Proceedings of the 2011 17th International Conference on Concurrent Enterprising (ICE 2011)
Klaus-Dieter Thoben, Volker Stich and Ali Imtiaz (Eds.)
ISBN: 978–3–943024–05–0

Conceptualizing Product Service Networks: Towards an Initial Framework

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Abstract
Product-Service Systems (PSS) are typically developed in heterogeneous networks of Small and Medium Enterprises (SMEs) and departments in larger organizations with some kind of end-user involvement. It can be said that these networks do not function as well as they should; in part, because companies need to reshape their organizations to effectively deal with the demands of these networks and processes. In part this is because new techniques are needed to determine end-user needs, and involve end-users themselves in different ways. Although techniques from experience design, product design and service design are promising, using these in practice for networked collaboration has proven difficult. The current article elaborates upon the diversity in these networks using a human-centred design approach. Based on various exploratory workshops reviewing and analysing existing cases a first framework for conceptualization and implementation of PSS has been constructed.

Keywords
Product Service Networks, innovation, networked collaboration, creative industry, design techniques.

1 Introduction

The growing complexity in society requires radical forms of innovation in industry. Adding a single feature or finding a single new target group is not longer enough to survive. For this, the move to product-service combinations enables disruptive innovation. It, however, increases the complexity of design processes and requires intensive collaboration from the earliest stages of development. In keeping with Martin (2009), we view the creative industry as invaluable for radical innovation and competitive advantage. Apart from the outcome in terms of better products and services, the benefits of design thinking are moving far beyond the growth and strengthening of the creative industry. Leading international business schools such as Stanford and Oxford are broadcasting 'design thinking' as a successful approach to innovation and include design education in their curriculum (Brown, 2009). The British Cox Review of Creativity has stressed this importance of stimulating the Creative Industry in Business as well (Cox, 2005). Obviously, the goal should be making industry more creative and in this way more competitive. In a similar vein, the current project aims to enhance the creative potential of product-service networks through creating connections between the various disciplines needed to gain long-term benefits –rather than short run benefits– for individual companies, resulting in sustainable benefits for society and the economy.

Successful innovation is often a combination of a product, service and ICT. Not only the complexity on product/service level is growing, the number of parties involved are increasing as well: think of R&D, design, manufacturing, marketing, suppliers and distributors - different parties, each with its own jargon and self-interest. A human-centred design approach, in which the user's experience guides the parties in such networked collaborations, seems to offer great

opportunities. Large international companies such as Apple, Microsoft and Philips have already adopted human-centred innovation approaches.

A focus on the end user not only affects the outcomes of the design process, it also guides communication and collaboration among different parties during the process. In the current work we look will beyond traditional paradigms of product design and service design, and focus on a combination of the two: Product Service Systems (PSS).

2 Product-Service Systems

The term Product-Service Systems is not new; various definitions exist, originating in differing disciplines such as business strategy, concurrent engineering, marketing, networked collaboration, or product development. According to Mont (2002), a product-service system is a system of products, services, supporting networks and infrastructure that is designed to be: competitive, satisfy customer needs and having a lower environmental impact than traditional business models. It can be said that PSS are typically developed in heterogeneous networks of Small and Medium Enterprises (SMEs) and departments in larger organizations with some kind of end-user involvement. Consequently, this entire network dominates how the PSS functions.

However, the networks do not function as well as they should. In part this is because companies need to reshape their organizations to effectively deal with the demands of these networks and processes, but also because new techniques are needed to conceive the needs of end-users, and to involve end-users themselves during the development process. Although techniques from experience design, product design, and service design address this problem, they exist in isolated parts of design, and consequently industry faces difficulties with adopting them in developing PSS as a whole. Interestingly, those emerging PSS networks that are able to leave old paradigms behind seem to be more successful. Figure 1 illustrates how PSS networks emerged.

