Highlights in

service research

VTT

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Research on services – a path to increased productivity

Services have rapidly become a central topic of both concern and interest in research and business. Both the public and the private sector are facing increasing demand, cost, and quality challenges in their attempts to deliver services effectively and efficiently. The changing structure of the population, growing competition and mobility through globalisation, and new opportunities for services' digitalisation are among the factors forcing us to re-knit the web of services needed for enabling a sustainable operation environment for companies, providing citizens with adequate conditions for good quality of life, and protecting our environment from overload caused by human activity.

Service research has been gradually evolving at VTT Technical Research Centre of Finland. At first, this was in connection with traditional engineering disciplines, but recent years have seen service research targeting service businesses more broadly, along with public services. In 2012, the total volume of research projects focusing primarily on services has reached an annual level of several million euros. In parallel with this development, service research has become a highly visible and important part of R&D projects tackling, for example, research problems of information and communication technology, the built environment, and security. This means that it is not possible to determine the actual volume of service research accurately, as it intertwines with research agendas from several other disciplines and domains.

With its systematic efforts to build service research competencies, VTT has become one of the central actors in service research and development in Finland and is also becoming well-known at the international level. In particular, our contributions to the following research approaches have demonstrated both practical value, through industrial interest and applicability, and scientific value, through recognition in the scientific community:

- applying service-dominant logic (SDL) in service innovation and fostering both servitisation and service thinking in business transformation
- combining the goals of user-centricity and efficient service production, including development of co-production in service practice, for fostering of mutual understanding among service actors
- taking advantage of information and communication technology's possibilities in digital services.

This collection of highlights of VTT's service research illustrates the versatility of service research. Service research has become a theme under which synthesis of traditionally separate research domains thrives. These range from industrial manufacturing to safety and security, from information and communication technologies to the building sector, and from media studies to public-sector innovations. Service research brings researchers from many disciplines together to discuss innovation, design, development, and adop-

tion of services in diverse domains, enabled by emerging technological breakthroughs.

In 2012, VTT had the pleasure of hosting two prominent researchers in the field of service science: Professor Stephen Vargo, from the University of Hawaii, and Professor Luis Rubalcaba, of Spain's University of Alcalá. In this Research Highlights, Professor Vargo discusses his research on service-dominant logic that also has implications for reframing the perspective of service innovation. Professor Rubalcaba continues his collaboration with VTT through his FiDiPro professorship, and in this issue of Research Highlights he discusses his ongoing work on service and social innovation.

In the domain of industrial manufacturing, some highlights of our research include exploring the role of service integrators, service offerings, the customer relationship, network management, and business development in a B-to-B context. Also examined are transformation toward service thinking and servitisation in industrial manufacturing companies. In the safety and security domain, analysis of customers' purchase motivations and liability issues in design services aimed at ensuring safety of engineering processes are presented. Digitalisation of services is discussed through research into the role of emerging information and communication technologies in the global service phenomenon and methodological exploration of value assessment for new digital services. Examples of service digitalisation are emphasised: how augmented-reality technologies can enhance services provided by interior designers, the ways in which digitalisation affects media markets, and challenges faced by health-care organisations in the creation of new markets for services that utilise information and communication technology. Value creation is highlighted also in the realm of building research, wherein value creation is explored in the context of procurement processes. Another topical aspect of the building domain is energy-related renovation services, explored here from the standpoint of emerging business models.

Service research as a scientific discipline can provide researchers of different background with a common framework and language to discuss research through, for example, exploration of value creation, service business development, and service dominant logic. The last part of our summary of research highlights provides examples of such generic approaches to services as can be applied across a wide range of domains. The discussion of these examples addresses service innovation, approaches to technology design, a tool kit for service design, and systems modelling.

We believe that research can contribute strongly to enhancement of organisations' capabilities of revising their service innovation and their production structures and offerings, to the design of services that are efficient in a modern world, and to creation of new technological resources that can be used to deliver better services for all. With this publication, we illustrate VTT's efforts toward these goals. We hope you will enjoy reading it and will join us in making a future of better services!

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Service-dominant logic reframes (service) innovation

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A little less than 10 years ago, Bob Lusch and I published an article on what is now called *"service-dominant (S-D) logic"* in the *Journal of Marketing* [1]. Since then, this article has been cited over 4,000 times (Google Scholar) and has motived hundreds of S-D-logic-focused articles, as well as over a dozen journal special issues/sections and a similar number of focused conferences. The purpose of this short commentary is to highlight how this dynamically developing literature stream, reframes the concept of innovation.

Service Dominant Logic

In the original S-D logic article [1], and its most significant refinement and extension [2], we tried to capture the essence of S-D logic in ten foundational premises (FPs). Since then, we have realised that some of the original FPs could be derived from others and, thus, have identified four FPs as particularly foundational, essentially the axioms of S-D logic (see Table 1).

FP1, which says that service, defined as the use of one's competences (knowledge and skills) for the benefit of another, is the basis of exchange, and is of course the heart of S-D logic. The FP implies that in economic exchange, as well as social exchange in general, fundamentally, *service is exchanged for service*; when *goods* are involved, they are best understood as *service-delivery mechanisms*. It is important to emphasize that this "service" (singular), a process, should not be confused with "services," (usually plural), usually intended to denote a unit of (intangible) output, which we associate with the traditional goods-dominant (G-D) logic.

FP6 establishes that *value is always co-created*. The original scope for this axiom was the micro level, typically involving a firm and a customer and was intended to shift the primary locus of value creation to the later – that is, from the primacy of *value-in-exchange*, toward the primacy of *value-in-use*. More recently, we have used to term *value-in-context* to capture the notion that value must be understood in the context of the beneficiary's world. However, it has become increasingly clear that, viewed from a meso and macro level [3], the collaborative nature of value creation becomes even more apparent. That is, value co-creation through service-for-service exchange (and as will be discussed, resources integration) is at the very heart of society [4].

One other comment on value co-creation is important here. We distinguish between co-production and the co-creation of value. *Co-production* refers to the customer's participation in the creation of the value-proposition (the firms offering), such as through co-design, customer-assembly, self-service, etc. Co-production is thus relatively optional and its advisability depends on a host of firm and customer conditions. This is different from *co-creation of value*, which is intended to capture the *essential nature of value creation*: it always involves the beneficiary's participation (through use, integration with other resources, etc,) in some manner.

Table 1. The Axioms of S-D Logic.

	Premise	Explanation/Justification
FP1	Service is the fundamental basis of excange	The application of operant resources (knowledge skills), "service", is the basis of all exchange. Service is exchanged for service.
FP6	The customer is always a co-creator of value	Implies value creation is interactional
FP9	All economic and social actors are resource integrators	Implies the contex of value creation is networks of networks (resource-integrators).
FP10	Value is always uniquely and phenomenological determined by the beneficiary	Value is idiosyncratic, experienta, contextual, and meaning laden.

FP9, identifies the other core activity (besides service provision) of economic (and social) actors: *resource integration*. It sets the stage for thinking about the mechanics and the networked nature of value co-creation, as well as the process through which the resources for service provision are created, the integration of resources, resources from various market-facing, public, and private sources. Importantly, this resource-integration does not just apply to the actor typically referred to as a "producer" (e.g., the firm) in G-D logic, but also, and even more importantly, to the actor, usually referred to as the "consumer" or the "customer".

FP9 thus also sets the stage for the explication of the *contextual and unique nature of value realisation and value determination* and, thus, for FP10, the last axiom, which states that value is always uniquely and phenomenologically determined by the beneficiary. Here "phenomenological" is intended to capture the *experiential* nature of value. That is, value must be understood in terms of the holistic combination of resources that lead to it, in the context of other (potential) resources. It is thus always unique to a single actor and, it follows, can only be determined by that actor, or at least with the actor as the central referent.

Innovation from a service-driven perspective

Traditional conceptions of innovation (see Table 2) have been based on G-D logic and have focused on manufacturing models of producing better products and creating more efficient corporate processes. This focus on the technological advancements of goods and firm efficiencies has dominated the debate and deliberation of both academic and practitioner innovation experts. These focus areas have been viewed as foundational for the goal of corporate producers to gain higher unit profit and market share.

Similarly, initial services innovation approaches (see Table 2) also focused on these manufacturing principles of innovation, based on the idea that service innovations are fundamentally similar to manufacturing innovations [5]. Miles [6], for example, describes how the fast food industry often uses a manufacturing approach to increase the standardisation and quality of its service. Since goods and services were both viewed through a manufacturing lens, atten-

Table 2. Views on Innovation.

Goods Innovation	• Making better output (goods)
	    • New technology
	    • Efficient processes
	• Purpose: Increase market share

"Services" Innovation	• Making better output ("services") • Apply goods innovation principles, adjusted for "IHIP" deficiencies

Service Innovation	• Providing input into customers'/actors' value-creation processes
	    • Link firm-available resources to peoples' purposes
	    • Effective solutions
	• Purpose: "Owning" the market -- market shaping
	• Deinstitutionalisation and reinstitutionalisation

tion turned to the distinctive characteristics of "services" with models of innovation based on the necessary adjustments to goods innovation, given these differences. These characteristic differences are sometimes referred to as the "IHIP" characteristics of services – intangibility, heterogeneity, inseparability of production and consumption, and perishability [7]. In spite of the minor adjustments for the IHIP characteristics, services innovation continued to be consistent with G-D logic thought – finding ways to develop better outputs ("services").

The emergence of S-D logic and similar service-driven approaches (see Table 2), has it made increasingly apparent that "service"-based models of value creation and innovation might not only provide more meaningful of service innovation but might also actually contribute to the understanding of innovation in general and also provide insight into market formation and re-formation [8]. This emerging approach calls for a unified model of innovation, including innovation involving goods, based on the overarching qualities of service. Coombs and Miles [6, p. 100] argue "we are moving away from a model of innovation that puts all the emphasis on artifacts and technological innovation; and toward a model which sees innovation in

terms of changes in market relationships but with major artifact and technological dimensions." They also suggest that this movement is "liable to lead to nothing less than a widening or even complete reinterpretation of the concept [of innovation] itself."

This view of innovation suggests that technological advancements are embedded within networks of market relationships, and that a deeper understanding of market relationships is needed in order to better understand innovate.

Importantly, a service-centered approach to innovation broadens the process of value creation beyond a firm's operation activities to include the active participation of customers and other stakeholders, through co-creation (FP6). This collaborative view points "away from the fallacy of the conceptualisation of the linear, sequential creation, flow and destruction of value and toward the existence of a much more complex and dynamic system of actors that relationally co-create value and, at the same time, jointly provide the context through which "value" gains its collective and individual assessment (FP10) [9]". That is, the unit of analysis moves from the firm, customer, or even the firm-customer dyad, to the service ecosystem(s) of which they are a part. The importance of

this ecosystems perspective was recently acknowledged by Stephen Elop, the CEO of Nokia: "The battle of devices has now become a war of ecosystems… developers, applications, ecommerce, advertising, search, social applications, location-based services, [etc.]… Our competitors aren't taking our market share with devices; they are taking our market share with an entire ecosystem."

From an S-D logic perspective, innovation becomes finding novel and useful ways of enhancing their own value co-crating activities by participating in ecosystems through resource integration and service provision to assist other actors in their own value-co-creation, also through resource integration and service provision. This view of innovation and value co-creation through resource integration and service-for-service exchange in service ecosystems is proving to be a fertile area of for meaningful, innovative research on innovation. Additional information is available through sdlogic.net.

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Service and social innovations – policy needs and potential impacts

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Introduction

The SOPPI project addresses the interaction between service innovation and social innovation. Service innovation and social innovation are two research and policy areas that have seldom been approached as connected. Both researchers and policymakers have dealt with the two topics in a separate or parallel manner. This project represents the first attempt to explore the two topics via a holistic approach. On the one hand, service innovation is often understood as a new way of doing business that has the provision of new or improved services as its main target. But service innovation is much more than a way of bringing improvement to private enterprise. Service innovation can be social to a large extent: in the provision of public and social services but also within provision of private services. Social innovation can be considered a way of transforming all dimensions of service innovation we are accustomed to dealing with: i) innovation in service-related sectors, ii) service innovation in businesses, iii) innovation through services, and iv) service-innovation networks. Social innovation can transform each of these four traditional dimensions, as in the case of i) getting patients involved in a health innovation, ii) having clients and organisations involved in service innovation promoted by a car manufacturing company, iii) having various knowledge-intensive services offering multi-partner alliances to cope with a particular logistics problem affecting distribution operations, or iv) transforming traditional public–private innovation networks (PPP oper-

ations) into truly innovation-oriented networks when third-sector agents are involved also, not only public and private agents.

At the same time, it is the common understanding that social innovation is a part of innovation related to the third sector, charities, and social entrepreneurship. This is only partly true. Social innovation is much more than a way of improving social activities – it may represent a way of innovating in any part of the economy that can have services at its heart. We can identify it in all of the examples mentioned in previous paragraphs just as we can identify service innovation in many of the social initiatives promoted by purely social and third-sector organisations. Service innovation is necessary for making social innovation effective. Therefore, social innovation is linked to service innovation, and vice versa.

Why have service innovation and social innovation come together?

Social–service integration can be considered a result of a natural process in which service innovation becomes a social issue since services are defined in certain levels of co-production. Basic services can stem from co-production between one provider and one client (person, firm, or other organisation), but the more complex the society is, the more services it needs and the more agents can be involved in the service co-production. Bilateral relationships in services tend to be transformed into more and more multilateral and social forms in a modern society characterised by globalisation and ICT. Current societies are

showing a number and depth of interactions between diverse individuals and communities never seen before. Social communities on the Web are one example. Social interactions are leading to new ways of life and new services, with new service demands and service provision. Service innovation is becoming social, given the 'socialisation' of service co-production.

The social dimension of service co-production allows citizens and organisations to play a major role in addressing new societal challenges. The societal challenges in the areas of health and ageing of the population, education and employment, sustainability and natural resources, and transport and mobility, to take a few examples, are huge, and innovation is needed if we are to cope with them. The complexity and severity of the problems require co-production in which firms, users, public administration, and the third sector all can contribute to seeking innovative solutions and improved welfare and growth. The various agents in society can be co-responsible for better innovation performance that leads to higher standards of living. Innovation can no longer be the result of work by an isolated group of researchers at a firm or public institution. Traditional R&D will always have its place and an essential role, but the demand for innovation today is to be largely social and service-oriented.

Research into both topics can be very useful in development of new innovation policies. There are increasing societal demands for citizens and organisations to be more involved in the decisions made by policymakers, particularly in innovation-related actions. Policymakers may address social issues via service-innovation policies and may also promote service innovation in policies oriented to social issues.

What is and what is not social innovation?

There is no common agreement yet on what social innovation is. A quite heuristic defini-

tion given by the European Commission in 2010 (BEPA Report) proposes that social innovation is innovation that is social in/by its means and its ends, The content might be the same for social innovation and other types of innovations, but the nature is different. Social innovation refers to new activities, with a social goal; new actors, representing society; and new ways of doing – the social actors are truly involved. Thus, social innovation is not merely innovation initiated by the third sector or a social organisation. Social innovation can also be promoted by private firms or by public administration. Social innovation can be bottom-up or top-down.

At business level, some may argue that social innovation is what is already happening with the open innovation and user-driven innovation paradigm. Social innovation would involve clients' involvement or engagement in the innovation strategy. However, this is not true. For business, social innovation is not just another name for open innovation. This is true for several reasons – firstly, because social innovation is not about clients' engagement and markets. The open and user-driven innovation models are business-oriented, while social innovation is not. Social-innovation goals are not primarily short-term goals of business and profits. Profits are compatible with social innovation, but their timing may be different from that in other innovation processes. Besides, the role of organisations, including not-for-profit institutions, is important too. Social innovation is not only about firms and clients. It is also about the participation and active involvement of all relevant actors in society. However, we have to be careful not to define social innovations as part of the CSR programmes. Social innovation may integrate actions under CRS, but it is supposed to be linked to the core activity of firms. From a certain perspective, social innovation is the integration of the CSR social perspective into the firm's core innovation areas without loss of the profitability goal in the medium and long term. Another important distinction between
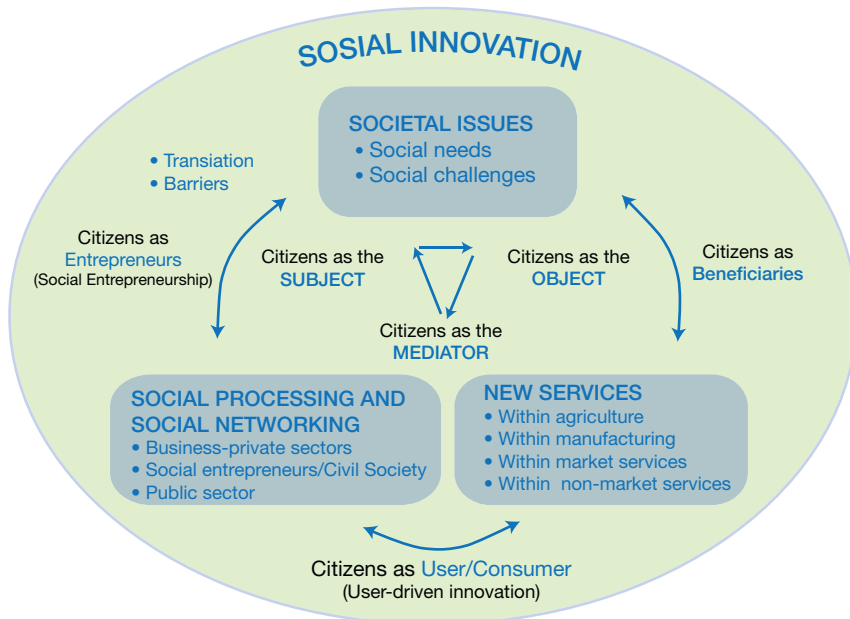
Figure 1. Services in the social innovation context.

open innovation and social innovation can be identified in the type of innovation produced: it is often product-oriented and technological in the case of open innovation, while in the case of social innovation it can be intangible, non-technological, and service innovation. These are more linked to systemic innovations. A final distinction may be drawn with reference to IPRs, since social innovation produces open, public knowledge in large amounts, in a contrast to the strict IP management (with a protection-oriented approach) found in many open innovation strategies.

The role of citizens and organisations in social innovation

The SOPPI project focuses on the role of citizens and organisations in social innovation. This role is threefold: as entrepreneurs (e.g., in social entrepreneurship); as beneficiaries (receiving the innovation output for development); and, in between, as users or consumers (participating in the social processing and in the production of new or improved services). In this sense, citizens (and organisations) are

the subject, the object, and the mediators of innovations. Thus, we can posit a relationship between social innovation and service innovation as depicted in the following diagram (Figure 1).

Key research issues

Within the project, many things could be placed on the research agenda. The next figure (Figure 2) depicts the types of key research dimensions to be explored, using the example of public services. Social innovation in the public sector is regarded as a result of four forces: i) new demands, social needs, and societal challenges; ii) the co-creating and diffusion done for all agents participating in the innovation processes; iii) the empowerment of citizens, organisations, and civil servants that should accompany the innovation process; and, finally, iv) public-sector resources, capabilities, and constraints. For solid understanding of public-sector social innovation, one must address all of these dimensions. Once the framework is prepared, impact analysis should cover both the general impact on
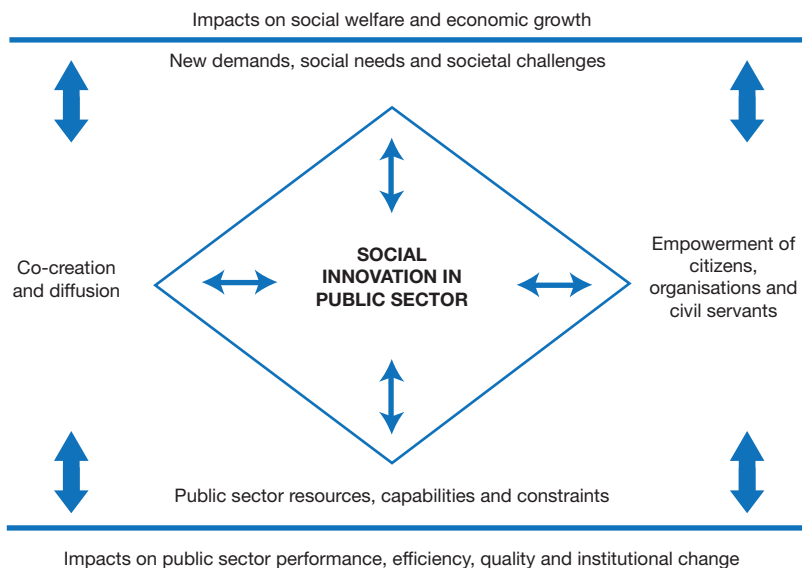
Impacts on social welfare and economic growth

New demands, social needs and societal challenges

Co-creation and diffusion

SOCIAL INNOVATION IN PUBLIC SECTOR

Empowerment of citizens, organisations and civil servants

Public sector resources, capabilities and constraints

Impacts on public sector performance, efficiency, quality and institutional change

Figure 2. CRISP project handout, from Rubalcaba and Windrum (2011), mimeo.

social welfare and economic growth and the impacts on public-sector performance, efficiency, quality, and institutional change.

These areas of research for social innovation in public services can be adapted to other types of private or private–public innovations. In any case, there is a need for research into the process, creation, and implementation of social innovations (in which the collective creation of knowledge is an important issue alongside the empowerment one and the formation of alliances and networks among different agents) and into the sustainability and replication of the successful cases (the latter being closely related to the entrepreneurial fit and social fit in the innovation framework and agents, to the life cycle of social networks, and to the issues of scaling up and dissemination).

