty and value increase.

Then, the list of functions of a product-service expected by customers consists in:

- the product-service *raison d'être*: help choosing, acquiring or using the main product,
- secondary functions linked to its interactions with the contact personnel, users and means necessary to realize it, the partners, environmental and legislative constraints and the realization constraints as mentioned previously and,
- the implicit functions coming from quality criteria discharged from the functions that refers to the delivery process: to obtain a tangible service.

The value determined by the firm from the customer point of view will be determined by putting in opposite the previous list of function and the distribution of the above mentioned costs via another value analysis matrix (see Table 3).

#### 4.3 Synthesis

Using aggregation operator, it is possible to deduce the whole value of the product-service proposed by a manufacturing firm. This one can have two positions: high or low and can be analyzed regarding two dimensions: the customer dimension and the firm dimension Figure 3.

		Firm value	
		High	Low
Customer value	High	Profitable and interesting	No profit but interesting
	Low	Profitable but No interest	No profit, no interest

Figure 3: Value matrix

- The value is high for the customer and for the firm. The product service is profitable for the firm and satisfies customers. It might accompany the product. To make the customer loyal, the company may propose the service but found solution to increase its value by decreasing its price if it is worth in the eye of the consumer or adding others services located in the high/high value.
- Firm value is high and customer value is low. This position is synonymous of customer loyalty if the customer participates or if the cost of the offer is not too important. Otherwise, he won't be interested by this list of sales point. The abandon of the product-

service or not will depend on the cash that is necessary to provide it or on the delivering difficulties

- Firm value is low and customer value is high. To make the customer loyal, firm may propose the service but found solution to increase its value by decreasing its price if it is worth in the eye of the consumer or adding others services located in the high/high value.
- Both values are low. The abandon of the product-service or not will depend on the cash that is necessary to provide it or on the delivering difficulties.

The value analysis of each product-service coherent with the firm position from the two points of view will provide a synthetic view of the equilibrium of the global offer. To ensure firm global profitability, the portfolio of product-services has to be shared out between all categories (High/low).

## 5 CONCLUSION

We have proposed in this contribution the two first steps of a methodology in four steps to support manufacturing firm core competence widening by the furniture of product-service taking account of the changes that are necessary to become a "service provider" and the dimensions that seems to be mandatory for the success of such a strategy: i.e. the product, the organization, the processes and the product-service. The methodology we propose to use stem from a project management process and allow to manage both operational activities and support activities inherent to any project that relate to risks, delays, costs, knowledge, organization and communication.

The first step proposes to choose an orientation between several product-service by analyzing the potential of the company as well as its environment and the customer demand.

The second step allows to analyze the relevance of a product-service offering based on its value analysis.

The originality of the methodology is that it gathers tools, methods and practices of different research communities. Further works include the definition of tools to help characterize the two last steps as well as a refinement of the two first one and application on real study cases.

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	Total cost	%Cost	Function (FC)							
			Make	Search	Increase	Reinforce	Occupy	Share	Increase	Shorten
			Customer loyal	For differentiation	Firm turnover	Corporate image	New market	Risks	Process quickness	Delays
			FC1	FC2	FC3	FC4	FC5	FC6	FC7	FC8
Elements										
Consumables										
Physical support										
Direct cost labour										
Indirect cost labour										
Overheads										
			Cost of FC1	Cost of FC2	Cost of FC3	Cost of FC4	Cost of FC5	Cost of FC6	Cost of FC7	Cost of FC8
		% cost	FC1 percentage of importance	FC2 percentage of importance	FC3 percentage of importance	FC4 percentage of importance	FC5 percentage of importance	FC6 percentage of importance	FC7 percentage of importance	FC8 percentage of importance

Table 2: Value analysis matrix from the product-service provider point of view

	Total cost	%Cost	Function (FC)							
			Help	Make	Satisfy	Satisfy	Satisfy	Satisfy	Satisfy	Satisfy
			Choosing, acquiring or using the main product	Service tangible	function concerning interactions with contact personnel	function concerning interactions with users	function concerning interactions with means	function concerning interactions with partners	Environment or legislative constraints	Realisation constraints
			FC'1	FC'2	FC'3	FC'4	FC'5	FC'6	FC'7	FC'8
Elements										
Consumables										
Physical support										
Direct cost labour										
Indirect cost labour										
Overheads										
			Cost of FC'1	Cost of FC'2	Cost of FC'3	Cost of FC'4	Cost of FC'5	Cost of FC'6	Cost of FC'7	Cost of FC'8
		% cost	FC'1 percentage of importance	FC'2 percentage of importance	FC'3 percentage of importance	FC'4 percentage of importance	FC'5 percentage of importance	FC'6 percentage of importance	FC'7 percentage of importance	FC'8 percentage of importance

Table 3: Value analysis matrix from the customer point of view