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Procedia CIRP 73 (2018) 173–178

www.elsevier.com/locate/procedia

10th CIRP Conference on Industrial Product-Service Systems, IPS^2 2018, 29-31 May 2018, Linköping, Sweden

Understanding product-service systems in a sharing economy context – A literature review

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Abstract

The continuous development of the sharing economy calls for the attention of the design community. Practical knowledge of where, how and what roles designers could play, in developing the phenomenon out of its infancy into a full-grown alternative way of consuming and living with social and ecological benefits, remains absent. This article reports upon an exploration to match product-service system design with the sharing economy. A literature study was needed toward understanding the sharing economy from a designer's point of view. A link was formed by focusing on different kinds of stakeholders. The result is a framework of five operable levels concerning PSS. One level concerns the product-service characteristics (0), while the other four concern levels of stakeholders mapped according to their involvement with the product-service. These four levels are the users (1), the ecosystem (2), the organization (3) and society (4). The framework results in an overview of workable parameters and leverage points: an attempt to support designers in understanding and designing PSS in a sharing economy context.

Peer-review under responsibility of the scientific committee of the 10th CIRP Conference on Industrial Product-Service Systems.

Keywords: Product-service systems; sharing economy; collaborative consumption; product design; role stakeholders; characteristics

1. Introduction

Since the beginning of mankind, products and services have been exchanged. This exchange happened by barter. Gradually, the use of money was introduced. As a result, the speed at which business could be done, increased significantly [1]. Eventually local markets became more integrated, as specialization and trade increased. Resulting into the globally interconnected societies of today [2]. This current market, also known as the traditional market, is one were consumers buy products and gain ownership [3].

Nowadays, the market landscape has changed. To survive in developed economies, manufacturing firms rethink your business strategies from selling products to offering services through products [4–6]. In addition, consumer behavior and preferences also have changed [7].

Referring to the economic and financial crisis of 2008, purchasing power and consumer trust in this traditional economy dropped significantly [8]. However, consumers still needed to obtain their products and services. Interest in other ways of earning and spending money rose [7,8]. It appeared that people were willing to pay for temporary access to a product or a service, instead of owning them [3]. Nowadays, more and more consumers turn to peer-to-peer business models that are focused on consumer needs [3].

This phenomenon is called the sharing economy, a peer-to-peer socio-economic ecosystem with customers both as buyer and supplier [3]. Coming up with a solid definition of the sharing economy is nearly impossible [9]. However, a general working definition was presented by Matofska [10] as: *"A socio-economic ecosystem built around the sharing of human, physical and intellectual resources, which includes a shared creation, production, distribution, trade and consumption of goods and services by different people and organizations.*" Well known initiatives are Uber and Airbnb, both founded in 2008.

2212-8271 © 2018 The Authors. Published by Elsevier B.V.
Peer-review under responsibility of the scientific committee of the 10th CIRP Conference on Industrial Product-Service Systems.
10.1016/j.procir.2018.03.317

The contemporary status of the sharing economy is already extensively discussed regarding business models or descriptive definitions.

Yet, within the design community, the roles and capabilities of designers are only now being explored. It could be stated that practical knowledge of where a designer should focus on, while designing for the sharing economy to make a viable difference, remains absent. This research is based on the idea that contemporary sharing economy initiatives are currently situated around sharing existing products and services, not about how they are designed.

While a potential for sustainability of both the sharing economy and PSSs is still heavily studied and debated [9,11–14] it is also recognized by many researchers [8,9,15,16]. The sharing economy itself will not be debated within this research. It is the role of the design community to design innovative concepts that further stimulate the social and sustainable features of the sharing economy. It is not enough to place old products in new business models. The goal should be to design new, innovative concepts to further develop the potential of a phenomenon like the sharing economy. How are these sharing product-services designed? Whereon does a designer need to focus to make a valuable difference?