At policy level too, there are a number of important research issues. One is the inclusion of social innovation and the innovation systems, and how they match each other (which is linked to the central role of networks in social innovations, the complexity of social and system innovations, and the ongoing change in the intervention strategies of public

management). Another area for research may involve the policy rationale for social-innovation policies for reshaping in cases of market and system failure, as already demonstrated for service-innovation policies. Finally, there is a need to think about the right strategy between creation of new instruments and the adaptation of existing ones to take into account the interlinkage between services and social innovations. With any of the possibilities, policy measures and governance structures that support their creation and implementation must be researched.

Concrete objectives of SOPPI

Within this research framework, SOPPI proposes to focus on these objectives:

1. to examine the forms of social innovation and their manifestation in new services
2. to map the actors involved and investigate their roles in triggering, intermediating, co ordinating, resourcing, supporting, and sustaining social innovation
3. to investigate the role of the policies and innovation-process contexts, along with the barriers and supporting factors in

these contexts (resources, policy initiatives, IP matters, regulation, leadership, competing interests, and scaling mechanisms)

4. to investigate the extent and role of co-innovation with citizens/communities, and the mechanisms via which the engagement and interaction are operationalised

5. to assess the benefits, outcomes, impacts, and sustainability of social and system innovations by using a multi-criteria framework that includes job creation, contribution to well-being, financial viability, accessibility, and other elements

6. to explore future developments of social and system innovations

7. to answer the question of 'what works' via the analysis of successful and less successful cases.

Organisation of the project

The SOPPI project is organised into several WPs, ranging from more conceptual-analytical ones to the more empirical, based on case studies. The results lead to various policy recommendations. The project is led by Professor Marja Toivonen at VTT and has been organised under a FiDiPro scheme in which I am honoured to work as the distinguished professor participating in the project. This project, funded by Tekes, started in 2012 and will continue until 2015.

Generic approaches

Accelerating innovation with service dominant logic

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Introduction

In recent decades, innovation has been considered a crucial factor in the fostering of business growth and societal welfare. This emphasis is linked to the increasing rate of change and the significance of knowledge in modern economies. At the beginning of the 'knowledge economy' discussion in the 1990s, strengthening the knowledge base was seen as a central task. Today, learning is the core aim: what matters is not so much the knowledge possessed by agents and organisations at a certain point in time as the capability of rapid learning. This focus brings new knowledge and innovation to the fore – the knowledge economy is fundamentally an innovation driven economy [1].

On the other hand, businesses, other organisations, and policymakers face many challenges when they implement the innovation-driven view. Slowness and lack of radical thoughts are among the most typical concerns. Several researchers have linked these problems to overly narrow, science based thoughts about the nature of innovation and suggested that a more efficient approach can be achieved when innovation is seen as intertwined and co-evolving with practical activities. 'Learning-by-doing', 'learning-by-using', and 'learning-by-interacting' have been highlighted as essential in the emergence of innovations [2]. This 'broad view of innovation' – meaning in many respects a return to the original theory of Schumpeter (1934) – has been influential among innovation scholars, but less among practitioners. One apparent bottleneck is the lack of such alternative innovation models as would provide a credible alternative to the process model in which innovations are pursued on the basis of in-house R&D activities.

We propose that one approach for addressing these challenges is to analyse how service-dominant logic (SDL) contributes to the building of an alternative innovation model. We have selected this approach as our starting point for four reasons. First, it is applicable in all kinds of companies and other organisations, in both manufacturing and service sectors. Second, it summarises several approaches that have pursued a broader perspective outside the dyad of the producer and the customer. Third, it is in line with the broad view of innovation. Fourth, it fosters a radically new way of thinking about the principles of economic activity. From the standpoint of innovation, the core benefit of SDL is that it focuses on complex and dynamic systems of actors that relationally co-create value and, at the same time, jointly provide the context through which 'value' gains its collective and individual assessment [3].

Starting points for more effective models

Creation of shared experience

Traditional innovation models are heavily based on the idea of parallel stages and the separation of the front end. This is problematic, because of the nature of innovation as *a phenomenon whose end result is not known beforehand*. Engvall et al. [4] point out that

stage-based models have concentrated on the systematisation of the form of the innovation process but say very little about the content. However, it is precisely the content that is the main problem: the idea involved is still immature and difficult to express in words. Constructing a plan for something that is not well known and involves abundantly tacit knowledge is not a reasonable approach. Much more effective is a strategy enabling *the creation of shared experience of the object to be developed.*

Creation of shared experience means that *planning and implementation are merged* to some extent. Several researchers have questioned the basic idea of stage models that planning always occurs first and is followed some time later by implementation. Eisenhardt and Tabrizi [5] suggest *experiential innovation models*, which assume a process relying on real-time experience. They consider the acceleration of innovation a particular benefit of this approach: rapidly building intuition and flexibility are essential on the uncertain path through shifting markets and technologies.

Our own empirical studies indicate that the merging of planning and implementation is typical in KIBS, as these companies bring new ideas to the markets very rapidly after their emergence and continue the development hand in hand with execution, or the business behaviour changes first and the novelty included is recognised and conceptualised only afterwards. Two characteristics of KIBS encourage this approach: co-production with clients and the complex issues that KIBS as expert companies handle. Accordingly, planning cannot provide the details needed in implementation; instead, innovative solutions are sought in a mutual learning process with clients. [6]

Focus on the user

Traditionally, users have been considered important as the source of needs-based information, and still today companies typically interpret user-orientation as the gathering and storing of user information. The next step is emphasis on the elaboration of user information into user understanding, which means that this information is structured, interpreted, and shared within the provider organisation to make it applicable and link it to the organisational strategy [7]. The actual *involvement of users* is an emerging trend. Acceleration of the innovation process has been one motive behind it: direct interaction enables the application of user information more rapidly than do market surveys. Most often user involvement has, however, been linked to a stage-based approach, which means that the provider-centric view continues to dominate. The central question has been who should be involved in each of the stages of the innovation process, and when and how. There are approaches that highlight interaction with users in the front end; other approaches emphasise the criticality and complexity of the transition from the innovation process to implementation [8, 9].

The central position of interactive learning in innovation implies a profound change in understanding of users' role. The creation of shared experience of the object to be developed requires that *both the users and the providers be understood as innovators*. Work done by von Hippel [e.g., 10, 11] over three decades has paved the way for this perspective. According to him, users provide more than merely an idea for a new product. They may supply an innovating firm with the identification of a problem or need, product-related specifications, or even a complete product design.

Innovations with value

Focus on use value – and, more broadly, stakeholder value – is at the core of service-dominant logic (SDL). Value-based approaches are, however, coming to the fore more generally and also within the frameworks that apply a provider-centric perspective. Many of these approaches (e.g., supply-chain management) are influential in today's business and represent the way in which companies typically

have taken steps toward user-orientation. Instead of 'user', the core concept is usually 'customer' or 'client'.

According to the proponents of client-centric strategies, the main question that companies should set when developing their business is that of what new value can be offered to clients and how this can be done. Outperforming the competition and profitable growth are a result of succeeding with these *value offerings*. If a company concentrates only on how to match or beat competitors, it easily restricts itself to the conventional context, which the competitors too know and in which all seek to obtain competitive advantage by means of minor improvements. A strategy based on value offerings considerably extends the creative scope of individual companies and provides them with a wide range of options even irrespective of the general situation in their industry. [12, 13]

Application of dynamic modelling tools

System dynamic modelling is well suited to our research framework for several reasons. First, the *systemic perspective* plays a central role in our new approach. Second, dynamic modelling focuses on identifying *complex cause-and-effect relationships*, which are characteristic of innovation. Third, dynamic modelling is a useful tool in that type of theoretical analysis that is our aim: *building of an emergent theory.*

System dynamics models are formal and structural models incorporating hypotheses about causal connections between phenomena. The behaviour of a particular system is explained endogenously as a manifestation of the structure of the system. The emphasis is on understanding the dynamics of the system. The dynamics are a result of interactions that constitute feedback loops between parts of the system. There are two fundamental kinds of feedback loops: positive (i.e., reinforcing) and negative (i.e., balancing). There can also be time delays in the interactions, which exert influence on the system's behaviour in

various ways. Another typical characteristic of dynamic systems is nonlinearity.

Simulation included in dynamic modelling can illustrate in non-intuitive ways the elements of emergent theory – i.e., theory that has only a few constructs and related propositions with modest empirical or analytic grounding. Situations wherein there are several poorly understood longitudinal interactions between processes or nonlinearities (time delays, feedback loops, and thresholds) are especially suitable for simulation. It can be difficult to develop an emergent theory in these situations by using other techniques [14].

Conclusion

SDL contributes in several ways to the deepening of our view of innovation and to the search for further rapid-innovation models. It is in line with the so-called *broad view on innovation*, which highlights the social and systemic features of innovation and the recursive and complex nature of the processes in which innovations emerge [15–17]. Also SDL points away from linear, sequential views – which tend to be based on the dyad of provider and customer – toward interactive and systemic network-orientation. At the core of our approach is a shift from a product- and R&D centric view to *an actor-, resource-, and system-centric view.* The focus is on dynamic systems of multiple actors (both organisations and individuals) that co-create value and new markets. Products and services are temporal cross-sections in these value-creation systems – important but not sufficient as the target of development.

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Life-based design to ensure that technology is fit for life

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New information and communications technology (ICT) issues, such as embeddedness and mobility, are changing our relationship to the environment, to other people, and even with ourselves. Using ICT is seen as an indispensable grammar of modern life [20–21]. Without it, one cannot fully participate in the society, plan one's life, or express oneself.

Citizens of modern society face, with increasing speed, rapid technical development and growth of complexity in their environment. Nearly all public services employ information technology. At the same time, the structure of consumption has changed and the goods have become increasingly complex. ICT-literacy is needed in education, work, and hobbies, and even social contacts are organised more and more through information and communication technologies. Unfortunately, this development is not always a positive one; for example, many older people face difficulties and anxiety when trying to adopt new technologies [4, 13, 16–17]. This is, in most cases, due to failure in the design, specifically inability of the ICT design to consider everyday life properly, and the goals that people have in it.

People have diverse expectations of the emerging technologies. These expectations originate in several forms of life and the needs associated with them in different life settings [7–8, 19]. For example, ageing people's consciousness of their well-being and health has increased. In growing numbers, older adults take care of their own fitness and health [5], and technology is welcomed as a tool for reaching this goal. However, ageing people experience technology and adapt it in a manner that many times contradicts that of the young. Accordingly, technology that is designed from the perspectives of young users is often found to be somehow complex, obscure, confusing, and not aesthetically pleasing by older adults. In the worst case, it is stigmatising and violates privacy [12], and it does not meet the needs of older people at an emotional level. In development of the information society, one should consider how the various needs and expectations of all generations, who differ in background, could best be met. In the discussion that follows, we examine design of the information society from the angle of Life-Based Design, including ethical design and co-design.

Life-based design – designing from facts and values of life

Traditionally, the information society is designed from the standpoint of promoting technical development in society, and the core user challenge is associated mainly with usability [14]. A more advanced type of design thinking is the Life-Based Design (LBD) approach [9, 11], which emphasises a multidimensional and holistic understanding of human life as the foundation of the design. It aims to consider the development of the information society from the perspective of humans instead of technology and hence replace prioritisation of technical intuitions about the future information society with well-considered social, philosophical, psychological, and humanis-

tic facts of people's everyday life [9, 18]. The main aim is to increase citizens' quality of life. Here, technology is considered a good tool for reaching this goal [3, 15].

To guarantee that the technological change in the structures of our everyday life is positive, it is necessary to ask and answer design questions in terms of multidisciplinary conceptualisation of human life. Design practice that synthesises human life sciences and the scientific approaches derived therefrom into a working whole is needed in solving design problems. With LBD, the focus is shifted from technical artefacts and systems to designing good life; considering how technology is intended to support and advance people's various forms of life and thus enhance quality of life. The main question is what is needed for improved quality of life rather than how technologies should be used. The objective is design that meets the demands of ageing people, and the design outcomes can be expected to support well-being, facilitate participation in society, promote social relationships, prevent loneliness, and support meaningful roles, to mention but a few elements.

LBD has two essential impacts on design of products and services. Firstly, the concepts within LBD can be used to open up design issues, in a search for clarity of problems and solutions. Secondly, they can be used also for explanatory design, in determining why some solution for the design is better than some other and why it should be implemented. There are several phases in LBD, which guide the designers' thinking through the design process [11]. The process begins with thorough analysis of a particular form of life, which paves the way for concept design. It ends with clarification of how new technologies can be incorporated, as working innovations, in contexts of everyday life. From angles such as that of active ageing in a modern society, the most significant phase in the process is fit-for-life design. It examines the benefit and meaningfulness that users can receive from the solutions developed and the impact the solutions have on quality of life. It also clarifies from whose perspective and through what kinds of choices it may be possible to generate an increase in goodness and develop products with greater value in improving quality of life. This phase is followed by innovation design, which defines a procedure for creating usage cultures and exporting the outcome to general use.

LBD is a general method of deriving goals for technology design. It can be used for designing technology for any areas of life. Investigating different elements of a specific form of life can clarify requirements for the intended technology from biological, psychological, and socio-cultural perspectives. All of these must be considered if one is to form a holistic understanding of people's needs and preferences. For example, designing for older people to combat loneliness presupposes – along with the existence of the relevant technology – a socio-cultural and psychological understanding of this phenomenon as well as comprehension of the biological process of ageing [10]. By studying the influence of loneliness on people's everyday life holistically, one can design focused technologies for lonely older people, those close to them, and care takers, and thus may become able to improve the quality of people's life. Design of such service concepts presupposes analysis of the forms of life associated with biological, socio-cultural, and psychological ageing (see Figure 1).

Ethical design

Life-Based Design illustrates the logic for enhancing users' quality of life. Analysis of socio-cultural attributes of forms of life thus includes consideration of the ethics problems that may be created, transformed, or exacerbated by technology. Here the main question pertains to the interpretation of 'good'. What can be considered good, from whose perspective, and what kinds of choices generate an increase in goodness? In any event, inter-
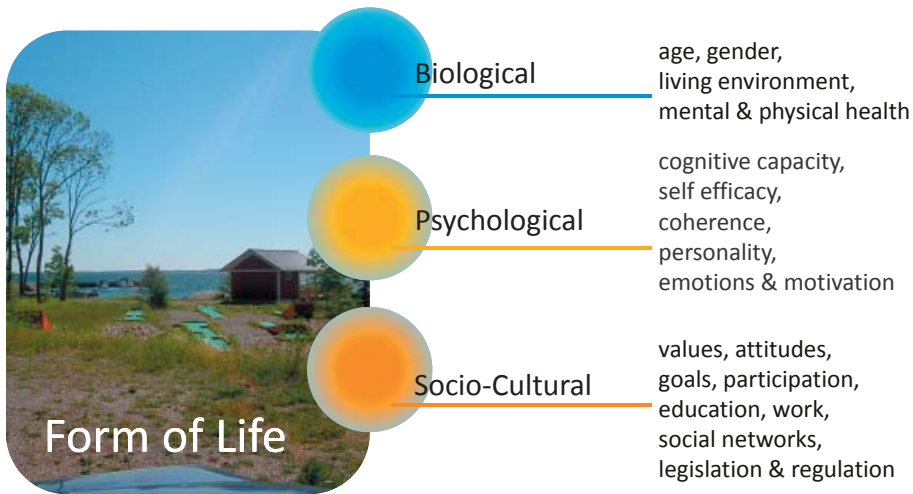
age, gender,
living environment,
mental & physical health

cognitive capacity,
self efficacy,
coherence,
personality,
emotions & motivation

values, attitudes,
goals, participation,
education, work,
social networks,
legislation & regulation

Biological

Psychological

Socio-Cultural

Form of Life

Figure 1. The holistic design approach employed in Life-Based Design presupposes analysis of people's forms of life from biological, psychological, and socio-cultural perspectives [9].

pretation of 'good' leads to discussions of moral rules and of people's rights and responsibilities. Therefore, ethics issues cannot be left outside the scope of design. They may have significant consequences for human well-being and should always be resolved within the design decisions [1].

One meaningful concept for justifying technology from a morals standpoint is ethical design. In ICT research and development, ethical design is grounded in information (or 'computer') ethics, the field of academic study that examines actual and possible impacts of information and communication technologies on important human values, such as life, health, psychological and physical well-being, happiness, abilities, peace, democracy, justice, and opportunities. The overall goal is to advance and defend human values in light of the possible and actual impacts of ICT [2].

Ethical design is interested in social and moral norms and rules and in their implications for technology design. Every form of life has its own norms and rules, some of which are morally oriented. These rules constitute a set of directives about what one should and

should not do, as well as what one is allowed to do. The directives are influenced also by non-moral rules, addressing, for example, what it is actually possible or impossible to do, and whether these things may be objectively positive. Conditional rules too, such as those to do with what happens if we act in a certain way, are part of our forms of life. In ethical human–technology interaction design, we can examine these moral rules and assess our design decisions against the backdrop they provide.

Ethical design means, first of all, conscious reflection on ethical values and choices with respect to design decisions. Secondly, it means reflection on the design process itself and the choice of design methodologies. In addition, ethical design involves what is ethically acceptable. Finally, ethical design must consider the issues of what are ethical goals – i.e., what constitutes the good of man.

With respect to ethics considerations in design decisions, there are two aspects to consider. Firstly, one should examine what the prevailing moral rules and the users' norms are and what kinds of impacts they have on

the design decisions. As an example, we can think about data-protection issues: there are users who, for example when using the Internet, do not follow the principle of doing no harm to others and may violate other users' privacy. This is why protection of user data has to be guaranteed, for instance, in network services. If we want the design work to support the forms of life of the target users, we should acknowledge that norms, rules, and values of users may determine the goals of the design.

Secondly, we should be aware that also the moral norms of the designers themselves may greatly influence the design. The developer or designer does not work in a vacuum, and the values in her or his life will also affect the design decisions. When this is fully acknowledged, it is possible to take into account the importance of values as an integral part of the design and exploit value-oriented methodologies for the design as well.

Co-design

LBD investigates whether the new design ideas are really fit for the life of the users. In other words, it examines the benefit users can get from the solutions developed and the impact the solutions have on quality of life. The associated data should be used effectively in concept design for products and services. The essential parts of the concept-design phase consist of ideation and reflection, then elaboration of the selected solution. Here the key element for a successful outcome is co-design sessions with end users.

There has been strong faith that living labs can introduce solid user involvement and innovation into the product and service design. In some cases, environments of this kind have been successful in that the innovation or co-design sessions usually occur in real-life environments and so the field trials for the concept, service, or product in question can be conducted quite well as a part of the user's normal life. However, there is often a gap between the development work performed and the real-world user trials. The users have

neither enough (effective) possibilities to have actual influence on the design nor direct contact with the designers. They are seen as research objects rather than experts on their own life who could participate in designing services and their own environment.

As the recent EU document 'Study on the potential of the Living Labs approach: Including its relation to experimental facilities: For future Internet related technologies" [6] states, there are clear indications that living labs and the living lab approach overall can add value to both research and development of new technologies and services. Currently, living lab environments are focused mainly on developing mobile or PC-based Internet services. However, living lab environments that would place great emphasis on embedded technologies are still rare. Furthermore, even if trials of this sort can be found, they are more experimental in nature than permanent spaces and locations for continuous possibilities for participation, ad hoc innovation, and development. In our approach, a clear continuum from laboratories to showrooms and living labs enables holistic yet agile design.

Furthermore, in most living lab environments, the focus has been only on allowing people to interact with products and prototypes in a naturalistic setting, not on true participation in the design of their environment. However, the shift from technology-driven or expert-based development of environments and services to more usage-driven and traditional participatory design increases the quality of the design. The users and citizens are the best experts in discovering how the technical enablers could be utilised in everyday life and how the future service environments should be designed.

VTT has introduced a multidisciplinary co-design approach (including engineering, humanities, and arts) wherein new environments and services can be conceived, conceptualised, developed, launched, and introduced. The VTT design framework includes permanent facilities that support

Figure 2. 'Ihme' innovation showroom.

development and innovation processes carried out jointly with various stakeholders in several phases of development work (see Figure 2).

Successful services and human-driven environments should integrate multiple technical enablers. Today, ubiquitous technology and decision-making processes remain highly fragmented and rely on many, quite different implementations, making it difficult for the parties involved to develop and apply the services in an effective way. By means of VTT's empowering design framework, interested parties gain a unique opportunity to use methods, tools, and technologies for service environment design in a unique and integrated fashion. Moreover, the standardised and systematic approach provided by the design framework will stimulate effective co-design of services: collaborating parties can use the same methodologies and tap the same sources of methods, tools, and technologies, enabling seamless integration of service components and services.

The empowering design framework offers great opportunity for societal actors of many types to learn from each other about different conceptualisations of future service environments. In addition, it offers possibilities for collaborative creation of appropriate ways of gaining new and acceptable knowledge about future development issues and acceptable governance structures. The existing knowledge in that area is mostly expert-oriented and therefore could well lack a localised element, thereby leading to overlooking the central problems of this quite complex matter. Furthermore, such expert-oriented knowledge is often inaccessible to the citizens who are the intended end users of the services. Lack of public involvement in policy-decision processes with regard to ICT creates a danger of absence of democratic legitimacy. Therefore, also the design of easy-to-use, user-friendly, and even entertaining applications for participatory activities is important. Naturally, at the same time, we must also conduct observations to explore how these technologies and applications change the manner in which people act in such 'living lab' or co-design environments.

Conclusion

The technological change in the information society should be based on the true value that technology brings to people's lives. Enhancement of citizens' quality of life is the only real justification for technology and can be achieved through analysis of people's forms of life and life settings as a starting point to technology design and efficient utilisation of said data in design processes. If this principle of Life-Based Design is accepted, and the design work is carried out in co-design with end users, the move toward a true information society will proceed in a meaningful manner.

