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Service Delivery and Co-Creation to support Value and Sustainability in PSS design

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Abstract

Product-Service Systems are considered as facilitators for value creation to attain sustainability. This paper studies how service delivery and the co-creation process are two means of enhancing the design of valuable and sustainable solutions. The paper shows how service delivery and co-creation process are both in the core of the interaction between the provider and the customer and can be considered as levers to create “sustainable value”. The case of a firm proposing clothes rental and cleaning services is reviewed in this light.

Keywords:

Product-Service Systems (PSS); Sustainability; Value; Service delivery; Co-creation; Design

1 INTRODUCTION

The rarefaction of natural resources all over the world has become a major concern today. Maintaining these resources on a level sufficient to enable their regeneration and thus their availability for future generations is a key issue in developed countries. The concept of “sustainable development” emerged in the 80’s to promote economic development which reduces environmental impacts and provides social welfare. Industrial solutions need to be found to support this kind of development. Manufacturing in developed countries is confronted to global competition, which leads manufacturers to find new strategies for providing additional value to their customers. Therefore, more and more manufacturers are integrating services in their product offers. Indeed, in a service-oriented strategy, the utility provided by the product has more perceived value for customers than the product itself. This new focus is centred on final user’s needs instead of on products. It enhances innovation to find sustainable solutions fulfilling needs. In this approach, products as well as services are seen as an opportunity for integrated offerings called Product-Service Systems (PSS).

Two goals are defined behind the PSS concept: adding customer value and reducing environmental impacts. On one hand, value is seen as the result of interactions between the producer and the customer and not as being embedded in the product. On the other hand, the notion of environmental sustainability drives PSS seeking to replace solutions based on ownership by offers with a lower impact but providing similar benefits for the customer. However, a fully integrated offer covering these two goals is complex. Manufacturers have to put the emphasis on design. Design considerations

are the key to valuable and sustainable PSS. Figure 1 summarizes the approach followed in this paper to study service delivery and the co-creation process as key PSS design stages.

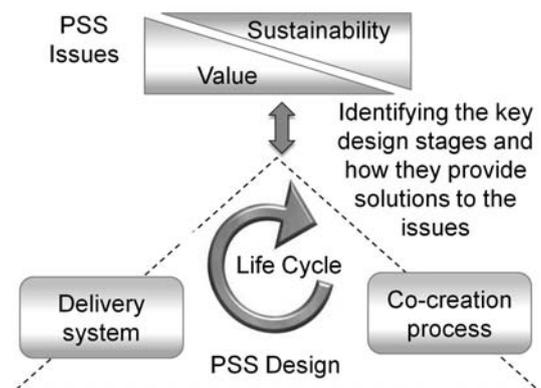


Figure 1: Linking PSS issues with design.

Following this introduction, this paper explores in Section 2 the PSS definitions and the notions of value and sustainability as key issues in the PSS literature. Then Section 3 put the emphasis on the importance of design and details how service delivery and co-creation can meet the PSS issues. Section 4 shows how service delivery and co-creation can support sustainable value creation. An existing case is presented and retrospectively analyzed in Section 5 to illustrate this idea. Finally the interpretation of the case is discussed in Section 6.

2 KEY PSS ISSUES

2.1 PSS Definition

Product Service Systems have several definitions in literature. While some authors see in these systems

a new business model transforming the economy, others consider that a functional approach is a lever to achieve more sustainable production and consumption patterns [1], [2], [3], [4], [5].

The term “servitization” was employed by Vandermerwe and Rada to express the fact that services take an important place in manufacturing firms to help them face competitive pressure. This service-based model implies changes in thinking about what is put on the market. Producers offer a value proposition, selling use of the product instead of the product itself and directly focus on customer needs [6]. In this context, PSS, proposing a mixture of products and services, are considered to be a special case of servitization [7]. Two research streams have studied new models for companies in developed countries: the business management literature and the sustainability-oriented literature [1]. The business literature defines PSS as a “value proposition” [2] or “integrated solutions” [3]. The sustainability-oriented literature mentions the necessity for a PSS to decrease the environmental impact in comparison with traditional solutions [4]. Vasantha et al. described the multiple elements involved in the PSS, where “innovative value addition” that is economical, environmental and social, encompasses the products, services and business models [5].

In this paper, we take that the role of PSS is to provide value. We define PSS as integrated offers seeking to provide value to the customer, the provider, the society and the environment. PSS design must care for overall impacts in space and time, with a global view of the external - positive or negative - changes caused by the system.