2. Literature review

In this review, the sharing economy will first be discussed (1). Secondly, the concept of product-service systems and their suitability in relation to the sharing economy is discussed (2). As a third, different levels whereon a designer could focus are explored. Five main levels are set up: One focusing on product-service characteristics (4) and four focusing on stakeholder characteristics (5). As a result, an overview of characteristics and parameters is presented. By setting up this overview, leverage points are explored whereon designers could focus while designing valuable product-service system concepts for the sharing economy.

2.1. The Sharing Economy

As mentioned before, the sharing economy has an abundancy of definitions and perspectives. A clarifying definition of the term is already mentioned in the introduction.

In this chapter there will be focused on a framework set up for the sharing economy [8]. There are three main drivers for a sharing economy: a social, an economic and a technological one [8].

The Social Driver has two focus points: trust in the system and in its participants (1) and the concept of "stranger sharing" (2). Stranger sharing is the development of sharing activities outside one's social network [9]. The Economic Driver has also two focus points: (non-) monetary pricing (1) and dynamic pricing (2). (Non-)monetary pricing refers to the manifestation that in a sharing economy a good or service not only can have a financial value but also a social or environmental one. Dynamic pricing refers to the condition that sharing the consumption of goods and services within the sharing economy is mainly being done on online platforms [17]. This ensures transparency and makes comparing different suppliers easier resulting in low prices. It also ensures wisdom of the crowds. The Technological Driver has one focus point: growing technological innovations resulting in better connectivity between consumers (1). This ensures a growing critical mass, which makes matchmaking easier and more successful.

Within the concept of the sharing economy there are many possible motivations for participating but four significant motivational factors based on scientific research are acknowledged [17]. Two intrinsic and two extrinsic. For the intrinsic motivations; enjoyment (1) and sustainability (2) are formulated. For the extrinsic motivation; economic gains (3) and reputation (4) are formulated. During this research, these four motivational factors are kept in mind.

In the sharing economy, the line between products and services is very thin, if not non-existent. After all, offering a product for sharing or renting can also be considered a service [8]. Following that reasoning, products within a sharing economy can never be seen apart from the service. This allows us to conclude that product-service systems are highly suitable for the sharing economy.

While discussing product-service systems, a shift in ownership is acknowledged [18] due to their evolution toward more sustainable concepts. This shift in ownership is also acknowledged in relation to the sharing economy: where people are more willing to pay for temporal access instead of owning [3]. Product-service systems and this shift in ownership in relation to the sharing economy will be discussed in the next chapter.

2.2. Product-service systems

Product-services are defined by Tukker as "*mixes of tangible products and intangible services designed and combined so that they jointly are capable of integrated, final customer needs"*. The system is defined as "the network, infrastructure and governance structure needed to 'produce' a product-service" [19]. This definition is extremely broad and acknowledges that there is a range of PSS possibilities between, on one side; pure products, and on the other side; pure services. Due to the intertwining of products and services in a sharing economy, it is sufficient to state that a PSS will either be more product-oriented or service-oriented, but never detaching itself form their counterpart within the system [20]. It is already established that the integration of products and services results in a potential for higher value [21,22]. In addition, by involving stakeholders such as other organizations, the government or consumers even more value could be created [23]. Due to the complexity of the sharing economy, it is encouraged for designers to look beyond the integration of products and services toward an integrated ecosystem with different stakeholders to generate continuously increasing value.

Product-service system design has been studied in many research groups [24,25]. It is a customer-oriented approach where the relationship between customers and companies

changes from transaction- to relationship-based [26]. As briefly mentioned, in the sharing economy the product-consumer relationship changes as well. It is marked by shifts in property rights due to the willingness to pay for temporary ownership instead of possession [3,18,27]. It is important to state that the shift in ownership takes place on the level of responsibility [18]. All goods, properties or competencies used within the sharing economy are owned by the consumers and suppliers themselves [3]. But, by sharing, the consumers end up in situations where they do not own the product, but where responsibility or careful behavior is needed. Regarding this change in ownership concerning PSS, four parameters crucial for a sustainable product-user relationship have already been discussed [18,27]. These parameters being: special meaning (1), user participation (2), self-learning service (3) and community feeling (4). Due to their universality, these parameters are valid in a sharing economy context as well. During this research we keep these four parameters in mind while referencing to PSSs in a sharing economy context.