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Prerequisites for managing service co-innovation in public–private–citizen networks

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Introduction

Public services face complex challenges in Western economies. From an open innovation perspective, two paradigm shifts are in progress, the first related to political decision-making and the second having to do with user-orientation in municipal service development [e.g., 1, 2]. Economic and demographic environments are undergoing dramatic changes, resulting in challenges to current structures of public services' production and development. Trends such as new public management and public–private partnerships have opened new opportunities for co-operation between municipalities and local companies. Equally, citizens are showing growing interest in societal issues and willingness to take active part in decisions related to their day-to-day life as enabled by digitalisation and social media. The traditional roles of public service development are changing. However, municipal and private organisations find it challenging to understand the profound changes needed in their core tasks and collaboration in emerging public–private–citizen networks.

We have studied Finnish municipal organisations that are seeking novel and user-driven ways to create, produce, and manage services [3, 4, 5]. Recent innovation literature uses the concept of *social innovation* to refer to collaborative innovation processes addressing complex economic and social problems. Social innovations can be created at *three, interlinked levels*:

grassroots level, among individual citizens; intra- or inter-organisational level among private, public, and third sector organisations; and the societal and policy level, in the form of radical systemic changes [6]. Thus, new, manifold, and changing needs in the management and facilitation of innovation processes are emerging. *The question then arises of how to manage the municipal service co-innovation in public–private–citizen networks in practice.*

The aim of this article is to structure the phenomena of managing co-innovation at grassroots and inter-organisation levels by summarising critical prerequisites for a public–private–citizen network. The work presented here is derived from case studies (2009–2012) involving a municipal organisation interested in more user-driven co-innovation of its services [3, 4, 5]. The co-innovation model was created in the concrete setting of co-designing the meeting place at a city's market square, then applied and further developed in a more conceptual setting in renewal of youth workshops and associated collaboration with local companies. Representatives of a municipal organisation, citizens, and local companies participated in the development work. A KIBS (knowledge intensive business services) company facilitated the co-innovation process, wherein representatives from VTT and the University of Lapland were involved as participatory action researchers [7].
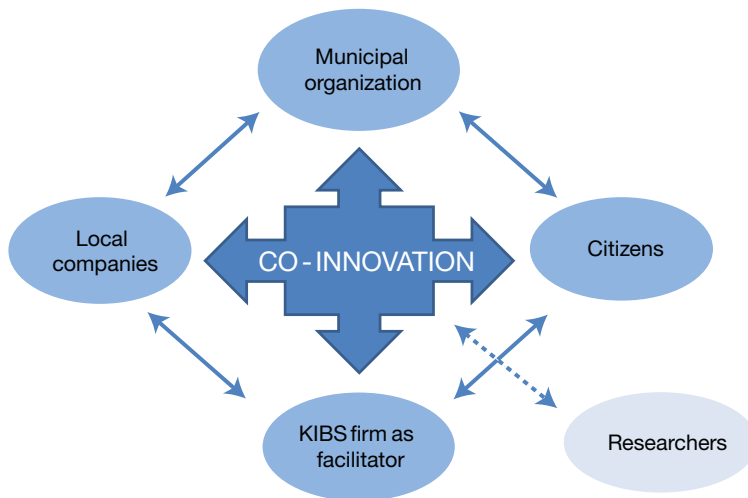
Figure 1. Our research focus and the parties to service co-innovation.

Empirical studies: Prerequisites for co-innovation in a public–private–citizen network

Our case studies [3, 4, 5, 8] demonstrate how goal-oriented and user-driven co-innovation can be carried out in practice. They further illustrate how the parties involved can have differing targets and timelines. Without a facilitative leader, there is a risk of the co-innovation not progressing effectively. Thus a new kind of facilitation – by actors either outside or within the organisations – becomes crucial. From our case studies [3, 4, 5] and current literature, we found certain prerequisites essential in planning, organising, and managing the co-development in a public–private–citizen network. We shall now briefly describe the critical prerequisites from a municipal organisation's perspective:

1. *Understanding of the multifaceted nature of innovation as a process and end result.* The prerequisites for co-development start with understanding that service and social innovations are multifaceted, dynamic, and non-linear phenomena that occur in practice through concrete and collaborative experimentation and renewal [e.g. 9, 6]. In our case studies, the progress and visibility of co-innovation aiming at many types of renewal, by different interest groups, was stressed and visualised throughout the process. In addition to many practical renewals, the co-innovation model created appeared as a service innovation for the KIBS company – creating new service business – and as a social innovation, as a new manner of service co-innovation, for the municipal organisation [cf. 10, 6].

2. *Cross-sector collaboration and combination of complementary competencies and personalities in the process.* Increasing collaboration and combination of cross-sector competencies are needed in order to serve increasingly complex customer needs in a goal- and process-oriented manner. From a municipal perspective, the collaborative process's planning and cross-sector strategic management of complex and multi-level processes within the municipality and with external stakeholders seems to remain challenging [cf. 11, 2]. When piloting user-driven service development, as in our cases, municipal employees have an opportunity to explore participatory practices,

new competencies, and shifting of work roles from sector- and expert-orientation toward user- and network-orientation.

3. *Entrepreneurial spirit and fit between parties*. Entrepreneurial spirit – in essence, openness to exploring novel opportunities collaboratively– has been seen as the key driver of innovations [12], but especially challenging when the interests of the various parties are to be fitted in a public–private–citizen network. Public organisations have often been regarded as problematic from the innovation standpoint: legislation, local politics, a communal decision-making culture, and organisational inertia are typically seen as the main hindrances. For local small and medium-sized enterprises (SMEs), multi-agent networks may serve as important arenas for renewal. However, both practice-oriented citizens and SMEs hesitate to commit themselves to processes whose benefits cannot be seen clearly. In our cases, entrepreneurial spirit and desire for mutual benefit were sparked but appeared challenging to maintain for the full duration of the co-innovation process.

4. *Commitment of top management and dialogue between top-down and bottom-up activities*. To be legitimate activity for the organisational participants and to have an effect on the innovation practice, service co-innovation should have a strategic orientation in the municipal organisation. This also means granting legitimate power to the innovation activity, especially in relation to important politically charged issues with cross-sector and external stakeholders [cf. 11]. Innovation activities in public organisations have long relied on top-down approaches, but co-development requires a combination of top-down and bottom-up processes. This means integrating employee- and user-driven approaches into the innovation management [13]. Our cases showed the importance of continuous dialogue between the municipal top management and employees in terms of common vision, resources' allocation, changes in authority, and diffusion lessons learned. Furthermore, the municipal top management could play an important role as a mediator in the building of new strategic contacts with local companies and their networks.

5. *Clear ownership in the co-innovation process.* When services are developed interactively within public–private–citizen networks, the aims, roles, and practices involved become more diverse and complex. For reaching goal-oriented, efficient, and useful co-development from the perspective of the entire network, the ownership of the co-innovation process has to be clear to everyone. In exploring and learning of novel means of co-development, as in our case studies, traditional beliefs about ownership are questioned. The change in co-innovation practices and their diffusion require ownership by the main target organisation at operative and strategic level (in our cases, municipalities). Therefore, an external facilitator cannot take this role [cf. 14].

6. *Balance among the various interests and power relations in iterative and knowledge intensive processes*. In opening up societal problems for co-innovation, balancing various interests and power relations in the public–private–citizen network becomes crucial for success. There are claims that, by combining economic and social elements, goal-oriented co-innovation could contribute to better services, well-being, and new business opportunities while boosting empowerment and collective responsibility [6, cf. 12]. In our cases, regular virtual core-group meet-

ings with a flexible process model, set of roles, schedule, and risk analysis were utilised for co-ordination of the multi-voiced co-innovation processes. Also, the progress was openly shared and diffused through several local media, including television, leading newspapers, and the city's Web sites, as well as in public places such as libraries, shopping centres, municipal service offices, schools, and day-care centres.

7. *Enabling mechanisms within organisational parties and between interest groups*. Alternative participatory approaches and methods are needed for empowerment of citizens and other stakeholders to solve societal problems collaboratively [cf. 1]. Crucial is to utilise such fora for face-to-face meetings and platforms for virtual social communication where people already are, a context familiar to various interest groups. Also new participation arenas and methods are needed, to integrate material, service, and experiential elements and a suitable technological infrastructure with the competencies [cf. 12]. For example, service design provides a practical means of visualising and concretising varied user needs, as well as empirically testing and evaluating alternative service concepts in even very early stages of innovation [15]. In our cases, applied service design methods, such as prototyping and role-playing, were experienced as inspiring. They served several aims and preferences of interest groups. [5, 8.] While e-government solutions present top-down services that support current political processes, social media may create new possibilities for bottom-up innovation [16]. In our cases, an external facilitator played an important role in supporting the utilisation of social media in order to enable open user participation in the co-innovation.

Contribution: Practical guidance for co-innovation and theoretical conclusions

Our classification for the prerequisites seemed useful in structuring how to manage the municipal service co-innovation at grassroots and inter-organisation levels. Coupling empirical cases with the classification enables deeper understanding of the dynamics of co-innovation, providing a framework for management and facilitation. Our empirical studies illustrate both the context-dependence of the service development and common features and challenges related to co-innovation in a public–private–citizen network. They support recent studies of growing mutual interest in bottom-up and user-driven innovations via social participation and combining local resources for better services [e.g. 16, 13].

In conclusion, it seems that such a planning-oriented and multi-level co-innovation process requires considerable resources and is more applicable to development of targets with strategic importance, wherein the process of participation is as important as the end results are. It seems that benefit can be derived from a new facilitative actor because the approach requires the municipalities involved to possess strong co-innovation and strategic capabilities [cf. 17]. In addition, an external facilitator may provide special support in, for instance, the adoption of competence in new co-innovation methods and tools. Further, our studies have demonstrated how the question is not only one of bringing new tools into use but also about a shift in paradigm toward more open and equal interaction between municipalities, companies, and citizens [cf. 1]. Mutual dialogue and respect for each other's competence and experience must be learned.

Our studies have shown that KIBS-type organisations may assist in facilitating and creating innovations in public–private–citizen networks [cf. 10, 17]. It seems that this kind of user-driven co-innovation approach is

still a fairly project-based activity rather than a legitimated activity integrated into public decision making as well as service production and development. Here, we have focused on a planning-oriented co-innovation model. However, our on-going study of a more agile co-innovation model with more active roles for users seems promising also.

Acknowledgement

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Systems modelling approaches to services

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Abstract
This article gives an overview of some mathematical systems science approaches that are helpful in analysing services – namely, system dynamics, agent-based modelling, and game theory. We present some example cases from our work in this field. The article concludes by pointing out some fruitful directions for future research.

Introduction
The systems approach aims to understand how behaviour is created by the interactions of various parts in a system. In the context of services, the systems approach is useful for understanding phenomena such as co-production and co-creation of value, both of which require interactions between participants before they can occur. Moreover, we argue that formal systems modelling approaches are useful in providing a better understanding of service systems. Firstly, formal modelling has the benefit that the behaviour of the system can be deduced from a set of assumptions. This allows 'what if' experiments to be carried out. Secondly, the use of computer simulation allows this deduction to be done quickly and easily, possibly revealing counterintuitive insights that are not readily obtained through normal verbal reasoning alone.

In this article, we present some modelling-based approaches for analysing service systems and point to examples from our work in this field. An exhaustive review of all possible modelling approaches is beyond the scope of this article. For information on some other methodologies, see, for example, Source 7.

Mathematical systems modelling approaches to services
In this article, we focus on three distinct mathematical approaches that can be used to analyse service systems: 1) system dynamics, 2) agent-based modelling, and 3) game theory.

Both system dynamics and agent-based modelling are computer simulation approaches that can reveal possible unintended consequences of policies in nonlinear systems. Decision making in both of these simulation approaches is typically modelled as boundedly rational. Both system dynamics and agent-based simulation focus on non-equilibrium dynamics. In many cases, the phenomenon of interest is precisely the transient phase before the possible convergence to equilibrium. For example, innovation adoption models portray how rapidly a particular innovation takes hold. Also, the system of interest may have multiple equilibria. In the context of innovation adoption, it is not clear at the outset whether the innovation will be fully adopted in the long term or whether its prevalence will eventually decline.

System dynamics models focus on the aggregate system structure – i.e., feedback loops, time delays, and accumulations [9]. The system is modelled by means of ordinary differential equations from a top-down perspective. The top-down approach has the benefit that
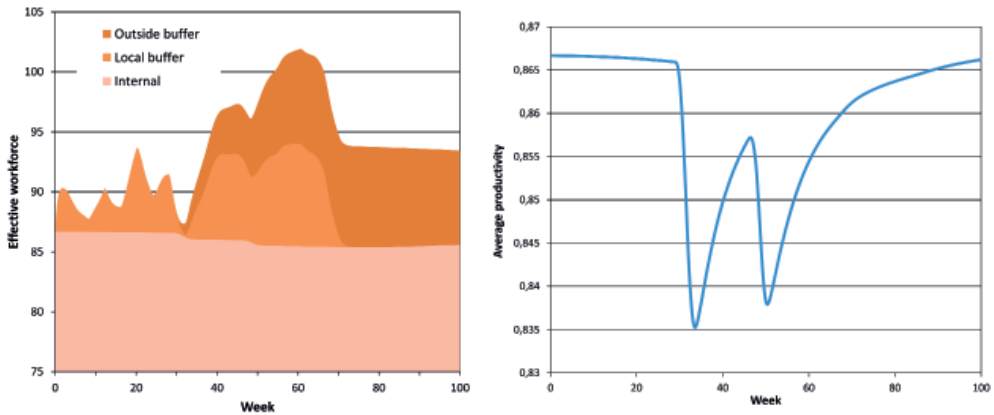
Figure 1. Workforce dynamics in a KIBS firm. An increase in the use of the outside buffer decreases productivity in the short term because of additional training and co-ordination work.

when the dependences between subsystems are known, the aggregate dynamics of a broad system can be examined.

Agent-based simulation [1] is a bottom-up modelling technique in which behavioural rules are assigned to multiple agents. These agents then interact, and in doing so create the dynamic behaviour at the macroscopic level. This makes agent-based simulation a natural choice for studying phenomena that involve a large number of interacting firms and customers, such as service value networks. Another advantage of agent-based modelling is that the effects of agent heterogeneity can be easily taken into account. This can be useful in, for example, the case of healthcare services, wherein patient characteristics vary along multiple dimensions. Agent-based models can also be used to study spatial dynamics, which can be helpful in study of, for instance, how new service innovations spread in different areas.

Game theory studies strategic decision making in situations involving multiple agents. Traditional game-theoretic models assume that decision makers perceive the decision situation in the same way. Hypergame analysis [5] is an approach in which the subjective perceptions of each agent can be taken into

account. It is useful for real life 'soft' situations, including service systems. Game theoretical analyses can be helpful for understanding negotiation situations, in contexts such as service agreements, and identifying mechanisms for promotion of win–win strategies.

Example cases

Project-based work in KIBS firms [8]: Work in knowledge-intensive business service (KIBS) firms is often organised into projects. We constructed a system dynamics simulation model for a Finnish engineering and consulting company to aid in project management. One aim with this model was to analyse the effects of delays in supplier and customer data during the detail-engineering phase of the design project. A second aim was to explore the effects of distributed work in multiple offices. Subsequent work has focused on labour-management issues in a multi-project setting. Here, the purpose of the simulation model is to show whether external labour is needed, and to what extent, when the future workload is not accurately known beforehand (see Figure 1).

Competitive dynamics [6]: When firms compete against each other, the competitive environment is not exogenous; rather, it

changes dynamically with the actions of each firm. In deciding on its actions, each firm has to take into account not only customer reactions but also the reactions of other firms. We have built a simulation model to analyse the dynamics emerging from the interaction of two firms that compete for the same set of customers. Unlike in standard game theoretical analyses, we assume that each firm is boundedly rational, with limited information and cognitive processing capabilities. Rather than assuming that firms play a Nash equilibrium strategy, we model firms' decision making by using psychologically plausible heuristics. Our simulation approach sheds new light on the non-equilibrium dynamics of competition.

Service innovation adoption [3]: In many platform services, customer value increases as a function of the number of service providers. Likewise, a large number of customers attracts new service providers to the platform. Electronic invoicing is a good example of this type of service. Electronic invoices have many advantages over their traditional paper counterparts, but their adoption in different countries has progressed at different speeds. For example, adoption in Denmark has been significantly faster than in Finland,

where the use of hybrid invoicing has slowed the transition to a completely electronic service. To understand how rapidly electronic invoices will be adopted in Finland, we built a system dynamics model. The model suggests that the speed of adoption strongly depends on how rapidly awareness of the new service spreads from one customer to another through word of mouth. Our ongoing work aims at better understanding this phenomenon, especially the interaction of heterogeneous agents, by means of agent-based simulation.

Value creation dynamics of industrial maintenance services [4]: Maintenance services for a large and complex production plant, such as a pulp and paper mill, have potential to create value in many ways: as increased production through better availability, cost savings, higher quality, and reduced risks. However, presenting value propositions is rendered difficult by the large number of components in the system and their dependences. We built a system dynamics simulation model that helps to communicate and present value propositions to customers. Simulation results show the effects of uncertainties such as the accuracy of condition-monitoring services and fluctuations in end products' market

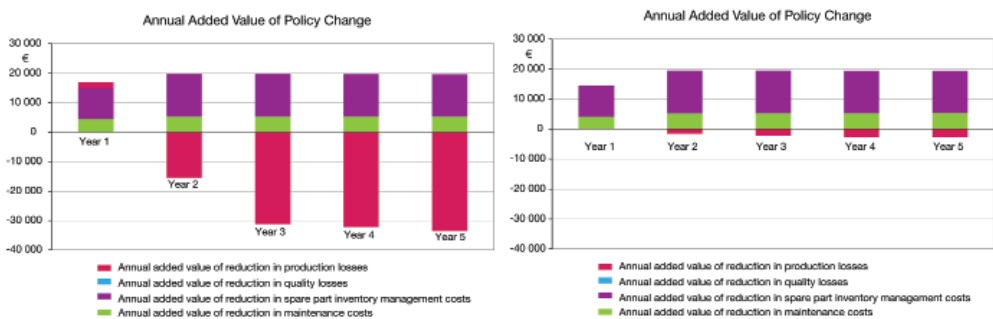Figure 2. The added value of industrial maintenance services when the market price of the end product is either €900 (left) or €500 (right). This suggests that there is no need to change service policies if the market price is expected to be high (the losses are greater than the benefits) but when the market price is low there are some potential cost savings to be achieved by changing the maintenance policies.

price. For example, the model makes it possible to compare the added value in different kinds of market situations (see Figure 2).

Dynamics of health-care services: Many health-care services consist of two sequential procedures, acute treatment and rehabilitation. If these two phases are managed separately, an undesired outcome is likely, both for patients and for society at large. In the case of traumatic brain injury, for example, a long waiting time after the initial treatment may well decrease the effectiveness of the subsequent rehabilitation. This affects whether and when the patient is able to recover and return to working life. We built a system dynamics model to study the short- and long-term impacts of health-care system reorganisation with this example case. What remains to be understood is how patient heterogeneity should be taken into account in the model. Here, agent-based simulation may prove helpful.

Special product manufacturing service [2]: Customisation in special product manufacture requires that the customer be intimately involved in the design process. This can make design and manufacturing less controllable because of at least two new customer-related uncertainties: the customer's competence (i.e., how well the customer knows what he or she needs) and the extent of customer-induced design changes. To understand the effects and propagation of these uncertainties, we built a project management simulation model. The simulation results suggest that uncertainty can be handled through application of carefully allocated strategic resource buffers. When the uncertainty was taken into account, stochastic optimisation yielded far more robust policies than did deterministic optimisation.

Discussion and conclusions

Systems modelling approaches can aid in explaining why a given service system has behaved in a certain way or how it might behave in different future scenarios. In many of our examples, the modelling and simulation process has deepened understanding both for us as researchers and for the companies involved. In other words, people's mental models have changed. This then enables better decisions. In this regard, the purpose of our modelling endeavour differs from that in hard operations research, where the aim is typically to optimise a well-defined system.

There is no single modelling methodology that would be suitable for every type of problem. Rather, it is better to have several approaches in one's repertoire and choose the most appropriate one for each specific case. So far, we have constructed a number of system dynamics models related to services. As a complement to this research stream, our current work in progress with the Tokyo Institute of Technology includes agent-based simulation models. We also see that game-theoretical approaches are useful in certain cases. One potential application area could be in designing service systems in such a way that the actions of individuals at the micro level are consistent with the desired outcome at the macro level.

Acknowledgements

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A toolkit for multisensory service design: cases in leisure services

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Introduction

How do the human senses affect customer experience? How can one gather data on the multisensory service experience and, in turn, use sensory data to improve existing services or create new ones?

These are some of the questions we studied in our recently completed project 'Matkailijan moniaistinen palvelukokemus' ('Tourist's multisensory service experience'), or MMP, in 2010–2012. We carried out the project in collaboration with the Laurea University of Applied Sciences, and the Tekes Tourism and Leisure Services programme supported the work financially. VTT contributed expertise in service design methods, especially the Owela online co-creation platform. We studied how online tools can be used to evaluate, create, and develop leisure services from a multisensory perspective.

Competition for people's time and money is fierce, and service providers need to improve their services continuously if they are to meet and surpass customers' needs and expectations. Appealing to multiple senses is one opportunity to provide a stronger sense of authenticity and experience and to increase the attraction of leisure services. Our key theoretical assumption was that customers are active co-creators of service experiences [1, 2]. Since each experience is unique, we can only estimate and create prerequisites for pleasant multisensory experiences.

