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## Interview study: How can Product-Service Systems increase customer acceptance of innovations?

Danilo Marcello Schmidt\*, Felix Braun, Sebastian Alexander Schenkl, Markus Mörtl

*Institute of Product Development, Technische Universität München, Germany*

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### ABSTRACT

Since customer acceptance is responsible for the success of innovative products, this study investigates how Product-Service Systems (PSS) influence customer acceptance of innovations. Using the example of electric vehicles (EV) in carpools, interviews were held with four PSS providers and four PSS customers from Germany and Sweden. The results of the interviews were then analyzed according to Rogers' theory of the diffusion of innovations: Providing innovative products as PSS can increase customer acceptance by reducing performance gaps that exist between innovative and existing technologies. The main gaps found with EVs are their limited range and high purchase costs. Customers perceive those gaps as less considerable if they rent EVs in a carpool.

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### Introduction

The key to the success of technological innovations is customer acceptance (see the Technological innovations section). If customers accept a new technology and are willing to pay for the technology's advantages, products involving technological innovations become successful. Rogers [1] claimed that innovations need time to diffuse into society. One example of this is the iPad, by Apple. The Apple Newton, which was launched in 1993, lacked customer acceptance, while 15 years later the Apple iPad became a great success. Even though both products had similar product designs, the iPad was more successful. This paper considers the customer acceptance of technological innovations. It deals with the question of how Product-Service Systems (PSS) can help increase customer acceptance by accelerating the diffusion of innovation. According to Tukker [2], PSS focus on customer requirements and enable faster innovations. Vandermerwe and Rada [3] stated that PSS support the diffusion of innovations. Rogers [1] defined five factors relating to innovations that are perceived by customers and that influence the customer acceptance. This study proves Rogers' factors using the example of electric vehicles (EV) in carpools. Based on Tukker's categorization of PSS, a carpool is the business system for use-oriented PSS. The

customer pays for the utilization period and for the distance if it exceeds a defined range limit. Four top managers from carpool providers and four carpool customers from Germany and Sweden were interviewed and analyzed according to Rogers' factors. The managers not only see the provider's internal processes, but also act as representatives of the companies and speak for the company's understanding of the customers' needs. The analysis shows how PSS can increase customer acceptance. It studies differences between station-based and free-floating carpools, as well as between full EV carpools and mixed carpools (i.e. EVs and combustion-engine vehicles). Since the carpools are located in Germany and Sweden, carpools from both countries were compared to one another.

This paper deals with customer acceptance of innovations. It examines only business-to-customer (B2C) applications, i.e. the relationship between carpool companies and private users, not business-to-business (B2B) applications. In addition, the terms "user" and "adopter", a term from innovation theories, can be applied. Nevertheless, they have the same meaning in this case: the B2C-customer is defined as the end user, the person who actually uses the innovation. This person is the decisive factor in the evolution of the innovation.

### Research methodology and structure

This work is based on the *Design Research Methodology* (DRM) defined by Blessing and Chakrabarti [4]. It delivers a set of methodologies to "help make design research more effective and efficient". The DRM layout consists of four different stages:

\* Corresponding author at: Boltzmannstraße 15, 85748 Garching, Germany. Tel.: +49 89 289 15135.

E-mail addresses: [Danilo.schmidt@pe.mw.tum.de](mailto:Danilo.schmidt@pe.mw.tum.de) (D.M. Schmidt), [Felix.braun@tum.de](mailto:Felix.braun@tum.de) (F. Braun), [Sebastian.schenkl@pe.mw.tum.de](mailto:Sebastian.schenkl@pe.mw.tum.de) (S.A. Schenkl), [Markus.moertl@pe.mw.tum.de](mailto:Markus.moertl@pe.mw.tum.de) (M. Mörtl).

research clarification (clarifying research goals), descriptive study I (collecting and analyzing empirical data to increase knowledge), prescriptive study (support for the research problem), and design study II (evaluating prescriptive study to assess its value). The research types differ in their sequence and the coverage of research stages. This work focuses on the first three stages. The research clarification is review-based. This literature review focuses on the terms “customer acceptance”, “Product-Service Systems”, “innovation” and “electric vehicles”, and it results in the research questions. The descriptive study I is a comprehensive study. Semi-structured interviews were used for this study. The interviews are designed in accordance with the research questions and described in the section *Research Questions and Design of Interviews*. The descriptive study analyzes and interprets the interviews by comparing them to the approaches identified in the literature. Fig. 1 shows the research methodology and its stages in connection to the chapters of this paper.

This work first presents the theoretical background of PSS and innovations. It first defines the research questions, then presents the interviews and their analyses. The interpretation shows how PSS can be used to raise customer acceptance of technological innovations, based on the assumptions made by Rogers [1]. The last section of this paper is a conclusion and an outlook for future work.