2.2 Value Creation

Value seems to be the concept which unites the different PSS definitions around a common goal. Indeed, in business-oriented literature, PSS are seen as more competitive by providing more value than ordinary products. The transition towards a service-oriented approach has made the value concept evolve, shifting from a perception of value embedded in a physical artefact to another, where value is perceived through the interactions between a combination of products and services and the customer.

In a goods-dominant logic, the concept of value is regarded as “value in exchange”. Value is considered mainly as monetary and is created by exchanging the product for money. The “value chain” described by Porter [8] represents successive additions of value to a product along the supply chain until the customer pays for it. However in the emergent Service-Dominant logic described by Vargo and Lusch [9], the value concept moves on and centres on usage. Value is thus driven by “value-in-use” instead of “value-in-exchange” [10]. What is put on the market by companies corresponds to a “value proposition” built in a supply network. Value exists only as “potential” until the user experiments this potential; and then value is created. In this theory of value considered as

“value-in-use”, the customer is always the value creator and creates value in his own sphere, before, during and after his “experience” and independently of the provider [11]. The provider can join the customer in the process of value creation and then value is co-created by both the customer and the provider. Therefore, the supplier’s role in value generation is to facilitate the customer’s process of value creation and to join it in a co-creation process [12]. Service-Dominant logic puts the emphasis on the fulfilment of the final user’s needs moving away from the focus on the means to the results. The “experience” or “satisfaction” provided by the integrated offering prevails over ownership. The responsibility of the provider moves to the satisfaction of the customer all along his use process because he is the value co-creator and pays for good use. The revenue of the provider is dependent on customer satisfaction, which becomes a major point to integrate in design considerations.

In other terms, PSS is an integrated product and service offering that delivers value in use [7]. Interaction between the customer and the service provider is considered as crucial for value creation through the customer’s experience. Service is the artefact of the PSS which allows this interaction to happen.

2.3 Sustainability

In 1987, the Brundtland Commission defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” [13]. To achieve sustainable production and consumption, societies have to drastically reduce their consumption of physical resources.

Early PSS authors understood that a deep transformation was taking place. Tomiyama described the Post Mass Production Paradigm, limited by environmental, social and market capabilities. It should reduce the volume of physical artefacts sold to balance natural and social constraints. In this theory, value is added through knowledge and service contents and would compensate the reduction of the sales volume. This “dematerialized value” is considered as crucial for reducing environmental impacts, decoupling economic growth from the consumption of energy and materials [14].

Similarly, Jackson identified the concept of a “new service economy”, where profitability is not based on material trade exchange but rather on the provision of services to meet essential human needs [15]. The dematerialization concept is seen as a way to decouple economic growth from environmental pressure. Indeed, in complex and advanced industrial societies, the consumption process is set in socio-technical systems (networks, infrastructures) and social welfare is less dependent on commodities consumption than on the interactions created in systems, where commodities are only a component amongst others

[16]. The production of physical products should constitute only a limited and decreasing part of the total process of generating value [17]. Meier argues that rental, sharing and pooling of capital goods could lead to important environmental gains and encourage the responsibility of the producer [18]. In the PSS approach, products are seen as a support for a global offer designed in a life cycle perspective. Therefore, the concept of sustainable Product-Service Systems emerged to create sustainable design in terms of environmental burden and resource use, whilst developing product concepts as parts of global sustainable systems that provide a service or function to meet essential needs [19].

Finally, PSS design should integrate business model design and ecodesign, which converge in a life cycle approach. This approach integrates service delivery and the co-creation process together to support value creation and sustainability.

3 DESIGN OF PSS

3.1 The life cycle perspective and design

Design to provide value in sustainable systems

Design is increasingly recognized as a relevant factor in business competition [20] and is necessary to establish the system's ability to meet the sustainable issue. Design is a very important stage of the PSS life cycle because this stage largely determines future costs engaged in the development project. Similarly, design impacts the future eco- and socio-efficiencies of the offer. Designers have to consider the offer and the necessary organization in a life cycle approach. Evaluation of the system as early as possible - for each stage of the design process - in terms of monetary benefits but also from environmental and social points of view is crucial [21]. "Without the contribution of design, the full potential of sustainable production and consumption, and thus sustainability, cannot be realised. Similarly, only in a sustainability perspective, can the full potential of design be released" [20].