By acknowledging product-service systems as a viable way to match products and services with the sharing economy, five operable levels are set up. As previously mentioned, by setting up these levels levers are exposed whereon a designer could focus for understanding and tackling the sharing economy.

2.3. Operable Levels

First, a distinction is made between the product-service and the system. This is based on the idea that the 'product-service' is the core of the PSS, while the 'system' is redefined as the scientific exploration of the whole structure [28] sustaining that core. Firstly, product-service characteristics are explored in relation to the sharing economy. Secondly, the system is explored by setting up four levels of stakeholders based on their involvement within the PSS.

2.3.1. Product-service characteristics

There is considerable research done about possible characteristics of successful products in the sharing economy. Due to the fine line between products and services, as previously mentioned, defining specific characteristics quickly gets complicated. Services, in practice, are very versatile and flexible, making it therefore specifically hard [29]. In this research, four general characteristics are presented.

The first characteristic focusses on a products' *suitability for the sharing economy*. Some products are more suitable for the sharing economy than others [3]. Products that are used on rare occasions, but are crucial for this one occasion, and seem to have a higher success rate in the sharing economy. An example is the sharing of industrialized equipment by EquipmentShare© [30]. This degree of sharing opportunity can depend on the availability and accessibility of the products being shared.

With the characteristic that a good should be sharable, a second issue occurs. *Products should be designed to be sharable* [8]. An example of how this can be achieved, is by plasticizing the covers of books in a library. This way it is prevented that books would be written off after the third time they are lend out. Producers that are willing to adapt to a sharing economy, should think about their designs to prevent wear-and-tear of their products. It is interesting to think about which kind of value will be fulfilled by the product alongside the intensity of usage. Products also should be made easy to pass on [31].

The third characteristic is the ability to apply *repeated customization* to a product [32]. An example of repeated customization is erasing all the personal information from a smartphone or computer before passing it on to somebody else. Stripping a house of personal belongings is also a way to make it feel 'new' in order to be able to resell it.

The last characteristic corresponds with the social and sustainable potential the sharing economy offers and refers to idea that products should be used by *multiple users at the same time* [8]. This does not necessarily apply solely on soft or hardware. Sharing a house or car ride with Airbnb or BlaBlaCar shows that also services are suitable for multiple usage. It is interesting to note that the quality of experience could depend on the amount of multiple users. For example, while attending a music concert, the experience changes when there are too few people in the concert hall, or when it is too crowded. Designers should take into account that the amount of multiple users can have an influence on the experience.

To sum up, four characteristics of products in a sharing economy are presented: *degree of suitability*, making products sharable by insuring their *longevity*, *repeated customization* and *multiple users*. We keep these four characteristics in mind regarding the design of PSSs in a sharing economy context.

2.3.2. Levels of Stakeholders

The concept of stakeholders is familiar to every designer, and a major aspect of the human centered design approach. At this stage, stakeholders and their roles within a PSS in the sharing economy are still not clear. Thus, different stakeholders are explored.

A comparison is made between three main stakeholders in regard to the traditional economy [8]: consumer (1), organization (the sharing platform) (2) and government (3). Other stakeholders are formulated as well [33]: other sharing economy companies (4), suppliers (5), investors (6) and lawyers (7). Regarding the design and development of a successful product-service system, more stakeholders line up: Society (8), ICT-unit (9), graphic or and industrial designers (10), App-developers (11) and (micro-)entrepreneurs (12) in regard to the deploy of the concept and marketing. Each of these stakeholders can be mapped in relation to their involvement with the product-service. By doing this, four levels arise: the users (1), the ecosystem (2), the organization (3) and society (4). These levels are loosely based on the levels of value [34]. While mapping the stakeholders in accordance to these levels of value, their roles become clear.