Another foundation for service design is consideration of the total service experience, which is influenced by four elements: access

sacrifices, service quality, effort sacrifices, and the experience of the actual value proposition the service offers [3]. Access sacrifices refer to the effort needed to come to the site: e.g., are the transport connections good / are there enough parking places? Service quality refers to how all the practical things related to the service function: e.g., are tickets easy to buy, and does the equipment function safely and correctly? Effort sacrifices cover the actions needed for enjoyment of the actual service: Is the weather too hot or cold? Are the queues very long? The value proposition of a leisure service such as an amusement park might be to give moments of thrills and excitement and to immerse visitors in a world very different from their everyday life. Senses and their interaction play an important role in all these areas.

Tools for multisensory service design

In the MMP project, we developed and tested service design methods aimed at understanding the role and potential of sensory elements in producing truly value-adding experience for customers. The concrete result of the project is a toolkit containing 20 methods, grouped into four application areas: customer under¬standing, ideation, service development, and design of new services. Most of the methods are based on well-known service design methods, but we modified and tuned them for capturing and utilising sensory observations.

All methods in the toolkit are presented on the project Web site, in Finnish[1]. The fol-

[1] See http://www.multisensorisuus.fi.

Customers' stories and visualizations of their experience

Probes Narratives

Tasks concentrating on the multisensory experiences

Sentence completion

Persoonat

Focus on sensory experiences of real or imaginary customers
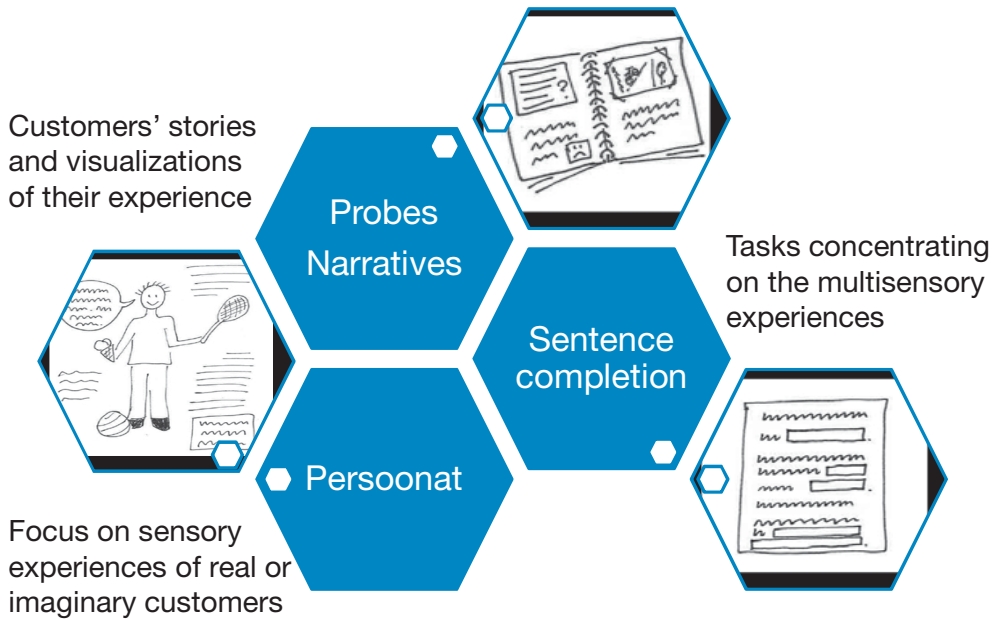
Figure 1. Methods for understanding customer experiences.

Observing multisensory experiences with ghost customers

Sense observation form
Sensory walk

Analysing observations on a sensory service journey

Sensory service journey

Online recollection

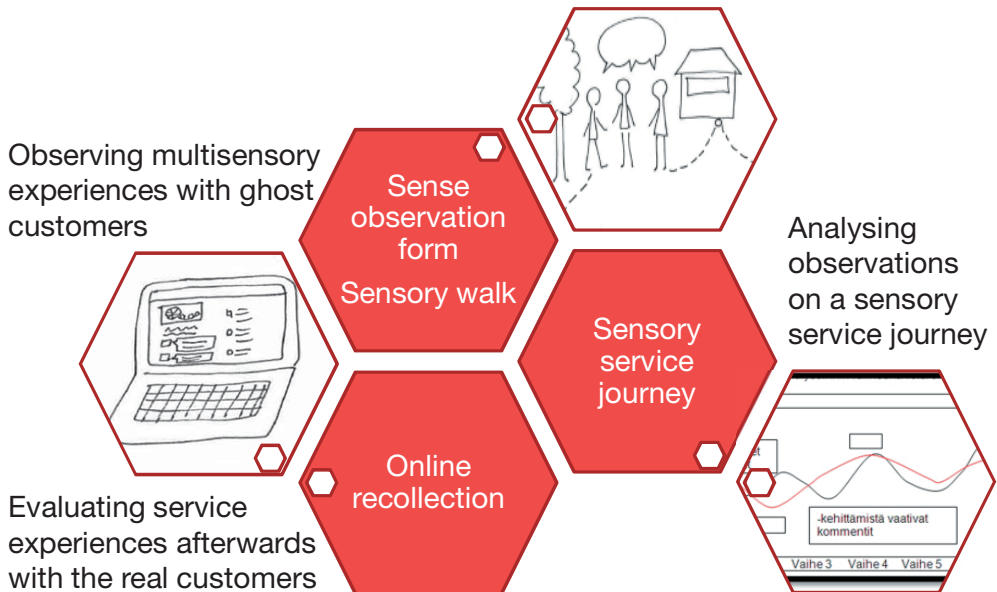Evaluating service experiences afterwards with the real customers
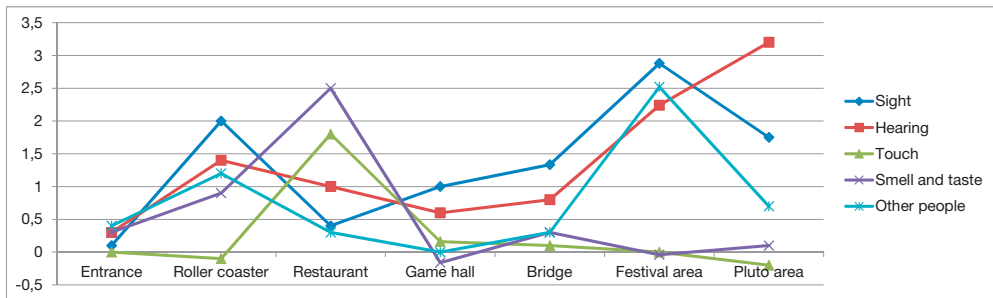
Figure 2. Methods of service development.

Figure 3. The subjective intensity (strength * pleasantness) of different sensory experiences at different touchpoints.

lowing figures give examples of the methods and their purposes. Figure 1 illustrates methods for customer understanding as a basis for service design, and Figure 2 shows methods of sensory observation for use in the further development of an existing service.

The tools were tested and developed in case studies with the seven service providers that participated in the project. In this paper, we present two of these case studies as examples. The Light Carnival is a special event at the Finnish amusement park Linnanmäki, where we used various methods to evaluate customers' multisensory service experiences and to find areas for improvement. In the City Adventure case, we developed a new adventure service alongside potential customers. Both online and in situ, offline methods were used in these two case studies.

The case of the Light Carnival event

The Light Carnival event at the Linnanmäki amusement park is a special, 10-day event that takes place after the main amusement-park season, in early October. We conducted a multisensory service-experience evaluation of the event on two occasions, in two consecutive years. This gave us an opportunity to test many methods and to improve them in light of the experiences. In the evaluation, we used 'ghost customers', because the methods require quite a lot of work and would disturb real customers experiencing the event.

In total nearly 100 students from the Laurea University of Applied Sciences acted as ghost customers during the two years and reported their sensory experiences, using various methods [4].

The most useful methods in this case were the sense-observation forms and probes. The form consists of items for quantitative and qualitative evaluation of the strength and pleasantness of various senses at touchpoints along the service journey. An example from our quantitative analysis of the observation-form data is shown in Figure 3. The probe method involved documenting events through and with the aid of an assignment notebook and photos. As the ghost customers walked about at the amusement part, their task was to note their observations in an assignment notebook that was structured in terms of the senses. They also attached photos that illustrated their experiences. After the amusement-park visit, they were asked to write two short stories in the notebook – one about their most positive experience and the other on the most negative one. The free-form narratives gave the service provider authentic understanding of the real service experience, in easily readable form.

To uncover more hidden sensory experiences, a sensory walk was arranged for a group of students. A sensory walk is a guided observation tour during which the participants pay attention to their various senses. The group went through the amusement park, stopping at pre-selected points. While moving

Figure 4. The City Adventure case started with online ideation and continued with service testing in the real world.

from one point to another, the observers had tasks, such as 'look up at the sky', 'pretend to be a child', and 'walk slowly'.

The observations were analysed with the aid of affinity diagrams and sensory service journeys. The development ideas were fleshed out into concrete proposals for new services for future events. They were written down in the form of scenarios in which imaginary personas participate in the event. This showed the value and utility of the sensory customer experience data collection methods in practical use.

To supplement the ghost-customer evaluations, real customers shared their experiences afterward online. On certain days, flyers were distributed at the amusement park's gate, inviting customers to an online discussion, for which they could choose a suitable time to participate. VTT's Owela[2] online co-design tool was used for collecting experiences via the Internet. There were questions pertaining to sensory experiences of various types as well as general questions about the service experience, its high points, and areas for improvement. After supplying their opinions and impressions, customers could see other people's input and continue by commenting on and discussing it. Real customers' comments were generally more positive than those of the students, who had paid extra attention to the negative experiences and areas for improvement. The real customers' stories supported

some of the ghost customers' notions and pointed to additional areas for development.

The City Adventure case

City Adventure is an adventure concept for adult groups by the Finnish company Go Experience. In the case study, we wanted to involve test customers in development of the service concept before its launch for real business customers [5]. We used both online tools and in situ testing with the test customers (see Figure 4). The starting point for the study was a prototype of the agent adventure in which competing groups solve problems in the city. The company had seen a need for further improvement before launching the service, and they were also interested in additional service concepts that might be produced in the service design project.

Consumers participated in two stages: first in online ideation and later in testing a prototype of the service in a real-world situation. The aim of both methods was to generate new ideas for adventure services. The online ideation, conducted by means of Owela, started with a survey aimed at inspiring individuals and stimulating ideas surrounding the adventure topic. After completing the survey, users were shown memories and ideas posted by other respondents, and they were asked to comment on these in the discussion workspace. Users could comment upon and rate other users' ideas, as well as develop

them or completely new ideas further. In all, 36 users participated in the two-week online ideation process, which was facilitated by a researcher.

After the online discussion, all users were offered an opportunity to participate in testing of an early prototype of the agent-adventure service. We expected this to stimulate new adventure ideas. Six people volunteered for the service-testing session, in which they experienced the service in groups of three subjects and one researcher. During the 1.5-hour adventure, one researcher took notes about user experiences and feedback during the trip, and another shot a video that was used later to show the service concept to other people. After the testing of the service, six users, the researchers, and three representatives of the service provider gathered to share their experiences and ideas for development.

The researchers created a summary of all user ideas and feedback from the Owela discussion and real world testing, then presented them in a workshop that was held with the service provider. A method called the Design Jam [6] was applied, with five stages: empathise, define, ideate, prototype, and test. As a result, the service provider received two well-refined suggestions for improving the agent adventure service.

Conclusions

Our case studies showed that multisensory experiences can be collected with various methods and taken as a basis for service design. The best overall picture can be created when multiple methods are used with both real and ghost customers. In the evaluation of existing leisure services, ghost customers are a good choice, since the experience of actual customers should not be disturbed by the evaluation research. Furthermore, ghost customers can be used for careful examination of quite different sensory experiences *in situ*.

For example, the sense-observation form produced a large quantity of systematic data

that gave the opportunity both to compare individual locations in the area and to analyse which senses contributed to the experience in these specific spots. For analysis and utilisation of the observations, verbal comments about the overall experience or specific senses were very important. The probe notebook gave observers more freedom in expressing their experiences. The observers mentioned that the predefined questions helped in making the observations and that they supported being specific in description of the experiences.

Real customers can be more fully involved afterward by means of online recollection tools. The Owela discussion provided a good opportunity for sharing customer experiences anonymously in a constructive manner. Our experiences suggest that online ideation can also be a good starting point for services' improvement or creation of new service concepts. Users have a lot of creative capacity; it only needs to be guided in the right direction with clear tasks that inspire and motivate them. Online methods cannot – quite yet – replace the physical service experience; therefore, face-to-face testing is needed too. However, online ideation reaches more people, at low cost, and so can be especially suitable in the design stages, which benefit from inclusion of many opinions and viewpoints. In comparison to online surveys, open discussion enables users to interact and build on each other's ideas, which increases the likelihood of coming up with more creative ideas.

Which set of service design methods is the most suitable depends on the stage of the service and the aims for its development. Narratives aid in grasping the experience as a whole, whereas sensory walks are suitable for pinpointing disturbing details that need to be fixed. Since every service is different, the methods always need to be adjusted to the case at hand. The multisensory service design toolkit provides a starting point for applying service design methods in creative ways.

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Industrial services

Challenges of a service integrator in B2B networks

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Introduction

The study described here is motivated by the challenges of system, service, and solution integration in a networked business environment [1, 2]. The call for more complete and complex solutions also requires changes in value networks' configuration. Accordingly, a service or solution integrator (SI) has an important and challenging role in the value network. The key challenge of the SI is centred on successfully combining the various pieces in the value network into an integrated and seamless solution. That is, the challenge lies in how to manage networked business operations [3, 4]. Network companies, both business-to-business (B2B) customers and suppliers, focus on their core competencies and acquire further expertise from their network partners [5]. Simultaneously, the trend among customers and suppliers seems to be to engage in forward transfer in their value networks. Therefore, today's networked business environment, where knowledge is distributed, demands a collaborative approach to integration of knowledge, resources, and technologies into seamless solutions for B2B customers. In other words, willingness and ability to work together is one of the key success factors in solution co-creation and service business networks [6, 7].

This paper explores the challenges of service integrators within a networked business environment. We apply a multidisciplinary approach employing network, solution-integration, and service business analyses. Using qualitative case studies, this paper deepens knowledge about a service integrator's challenges and tasks. The aim is to contribute to the literature by bridging the gap between solution integration and network management. Accordingly, the changes in networked business environments and different roles in service networks are examined first.

The results of the study, summarised in terms of service integrators' challenges and tasks, will form a baseline for network-management models and be incorporated into practical tools. The network-management models and tools are studied and developed further in the Service Network Integrator (SHINE) project, in order to support integration of seamless solutions in B2B networks and their delivery to customers in a value-creating way.

Networked business environment and B2B service networks

In both alliance and network research, there is intense debate as to the most useful models of collaboration between the various network actors (for a summary, see, e.g., [8, 9]). Exploration of the B2B network types and classifications presented in the literature reveals a number of underlying dimensions, such as the network's value creation, governance structure, and joint business operations. Therefore, networks should be configured and managed differently, in view of these dimensions [8].

A baseline for the study of B2B networks is the type of value creation in the network, from current value capturing to future busi-
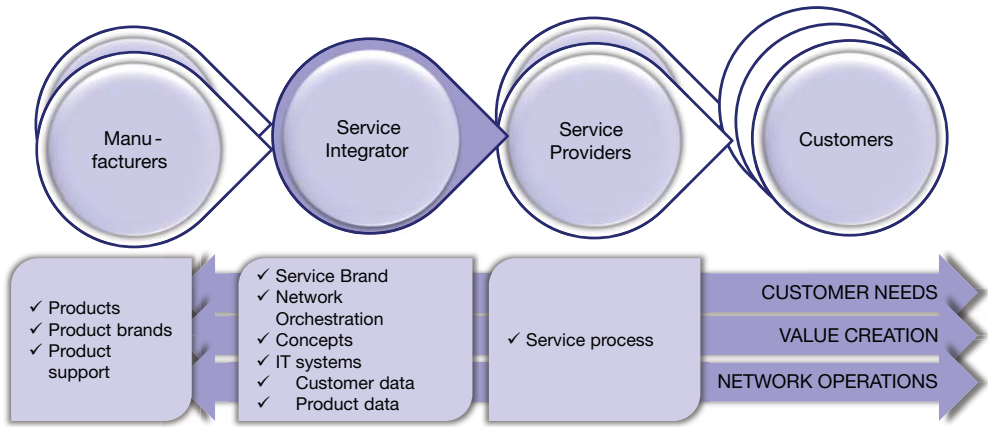
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Figure 1. Different roles in a service network.

ness opportunities. This study focuses on service networks, in which the value is created and captured jointly through the network-level business operations. B2B networks can be categorised on the basis of their configuration – for example, the structure of the network and the relationships between its actors. Governance models and structures are what bring actors into working together: the process, rules, and norms by which the network enables individual actors to influence the network's operations and decision-making. Three network governance models are typically distinguished. For instance, Provan et al. (2007) [10] classify types of governance within networks as follows: i) shared governance; ii) lead-organisation-governed; and iii) governed by a network administrative organisation (NAO). Under NAO governance, all activities and decisions are co-ordinated through one organisation specifically created to oversee the network. Although the integrator in service or solution networks operates as the network administrative organisation – in other words, as network orchestrator [3] – the network rules and operation models differ.

The key challenge of the integrator (e.g., the network orchestrator) centres on successfully combining the various pieces in the value network into a seamless solution. Figure 1

presents the main responsibilities for various roles of network actors in a B2B service network. The supplier roles here (e.g., product company, service integrator, and service provider) can be held by one or several actors, depending on the solution.

Service and solution integration

A significant amount of the solutions and service literature deals with industrial companies' shift from being product-centric toward being service- or customer-centric (for a summary, see, e.g., [2, 11]). Integrated solutions are defined as bundles of products and/or services that meet customer-specific needs and offer greater potential for value creation than the individual components would offer alone [2, 12].

In the service-dominant logic (SDL) approach, an important distinction is made between service (singular) and services (plural). In the SDL literature, service indicates a process while the plural form 'services' refers to intangible units of output. Service as a process involves using an actor's resources for serving another actor [7]. In other words, 'service' can be thought of as a verb and 'services' as a noun. In this paper, the term 'service integrator' is utilised instead of 'solution integrator', while in practice the roles of

companies vary; for example, some operate as service providers (focusing on the service process) while others tailor customer-specific solutions (focusing on output).

The increasing complexity and diversity of technologies and competencies suggests that firms may be forced to access new, unrelated knowledge and co-operate with several partners. That raises the issue of dealing with technology-rich and knowledge-intensive network actors and customers in a manner that creates shared knowledge assets. The ability to identify, select, and develop the right business opportunity is one of the most critical success factors [13].

Thus the integrator must align the interests and business models of the actors involved, in order to ensure their commitment.

Network management

Network management refers to the broad subject of managing various networked business operations conducted by network actors (see Figure 1). The main tasks of network management include 1) integrating value-related activities, 2) controlling and monitoring other actors and their activities, 3) co-ordinating the value-related activities of various actors, and 4) influencing the other actors and their underlying value creating activities [3, 8, 10, 14]. Integration refers to the act of combining the value-creating activities, capabilities, expertise, processes, technologies, products, and components that actors in the network provide. The degree of control varies with negotiation power and network position, which are based on the network's structure and the ownership of important resources from the angle of the goal of the network. Co-ordination is necessary for guiding the value-related activities of actors in the network toward common objectives and scheduling them. Naturally, the degree of influence varies with the business situation, and the actors' power of influencing others depends on their position in the network.

In order to integrate the solution and co-ordinate network-level business operations, the integrator must orchestrate network activities in both the creation and the capture of value.

Summary of the challenges of a service integrator

In summary, when compared to other delivery of services, integrating service offerings into solutions in B2B networks poses additional challenges for integrators. The main challenges facing a service integrator in B2B networks, as found in our literature review, can be summarised as i) alignment of customer needs, the solution, and the business models of the actors in the network; ii) orchestration of network activities; and iii) ensure creation of value. First, in line with the characteristics of integrated solutions, customer specific needs and value creation are highlighted. Secondly, the network management emphasises orchestration – e.g., integration, control, and co-ordination to ensure commitment of the network's actors.

Research design and case description

We used qualitative research methodologies – a multiple case-study method and qualitative data – because in-depth understanding of a little-studied area was necessary [15, 16]. We selected seven companies whose role in their value network can be viewed as that of a service integrator and whose offering is more or less (complex) product and service systems; see Table 1. These companies were selected because their operation as a service integrator was characterised by heavy demands for integration from the perspective of their end customers. The companies represented different sizes of organisation and came from different branches of industry, which brought diversity to the research.

Compared to other service deliveries, integrating service offerings with solutions in B2B networks includes additional challenges

Table 1. The case companies and their B2B solutions and sectors of industry.

Company	Solution	Industry and customers
Arpré Oy	Garage equipment and services supporting management of the installed base	Garage workshop owners and operators
Barona	Integration of recruitment and resourcing services in the engineering sector	Large global OEMs and their engineering service providers
Empower	Delivery of construction, maintenance, and professional services	Energy, telecoms, and industrial sectors
Flexolahti	Knowledge integration services within the packaging industry	Package producers and their customers (manufacturers) in several industries
ISS	Customised personnel support services (for real estate, catering, security, etc.)	Private companies and organisations, and the public sector
Konecranes (Machine Tool Service)	Tailored maintenance solutions for all types and brands of machine tools	Manufacturers in the engineering industry
Örum	Automotive spare-parts import and concept of integrated services for the distributor network	Garage workshops and operators

for integrators. Accordingly, the main question used in the interviews was the following: What are the main challenges of the service integrator in B2B networks? The interviewees were asked to describe openly their views about the integrated services they offer and the co-operation challenges in B2B networks in both directions – with the supplier companies as well as with the customers.