Life cycle as a key to PSS design

PSS have to be designed in a full life-cycle perspective placing the customer in the centre of the integrated offer. Ecodesign must support this point. Adding services in product-oriented offers leads designers to reconsider products, services, supporting infrastructure and the supply network, in a holistic way. A new business model based on the life-cycle approach is needed with a comprehensive view of the real customer's demand and would provide a way to develop ecological potentials while satisfying economical constraints [22].

3.2 Service delivery

To add services in their offers, suppliers have to redesign an essential stage of the life cycle: service delivery. Service delivery is the core of the value proposition building and is also essential to achieve sustainability.

Service delivery and value creation

Service delivery is the final point of the process of building the "value proposition" or "value facilitation". Since value is determined by the beneficiary, understanding use and customer behaviour becomes a challenge in designing service delivery.

The way to deliver the service to the customer impacts the customer's perception and the value creation. Supply network coordination to provide a fully integrated offering is necessary. Suppliers are supposed to learn about customer value, create it and develop the delivery process [23]. Therefore, new skills have to be developed for innovative firms willing to provide value. In a knowledge-based economy, skills and knowledge management through organizations is seen as the key concept. Offering a mixture of products and services requires a new design of the entire structure of the organization and the associated supply chain. Using knowledge and mental competences are the heart of competitive advantage and performance [9] and providing integrated solutions requires the full cooperation between all the actors of the supply chain.

Designing service delivery means understanding and forecasting the way the service would be used and the value created. Value is considered as being created during activity and based on the performance and outcome of the activity [24]. Activity-based approaches take an important place in service-oriented design methodologies. They seek to help designers to have a global understanding about how value is experimented and how to provide more value. For instance, the service blueprint representation proposed by Shostack enables a global view of activities necessary for the service delivery process at multiple levels for the provider and begins with the design of customers' activities. All the operations performed by the customer and the producer appear in a global service delivery process [25]. Vandermerwe proposes "customer activity cycles" explaining how the customer's activities provide him benefits during three steps: pre (before achieving the result); during (while the benefit is provided); and post (after) [26]. Service Engineering defines a service as an activity, which is cut into sub-activities to be done to achieve customer satisfaction [27].

To design service delivery, a representation of the activities performed by the provider to fulfil the user's needs is necessary. To design the activities performed by the provider, it is necessary to first represent the activities performed by the user in a scenario providing him satisfaction. Service delivery is the outcome of the value proposition, so this step has to be considered within the value creation scenario.

Service delivery and sustainability

As we argued in the precedent section, the use phase and the service delivery process are both represented in design methods by their related activities. Activity-based approaches are crucial

because all the benefits, costs or environmental effects of a product can only be determined when they interact with a customer or stakeholder, in an activity [24]. That's why designing service delivery and so the associated activities are fundamental for providing sustainable solutions.

Since service delivery has to focus on use, impacts generated in this phase have to be taken into account and PSS design has to integrate an evaluation of these impacts as soon as possible. The use phase has often been identified as being responsible for the largest environmental impacts in a goods-dominant logic. In a PSS scenario, the shift of responsibility forces the provider to reduce them. Design of service delivery and usage plays a crucial role, because that is when capital goods can be managed intensively and be shared, rented or pooled, leading to significant environmental gains [18].

As mentioned above, PSS have to be designed in a life-cycle perspective, identifying service delivery. Installing and maintaining availability and reliability of the products through maintenance services, or training and advising users, requires a clear identification of the roles and responsibilities in the supply network as well as a clear view on the delivery process (infrastructures, proximity with users, etc.). All these elements push designers towards innovative solutions. Resources can be managed in a more sustainable manner. The sustainability of an integrated offering depends on all the supply network processes during the full life cycle. The products life cycles have to be considered in closed-loop perspectives and the responsibility of producers can encourage this [18]. Beyond the simple cyclic view of the product life time, research has studied ways to manage resources in a continuous process, maintaining them infinitely in a "resource" status and not simply as end-of-line waste. The "value addition" process in the supply chain must evolve. The value chain concept [8] where potential value is added linearly and consumed by the customer is over. Added-value, which can be defined as the value proposition put on the market, is now shifting from a linear model to a cyclic model. Keeping materials in a resource status leads firms to consider them as "re-usable". Hence, resources are maintained as potential sources of revenue. Barber et al. propose a "value cycle", corresponding to the supply network cycle, whereby the continuation of the provision of functionality to the customer becomes the dominant focus of a sustainable business model [28].