Since there is not yet any scientific module regarding characteristics and their parameters of each of these stakeholders in relation to the sharing economy, general characteristics are presented. These are based on both literature studies about design and the sharing economy, as well as on general knowledge any designer should have acquired.

2.3.2.1. User(s)

In the traditional economy the first level would be that of the user. Within this research, this is redefined as user(s) since the user can be both consumer and supplier in a sharing economy, sometimes even at the same moment [9]. While discussing the users, two characteristics are interesting: *the willingness to share* and the *motivation for participating*. The willingness to share is determined by the relationship between a feeling of trust in the system and the presence of a secure sharing environment. Trust in the system can be obtained by integrating a level of transparency, enabling feedback systems [35] and through recurring (inter)actions such as communication [36]. A secure environment corresponds with the type of governance present both in the system (carried out by the organization) and outside of it.

Considering the motivations for participating four main motivational factors are conducted: social, ecological, enjoyment and economic gains. Reputation is placed under economic gains since reputation can be seen as a new kind of currency in the sharing economy [32].

2.3.2.2. The Ecosystem

In this research, the ecosystem is redefined as the bigger picture of all consumers and suppliers (the users) within the system. It manifests itself in the platform, which supports the social network. This platform forms the bridge between the organization behind the concept and the users involved. the platform plays a facilitating role: matchmaking [3]. In this role of facilitator, suppliers and consumers can access skills and property, owned by other users [8].

While discussing the platform three main characteristics are interesting: *trustworthiness*, *low threshold* and *the degree of user participation*. Considering trustworthiness, it is interesting to think about the degree of anonymity the users have within the system [37]. Regarding the low threshold, the accessibility and approachability of the platform are important factors. Note that most of current sharing economy initiatives are solely based on digital interaction. Elderly are therefore often excluded due to less familiarity with the internet [3]. The degree of user participation depends on the experience of how each user can exert its involvement [27], and the focus whereon he or she can do it.

While discussing the social network four main characteristics are interesting: *the degree of interculturality, mutual reputation assurance between the different users, involvement between the users* and a *community feeling*. To enable the social potential the sharing economy has to offer, the presence of different cultures and people with different ethnic backgrounds should be taken into account. It is a designer's job to make sure that the PSS can thrive in today's multicultural society. The degree of interculturality is measured by the intensity of different cultures involved. In the sharing economy, reputation is extremely valuable [38]. It is important that in the social network the right reputation is correctly assured. This depends on the quality of the feedback systems present [35], but also on the amount of community engagement users preform. The involvement between users is measured by the amount of contact points both online and offline [18]. The community feeling is the feeling of shared common values, needs, resources, intents, beliefs, etc. present in the community [39]. To enable community feeling, designers should think about the amount of contact between the people in the community and the focus of the community.

2.3.2.3. The Organization

Within this research, a significant distinction is made between the platform and the organization. As previously mentioned; the platform is defined as the bridge between the organization and the users. In this research, the organization is redefined as the structure that supports the platform in establishing its value proposition: matchmaking. The organization concerns all the people and assets 'behind' the platform such as; (micro) entrepreneurs, ICT-unit, investors, legal persons (& lawyers), graphic designers, industrial designers, app developers and intermediaries. In relation to the sharing economy, three main aspects are important. The organization should enable the *infrastructure* needed to set up a working sharing environment. This can be both digital (e.g., platform) and physical. This sharing environment should be secure and safe for both suppliers and consumers to operate in. *A level of insurance* is thus also highly needed. Furthermore, in relation to the critical mass of both suppliers and consumers, the organization should take *scalability* into account in order to continuously meet users' demands [3].

2.3.2.4. Society

The level of society is the fourth and last level. It is redefined as the biggest picture as to where the PSS operates. It concerns the aspect of governance, partners and competitors in regard to the system. Concerning society, three stakeholders are discussed: the government, competitors and partners.