Results and conclusions
The purpose of this paper was to explore the challenges of a service integrator within a networked business environment. Most of the case companies integrated product–service bundles for their B2B customers (see Table 1). Within such a service offering, the integrator has to link networked processes, knowledge, resources, and technologies of diverse actors to each other.

According to our literature review, the main challenges of a service integrator in B2B networks can be summarised as being to i) align customer needs, solution, and business models; ii) orchestrate network activities; and iii) ensure value creation. In the study's empirical work, these challenges were reformulated as both the challenges and main tasks of the service integrator (see Table 2).

Table 2. The main challenges and tasks of a service integrator.

CHALLENGE	MAIN TASKS
NETWORK INTEGRATION	Pooling the network resources as an integrated service solution
NETWORK ORCHESTRATION	Integrating service processes to match the customer needs
VALUE CREATION	Managing the customer relationship and value co-creation
BUSINESS MODEL CONSTRUCTION	Governing contracts and responsibilities, and also pricing and earning models
COMMITTING CUSTOMERS AND NETWORK PARTNERS	Creating a customer-oriented service culture in organisations
APPLYING NEW TECHNOLOGICAL SOLUTIONS	Utilising new enabling technologies, and technologies boosting operations' efficiency

The service integrator's tasks identified in this paper should form a solid baseline for network-management models and practical tools. The models and tools will be developed further in the SHINE project, to support integration of a seamless solution into B2B networks and its delivery to customers in such a way that it creates value for the customer. The next step is to study further what kinds of network-management and collaboration models facilitate value co-creation at network level. Example cases indicate that these service networks are quite typically 'one of a kind' in nature and that they are often configured to deliver a tailored solution to a single customer. For this reason, it is important to distinguish between the company- and network-level decision-making in terms of models and tools supporting operations at different levels.

Acknowledgements

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The chicken or the egg: Does the service offering define the customer relationship or vice versa?

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Introduction

This study was motivated by supplier companies' increasing willingness to develop and deliver services in co-operation with their customers. Understanding of customer needs and tailoring of service offerings accordingly require customer involvement, and long-term relationships are emphasised for achieving the optimal fit between customer needs and the service offering. In the present networked business environment, where knowledge is distributed, a 'collaborative approach' between customers and suppliers is required in service co-creation (see, e.g., [1–3]). In other words, willingness to work together is one of the key success factors in service co-creation [4]. Both prior literature and observations within companies suggest that customers differ in their openness and in companies' willingness to involve the supplier in service co-creation [e.g., 5–7]. A supplier with a specific service offering may be able to provide a wider selection from that offering to some customers while other customers purchase only physical products.

Relationships between globally operating customers and their suppliers are often unequal. Customers may strongly dominate the co-operation, and suppliers may have little negotiation power in the customer relationships. Customers may even have an 'adversarial' attitude toward their suppliers, and suppliers are evaluated primarily for the price of their products and services.

Thus, occasionally the aims of suppliers and customers diverge from each other considerably, as the suppliers may seek expansion of their service offerings and closer long-term co-operation with their customers, while customers may look for short-term benefits. Still, the customer could benefit from closer collaboration, as, in tandem with the growing trends of centralisation of purchases, customers have become more dependent on their suppliers, in part because their own knowledge base on manufacturing systems, technologies, and methods has vanished [5, 8–11].

The purpose of this paper is to explore the interplay between the service offering of a supplier and the relationship between a supplier and its customers. This study contributes to the theoretical discussion of service offerings and B2B relationships by suggesting reasons suppliers struggle in utilising the full potential of their service offerings and proceeding to another level of co-operation with their customers. The dyadic B2B relationships between a metal-industry supplier and its four globally operating customers were studied through application of a qualitative case-study research approach, with in-depth interviews being the main data collection method.

Customer–supplier relationships in service co-creation

Supplier participation in a customer's product development is not a new phenomenon, and
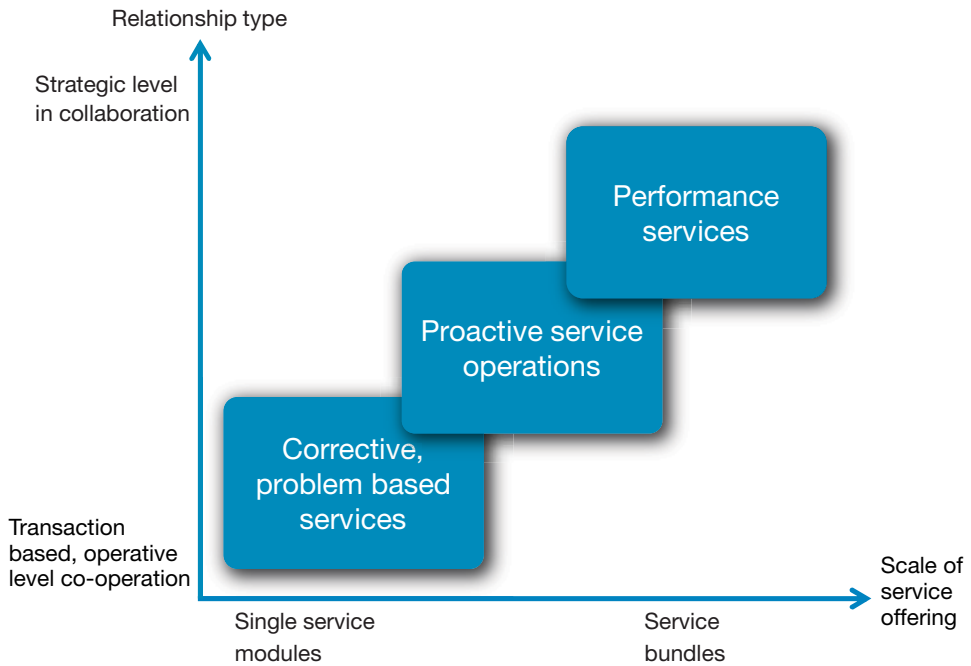
Figure 1. A tentative framework for study (modified from [18]).

various authors have reported the positive effects of involving suppliers in the product-development process [e.g., 8–10], including descriptions of several co-operation models. Similarly, the New Service Development (NSD) domain emphasises the notion that suppliers and customers are both engaged in value co-creation [2]. In exploring of customers' involvement in product development, three types of involvement have been identified: design for customers, design with customers, and design by customers [12, 13]. Similarly, some innovation researchers [14] distinguish among 'customer-focused innovation', 'customer-centred innovation', and 'customer-driven innovation'. Therefore, within the B2B relationships research stream, a relationship between actors is taken as the unit of analysis, instead of customers or supplier firms being studied separately [e.g., 15–16].

In today's networked economy, the boundary between a customer and a supplier has become unclear [5]. The customer–sup-plier relationship can evolve in several stages. For example, [11 and 17] have identified four distinct levels in the evolution of customer–supplier relationships within manufacturing networks:

1. The conventional level of co-operation represents traditional thinking wherein the supplier takes a reactive approach and delivers cost-efficient capacity according to detailed customer specifications.

2. At the co-operation level, the supplier seeks to upgrade its offerings and is involved first with capacity-planning. At this level, the customer also shows willingness to reduce its own capacity or responsibilities.

3. Partnership can be regarded as a co-engineering relationship in order to optimise product performance or even involve the supplier in product development, where the supplier's products may be complemented with value-added service offerings.

4. Strategic collaboration emphasises network thinking, in which all of the actors work together for joint goals and future benefits for all actors involved.

The current literature on B2B relationships is mainly preoccupied with new product development [e.g., 5], and services have received less attention. The starting point for this study is the different levels of co-operation and the scale of services provided by a supplier.

A tentative framework, which was built on the base of the service business mapping [e.g., 18] and inter-organisational-relationship literature, guided the study. The tentative framework categorises customer–supplier relationships by the level of co-operation (i.e., from operative to strategic) and the scale of the service offerings that the supplier provides to the customer.

In the tentative framework, the customer–supplier relationship can be categorised as operational- or strategic-level co-operation. From an alternative standpoint, the scale of the service offering that the supplier provides for the customer varies from single products and services to a wide range of service offerings. Thus, the value co-created within service delivery and development is dependent on both the relationship type and the scale of the service. Supplier companies often seek to proceed from one level to another – from operational level to strategic level and from offering single products or services to offering more extensive services.

Methodology

The research strategy applied in this study was that of the qualitative case study. The tentative framework (see Figure 1) guided the case selection. A supplier company ('Supplier') was selected as a case for offering a wide range of industrial services and being engaged in both operational and strategic relationships with its customers. Therefore, they are capable of operating in every quadrant of the tentative framework and the representatives of the

company have extensive experience of co-operation with customers of various types. Four supplier–customer dyads were selected as the unit of analysis. The main data-collection method was semi-structured interviewing (n = 12) of the key persons in one supplier company and four of its customer companies. Additional data were collected in a customer workshop for each supplier company. Before proceeding further, we briefly describe the companies studied and the supplier–customer dyads.

Supplier operates in Finland and provides production machines and systems for globally operating customers in the metal industry. Its product technology includes applications for robotics, sawing, grinding, edge-machining, and die-stamping. Nowadays, Supplier also offers life-cycle services, such as maintenance and modernisation, related to their products. On the basis of their influence on customers' business success Supplier has grouped the services into three categories: product, operation, and business-support services.

Customer A offers flow-control solutions, automation, information-management systems and applications, and life-cycle services for several sectors of industry. The relationship between Supplier and Customer A started when Customer A was looking for a new supplier of tailored production machines, and the relationship has lasted for just over five years. In addition to six machine deliveries, Supplier has performed some transfers and modifications of customer A's old production machines. Currently, Supplier also delivers some spare parts to Customer A's international unit through Customer A's global maintenance partner.

Customer B is a leading European producer of engineering steel for customers in the bearing, transportation, and engineering industries. Supplier has delivered several modernisations, production machines, and systems to Customer B. The relationship between Supplier and Customer B has

Table 1. Outline of the services delivered by Supplier to Customers A–D.

Customer	Services provided by Supplier		
	Product support	Operation support	Business support
A	Spare parts	Assembly and production ramp-ups Operation and maintenance training	
B	Spare parts Modernisation Maintenance contracts	Assembly and production ramp-ups Operation and maintenance training	Production audits Mapping of needs
C	Spare parts Modernisation	Assembly and production ramp-ups Transfer and re-assembly of machines	Mapping of needs (plans for production investments)
D	Spare parts Modernisation Maintenance operations	Assembly and production ramp-ups Operation and maintenance training	Mapping of needs (plans for production investments)

evolved since the early '90s, and Customer B is one of Supplier's largest customers by service business turnover.

Customer C is a manufacturing facility belonging to one of the leading global suppliers of systems, equipment, and services for the pulp and paper industry. Supplier has mainly delivered updates to Customer C's old machines, as Customer C already has a strong maintenance partner. The relationship between Supplier and Customer C has been evolving since the early 1990s.

Customer D develops, manufactures, and markets electric warehouse trucks and automated guided vehicles, also providing information services throughout the products' service life. The relationship between Supplier and Customer D started with production-concept planning, and Supplier has delivered one large production machine to Customer D and also supplied maintenance

services. As in the relationship with Customer A, the co-operation between Supplier and Customer D has lasted for just over five years.

Table 1 summarises the services delivered by supplier to its Customers A-D.

Results and conclusions

Figure 2 outlines the dyadic relationships between Supplier and its Customers (A–D), categorised on the basis of the services exchanged and the level of co-operation. The relationships between Supplier and Customers A and D can be regarded as operative-level co-operation, while the relationships between Supplier and customers B and C are strategic-level co-operation. Supplier delivers 'product-centric' single services for Customers A and C, and 'business-centric' service bundles for Customers B and D.

All of the customers taking part in this study pointed out that Supplier is one of the
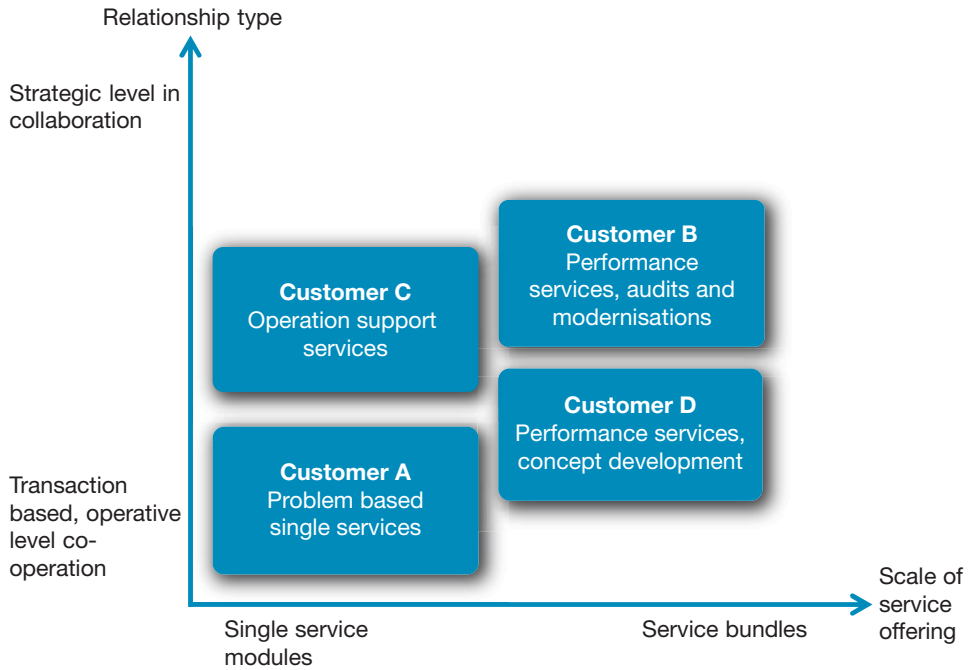
Relationship type

Strategic level in collaboration

Customer B
Performance services, audits and modernisations

Customer C
Operation support services

Customer D
Performance services, concept development

Transaction based, operative level co-operation

Customer A
Problem based single services

Single service modules

Service bundles

Scale of service offering

Figure 2. The supplier–customer dyads studied, outlined within the tentative framework.

few suppliers that can deliver tailored production machines or systems to them. The customers are dependent on the technical knowledge and innovativeness of Supplier with respect to the machines purchased. These turnkey deliveries typically include services related to project and network management, although the customers perceive those activities as included in the project delivery and not as separate services. All the customers had outsourced at least part of their maintenance operations to another service provider, and they did not consider Supplier an appropriate partner for delivering those operative maintenance services. It became evident that the customers perceived Supplier as more a specialist and a problem-solver than an efficient process operator or a provider of a wide range of industrial services.

In summary, Supplier has the potential to offer a wide range of diverse industrial services for its customers successfully and also operate in both operative- and strategic-level co-operation with its customers. However, despite several attempts, Supplier has not been able to sell a wider range of the services to all of its customers (e.g., Customers A and C), as the customers see Supplier's main role and strengths as lying in delivering technical solutions. The customers cannot see Supplier as a convincing partner for service provision, although some other customers perceive Supplier as a trustworthy service supplier and even as a 'strategic partner' in industrial services. Although the service offering of Supplier has potential to provide various customer relationships, the long-term relationship determines the services that can be offered. Especially within the Supplier – Customer C dyad, both companies may be stuck in the customary long-term relationships between them. Neither of the companies is able to change the product-centric, and only technically-oriented, mindset that dominates the relationship. This kind of path-dependency within the relationships hinders Supplier's pos-

sibilities for expanding its service offering to certain customers.

On the other hand, Supplier is able to offer various services (e.g., maintenance and modernisation) to Customers B and D. As has the Supplier - Customer C dyad, the relationship between Supplier and Customer B has continued for decades already. However, Supplier has been able to widen the service offering provided for Customer B over time. In this case, it seems that it is the customer's mindset and willingness to work together and, for instance, discuss its problems, requirements, and needs that have facilitated the change in which the Supplier has widened the range of services provided toward business-support services. Thus, in these cases, the service offering of Supplier 'defines' the customer relationship, which is often the aim of supplier companies – they could utilise their full potential and offer a customer all of the services that are included in their range of offerings. In other cases (e.g., the Supplier – Customer C dyad), the customer relationship defines the delivered service offering.

This study illustrated, through a case example, the interplay between the service offering of a supplier and the relationship between a supplier and its customers. In some cases, the supplier has been able to widen the service offering for certain customers, and in some dyads it seems that both actors are stuck in the usual way of co-operating and thinking. Accordingly, 'The chicken or the egg – does the service offering define the customer relationship or vice versa?' remains an open question, one that provides interesting avenues for future research. Our study suggests that more research could be conducted on the factors affecting the interplay between the service offering and customer relationships. As for managerial implications, supplier companies are advised to analyse how their customers differ in purchasing services, to focus on the ones with the most potential, and to question their mindset and that of their employees – as

that mindset may hinder the success of their service business or the evolution of the customer relationships.

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Development of knowledgeintensive product–service systems

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Introduction

Many manufacturing companies are considering the opportunities industrial services can offer them alongside their core products. The development of services offers new growth opportunities for these companies. Growth of technology-based knowledge-intensive business services (KIBS) has been enabled by such phenomena as outsourcing and globalisation. Moreover, the profitability of services is often claimed to be higher than that of tangible products, and they offer profits throughout the life cycle of the product.

The development of integrated product–service solutions is not without its challenges. Product and service design are typically accomplished separately, in different organisational units. Technical personnel are responsible for the development of physical products while service planning is handled by the marketing organisation. Consequently, services are generally planned later, causing problems in the compatibility of products and services. Moreover, in many cases too little attention has been paid to business analysis of product–service systems (PSS) – for example, life cycle profit evaluation or assessment of the revenue logic of alternative product–service systems.

At manufacturing companies, the processes related to the development of products are usually systematic, but the service development is intuitive and disconnected from the product-development processes. However, the services offered and developed should be compatible with the existing product and service portfolio. Customers increasingly demand comprehensive solutions from their suppliers.

The development of product–service design processes enables companies to design solutions consisting of the best possible combination of products and services from the perspective of the customer and the supplier both. The adoption of PSS design helps the companies in question to take the services into account when developing products, and vice versa. With the aid of some new PSS design methods, the lead times of the development processes may be shortened, and higher-quality solutions can be achieved when the specific characteristics of the products and services are taken into consideration as early as possible.

The goal of the MaintenanceKIBS project was to develop methods for knowledge-intensive service and product design. For instance, tools and practices were provided for concurrent design of products and services, for management and utilisation of information gathered in different phases of planning, and for assessment of the life cycle costs and profitability of the alternative product–service system concepts.

Methods

The MaintenanceKIBS project has concentrated on developing methods and tools for the development of products and services. A literature review examining various product and service development models was conducted, and semi-structural interviews among Finnish manufacturing companies were used for gain-
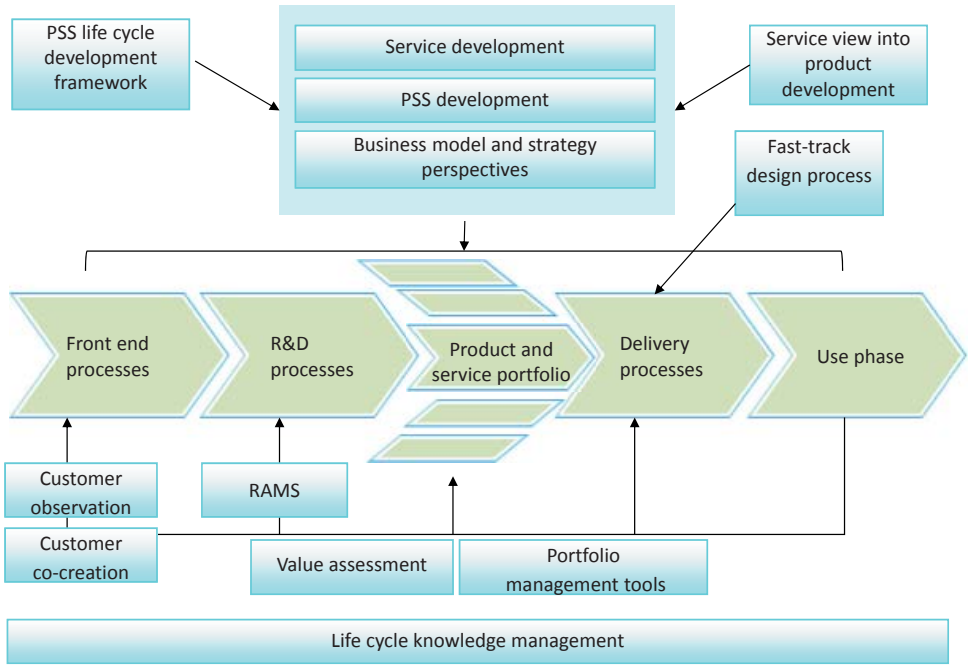
Figure 1. Overview of the outcomes of the MaintenanceKIBS project – methods and tools (blue boxes) proposed for application in the various stages of the product and service life cycle (grey arrows).

ing in-depth understanding of the research field. In the development of the methods and tools, a constructive research approach was utilised. The development of tools and methods was carried out in co-operation with case companies in the course of workshops. Methods for capturing observations and ideas from customer contacts, for assessing service value by combining qualitative and quantitative elements, and for implementing a life cycle model of diverse information needs were created through this methodology. The method for capturing observations and ideas was successfully tested in one of the case companies [1].

Results

Typically, service development concentrates on the processes of delivering the product (see Figure 1). One important goal of this project has been to take the service perspective into account at an earlier stage of the product development process. Ideally, the service development would start in the very earliest stage of the innovation process, at the front end of innovation (i.e., in front end processes). On the basis of the needs, products, and services of the company, it may develop its PSS to be product-driven; service-driven; or balanced, with the product and service components seen as equal in import.