3.3 The co-creation process

The co-creation process is defined here as a value creation sequence involving different stakeholders, such as supplier networks, customers, etc. In service-dominant logic, "the elaboration of solutions results from a value co-creation process involving actors from both the supply network and the customer network" [29]. Each one of these actors takes part in adding value during the life cycle of the offer (see Figure 2).

Co-creation and value creation

A value proposition is built by a supply network. Value is potential and will become real value during the customer experience, which is only partially in the hands of the provider.

Grönroos represented these two processes in two different spheres: the provider sphere and the customer sphere. These spheres may meet in an interaction which provides "value co-creation" [11]. During this interaction, from the provider perspective, the customer participates as co-producer of resources and processes; while from a customer perspective, the provider participates as co-creator of value (value-in-use).

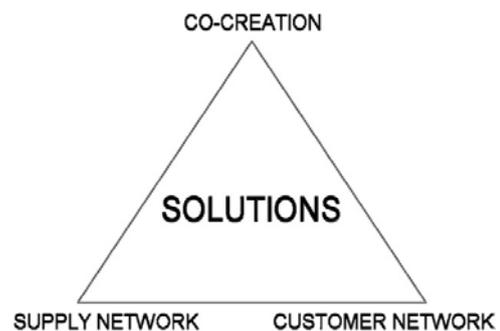


Figure 2: Three strategies of offerings in the service-dominant logic [29].

With this approach, the customers and supply chain partners are collaborators in the marketing process and solutions are co-created by a supplier and a customer [30]. Considering that the provider has to build the value proposition to facilitate and co-create value, this interaction has to be well-designed. Interactions occur during service delivery and so these two points are strongly linked. Value co-creation results from a participative process between the provider and the customer, where they benefit from one another. This means that the provider can receive value from the customer, which could be, for instance, new knowledge. The customer perceives more value in use or gets better satisfaction. This is often linked to the perception of a relationship during service delivery and depends on the completeness of the offer. Therefore, value co-creation is dependent on the quality of resource and management competences within a network and also on the ability to learn from the users. Being connected to a global network that includes resources, suppliers and customers enhances innovation and value creation in the global knowledge economy [31].

Value co-creation emerges from the interactions between actors. Interdependencies have been largely studied in the past and several models and theories, such as network science or agent-based models, providing better understanding about them, exist.

Indeed, in a co-creation system, the elements are agents that make various decisions; have self organization which causes individual behaviours; and mutually interact [32]. These interactions have

to be designed throughout the entire life cycle of the offer, in order to maintain continuous value creation. Indeed, value co-creation is a dynamical process which can evolve during the life cycle.

Co-creation and sustainability

The co-creation process requires full involvement of all the stakeholders, and this cooperation is in itself a response to sustainability principles. In a sustainable society, common decisions have to be taken regarding whole systems and individual purposes. The co-creation process in PSS building is fundamental for the development of solution oriented partnerships, and consequently for sustainable solutions [33].

Value is generated for both the customer and the provider during the co-creation process, but value must also be generated for society. This can be understood as sustainability achievement. Socially, constructive and co-creative interactions between humans are a lever for knowledge generation inside the system but also for social equity and welfare more generally. Intensive knowledge employment leads to a more balanced distribution of workforce, geographically [34]. Economically, fulfilling customer needs during a prolonged interaction can generate long term benefits for the provider and reduce cost [1]. The provider can also improve his offer by integrating the customer. Concerning the environment, the co-creative process is a win-win relationship; it can enhance responsible behaviour and sustainable usage if the service delivery is correctly designed. However, behaviour or other external parameters such as individual decision-making by actors, constitute uncertain variables, which could make the rebound effect appear. The rebound effect "refers to a behavioural or other systemic response to a measure taken to reduce environmental impacts that offsets the effect of the measure" [35]. Bartolomeo considers that behavioural changes can occur due to the shift in property rights and the result can be a lower degree of responsibility felt by users for the equipment's proper usage and maintenance [36]. That is why user behaviour and acceptance have to be carefully taken into account.

The co-creation process can help resolve value creation and sustainability issues. However, human systems are complex and design must be fully conscious of the potential risks in relational, progressive, adaptive and dynamical interactions.

4 TOWARDS SUSTAINABLE VALUE

Following the discussions above, the question of the definition of value is posed. For Ueda, value co-creation is derived from relations among systems of artefacts, humans, and society; where value creation of artefacts is part of systems that include natural systems [32]. Value creation and Sustainability represent two major issues in PSS, justifying the need to integrate sustainability into the value notion.