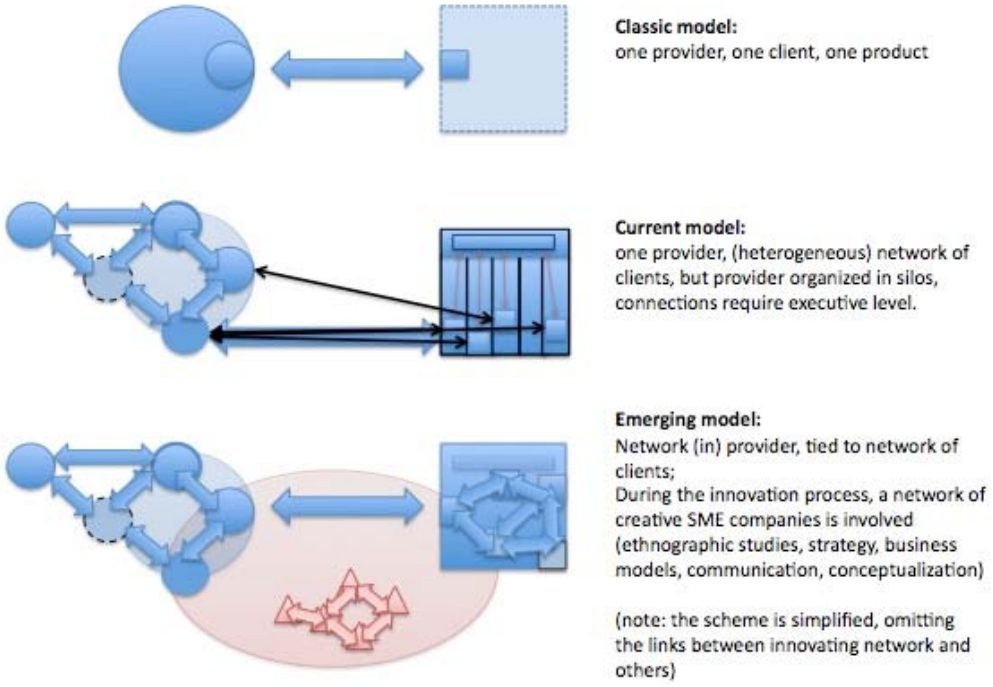

Figure 1: Networks emerging in PSS development, starting from the basic product offer, through the realisation that the end-users are actually a network, to the conception of development involving heterogeneous networks in all three parties.

The challenges are to understand and involve parties as a heterogeneous network rather than a set of isolated individuals. In order to facilitate the clients' functioning by the provider, the latter

needs to adapt the own organization to breakthrough interdepartmental boundaries between silos, which currently obstruct the implementation of PSS. Moreover, this development poses challenges working with the (often short-lived) network of creative industry partners, which participate in the innovation/development phase for new services.

Although techniques for the field of experience design, product design and service design are promising, using these in practice for networks of users has proved difficult, because:

- methods typically have focused on the needs of singular target groups (e.g., restaurant owners), not the networks new PSS are aiming to understand and serve (restaurant + food supplier + personnel agency + financier + repair + cleaning);
- experience with the tools has been limited to academia and isolated departments in companies;
- established companies need to change their organizational structure and develop a roadmap to really cooperate with their customers' networks. SMEs in the Creative Industries are only just catching up on these techniques;
- no effective early-phase simulation tools for services are available (as there are for products or software), which reduces the effectiveness of conceptualization efforts. Especially the interaction-over-time dimension is difficult to simulate with current means.

The current work emphasizes the value of a human-centred design approach while developing a framework of methods, techniques, and tools that enables the conceptualization and communication of product-service systems. The framework and tools will comprise a methodology of: (i) understanding the needs, values, and ambitions of end-users in their networks; (ii) formulating a shared vision for a PSS proposition to fit and fill those needs, goals and motives, and (iii) developing and evaluating that vision iteratively into a context-driven PSS concept. Next to that it will (iv) provide a guideline for developing roadmaps for companies to implement such services. The current article reflects upon the construction of an initial framework based on a historical review of collected cases. The aim of the paper is to get insights why some PSS are more successful than others. What are success factors for leaving the old paradigm and to discover the benefits and challenges of implementing successful PSS for networked collaboration? We elaborately reviewed three cases in various workshops with academic and industry professionals having a background in various disciplines, but having a mutual interest in finding the answer why some PSS function much better than others do. Our current explorations are foundations of an initial framework for conceptualizing product service networks, which is described in Section 5.

