

Product-Service Systems across Life Cycle

# Exploring the critical factors for sustainable product-service systems implementation and diffusion in developing countries: an analysis of two PSS cases in Brazil

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## Abstract

This paper aims at exploring how some factors identified in the PSS and product/service innovation literature can hinder or foster sustainable PSS implementation in developing countries, since there is a lack of knowledge concerning the characteristics of PSS transition processes in different contexts. The identified factors were investigated empirically, through two PSS solutions located in an emerging economy. The main results demonstrated the role of some potential factors in supporting the implementation and diffusion of PSS solutions, especially those related to the involvement of multiple actors in the value creation and the social embeddedness. However, the role of those factors still need to be investigated in future works, since only two cases were analyzed in this research. Analyses of successful and unsuccessful PSS cases as well as the identification of other factors and characteristics of PSS implementation in different contexts are directions for further research.

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Peer-review under responsibility of the scientific committee of the 8th Product-Service Systems across Life Cycle

*Keywords:* product-service systems; PSS; sustainability; developing countries.

## 1. Introduction

Product-service systems (PSS) have been discussed as a promising opportunity for industries to propose both successful and eco-friendly solutions to fulfill consumers' needs [1]. With the focus on a satisfaction-based economy, PSS presents the potential for generating win-win solutions that promote profit, environmental and social benefits, and its effects can be significant for developing countries [2]. Indeed, PSS may act as business opportunities to facilitate the process of social-economic development in emerging and low-income contexts by jumping over or by-passing the stage of individual consumption/ownership of mass produced goods towards a 'satisfaction-based' and low-resource-intensive advanced service economy [3].

However, PSS business models have been mainly studied and implemented as eco-efficient opportunities in industrialized contexts, and there are still very few PSS cases from developing countries explored and analyzed in the

literature [4, 5]. Nevertheless, considering sustainability in all its dimensions and all types of contexts it is important to deepen the understanding of PSS as a promising approach to couple not only economic and environmental benefits but also the socio-technical dimension of sustainability [2-4].

Indeed, academic discussions of service innovation tend to investigate well-established economies, which appears insufficient because emerging economies have been growing at faster rates and these economies are a source of disruptive innovations in many fields [6]. In addition, research on transformative services could also make a valuable contribution to understand the social and ecological consequences of services offerings for developing economies [7]. Moreover, service research in those contexts is also necessary because the well-established theories and empirical generalizations derived from data gathered in the high-income segments could not always be applicable to developing markets [7]. The transition to PSS in different contexts remain a research gap, and there is a lack of knowledge concerning

the characteristics of the PSS transition processes in each context [4]. In this sense, this paper aims at exploring and discussing how some potential factors discussed in the PSS and service innovation literature can hinder or foster the introduction of PSS in developing contexts. The factors are discussed empirically through the analysis of two PSS solutions located in an emerging economy (Brazil), in order to better understand the extent in which they may affect sustainable PSS solutions implementation and diffusion. The paper is an exploratory study that aims to deliver some initial insights about the particularities of PSS implementation in developing contexts. The remainder of this paper is structured as follows. Firstly, a brief overview of PSS as sustainable solutions, especially for developing segments is presented, and the factors that are part of the theoretical framework of this study are discussed. Secondly, the research methods to identify the factors, to collect and to analyze data are presented. This is followed by an analysis of the two PSS solutions from the perspective of the identified factors. Finally, conclusions are drawn regarding the implications of this study, its limitations, and directions for future research.

## 2. Theoretical framework

PSS business models have been discussed as promising to achieve the sustainability [8] and many PSS cases have been discussed in the literature. However, in developing contexts the PSS concept is less emphasized when compared with a large number of empirical case studies from developed countries. Table 1 summarizes the papers from peer-reviewed journals identified in a literature review that explores PSS cases in developing countries.

Table 1. PSS case studies in developing countries.

PSS type	Country	References
Coffee association	Bolivia	Devisscher and Mont [5]
Bike sharing system	China	Zhang et al. [9]
Water purification system	Brazil	Sousa-Zomer and Cauchick Miguel [10]
Air compressor manufacturer	China	Xu et al. [11]

However, it is also important to understand how PSS concept is shaped in other contexts than the developed ones [5]. Innovation in services is a particularly relevant topic to explore in developing economies and bottom of the pyramid (BoP) contexts because innovative and productive services create new competitive sectors. Addressing challenges in BoP markets means to design new solutions that could be a driver for market transformation towards a more sustainable society by means of both clean technological solutions and changes in habits, favoring the efficient use of resources [13].

The literature has been stating that socio-cultural embeddedness is required to service innovation in BoP and developing contexts. Reynoso et al. [6] pointed out that culture might promote or hinder entrepreneurship, encourage or discourage risk taking, facilitate or prevent the integration of fragmented resources in emerging economies, or boost or interfere with service innovation. Some studies have also been

arguing that consumption choices are dependent on prior consumption patterns, and the diffusion of a PSS in the market is highly dependent on being sensitive to the culture in which it will operate [14]. In BoP and developing contexts, the most important factor of success is the willingness to understand what the local community need, responding to socio-cultural dimensions [15]. Micro-level challenges can be met only if the local context is well understood [16]. Culture is more relevant in emerging economies than for other segments because they often are governed more by social norms than by institutional instruments [6]. In this sense, cultural aspects of developing contexts may affect the implementation and diffusion of sustainable PSS offerings. Indeed, creating products and services for developing markets require a clear understanding of the needs and the context of the people within [15] and social embeddedness is thus required to design relevant services with local focus [16].

Moreover, it has been argued in the literature that governments can help to expand business opportunities by developing PSS-related policies and making them part of existing procurement policies, and by creating clear markets for companies' offerings [17]. New business models in BoP and developing contexts should feature balanced collaborations driven by different socioeconomic actors who can build on their complementary competencies to create value [16]. Furthermore, the literature states that there is a need for governmental support to disseminate knowledge about PSS [18]. In fact, customers may show a lack of knowledge and understanding about the PSS concept [14]. This must be even more emphasized in BoP contexts that consumers are deficient in skills and the education of consumers about products and services is a key factor [19]. The orientation of consumers about PSS can be valuable to help to change the consumption and production patterns. Knowledge may also influence the sustainability performance of the solutions in those contexts, also helping to avoid the rebound effects. Indeed, services in developing contexts results from the interaction between several actors and there is a need for a holistic implication of the network of actors in the co-creation process including active participation of the customers [16]. The diversity of actors in the co-creation process is essential to obtain value for all parts involved [16].

Technology has also been discussed as an inherent element of social innovation, providing reliable access to new services in BoP contexts [6]. Actually, BoP contexts offer the opportunity to study clean technologies such as renewable energies, water, and sanitation, which have the potential to disrupt traditional ways of delivering services [7]. Sustainable business models with a dominant technological innovation component may allow maximizing material and energy efficiency, for instance, through the dematerialization [20]. Product-service offerings with clean technological innovations may also be valuable in the context of developing countries as an environmentally sound path to economic development. Social innovations supported by new technologies and a clear understanding of the social needs and habits may help to solve societal problems [7] while it could provide environmental benefits. Next section outlines the research methods adopted in this research.

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