Adding services to product-based offers has implications on the way to consider value for the

provider. Instead of thinking only of the product life cycle, providers have to think about the PSS life cycle, which is a continuous process of maintaining and regenerating the value proposition for the customer. The customer experiments his own, particular value-in-use in his own, individual process. Imagining the customer's activities generating value enables the provider to design the service delivery process more efficiently. With efficient design, the co-creation process results from the interaction with the customer when the service is delivered. These two processes and their mutual interaction look like the two spheres represented by Grönroos [11], in which the provider sphere corresponds to the production system where potential value is created; and the customer sphere represents the value creation by the customer in an independent process and in different spatial and temporal settings.

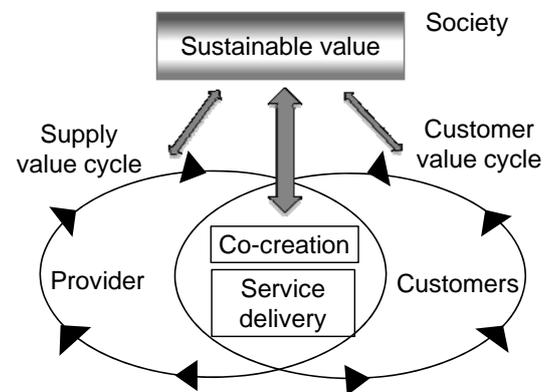


Figure 3: Co-creation and service delivery to provide sustainable value.

Figure 3 illustrates the continuous process of value co-creation feeding virtuous circles in both the supply and the demand sides. Sustainable value for society is linked to the closed-looped cycles of the provider regenerating the offer to new customers without material losses. Efficient design of service delivery enhances the co-creation process, so that they combine to meet the PSS issues of sustainable value creation. Indeed, correct design of service delivery will help organize the PSS life cycle in a closed-loop approach supported by learning and co-creation. It will also help to efficiently manage resources during usage. During interaction with the customer the potential of the value proposition will be confronted with the reality of value creation by facing the complexity of human behaviour. Success depends on the ability of the provider to co-create value with the customer. This co-creation process corresponds to a win-win relationship where customer behaviour must be understood and guided in a process where actors are voluntarily involved and satisfied. Finally, sustainable value emerges from a life cycle perspective of a production network and consumption activity.

Sustainability is intrinsically linked to the value of services provided by natural and human systems. Sustainability principles promote stakeholder

involvement to build sustainable solutions. Continuity and time perspectives are major pillars of sustainable development as continuity of the provision of the functionality for generating value. Cyclic approaches are the foundations of all ecosystems. Sustainability can be considered as a value concept. A PSS providing value should provide value for the present as well as for the future generations and value to society should be measured consequently.

5 CASE STUDY

5.1 Case description

This paper will now interpret, in terms of service delivery, co-creation and sustainable value creation, a clothing rental and cleaning service. The original study was carried out during the Environment Round Table [37] in 2008 in France. The clothing rental and cleaning service provided by the company Elis [38] was studied to evaluate the benefits on the environment. The information used here is found on the web site of Elis and the 'chantier 31' report of the Environment Round Table. Elis provides clothing rental and cleaning services addressing different types of companies in different sectors of activity. Instead of providing work wear individually to each of its employees, the client company outsources both the ownership of the clothes and their cleaning.

5.2 An offer with continuous value cycles

Elis provides clean clothes to its customers, who are interested in the continual performance of the offering. The main advantage for the customer in the proposed service is that its employees can concentrate on their core-skills and competencies, while always wearing clean clothes adapted to their daily activities. To satisfy this need, the provider supplies the clothes and cleans them. These two service activities have to be designed to provide better value for the customer while reducing cost for the provider, who should optimize the organization of production, delivery, recovery and cleaning processes.

The customer is continuously provided with clean clothes, and proximity with the provider makes services customized and adapted to his specific needs. The co-creation process improves the offering in the relationship developed with the customers through service delivery. Service delivery begins with an on-site diagnosis carried out by Elis to determine the needs in terms of specificities, stock dimensions, delivery frequency, etc. The sizes of the employees are measured in order to provide the most adapted products. Clothes are collected and delivered in function of the needs; they are regularly controlled and repaired. The customer's image is improved because of continuously cleaned clothes of the employees; he can access multiple products adapted to different situations and can adapt the clothes more flexibly. The provider maintains closer relations with the customers and can improve his understanding of usage. With strong implication in cleaning all along the use

phase, he can gain knowledge on the ways clothes are used or worn out and improve his offer consequently.