3 Approach

In keeping with the stressed multidisciplinarity in PSS networks, we 'put our feet where our mouths lead' and operate as a PSS design network ourselves in the present research project. Although starting from a human-centred design perspective, the project team includes academic and industrial professionals from various disciplinary backgrounds among others such as industrial design, change management, software and service engineering, human-centred design, organisational development, business strategy, product development and service design and about 15-25 years of project experiences regarding product-service systems and/or networked collaboration. All participants are involved in all activities throughout the project enabling multidisciplinary discussions and enabling them (we expect) to look beyond traditional paradigms. The 4-year-project distinguishes 3 phases: 1) exploration, 2) design and evaluation, and 3) consolidation.

The first phase consists of a historical review and a first formulation of a conceptual framework. Completed case experiences of all parties are collected and analysed leading to a first framework

for conceptualization and implementation of PSS. This framework will be guiding the second phase: iterative design and evaluation in case studies. In this phase, the initial framework, tools and methods are iteratively developed. Three case studies are conducted in complementary fields with the industrial partners. Each case has a focus on developing PSS involving a PSS providing company (industrial partner) and a network of its users (SMEs, departments, citizens/consumers). Researchers and designers from both Delft University of Technology and the Design Academy Eindhoven design tools and techniques to support the exploration, conceptualization, and implementation process. During each case, several iterations are made of design and evaluation, leading to improvements in the PSS concept, improvements in the PSS design method, and improvements to the theoretical framework and tools. Throughout this phase, the evolving framework will be shared with the international academic and Dutch creative industry communities, and in design education. This also is a two-way process, serving dissemination and recalibration of the framework to optimally serve the needs of these audiences. After the case studies, in the third phase all findings are combined and consolidated. Figure 2 shows these phases and the referred outcomes.

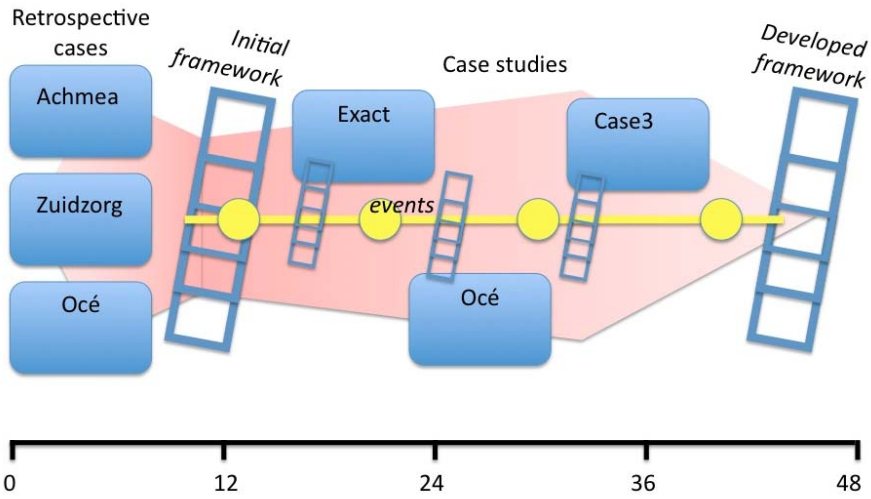

Figure 2: The project establishes a framework on the basis of retrospective cases and iterates this in a sequence of case studies.

At several levels, heterogeneous networks of actors play a part, requiring us to rethink existing thinking, tools, and methods, which are geared toward (homogeneous groups of) individual parties. Instead, we need tools to support using, providing, and developing PSS in collaborations. This provides new challenges for companies such as Océ (who moved from selling printers to supporting document management across complex organizations), Exact (who are moving from administrative software for a single SME to comprehensive business support, including relations between SMEs), and Achmea (who move from insuring individual clients from damage costs, to providing complete damage recovery through networks of SMEs). Non-profit organizations (e.g., Zuidzorg) are taking similar approaches while developing care systems across distance using ICT). In all these cases, multi-disciplinary networks are the key to both the 'result' (the product-service system itself) and its development (the PSS design process). In large companies and government, it requires crossing departmental boundaries. In SMEs, especially those involved in product-service development, innovation typically takes place in networks of agencies (e.g., STBY), rather than in a single agency; mainly because skills needed in product-service development are elaborate and may vary during the development process.