## Theoretical background

The basic research consists of two topics, Product-Service Systems (PSS) and customer acceptance of innovations. First, the work introduces PSS and explains the focused kind of innovations. Then, it defines customer acceptance and clarifies its implications for this work. The next subsection analyzes the question of how PSS can help to increase innovations' performances. Beyond other theories that explain customer acceptance of innovations, this paper focuses on the Diffusion of Innovations theory first stated by Rogers [1] in 1962.

## Product-Service Systems

Product-Service Systems (PSS) integrate product and service components in an integrated market offering [5–7]. PSS are characterized by integrated lifecycle phases, e.g. planning, development, delivery, and use [8,9]. While several authors define the term PSS as the service and product components included

[6,7,10], Manzini and Vezzoli [11] characterize PSS as an innovation strategy, [12] and [5] define PSS as a value proposition. PSS imply a paradigm shift from selling technical products to fulfilling customer demands [5]. PSS have a wide range that Tukker divides into three main types [2]: (1) Product-oriented PSS are dominated by the product content and incorporate product-related services such as maintenance or consulting for product usage; (2) Use-oriented PSS incorporate renting, sharing and pooling of products (car sharing is an example of a use-oriented PSS); (3) Result-oriented PSS are dominated by the service content, e.g. a functional result may be the transportation of a person without the means of transport having been defined. The term “servitization” is often used in literature and describes the transformation from selling a stand-alone product to providing a PSS [13,14]. Other related terms in literature are *performance based contracting* [2], *maintenance outsourcing* [2], *functional sales*, and *functional (total care) products* [15]. Those terms describe subcategories of PSS, e.g. maintenance outsourcing is a special case within a product-oriented PSS. The overall concept of those approaches is called PSS.

PSS promise benefits for the provider, the consumers, and the environment. The dematerialization of PSS decouples economic growth and sustainability [5,6,12]. Benefits for the customer are higher customer values because of a shift in the provider's scope from selling technical products to fulfilling customer needs [2,11]. The possible distinction from the competition is seen as beneficial for the provider [5,6,12,16]. Other potential benefits include long-term customer relationships [17], higher customer loyalty as well as higher revenues due to expanding business activities by services [18].

## Technological innovations

Authors from multiple disciplines have created definitions for the term innovation [19,20]. One way in which it can be defined is the “generation, acceptance, and implementation of new ideas, processes, product or services” [21] or “the successful exploitation of new ideas” [22]. An invention's novelty and benefits do not have to be superior but market success must be achieved, and this depends on customer acceptance [23]. In a technological context, an innovation is an innovative technology. For a technology to achieve customer acceptance, a product or service is needed that involves the technology and carries the technology to the customers. As this research focuses on customer acceptance of technological innovations, the innovative technology cannot be considered separate from the product. Therefore, this article deals with product innovations that are innovative because they include an innovative technology, e.g. electric vehicle (technology: electric drive system, product: vehicle), MP3 player (technology: MP3, product: music player), digital camera (technologies: image sensor, digital storage medium, product: camera). This study refers especially to innovative technologies that are in competition with existing and established technologies in similar products, e.g. electric vehicles compete with internal combustion engine vehicles, MP3 players have competed with CD players, digital cameras compete with analog cameras. The innovativeness on which this paper focuses has to be extensive enough for customer acceptance to justify greater efforts to implement a PSS. The study focuses on radical innovations and system innovations [20] that are more likely to fail in customer acceptance, compared to incremental innovations in system components. Hauschildt and Salomo [20] differentiate between four content-related categories of innovations: technical (products, processes), organizational (management, cultures, structures) and business-related (business model, market structure) [20]. Thinking in those categories, this study focuses on technical innovations. Since the transition toward

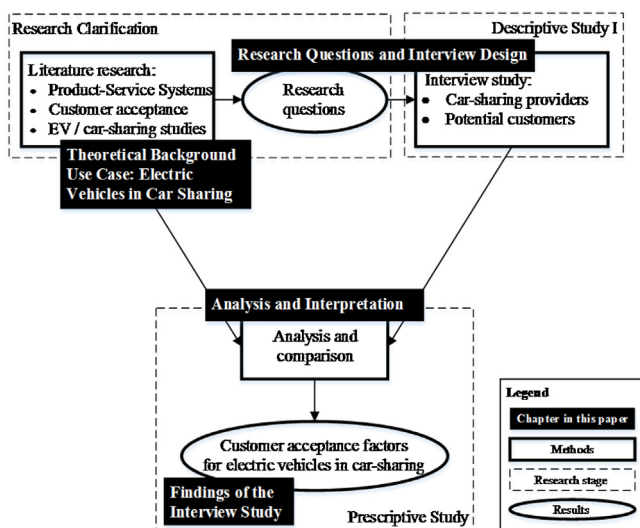


Fig. 1. Methodical procedure of this work.

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