The main objective of MaintenanceKIBS was to create a knowledge-intensive product–service business development approach and model. For reaching this objective, several methods were proposed for the full life cycle of product and service. Figure 1 summarises the outcomes of this project. The front end processes include the creation of new ideas and the collection and evaluation of, for instance, the problems, improvements, or needs identified. The new ideas are then further developed

in the R&D processes, which should be more formal and systematised than the front end of innovation. In the MaintenanceKIBS project, the focus in the portfolio management phase was placed on the product–service systems. In this phase, the existing solutions are analysed, evaluated, and managed, to streamline the portfolio with the strategies and business models of the company. The portfolio management practices may reveal deficiencies in the offerings of a company. The solutions created in the earlier phases of PSS development are delivered to the customer through set delivery processes, which include, for instance, tailoring the solution to the customer's needs and providing installation and training services. Carried out alongside the development processes are the life cycle management processes, which are intended for managing all of the relevant information created and needed in the various stages of development.

Manufacturing companies need a more systematic approach to the development of PSS. If systematic product development practices exist in a company, they serve as a good foundation for systematic PSS development processes. The literature review revealed that there are few systematic approaches to the development of PSS available, and none of these methods are commonly used. Nonetheless, the concept of PSS is strongly supported in academia and several practical PSS applications can be found in the literature [e.g., 2]. The benefits of PSS are also widely discussed in the literature [e.g., 3–6]. Taken together, these factors show that there is a need for systematic PSS development processes. It also became clear through the literature review that the creating a comprehensive and universal PSS development framework would be extremely difficult, indeed impossible. Instead,
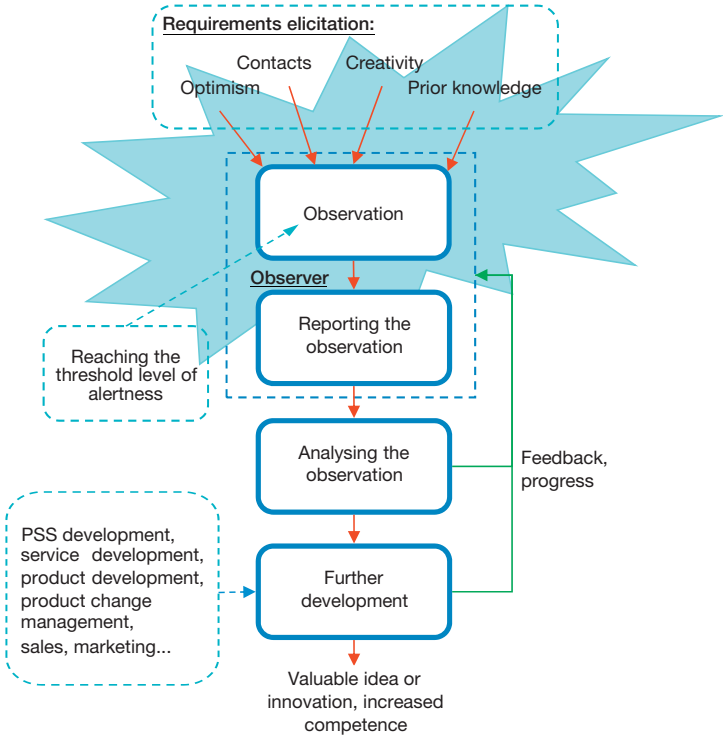

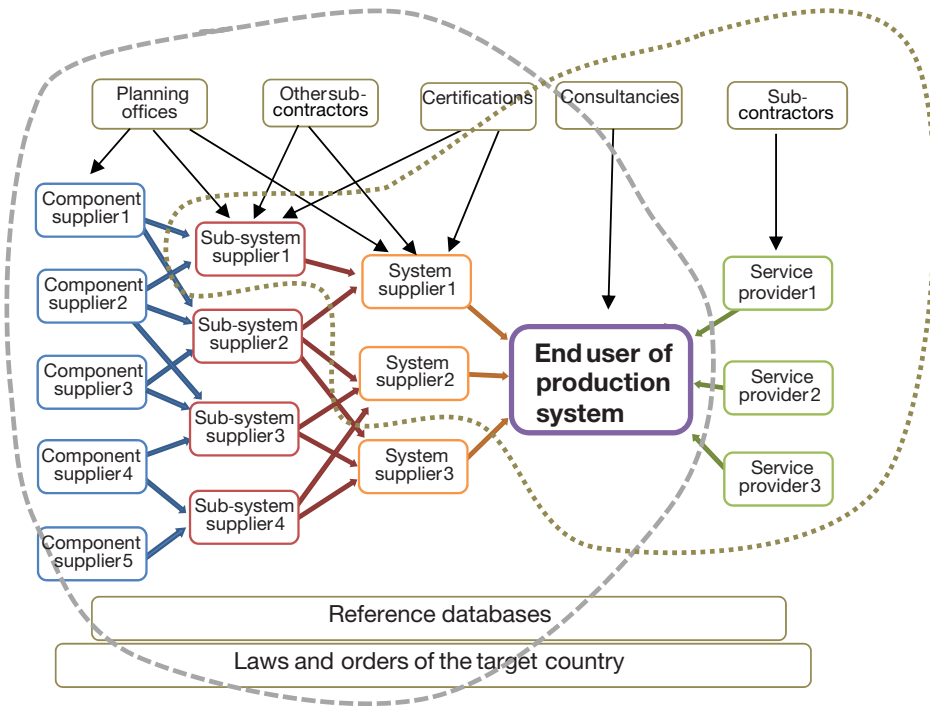**Figure 2. Customer observation method.**

Figure 3. Two networks of actors from the end user's point of view (the grey broken line describes the network for before the operation phase, and the light green dotted line describes that for the operation phase).

it was decided to provide the companies with a toolbox (see Figure 1) that offers help in the various stages of PSS development and the related processes, such as the data and knowledge management.

Various kinds of knowledge are needed in the development of product–service systems. The knowledge is especially important in the very first stages of the PSS development processes. In this project, the various types of business and production environment related knowledge and of customer related knowledge were identified. However, methods of capturing that crucial knowledge are needed too. To capture customer related knowledge especially, a customer observation method was created (see Figure 2). Other customer related information sources were contemplated also, in discussion of the opportunities and risks inherent in customer co-creation

(incorporation of the customer into the development processes). Effective and efficient idea and knowledge capturing processes when coupled with good idea and knowledge management processes create a competitive advantage for a company. The methods developed and discussed in this project, however, are not enough to bring about complete processes for knowledge and idea capture; more conventional sources of ideas and knowledge (surveys, interviews, customer satisfaction questionnaires, patents, technology reports, market information, etc.) are needed in addition.

Also addressed was evaluation (and also management) of PSS portfolios. Strategic and management issues, along with the optimisation of the various products, services, and activities in the PSS portfolio, were discussed. The decisions on portfolio management are

to a great extent connected to the strategy and affected by the business models of the relevant company. To enable evaluation of the profitability, risks, and benefits of the portfolios, criteria for evaluation of the PSS portfolio were created. Other tools for evaluation of portfolios were presented also. An important and under-researched part of PSS portfolios' evaluation is the assessment of the customer perceived value of services. In this project, qualitative and quantitative methods for assessment were presented. Portfolio management and evaluation methodologies, especially in the context of PSS development, have not yet been extensively researched. In addition, the complexity of PSS contributes to the need for new PSS portfolio management frameworks.

Potential information sources and needs that could be bases for new knowledge-intensive business services were contemplated. An important and growing part of services, KIBS include, for example, many of the maintenance services provided. Data and data collection are central in provision of KIBS. To form a full view of the sources of and needs for information, a hierarchical life cycle model of information was created (an example is presented in Figure 3). The potential users, benefits, level, and quality of the data were addressed comprehensively. As an important factor, the network of actors involved in the delivery of KIBS was presented also. An important perspective related to maintenance-based KIBS is that of management of RAMS data, which can guide the complex system development processes and offer a source of opportunities for KIBS.

Discussion and conclusions

To cater better for the needs of the PSS in the development processes, company- and case-specific processes such as those presented in Figure 1 should be defined. Systematic product and service development processes are prerequisites for systematic PSS development processes [7].

Companies should consider comparing the benefits and weaknesses as well as the risks and opportunities of the individual methods. Application of a bundle of methods should also be assessed as a whole, to allow determination of which combination of methods best serves the needs of the company. The benefits of PSS cover a broad field, and companies should contemplate whether they could translate these benefits into business success.

Nonetheless, a considerable amount of research in the areas of KIBS and PSS remains to be done. More research is needed to verify the benefits and risks of PSS development. Some of the methods proposed were tested in practice, but the proposed toolbox as a whole is yet to be piloted. Further research is needed to create models for managing complex PSS portfolios.

The end-of-life phase of PSS development processes was not addressed in our model. However, it is an important part of the development process in terms of sustainable development and a life cycle perspective. Remanufacturing, relocation, modernisation, and recycling of products and systems are important activity alternatives that should be considered when one is designing PSS.

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Sustainable value creation in manufacturing networks: analysis of methodologies supporting innovation and solution engineering

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Introduction

The European report 'Vision for 2020' calls for an understanding of manufacturing as a network of complex development-oriented relationships. The significance of the manufacturing industry in Europe is widely known and accepted. Directly and through services, manufacturing companies generate wealth and jobs in every country in Europe. Globalisation has sparked a novel industrial revolution, leading to a new worldwide distribution of production and markets. Increasing demands for sustainability, however, have created new challenges and emerging opportunities for society and for business. The traditional transnational product and service solutions cannot be sustained in the emerging eco-sensitive business environments, where growing volumes of trade and the patterns of commercial operations impose significant environmental challenges all over Europe.

Much of the opportunity to address sustainability is found in enhanced network management. Therefore, leading companies are looking for new approaches, so as to manage sustainability impacts effectively – from sourcing and production to distribution, product logistics support, and 'afterlife'. If the partners in the manufacturing network do not manage the future challenges surrounding regulation, reporting and compliance assurance, scarcity of resources, or the effects of climate change on their business, their ability to operate as a network partner could be dramatically affected. That could be fatal to their business.

To be successful and resilient in this changing business environment, manufacturers must be proactive. Industrial practitioners need to be creative in recognising the opportunities that the sustainable economy will present for the development of new products and services, the identification of changes in markets, and the optimisation of their internationally operating network in view of the new sustainability criteria. A concrete way of exploiting these opportunities involves the development and implementation of new sustainability based industrial models and concepts.

Method

The overall goal of the project entitled 'Sustainable value creation in manufacturing networks' (SustainValue) is to develop industrial models, solutions, and performance standards for new sustainable and better performing value networks. The research contributes to extended product utilisation by creating new business models and value-added services. New business models that emphasise long-term relationships and sustainable performance are more resilient and reward manufacturers that learn to deliver greater value with less material, and they offer higher customer value. Such

business models allow competition with low-cost countries and also reduce environmental impacts. Business model and networking-related innovations provide considerably more value than product development-related innovations do. The research will provide innovative solutions at value network level in order to guarantee sustainable and economically sound business.

The research focuses on 1) designing governance models and business architecture for sustainable manufacturing networks, on 2) delivering a set of tools and methods for sustainable and value-added business modelling and network analysis and providing a methodology for developing sustainable solutions, on 3) developing a governing framework for sustainability-performance standards across integrated value networks and verification processes, and on 4) testing and validating the tools and methods in real-world use cases. In the research, sustainable manufacturing network is defined as an organisational form which targets to gain future competitive edge to all participants through interaction and collaboration, and thereby is able to balance the three key aspects of sustainability (environmental, economic and social aspects) [1]. In manufacturing industries lead producer and its suppliers and customers form a typical value network thus covering both upstream and downstream networking, and encompassing both production and service networks [2].

The purpose of this paper is to examine current methodologies of innovation (including its management) and solution engineering that are used in manufacturing against the requirements for sustainable solutions. In this research, the existing methodologies are studied from a life cycle perspective. The findings of this research serve as a basis for the creation of new development methodology for sustainable solutions, products, and services in the SustainValue project. The paper is based on the results of the work package titled 'Life-cycle-based products and service development' [3].

Results

Sustainable development must have a clear connection to several levels of organisational decision-making and performance management – starting with strategy and continuing to portfolio management and further to an individual new product development project, for example. Business models are considered to be a link between the strategy and operational level, and business-model innovation is argued to be an essential element in delivery of the 'system innovation' that is necessary for radical change. As sustainability is becoming increasingly essential for firms' long-term success, those that fail to rethink the business models around sustainability will fail in the longer term to create competitive advantage. Though there already are a number of businesses that seem to be leading the way in efforts to develop progressive sustainable business models, overall there has been limited focus on systematic development of business models with broader applicability for sustainability, and embedding sustainability in the business models' elements has been considered difficult. [4]

In addition to the importance of business models that take sustainability into account, several authors [e.g., 5–7] have suggested that there is a need for integrating sustainability through the life cycle approach. To highlight the importance of a strategic approach to sustainability, this research has complemented the five stages (design, planning, and development; manufacturing; distribution, logistics, and services; usage; and end-of-life) with a business strategy development and innovation management phase.

In practice, the life cycle phases are intertwined with each other, and thereby development methods as well as requirements are also linked to each other. For instance, Aurich et al. [8] have described the product service system (PSS) engineering process as life cycle management (LCM) that includes two product life cycles – the manufacturer's and the customer's. However, in the present networked
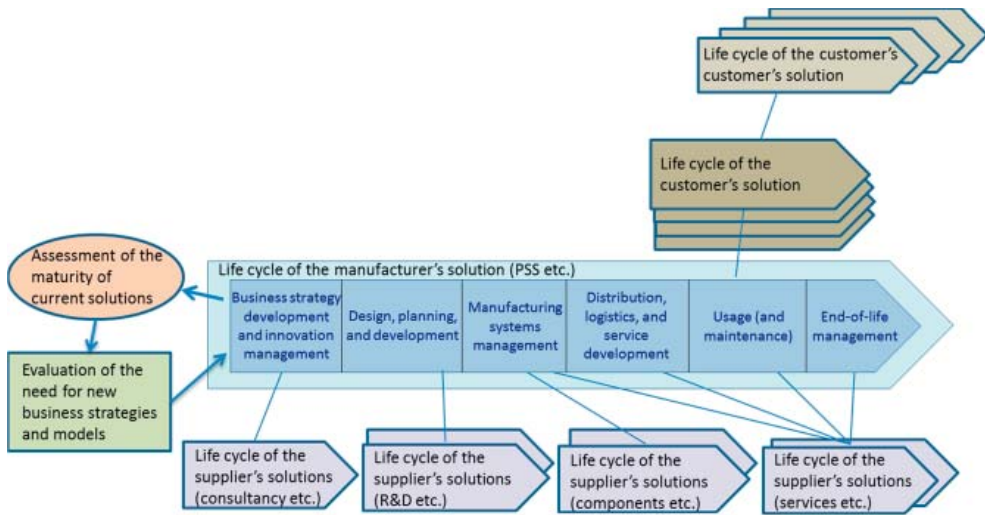
Figure 1. Life cycles that influence the life cycle of a specific solution from a manufacturer.

business environment, the challenge of managing sustainability requirements is even more complicated than this model indicates. When the life cycle of a particular solution from a manufacturer is explored, several life cycles of various solutions that influence sustainability can be found. Figure 1 illustrates this complexity of manufacturing value networks. Taking into account the overlap between phases in the life cycles and value network is relevant also when the aspect of sustainability requirement management of current methodologies is considered.

In addition to the various life cycles of the individual solutions influencing the life cycle of a manufacturer's solution, the life cycle stages depicted in Figure 1 are all connected to a number of methodologies and approaches that are important for the development of sustainable solutions. For the first stage – i.e., the business strategy development and innovation management stage – scenario analysis, road-mapping and forecasting, and PESTEL are among the methods that can be used. The existing methods recognised as linked with the design, planning, and development stage include approaches such as new prod-

uct development (portfolio management), the stage gate model, systems engineering, service development and solution engineering, design for excellence (DfX), design for sustainability (D4S), and PSS development with a focus on sustainability. Approaches that have a connection to sustainability in the manufacturing systems management stage include sustainable and green manufacturing, and lean manufacturing, to mention only a few, whereas the following stage – distribution, logistics, and service development – connects with green logistics and distribution, and reverse logistics approach. Approaches that have overlapping views of sustainability in the management of usage stage include quality, safety, health and environmental management, maintenance during use, and performance management. Finally, in terms of the end-of-life management stage, approaches such as 3R ('Reduce, reuse, recycle'), and 6R ('Reduce, remanufacture, reuse, recover, recycle, redesign') have clear perspectives on sustainability.

The above-mentioned methods and approaches have their limitations, however, when the aspect of how they could sup-

port innovation management and solution engineering toward sustainable solutions is considered. The following list presents the gaps recognised in the current methodologies:

- Methodologies in business strategy and innovation management: Few tools clearly link sustainable development to strategic decisions and innovations – e.g., how sustainability can offer competitive advantage, differentiation, and new business opportunities
- Methodologies in design, planning, and development: The existing tools typically focus on how to ensure that strategic targets are considered during the development work for the new product or service, rather than on establishment of the strategy
- Methodologies in manufacturing systems' development: Current approaches do not cover network and life cycle factors, although holistic thinking and integrated approaches are required
- Methodologies for distribution, logistics, and services: As in manufacturing approaches, the focus has been on the individual company, while service thinking highlights that collaboration with customers should be covered also
- Methodologies in the operation and maintenance phase: Modern versions of management methodologies applied in the operation and maintenance phase address sustainability factors too, but once again the focus is on the individual company
- Methodologies in the end-of-life stages: Broader approaches (3R and 6R) already exist, yet network and strategic approaches within their context are missing

Conclusions

Several methods of innovation management and solution engineering already exist. As they have all been identified as considering at least some of the elements of sustainable development, they can be utilised also for the purpose of sustainable development along some dimensions. With the gap analysis, however, the research has revealed that the present methods focus on an individual company rather than a network, and consider operational issues more than they do strategic thinking.

No company can reach the sustainability targets on its own in today's networked manufacturing environment, so a holistic approach for strategic thinking is required. It is important to consider sustainability at network level and throughout the solution life cycles. Therefore, system boundaries must be extended from individual-company to value network level – and even to the level of a business ecosystem that includes also other stakeholders.

New methods should support actors in judging what sustainability means in their industry and how it is regarded in the business actions and business models of all actors involved. Furthermore, companies should be able to position themselves within the value network in order to recognise how they can influence other actors and drive the network-level change toward sustainability. Present methodologies support sustainable development at operational level, but descriptions of how to set strategic objectives are partly absent. In other words, the foundation for sustainable development should be an understanding of the level at which the strategic choices leading to sustainability should be defined. For understanding the interests of the actors involved and ensuring their commitment, a multi-level approach to sustainability is required. Accordingly, it can be noted that some of the current methods support sustainability requirement management also at the network level if the system boundaries are defined transparently and also the strategic targets are agreed upon at the network level.
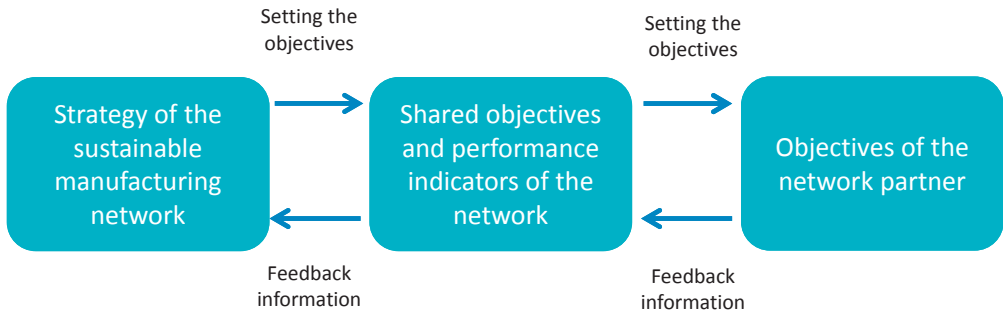
Figure 2. Strategic approach to sustainable co-development.

Managing sustainability requirements in the present networked business environment is a complex challenge. When exploring the life cycle of even a single solution from a manufacturer, several life cycles, of different solutions, that influence its sustainability can be identified. The gap analysis highlighted that it is crucial to integrate sustainability into companies' as well as networks' core strategies. The importance of the strategic connection is emphasised also by other authors (for instance, see [5]). Still, the strategic connection is typically considered at the level of the individual company only. A network level strategic approach to sustainability is necessary, and the key challenge here is to identify which are the company- and the network-specific 'sustainability recipes' and how to guide the entire network toward sustainable development. Figure 2 illustrates the importance of a strategic approach and the connection between the main levels of sustainable co-development in a broader context.

Firstly, the strategic importance of sustainability should be discussed at the manufacturing network level. Secondly, the shared objectives and performance indicators should be determined on the basis of that network level strategy. Then, the network partners' objectives should be aligned with network level objectives; furthermore, also the feedback loops between the individual levels are important.

Acknowledgements

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Three means of evaluation to boost industrial service culture

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Introduction

Although industrial services are attracting increasing attention, both in industry and within the research community, many companies seem to have difficulties in achieving significant progress in their service business. The challenge has been characterised as a transition in companies' orientation from *product and technology* toward **service** and *customer* (see, for example, [1, 2, 3]). Adopting service-dominant logic [e.g., 4, 5] and interpreting the business transformation in a new, holistic way could serve as a stepping-stone to a renewal of practices and culture along with development of new competencies [6]. However, there is a need for theoretically grounded and practically tested approaches to supporting companies in the transformation. In particular, the industry lacks concepts and methods for creation of a personal and shared understanding of 1) why the change is needed: motives and commitment, 2) *what* kind of organisational change is needed, and 3) how the intended change could be supported and managed in practice.