The needs of the product-service design sector are reflected in the current approach. In order to meet the objectives we need to collaborate with a complementary network of disciplines (design, user-centred methodology, organisational change management, and (interactive) simulation of service elements). The current approach therefore involved close interaction of the involved

parties in joining and confronting their experience, knowledge, and skills. This requires an iterative 'research-through-design' approach, during which both theory and application evolve in parallel. Moreover, it involves the fitting together of three quite distinct parties: academia (delivering methods and techniques), networks of SME, including design agencies (delivering innovation concepts, supported by partial simulations), and large industries, service providers, and government (which facilitate and form the backbone for new ways of working).

4 Cases: a historical review

In a historical review, we confronted and modelled experiences in both large-scale innovation in the financial services sector (4C-MG) and the modus operandi of small-scale multi-SME networks (STBY). These are combined with the existing knowledge on product and service development in two industrial cases, one starting from products and widening to product-service combinations (Océ technologies), one starting from software services, and widening to integrated and tangible PSS (Exact). During this historical review, all partners actively contributed in these workshops to ensure the findings fit into their respective disciplines. For this, several workshops were organized. The workshop format was similar; each workshop started with a summary of past experience in a case, and a discussion on the results of the preceding (videotaped and analysed) workshops. The visualisation of the current and emerging networks shown in Figure 1 was used as a starting point and to guide the debate on conceptualizing product service systems. During the interactive sessions participants were invited to put their thoughts and experiences on post-its. Then, post-its were clustered; grouping the post-its lead to deeper discussion and joined sense making. The first workshop session mainly explored experiences and knowledge of all partners and was helpful in building a shared language. In the next workshop the focus moved on to deeper analyses of the cases at the industry partners' premises. In a third workshop elements and ingredients for the initial framework were discussed. In the next sections findings from the three workshops are highlighted.

4.1 Workshop 1: historical case overview

Historical cases from among others Achmea, Exact, Oce Industries and Zuidzorg were presented and guiding the workshop sessions. The presented network model (see Figure 1) was used to explore and share experiences between the involved partners in a first meeting and was helpful in defining a shared language and mutual understanding among the partners. Interestingly, industrial partners sketched similar network models while introducing their case (see Figure 3).

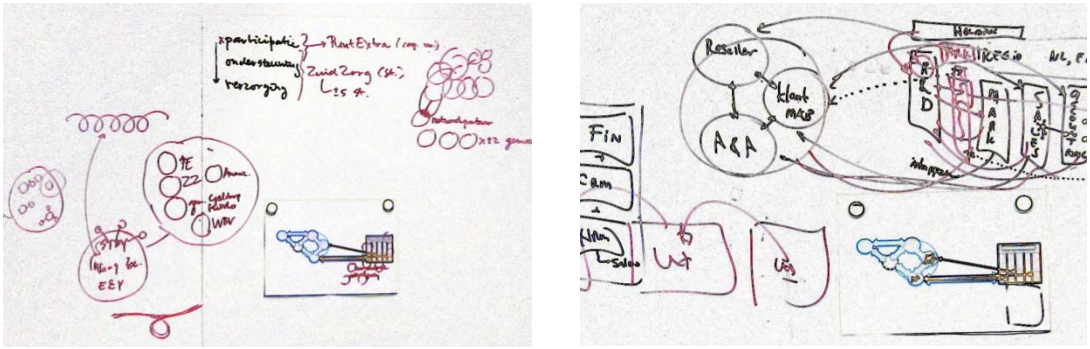

Figure 3: Sketches by industrial partners show their understanding of the networked nature of innovation.

The exploration of each case provided insights and understanding of the complexity of the service design ingredients. '*Though we offer services there is no experience in service innovation in our company'* and '*in different departments service design takes place but these departments do not collaborate'* one of the partners declared. Other striking remarks were that '*all managers*

should learn how to deploy clients' needs', '*too often the incentive is based on meeting individual targets'* and *'linking client networks has both social and commercial benefits'*.