The continuity of these value creation cycles in which the customer and the provider are in a win-win relationship also supports the emergence of a sustainable value.

5.3 Sustainable value creation

The rental service means that Elis keeps the property rights on the products. The provider's economical interest is to prolong the useful life time of the products. Therefore, Elis re-designed new working clothes using more robust synthetic material rather than the traditional cotton-wear in the reference scenario. The new time of use is about twice as long with this material. Professional cleaning techniques including washing, drying and ironing are re-designed, and combined with the properties of the new materials; the cleaning process finally consumes far less water, electricity and detergents. This is an environmental improvement, but also an economic advantage for Elis.

Life Cycle Assessment was realized in 2008 during the Environment Round Table to evaluate the environmental performance of the value proposition. The reference scenario compared with the PSS scenario is a case of working clothes for mechanical industry where the client company purchases the wear and assigns it to a particular employee who is responsible for cleaning it at his home. The study showed that the rental solution proposed by Elis enables a reduction from about 50 % of the energy consumption and of the CO₂ emissions compared with a traditional scenario. The water consumption is also divided by 10.

The Life Cycle Assessment identified environmental gains obtained by the PSS solution. The global environmental performance achieved was composed:

- 30 % from use of new materials;
- 50 % through pooling the wears between the customers;
- 20 % from improved organization of the cleaning processes and logistics.

The location of the storage and cleaning facilities in an industrial area rather than in the city centre was chosen essentially for economical reasons. In order to minimize environmental impacts during transportation, design of the delivery logistics needs to be optimized. Moreover, Elis and its customers are implied in a close relationship supporting the co-creation process. This orientates the offer towards a 'multiservice' concept. Multiservices cover the customer needs very largely by proposing multiple services in a same delivery package, which could include different types of clothes but also sanitary services, mat services and drink services, designed to provide fully integrated solutions. The environmental and economical impacts of transportation are greatly reduced with a larger turnover since the time spent with the client does

not increase proportionally. The multiservice concept aims at providing a deeper service 'experience' to the customers. These improvements on the offer can be achieved since the relationships between the provider and consumers enable the value co-creation. Environmental or sustainable value is therefore encouraged. Since 2008, Elis has improved the quality of its products, guaranteeing the users a better comfort. The washing processes have been optimized and recycling of the products organized. As a result, the water consumption has been reduced from 19 %, the energy consumption from 14 % and the washing liquids use from 20%. The continuity of the improvement of the offer by continuous customer' satisfaction has the potential to provide more benefits for the provider, while fulfilling the customer's needs and displaying sustainable value. Another illustration is that Elis recently launched a new collection of working clothes, using biological cotton resulting from fair-trade. Elis is now developing this clothes collection for rental services.

"Sustainable value" emerges through careful design creating valuable provider-customer interaction in which the co-creation process generates value for the provider, the customers but also for sustainable development.

6 DISCUSSION

The case is an example which illustrates the potential of PSS for providing win-win relationships and creating value in a sustainable way.

The PSS solution provides additional value for customers in comparison with the reference scenario. Design of new products, processes and professionalization of the activities leads to value creation for the customer and the provider, while largely reducing the environmental impacts compared to the reference scenario. The continuity of the value creation on both the supply and demand sides allows the sustainable performance to be improved continuously.

The co-creation of value encourages the emergence of sustainability through interactions provided by the service. In the case study, the provider notices that his delivery process has to be optimized while the customer has other needs, which can be fulfilled by the same type of rental and maintenance services. Therefore, Elis designs "multiservices" with the potential of completely fulfilling the customer's needs, while providing economic benefits and reducing environmental impacts. The firm's development and the enlargement of his competencies is also a lever to enhance the employment in professional and specialized fields.

The study illustrates the creation of "sustainable value" emerging from the co-creation process strongly supported by design, which provides additional value for the customer, the provider and society.

7 SUMMARY

This paper has provided an overview of two major elements involved in PSS design: service delivery and the co-creation process. It was shown that these two factors enhance solutions meeting the value creation and sustainability requirements in developing PSS. "Sustainable value" can emerge. A case of clothing rental and cleaning services firm has been analyzed under this point of view in order to show the possible links between service delivery, the co-creation process and "sustainable value" which can be provided.

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