We approached the transition challenge for companies in terms of a shift from *a technology- and product-oriented culture toward a more service- and customer-value-oriented culture*. We have developed an assessment approach that bring new insight into overcoming the challenges, by studying them from an organisational culture perspective [7]. The approach, developed first with manufacturing companies, has been further applied in several industries, such as technical trade and ICT. The purpose of this article is to present, in brief, three distinct procedures for applying the industrial service culture and capability approach. We briefly describe the approach, then illustrate it and consider its utilisation for three specific uses:

1. as an assessment tool for use by management groups
2. as a booster of the organisational learning process
3. as a structuring framework for roundtable work and external benchmarking.

Industrial service culture and capability approach providing an evaluation framework

We have applied organisational culture (see, for example, [8]) and core task definitions [9] when studying the shift from product-oriented toward service- and customer-value-oriented business logic as it leads to challenges for comprehensive organisational learning in terms of culture and capabilities. Practically speaking, this means that the personnel's deeply rooted and partly subconscious perceptions of the organisation's core task should change. Transformation can be facilitated by exploring and communicating new core task demands and simultaneous development of customer relations, management, service development practices, and service business understanding [4, 7].

Industrial service culture is defined as an organisation's learned manner of responding to perceived changes in the demands of the core task when one aims to develop the
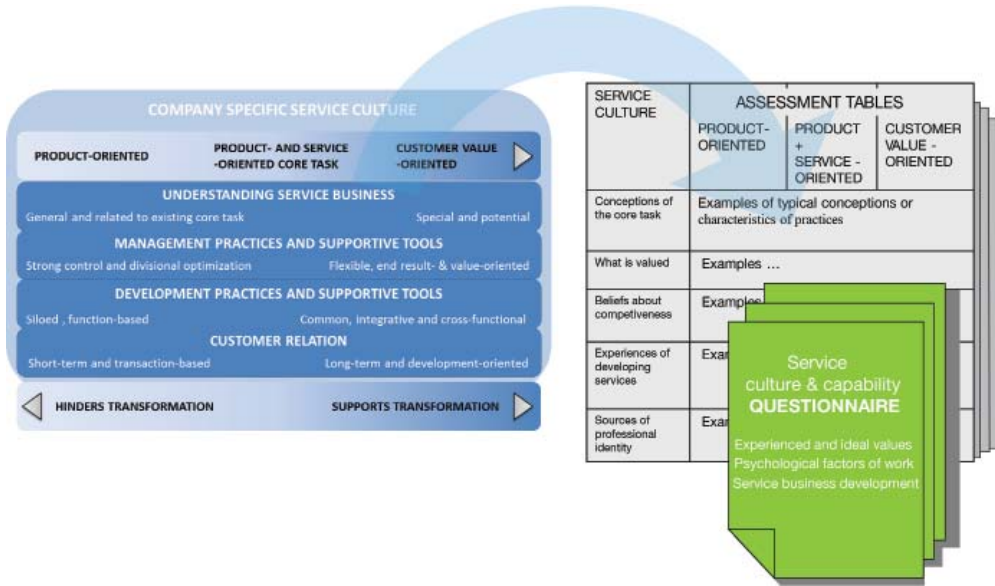
Figure 1. Targeted transition and elements of service culture and capability – the general framework, assessment tables, and questionnaire.

service business. Industrial service culture manifests itself in:

- service capability (how the demands of a new service-related core task are recognised and taken into account)
- experienced and target values within the work community and in operations with customers
- work motivation factors: sense of meaningfulness, match between requirements and available resources, and the sense of having control over one's work.

Industrial service capability consists of commonly developed operations-related cognitive (and cultural) solutions, which manifest themselves in four elements [7, 10, 11]:

1. Understanding of service business
2. Service business management practices
3. Development practices for the service business and services
4. Customer relations

For each of the elements, the intended transition is defined at the general level (see Figure 1). The elements overlap and are interconnected, and they should be analysed at multiple levels in the target organisation. The evaluation framework provides five basic elements, with criteria for assessment of the move from technology- and product-oriented organisation toward (more) service- and customer-value-oriented organisation. Each transition within the element in question is then described in more detail via tables that include examples of typical opinions and conceptions of the relevant phase. On the basis of these, the individual statements for the service culture and capability questionnaire are formed [12]. The idea is that the framework, examples, and statements are always specified on the basis of the context and company in question.

The approach is aimed at providing a *complementary* perspective in order to tackle those complex cultural challenges faced when one pursues significant strategic growth, especially in manufacturing and technical trade industries.

Three evaluation procedures for supporting transformation

The evaluation framework described above could be utilised for many purposes and phases for supporting companies' industrial service business related transformation. According to our previous studies, companies lack practical but holistic procedures and frameworks for at least three goals [10, 11, 13]. Firstly, there appears to be a need for a simple but holistic tool to assess quickly how the top *management view* the current state of a company's service business capabilities, obstacles, and opportunities. Such assessment is particularly essential in building the commitment for major strategic change, as well as checking the direction or progress of an ongoing change process. Secondly, companies lack methods of acquiring multi-voice views and shared understanding of the motives, aims, and means related to service business transformation *throughout the company, as a collective learning process.* Thirdly, companies seek suitable external *benchmarking fora*, with methods that allow comparing their strategic choices, service concepts, and practices with those of other companies in their industry and mutually discussing them. Ideally, these external fora should provide means for continuous reflection, new ideas, and collegial support for managers during the companies' long-term transformation processes. Our three procedures, with their associated purposes, processes, and resource needs, are described next. Some applications and feedback are demonstrated in brief to illustrate their practical benefits.

A management group assessment tool

The first use of our approach is to serve as the management group's tool for assessing the current state of the company's service culture and capabilities. The process begins with motivation and introduction to the entire evaluation, as well as the first phase, an *individualised assessment*. As guidance for the evaluation, each of the service culture and capability elements and the related transformations are described in more detail by means of tables giving examples of typical challenges or contradictions [11, 14]. These examples are presented as propositions, and the members of the management group choose and mark the proposition that best describes the company's current situation. The answers are collected in a summary table. After the individualised assessment, each manager's results are *collected, examined, and discussed* in a workshop, to create shared understanding within the company. An internal or external facilitator can be utilised for making the workshop more effective and constructive. Thus, the concurrence between results, the shared understanding, and the goals of the service development are easier to see. Any great variation between individuals' results points up contradictions and challenges that must be resolved before efficient service business development can be pursued. This discussion is vital. After that, the idea is to *identify, iterate, and prioritise development targets*.

Feedback from management group assessments in the companies studied indicates that the method aided in identifying the present situation and highlighted any contradictions present. For example, one participant described his increased understanding of the current situation as follows: 'I noticed that there exists will for change but we are only in the beginning of the change.' The opportunity to learn to understand how others see the situation (e.g., in view of local conditions) was cited as a key benefit of the procedure. Recognition of concrete barriers to development in customer relationships, customers' process understanding, IT systems, and responsibilities were mentioned also.

The main benefits/results *are an updated, shared understanding of the current state, goals, conditions, and main development targets of service business transformation in the company.*
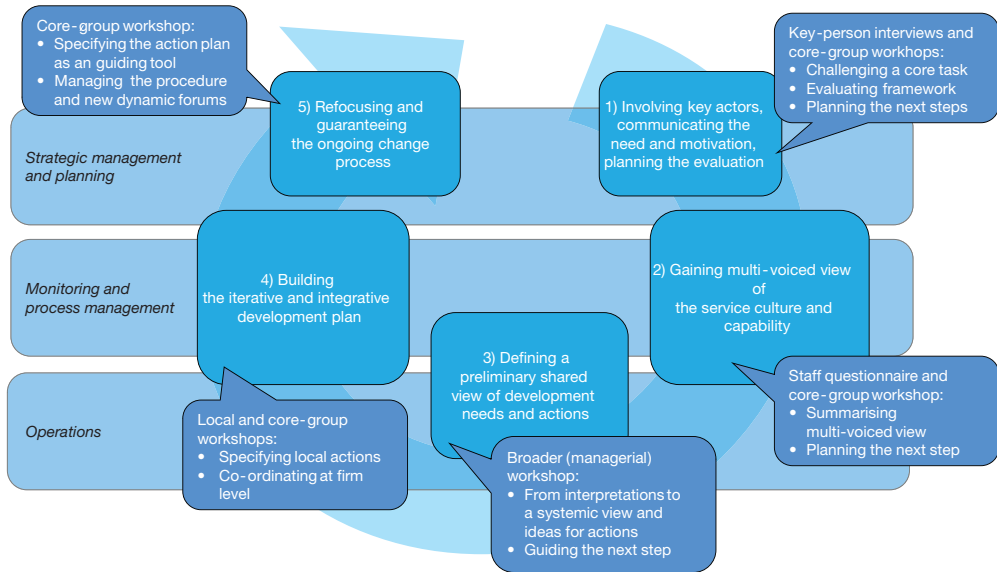
Figure 2. The evaluation as a collective learning process – phases and methods.

Evaluation as an organisational learning process

Here the conceptual evaluation framework is applied in conjunction with the practical procedure for evaluating the collective mindset of the organisation in relation to service business development. The participatory evaluation procedure provides systematic means to create shared understanding of the complex, ongoing change and manage it more purposefully. The multi-level nature of the assessment is illustrated in Figure 2, with three main levels of organisation. Evaluation is conducted as a collective learning process modified in line with company-specific needs. The figure also shows the main phases of the evaluation process, with their data-gathering methods and work practices.

The approach was piloted and further developed with a global company providing a broad range of innovative observation and measurement products and services for meteorology, weather-critical operations, and controlled environments. The evaluation process was conducted when the company was undergoing organisational restructuring of its service operations. The participatory assessment was designed to support the ongoing change process by providing research-based information about the state of development of the organisational service capabilities and facilitating the formation of a service-oriented culture and internal collaborative work practices. In addition, raising staff awareness and enhancing the commitment of key personnel to the service business development were anticipated. Finally, it was agreed to state the development actions in a development plan.

The evaluation process could be utilised in various phases of service business transformation, preferably repeatedly when perennial change is involved. Initially, an external assistant is necessary for this, but the procedure has been developed to encourage companies to take ownership of its application themselves (for more, see [12]). We also have good experiences of supporting SMEs in accordance with the same principles but in a more agile way.

The main benefits can be summarised as 1) increasing individual and collective understanding of the needs, potential, and

mean of the service business development; 2) a development plan to guide service business transformation complementary to the ongoing-change agenda and activities; 3) a repetitive approach with practical methods to evaluate and support service culture and capability; and 4) possibilities for revising traditional collaboration and innovation practices within the company.

Structuring of the roundtable work and external benchmarking

The general aim of the cross-company roundtable work is benchmarking and learning from each other. It offers a good context to share best practices; solve a practical problem; or work on a real case, visioning work, and service value network integration [15]. Also important is sharing current problems with people in similar positions [13]. The participants might be 5–10 non-competing companies' representatives, a researcher, and/or a consultant. The idea of applying the service culture and capability framework is to systematise and focus the discussions as well as to enhance more in-depth step-by-step analysis of each participant's situation and the differences between the companies. The target group is CEOs or business developers of companies that are not competitors but still act, for example, within the same industry. The roundtable work has been designed to involve six meetings, each lasting 3–4 hours. The process of co-learning in the roundtable work can be facilitated by several methods (see Figure 3).

We piloted the approach in the context of technical trade roundtable work (2009–2010). The Association of Finnish Technical Traders set up a project aimed at new service innovations and profitable service business. One of the concerns was that growth in service business is impeded by the present organisational culture – i.e., the personnel's values and conception of the work. To overcome this challenge, a special roundtable group was established, focusing on

this issue. Six persons, from six companies, participated in the roundtable sessions. The case is described in more detail by Nuutinen and Valjakka [13].

The views the group members expressed on the roundtable work were mostly positive. For example, the possibility of sharing experiences and obtaining feedback on one's development ideas was valued. Moreover, simply sharing concerns and doubts was regarded as valuable: managers do not have many people who understand their situation. A positive element of the roundtable method structured within our framework is that it offers a kind of 'safety valve' for the managers – they can express their doubts more freely than within their own organisation, where they may feel greater pressure to be a 'believer'. Discussion with others can also encourage eye-opening moments – one's own culturally rooted excuses for not proceeding with service development pose challenges.

The main benefits can be summarised as 1) reaching deeper understanding of one's company's situation and alternative solutions, as well as the dynamics of change; 2) constructing/strengthening the benchmarking network; and 3) gaining new development ideas by comparing good practices.

Conclusion: Theoretical and practical contributions

The aim of this article was to present, in brief, three procedures for utilising the service culture and capability approach in enhancing personal and shared understanding of changes needed in the transformation of industrial companies. We have described the utilisation of our conceptual approach for three purposes: 1) as a management group assessment tool, 2) as a booster of the organisational learning process, and 3) as a structuring framework for roundtable work and external benchmarking. Each procedure supported transformation, but their 'power' is strongly related to the participants (who takes part, in what numbers) and the
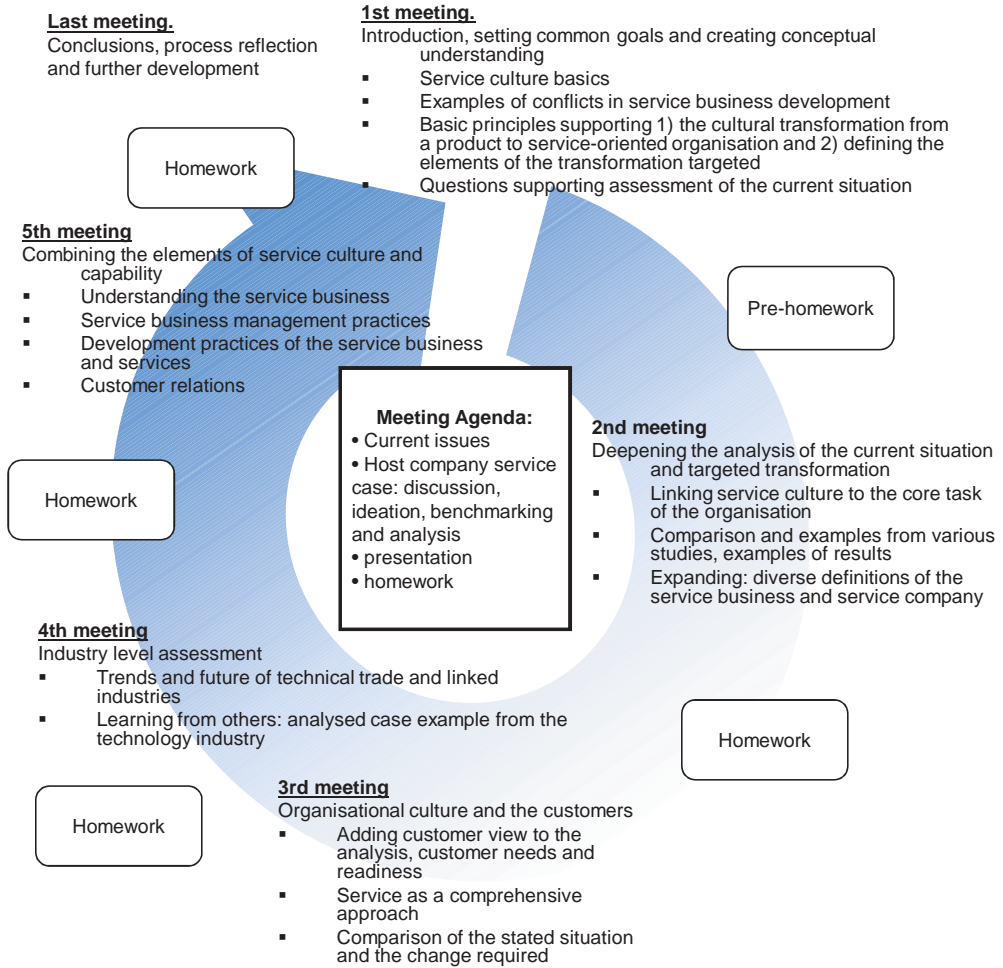
Last meeting.
Conclusions, process reflection
and further development

1st meeting.
Introduction, setting common goals and creating conceptual
understanding
- Service culture basics
- Examples of conflicts in service business development
- Basic principles supporting 1) the cultural transformation from
a product to service-oriented organisation and 2) defining the
elements of the transformation targeted
- Questions supporting assessment of the current situation

Homework

5th meeting
Combining the elements of service culture and
capability
- Understanding the service business
- Service business management practices
- Development practices of the service business
and services
- Customer relations

Pre-homework

Homework

Meeting Agenda:
• Current issues
• Host company service
case: discussion,
ideation, benchmarking
and analysis
• presentation
• homework

2nd meeting
Deepening the analysis of the current situation
and targeted transformation
- Linking service culture to the core task
of the organisation
- Comparison and examples from various
studies, examples of results
- Expanding: diverse definitions of the
service business and service company

4th meeting
Industry level assessment
- Trends and future of technical trade and linked
industries
- Learning from others: analysed case example from the
technology industry

Homework

Homework

3rd meeting
Organisational culture and the customers
- Adding customer view to the
analysis, customer needs and
readiness
- Service as a comprehensive
approach
- Comparison of the stated situation
and the change required

Figure 3. The process of the roundtable work and the main facilitation methods.

resources invested. Also, more systematic analysis of the applicability of these three methods can be found [6].

Our previous studies have shown that all three procedures are suitable for tackling the three fundamental questions that should be answered within the company if it is to achieve radical growth in the industrial service business – 1) *why* the change is needed: motives and commitment, 2) *what* kind of organisational change is needed, and 3) *how* the desired change could be supported and managed in practice.

Firstly, all three procedures start with a *critical reflection or a challenge* to current beliefs about the core task of the company – in other words, the company's strategic role as a service provider within a business environment and the participants' own roles in contributing to the service business [cf. 16]. Questioning the current beliefs personally and collectively enables to see gaps and contradictions explicitly between participants as well as between time scales, such as current needs vs. future potential [17]. The motives for the change need to be clear enough that the

change in all its complexity is seen as worth pursuing and gaining commitment for [cf. 18]. In this early stage, both internal reflection and external benchmarking seemed to be beneficial, and they appeared to complement each other.

Secondly, even while attaining significant and radical growth in their service business, managers still have faced challenges in *understanding systemic and complex relations* between different business logics and related pricing, offerings, management, competence, and organisational issues [2]. Therefore, holistic frameworks and practical procedures such as management group assessment are needed for creation of personal and shared understanding of the goals reached and of new business and management models with core competencies at the first managerial level. The top-down perspective has been criticised, but it appears necessary when one pursues strategic transformation, which calls for strong managerial support in terms of vision and resource allocation (ibid.). Corresponding participatory procedures are needed to motivate and involve all in the organisation step by step, to adopt and *reconstruct* operation models and practices in relation to their own responsibilities for renewal and their own competencies. For that purpose, the evaluation as an organisational learning process appeared to provide a relevant basis in terms of cyclical, iterative, and long-term learning, by mediating elements and aiming at creation of conceptual models to guide renewed practices. Furthermore, creating the new service business agenda is seen fundamentally as a social, *co-creation process* [cf. 16, 17].

Thirdly, all three of our procedures seem to provide practical support for creation of an individual level and shared understanding in choices between *alternative ways of implementing* renewed business and operation models. The challenge is to fit together those different models in daily practices involving risk of reverting to a product- and technology-oriented business logic and culture [11, 12,

19]. Thus external benchmarking of alternative strategies and learning from other companies by means of industrial field specific roundtable work and open discussion fora provide much-needed support for managers. The lessons learned could be shared during management group assessments and processed further collectively for building of company-specific solutions. A participatory evaluation process contributes to the co-creation of new networked structures within the company as well as a development plan to guide the service business transformation from a culture point of view.

This article has provided a quick look at practical means for companies' use to create a shared understanding of the necessary changes or to evaluate reformulated service practices, thus facilitating their complex service business transformation. The approach provides an essential but typically unavailable perspective, with practical tools for industrial companies' application to understand and better manage their complex and dynamic change process when gaining growth via services. Furthermore, in adding the perspectives of customers and external service providers to the evaluation, the approach would support even more comprehensively an increasingly networked service business development. In our ongoing studies, we have placed great emphasis on the importance of involving customers more in the service business development process.

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Towards service business in Finnish industrial companies

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Introduction

The business environment is much more complex today than ever before. The changing business environment and more demanding customer needs are forcing companies to develop new solutions to serve their customers and fulfil their needs. Many companies are, therefore, 'upgrading' their products by integrating services into their core product offering [e.g., sources 1–2]. This phenomenon is called servitisation [3, 4, etc.] or PSS – product-service systems [5]. No matter how clear the service business drivers are, the transition from product manufacturer to service provider is not an easy, fast, and linear process. The objective of our study is to investigate the main services Finland's large and globally functioning industrial companies offer their customers. Besides listing the services, we look at how companies sell or offer these services to customers – i.e., what types of contracts they have with the customers. Most previous servitisation studies have focused on the drivers of the move toward service business or challenges in adoption of servitisation, while enhancers in that adoption process have received no attention. It is this gap we attempt to address by investigating how the transition toward service business has gone, through exploration of both challenges and enhancers. The study is based on four cases, with data collected in special interest group meetings (SIGs). Another contribution is description of this new development and research method.

Theoretical framework

Classification of industrial services

One classification of industrial services [6] is quite simple, classing industrial services into two groups: 1) maintenance and repair services (e.g., equipment, repair and janitorial services) and 2) business advisor services (e.g., legal, accounting, advertising, and management consulting).

According to [7] and [8], services and solutions could include activities such as
- customer service – e.g., technical support
- product service – such as preparation and/or maintenance
- professional services (service products), such as process consultation, adding value for the customer and end user
- industrial service – e.g., pre-purchase and after-sales.