Discussion and further explorations lead to the insight that it is not just about conceptualizing networks and changing the service providing companies' structure. Another striking outcome was the emphasis on transforming service organisations and sustainable benefits for society and economy. It was concluded that this requires a paradigm shift towards mutual cooperation, a balance between users' value and organisations' and service systems' value. This is in keeping with the pamphlet 'The journey to the Interface', in which Parker and Heapy (2006) stress a similar approach: the new paradigm is "*less about competition and contestability and more about closing the gap between what people want and need, and what service organisations do*".

4.2 Workshop 2: what do we want to learn in this project?

In the second workshop partners' ambitions and knowledge, and the experiences that partners are curious about, were explored. The differences in background of the participants were clearly illustrated by the topics that were covered. One of the academic partners brought forward that *'service bundling and orchestration should be part of the knowledge and skills (in those guiding the development process)'* and *'there is a need for a clear, phased approach for service innovation'*. He also highlighted the information infrastructure as enabling technology for service innovation (Tan et al., 2011), while the industry partners wondered '*how to measure value for users'* and *'how will the creative industry be taught how to deal with the Board of Directors"*?

Discussions, and sharing stories about partners' experiences and questions, lead to an overview of network domains and collaborations, relevant theories, methods and techniques and interesting aspects to question in the (retrospective) case studies which was helpful in refining the setup and theoretical perspective to be used for the case studies in the second phase of the project.

4.3 Workshop 3: exploring knowledge, skills and experience

The third workshop further explored upon the knowledge, skills and experience of the project partners by discussing the network domains and collaborations and findings from the previous workshops aiming to construct an initial framework.

Figure 4: Project partners exploring theory and skills in relation to the Product Service Networks.

A striking example of the third workshop addressed the collaboration between networks. The industrial partner involved in the Achmea (insurance) case and expert on network collaboration stressed an interesting direction in this network phenomenon: '*I am especially interested in the relations/collaboration between networks. Transformation starts when organisations understand the clients' networks. Sometimes people in these networks are of no interest for the organisation*

but of great interest for their immediate clients…. beyond traditional marketing', 'Keyword here is the balance in interests and values'.

It was agreed upon that the collaboration between networks should be emphasized in the remainder of our project. A main challenge seems to be deploying actual experiences of people as drivers for service transformations.

5 Discussion and Conclusions

As motivated in the introduction, the aim was to construct a framework of methods, techniques and tools enabling conceptualisation and communication of product-services combinations with end-users. Such a framework should make a clear link between knowledge (theory), skills (methods and tools) and practice (point of reference for practitioners as well as pointers towards applicability). Findings and insights from the workshop sessions were used to construct an initial framework (see Figure 4). The framework shows 3 fields illustrating the relevant networks and 4 overlapping fields illustrating the collaboration of the networks. These networks are labelled as Service Design Network, Service Organisation Network, and Service Experience Network.