While the role of the government is highly debated in academic literature [8,9,40]. In this research, while focusing on the design aspect, a regulating role is acknowledged. Concerning the government, it is interesting to think about *the degree of an existing legal framework* regarding general laws, and the overall *willingness regarding taking up different roles*. The degree of an existing legal framework is measured by the transparency and uniformity of this legal framework toward designers. The overall willingness to adopt different roles can be measured by the attitude of the concerning government toward the sharing economy.

Concerning competitors, it is necessary for a designer to understand brand identities and market positioning. Analyzing competitive brands is an aspect every designer is familiar with.

A comparison can be made between the *focus* and *type* of the competition. The focus could either be product-oriented or service-oriented, while the type refers to the kind of needs to competition fulfills. This could either be functional or emotional needs.

Concerning partners, it is necessary for a designer to think about possible joint ventures and situations where different organizations can work closely together with mutual benefits for each partner.

The goal should not be to analyze the competitors and/or partners so thoroughly it exceeds the competencies of a designer. It should be to get an overview of what is going on in the market, who is doing what and where opportunities can be found.

In figure 1, the general structure of the five operable levels is presented.

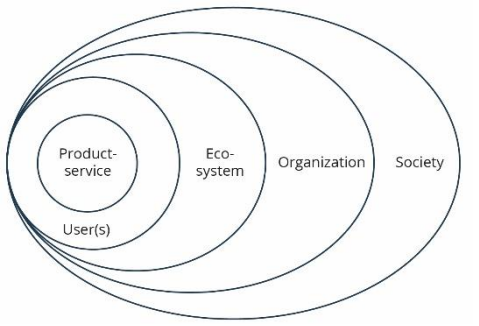

Figure 1. Framework of five operable levels concerning PSS in a sharing economy context.

3. Discussion & Conclusion

While sharing is not a new concept, the development of the sharing economy in this digital age is quite a recent phenomenon, therefore the biggest point of discussion is still understanding and defining it. After all, defining the sharing economy in such an early stage of the phenomenon is difficult [8]. Therefore, it is necessary to understand that, for a lot of research considering the sharing economy, it could have missed some new aspects by the time it is published. To minimize the risk, a lot of researchers regard only the broadest, most characteristic aspects of the sharing economy as valuable. Within this research, this is not different. This research focusses on the front-end of the design process concerning PSS. It tries to create an overview wherein a basic structure is presented to match PSS and the sharing economy. Different stakeholders are explored, and their roles are discussed. One of the main challenges concerning PSS design in regard to the sharing economy is understanding all the different stakeholders, their roles and their influences on each other and on the system.

As previously mentioned, the potential roles designers could play are often overlooked. Because of the relative early stage of the sharing economy phenomenon, it could be stated that designers have a role to play in developing the phenomenon out of its infancy into a full-grown alternative way of consuming and living with social and ecological benefits for everybody. Especially now, amid heated discussions and debates surrounding the sharing economy. A grand challenge in the current research of PSS in a sharing economy context, is understanding the relations and influences between the multiple parameters and stakeholders. Only by understanding the complexity, and thus by approaching PSS from a systemic point of view, can design for valuable ecosystems be enabled.

The result of this paper is an attempt to understand the product-service structure present in a sharing economy context, through product-service and stakeholder characteristics. Five operable levels were set up, each with focus points regarding PSS design in a sharing economy context. Setting up this framework results in an overview of interesting parameters and possible leverage points which could support the PSS design process in a sharing economy context.

4. Future Research

This study explores the design of PSS in a sharing economy context. Focusing first on the product-service and then on four levels of stakeholders. Due to the lack of research considering the sharing economy and its relation to design any research considering this topic is encouraged. A suggestion could be made about the investigation of the guarantee of trust within the PSS and the influence design could have on it. Also, further research into the internal influence of these parameters on each other is encouraged. These findings could lead to a deeper insight into developing PSS in such a complex context. The ultimate outcome is a set of guidelines for designers, facilitating the design process of Product-service systems in a sharing economy context.

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