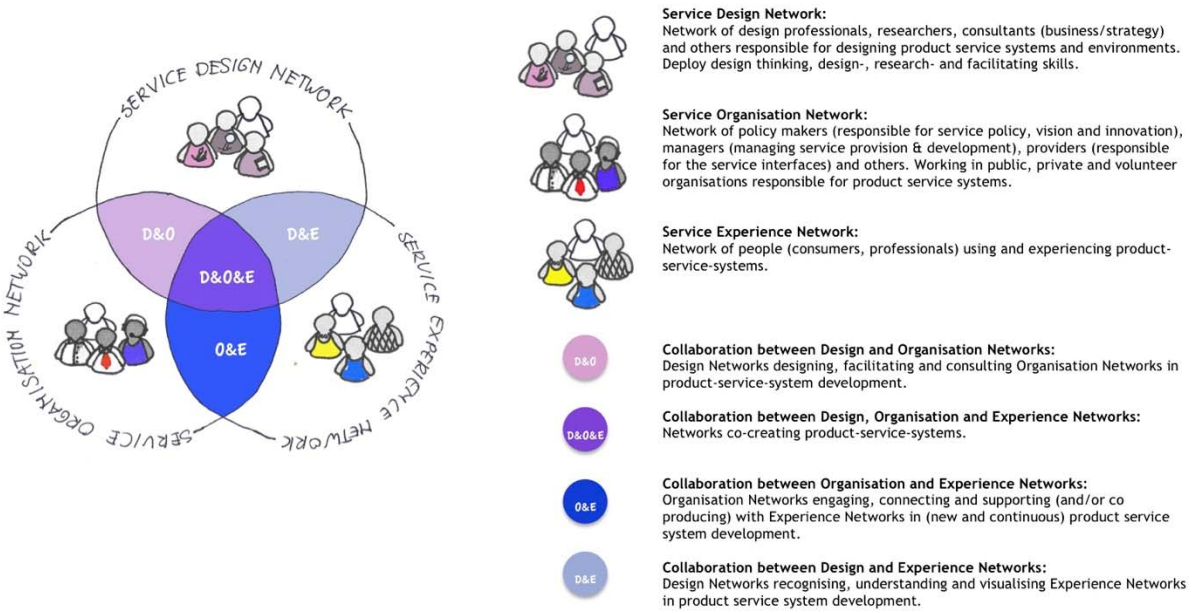

Figure 5: The initial Product Service Networks framework stresses the interactions on the boundaries of the networks.

A next step is to include appropriate methods, techniques and tools enabling conceptualisation and communication of product-services combinations with end-users for the three networks and for communication between those networks.

Service Design Network (upper circle in Figure 5): Industry partner STBY was recently involved in the development of a modest toolkit described in a basic book on service design (Stickdorn & Schneider, 2010). However, deeper knowledge and methods to multi-agent projects are still lacking. Best practices mainly come from design agencies and design disciplines working together on a single service design project, or from new players in the design network like the business strategists. Recent discussions in *Touchpoint Magazine* seem to be promising (Samalionis & Moed, 2009; Guldbrandsen & van Dijk, 2011).

The *Service Organisation Network* field covers knowledge on traditional collaboration in and between organisations. Although knowledge and skills on New Product Development (NPD) and human-centred design are widely covered the practice is troublesome. Stompff and colleagues (in press) show the complexity of collaborative NPD at Océ. Service development is even more

complex. Knowledge and skills are lacking for deploying actual experiences of people as drivers for service transformations.

The *Service Experience Network* covers practice of experiencing services and social networks. We use the term Experience rather that Service Use Network to go beyond the 'use' of services and include all touchpoints related to services and product-service combinations. Moreover, we aim to go beyond the 'user' of services and include all people influenced by the service.

The overlapping fields cover knowledge, skills and practice on human-centred design and collaboration between the disciplines. Although this topic is on many (multidisciplinary) agendas in the field on user-driven innovation and competitive advantages, a review of Mulder and Stappers (2009) shows deeper understanding of co-creating as well as applying these skills in practise is still lacking. Furthermore, knowledge and skills for deeper understanding and communicating these among networks and disciplines is key.

A first iteration of the framework has been established by reviewing best practices in lead cases in product and service design. The current version is guiding the retrospective case studies are formulated. In the next phase, new tools (with an emphasis on new methods of simulating PSS) are developed and tested within the upcoming case studies. This framework aims to guide and tune existing human-centred design tools (e.g., participatory design and contextmapping, see Sleeswijk Visser et al, 2005) towards product-service development, and aims to establish a technological base for *product-service design thinking*, which can be applied in the context of Product Service Networks.

Acknowledgement

This work is part of the 'Creative Industry Research Programme' (CRISP) granted by a FES subsidy. We thank all partners involved in the CRISP 101 project; industrial partners are 4C-MG, STBY, Exact, Océ industries, and Zuidzorg. Academic professionals are from the Design Academy Eindhoven as well as the Delft University of Technology, both the Faculty of Industrial Design Engineering and the Faculty of Technology, Policy and Management. We wish to acknowledge our gratitude and appreciation to Jo Geraedts, Toine Hurkmans, Marten Jansen, Behzad Rezaei, Bas Raijmakers, Yao-hua Tan, Klaas Jan Wierda, who actively contributed to the development of the current framework and concepts presented in the current contribution.

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