The main drivers of the move toward service business

In the literature we find three main drivers for the transition from product manufacturer to service provider. The first is the financial driver; services are said to be a more stable source of revenue, and services provided for the installed base have higher profit margins than products do [5, 8]. Second is the marketing driver; marketing personnel believe that better services help companies to sell more products [9]. Marketing drivers also include the claim that services create customer loyalty [10] and the notion that services tend to induce repeat sales [11, 12]. The

third driver is strategic; the whole of the competitive strategy is based on services, and companies use service elements to differentiate their manufacturing offerings from others' and to give themselves competitive opportunities [11, 13].

The main challenges in the transition from product manufacturer to service provider

The challenges in the transition from product manufacturer to service provider, according to previous literature, are mainly cultural and corporate challenges [e.g., 6]. The challenges can be divided into three groups: those 1) in service design, 2) in organisational strategy, and 3) in the organisational transformation. Service design differs from product design in that the fuzzy nature of services makes them difficult to define [14]. Companies also need to describe the value proposition of the service clearly to the customer in the design of service provision [11]. A service-oriented strategy forces the companies to adopt the necessary organisational structures and processes [e.g., 8–9]. Companies moving toward a service-oriented strategy find challenges in this adaptation of their organisational strategy [5], and the service management principles are often contradictory to existing manufacturing practices. Implementing the service-oriented strategy is also not an easy task. Companies often encounter resistance in those parts of their organisation where the service strategy is not understood or where people are afraid of the infrastructural change it entails [11].

Research methodology

Research strategy

The research methodology employed in this paper is a qualitative case study. This method was chosen for its suitability [15] for situations that involve complex and numerous variables and processes. Also, Source 16 states that the case study method is a useful approach for increasing one's understanding of topics that have been under-investigated.

Case selection and case description

Four cases were selected to explore the change toward services business in Finnish industrial companies. The case companies are all roughly the same size and act in global markets, which enabled comparison among the cases with respect to what kinds of services large and successful Finnish industrial companies offer to their customers.

Case company A is a large company operating as a global supplier of technology and services to customers in the process industries, including mining, construction, pulp and paper, power, and oil and gas. Case company B is a large company that manufactures electrical power and propulsion systems for ships in global markets. Case company C is a large cargo handling solutions provider with global operations. Finally, case company D is a large global supplier of bearings, seals, mechatronics, lubrication systems, and services.

The special-interest-group method as a base for the research setting

Special-interest groups (SIGs) act in two roles: as a development tool and as a research method. The aims of SIGs are

1. to increase the utilisation of systematic co-operation and knowledge exchange between companies and also between companies and research organisations
2. to reach concrete and useful results for the relevant topics
3. to act as a data-collection method for researchers.

The initial framework for SIG operation was based on experience and the methods employed for change management (see, e.g., [17]), knowledge-transfer partnership in business/ academia co-operation [e.g., 18, 19], and experiences from a roundtable open innovation forum [20]. In this article, we focus on SIGs mainly as a data collection method.
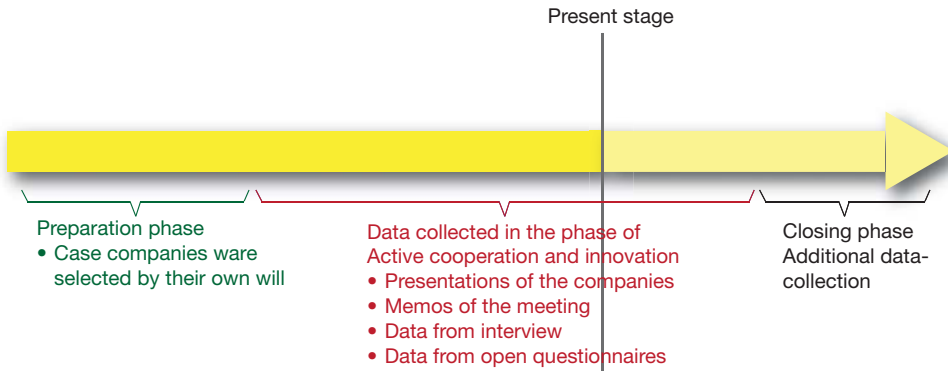
Present stage

Preparation phase
• Case companies ware
  selected by their own will

Data collected in the phase of
Active cooperation and innovation
• Presentations of the companies
• Memos of the meeting
• Data from interview
• Data from open questionnaires

Closing phase
Additional data-
collection

Figure 1. The research setting.

The SIG activity took place on the following principles:

- The SIG has a well-defined and relevant topic, and it is in line with the programme's themes.
- The chairman is from a company, and the group facilitator from a research organisation.
- The SIG session has an explicit clear starting point and end state.
- The SIG has 7–10 members, who are selected on the basis of registration.
- Details of the work, results, and material of a SIG are confidential within the group.
- SIGs communicate the main findings in two ways: via generic free-form reports on heir main findings and through free-form presentations at a workshop.

Collection of the research data

The research was conducted in collaboration with two academic affiliates within a large research project that included, in all, nine research affiliates and 19 companies. The collection of research data was conducted in August–September 2012.

The gathering of qualitative research data was done mainly in SIG meetings (n = 3). The SIG process is still in progress (see Figure 1). Each meeting had a pre-selected theme and detailed questions to be answered. Every case-company representative had his or her own presentations discussing how the issues were resolved in the company. In addition, presentations were made by various researchers specialising in the themes, one at each meeting.

Table 1. Targets, methods, and data.

Research question / target	Method	Data
Service offerings and contracts	Archival data Observation Open questionnaires	Presentations (n = 5), memo Notes n = 5
Enhancers and challengers the companies have faced	Archival data Observation Open questionnaires	Presentations (n = 4), memo Notes and memos n = 5

These presentations offered archival data as well as memos on the meetings. Additional data were gathered via observations and open questionnaires (n = 5) (see Table 1). Researchers took notes at each meeting. The first open questionnaire, sent to participants in the preparation phase, included questions about the themes that were most important in terms of development of service business and about the SIG's expected benefits. Another questionnaire was sent after each meeting. The open questions were 'What were the main lessons learned in the previous meeting?' and 'What are the detailed questions you would like to focus on under the selected theme at the next meeting?'.

Findings

The service portfolios and service contracts of the case companies

According to Source 6's classification of industrial services into 1) maintenance and repair services and 2) business advisor services, the emphasis of the service offerings of the case companies seem to fall into the first group. All of the case companies nevertheless offer at least one kind of business advisor service as well. In the typology of sources 7 and 8, all of the case companies offer product services (such as maintenance, spare parts, and condition monitoring) and industrial services (after sales services). Most of the case companies (3/4) also have some customer services in their service portfolios (e.g., training and support services). None of the case companies had similar service portfolios, and each company had at least one unique service in its offering that none of the others had in theirs. Services are offered to the customers as modular service packages, with a service contract normally covering 2–4 service modules. The quantity of services multiplies as one moves from a basic service package toward more comprehensive service packages.

Enhancers and challengers the case companies have faced on the way to service business

The most common enhancers the case companies recognised were sales support and concrete measurement indicators. As other enhancers the case companies listed common work tools inside the organisation across national borders, a wide service offering and contract base, and the fact that they have salespersons who concentrate purely on selling services. The enhancers the case companies mentioned were linked mostly to the company's support systems (sales support, measurement systems, and global work tools) and its common interest in service business in the forms of a wide service offering and contract base and people working full-time in the field of service business.

The challenges the case companies mentioned most often lay in reorganising the organisation and in networking. Besides these, the case companies noticed challenges in training their own personnel, difficulty in describing the benefits to their customers, and the work-in-progress nature of productisation of service contracts. Also, changing customers' mindset is not an easy task. Some of the companies that previously worked as manufacturers have the challenge of getting customers to see them as service providers. The sales staff for the customers in particular still have a slightly inadequate understanding of the concept of total cost of ownership (TCO) and of the additional value that a product–service bundle could offer. Of the challenges mentioned in the literature, the case companies recognised the difficulty of describing the benefits to their customers in some cases. The case companies went even further by saying that they have some difficulties in changing the customers' mindset. The challenges in reorganisation were also mentioned both in previous literature and by the case companies. The literature named a third challenge – the challenges in service design – but the case companies did not seem to have seen this as problematic. Other challenges the

case companies mentioned were linked to networking, training, and work-in-progress productisation of the service contracts.

In the third special interest group meeting, we also discussed about the lessons learnt about the transformation process. The companies highlighted that the change management requires constant interaction, communication, and monitoring. The change demands commitment and a sense of direction at every level of the company, starting with the management. Also important is that, to manage the change, one must first understand the current state and then see what is going to change and why. The change is not going to occur unless the company has clear drivers and a plan for how the change is to move forward alongside the old business.

In the SIG- meetings, we didn't really concentrate on why the case companies wanted to move toward service business in the first place. The drivers that arose in the discussions were mainly strategic in nature. The case companies saw services as a competitive advantage, as a way to stand out from their competitors. Services were also seen as a way to expand one's operations and gain more stability of business. The case companies did not cite a marketing driver (a.k.a. service selling) as a way to sell more products among the reasons to move toward service business. On the contrary, they considered important the fact that they have salespersons who focus on selling services instead of selling them as a sideline to product sales.

Discussion and conclusions

In this paper, we have studied what the main services are that large and globally operating Finnish industrial companies offer to their customers and what types of contracts they have with the customers. There is a lot of theoretical discussion of the importance of servitisation or product-service systems but little empirical research on how this transition has gone. It is this gap we have tried to address by investigating the enhancers and challenges the

companies have faced on their way to service business. The primary managerial contribution of this study is to help managers benchmark the situation in Finnish industrial markets on the way toward service business and to explore what the enhancers and challenges have been for the companies on this path.

A special interest group made a contribution to knowledge exchange. It encouraged knowledge transfer between the companies and enabled quantitative benchmarking. It also offered an effective platform to business/academia interaction in two ways. In SIG activity, the researchers gained good insight into companies' present issues and a way of collecting data concisely. While a SIG is an effective method for combining multiple cases, one of the themes was discussed at only one meeting, for three hours. For study of the issues in more depth, more data should be collected and analysed (e.g., via detail-oriented interviews, action research in case companies, and analysis of company data). Nonetheless, the SIG method offers a fruitful starting point for further research once systematic, open, and compact co operation have increased mutual understanding and built trust among the participants.

Acknowledgements

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Safety and security

Cutting costs and looking good: why customers buy security services

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Introduction

Outsourced security services are an essential part of business and risk-management strategy in almost every contemporary company. Increased need for security services in private companies has created huge market potential and new business prospects for security companies. It is estimated that the security sector will continue to grow globally by around eight per cent per year [1], being one of the most rapidly growing industries in, for example, Europe [2]. In this paper, we use 'private security industry' to refer to privately funded business entities and organisations supplying security related products and services for a fee [3]. The security industry's customer base is very wide, and it cuts across all sectors of the market, to include government entities and commercial and industrial enterprises [4] as well as individual citizens and private households.

Previous research has revealed that security companies' product offerings consist increasingly of various services, and they advertise themselves as real service companies [5]. What is contradictory, however, is that when we took a closer look at the security business from the central perspectives of service research, such as servitisation, service-orientation, or marketing communication, we discovered that the security companies do not actually follow service-oriented business logic [5]. Too often, transactional and goods-based business practices take precedence over the more relational and customer-oriented approach. We argue that the security business could benefit from a move toward more service-oriented business logic, and that a more profound understanding of customer perceived value and value drivers is needed in security services. The purpose of this paper is to discuss why customers purchase security services and, after this, what the prerequisites are for value creation. Two models are introduced in the paper: a model of the fundamental motives for the use of security services and a ValueSSe Value Map.

Methods

This paper is based on the findings of the research project ValueSSe (i.e., 'The Value of Corporate Security Services'), which was carried out in 2009–2012 [6]. The main object of ValueSSe was to strengthen the current understanding of customer value in business-to-business security services. More specifically, the final research questions of ValueSSe were the following:

- What constitutes security as service (understanding value)?
- How to bring security services forward to meet customer business needs (creating value)?
- How to increase the relative bargaining power of security service providers in buyer–seller relationships (capturing value)?

Moreover, ValueSSe was a move toward establishing security services as a research topic attracting interest in service research.

ValueSSe consisted of company-specific development projects and a joint research project. The project consortium included 10 security and customer companies, two research institutes, and an external co-ordinator. Eight of the companies represented security-service providers, and two were customer companies. A further 60 customer companies and a number of individual end users were interviewed, for forming of a more comprehensive picture of customer value in security services. The participating organisations were

- Niscayah Oy
- G4S Security Services Oy
- Palmia Turvapalvelut
- Outokumpu Oyj
- the City of Espoo
- Flexim Security Oy
- Verifi Oy
- Schneider Electric Buildings Finland Oy
- Granite Partners Oy
- Turvatiimi Oyj
- Tamlink Oy (as co-ordinator)
- VTT Technical Research Centre of Finland
- Aalto University School of Business.

Methodologically, ValueSSe was a multi-method study based on multiple data sources and taking advantage of several research approaches and strategies. The majority of the research activities followed the research strategy of action research or a case-study design, utilising mainly qualitative analyses of interview data. Survey data were also gathered in the project and analysed deductively through establishment of a research model and its testing with the data gathered.

The findings described in this paper stem from the customer interviews and survey data. The models introduced in the paper were constructed by gathering of all the various elements that customers indicated as having a role in the value creation. The preliminary list of factors was then grouped by theme, reflecting different approaches seen in the customer-value literature [e.g., 7–11]. Lastly, individual factors were merged, re-labelled, and organised hierarchically as representing fundamental motives for the use of security services and individual factors that have an influence on value creation – i.e., value drivers.
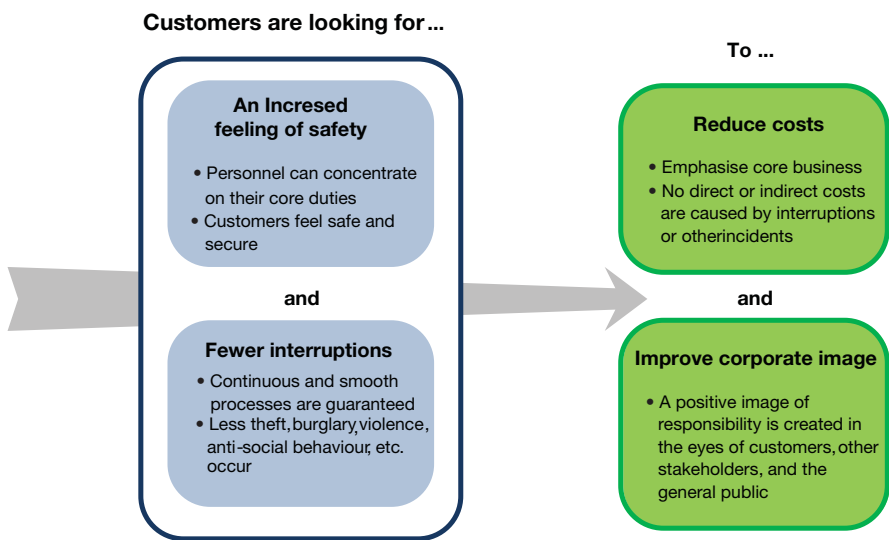
Customers are looking for ...

To ...

An Incresed feeling of safety
- Personnel can concentrate on their core duties
- Customers feel safe and secure

and

Fewer interruptions
- Continuous and smooth processes are guaranteed
- Less theft, burglary, violence, anti-social behaviour, etc. occur

Reduce costs
- Emphasise core business
- No direct or indirect costs are caused by interruptions or otherincidents

and

Improve corporate image
- A positive image of responsibility is created in the eyes of customers, other stakeholders, and the general public

Figure 1. Fundamental motives for the use of outsourced security service.

Customer relationship

- Customer orientation
- Understanding of customer needs
- Understanding of customer's business
- Long-term customer relationship
- Reciprocal commitment and trust
- Regular dialogue
- Personal relationships
- Reporting and transparency
- Informing the customer
- Co-development
- Flexibility

Organisational capabilities

- Service processes
- Solving customer problems
- Efficient specification phase
- Management system
- No discontinuities
- Keeping a schedule
- Security expertise
- Carefully selected service employees
- Reporting
- Communications
- Auditing

Image

- Domestic or local brand
- Global brand
- High visibility
- Reputation
- References

Organisational culture

Service operations management

Service delivery

Cost-benefit analysis

- Transaction costs
- Life-cycle costs
- Indirects costs, e.g. effort and time

Proactivity

- Development suggestions
- Information on new products
- Emphasis on preventive measures
- Diverse range of solutions
- Keeping up with technological development
- Surpass expectations

Service staff qualities

- Friendliness
- Helpfulness
- Communicativness
- Proficiency
- Security expertise
- Stress tolerance
- Adaptablity to customer requests
- Presence
- Vigilance
- Appearance and clothing

Technology

- Usability
- Functionality
- Realiability
- Modularity
- Easy to maintenance
- Easy to integrate
- Easy to use

Situational awareness

- Fast responses
- Handling of incidents
- Accessibility
- Co-operativness

Figure 2. ValueSSe Value map.

Results

The findings of the study show that there are two fundamental motives for security services' adoption: protecting and improving the corporate image of the company and seeking cost reductions through decreased interruptions to business. When customer companies seek enhancement of their corporate image, they either want to do so before anything negative happens or have just faced adverse events that have dealt a blow to their public image. For example, a company may want to make sure its image remains impeccable in stakeholders' eyes or that customers are safe when doing business with the company. When customer companies seek cost reductions, on the other hand, there have usually been interruptions or incidents that the company wants to keep from recurring. Sometimes, adoption of security services is also based on benchmarking. When companies realise that other companies are investing more in security, they may not want to sit by and watch. The fundamental motives behind the use of security service are depicted in Figure 1.

An increased feeling of safety and lower number of different interruptions were identified as central constructs through which cost reductions and corporate image were influenced. An increased feeling of safety enables company personnel to concentrate on their core duties in a safe environment. It can also refer to the feeling of safety perceived by customers of the company. This is an important element in, for example, a retail business, where consumers' safety is

of particular importance. Decreased number of interruptions refers to all kind of interruptions, breaks in service, and incidents that disturb the core processes of the company. These disturbances might be caused by thefts, burglary, vandalism, violence, or antisocial behaviour.

When we take a closer look at various factors behind these two central constructs, a huge number of individual factors emerge that affect a customer's perception of the service provided. These individual factors can either add value or reduce it; therefore, they can be regarded as value drivers. Customer value is traditionally understood as a trade-off between benefits and sacrifices as perceived by the customer [e.g., 7, 9], and customer value in the security-services realm can be constructed from the value drivers identified. A ValueSSe Value Map is presented in Figure 2. It is worth noting, however, that only some value drivers are usually relevant to any given customer relationship. Moreover, value drivers are also dynamic in nature and can change over time.

The list of the value drivers identified in each category is not meant to be exhaustive. The idea is to give an overview of the kinds of factors that are usually involved in value creation from the customer's perspective. At the lower level of the Value Map the individual value drivers are divided into eight categories: organisational capabilities, customer relationship, image, service staff's qualities, proactivity, cost–benefit analysis, situational awareness, and technology. At the upper level, these eight categories are then split in two. One part is related to the work of service managers, and it pertains to serviceoperations management issues. The other part, representing the work of service staff, has to do with operations issues in service delivery. Moreover, the organisational culture in security-service companies is like a glue that keeps the eight categories together, with some value drivers being more culture-bound than others.

Conclusions

The study led to two main conclusions. First, security services are traditionally categorised as support services, and the benefits for commercial enterprises and public organisations are considered to be mainly operations-oriented. This is in line with previous studies, which indicate that little effort is directed to strategic measures in corporate security [12], and that the emphasis is rather more on preventive security measures [4]. Our work indicates that security services can capture a more strategic perspective too. The value of security services stems from avoidance of diverse risks, some of these being traditional security incidents without any long-term company-level impacts but others involving more complicated business risks with possibly significant strategic implications for the company. For example, a better corporate image and a reputation as a security conscious firm in the eyes of customers or other stakeholders are clearly benefits that lie beyond tackling of everyday security incidents.

Second, the two models introduced above help security suppliers to see value from the customer's viewpoint. They offer an overview of various benefits, sought by different customers. There is already evidence that security-service providers hold somewhat different conceptions of the key components of customer value than their customers do [3]. To understand the most important value drivers for individual customer companies, service providers could try to establish on-going dialogue with the customers, thus minimising the risk of misunderstandings about the benefits brought by the adoption of security services. For example, the models can be used in joint work with the customer to form a shared understanding of the specific customer needs for security services. Nevertheless, it is only natural that different customer segments have different security needs. Analogously to contingency theory (see, e.g., [13]), this calls for different strategies also from the security companies.

Simple and generic tools, such as the models in this paper, can be used as a basis for regular dialogue with customer companies as well as a checklist in development of new services or customer-relationship management practices.

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No services without responsibilities

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As a consequence of outsourcing, Finnish process-industry companies aiming to invest in new processes, or wanting to modify old ones, usually face the need to rely on external engineering services. It is typical that more than one external service provider is involved in major engineering projects. Although most of the external companies offering engineering services are domestic, some may be located in other countries.

The obligations and various roles of the 'external designers' in design and construction work also mean responsibilities in relation to safety-related issues. The importance of process-design safety management during the design procedure, involving several parties and dissemination of safety related information between the engineers and other parties, cannot be overemphasised. Good safety management already at the start of the design process lays the foundations for the safety in the later stages of a process plant's life cycle.

Poor design is rarely deliberate, but, as has been seen, mistakes do sometimes happen. In the case of accidents or other technical failures, questions of responsibility often arise. In those cases, involvement of external services also means that responsibilities are divided among all companies and actors taking part in the design, construction, operation, and maintenance of the process plant.

The need to emphasise and discuss the safety-related obligations and the various roles of 'external designers' taking part in designing Finnish process plants was a driving factor for a project called 'USVA – roles and liabilities of external designers for the safety of process plants', carried out in 2010–2012. The project was funded by the Finnish Work Environment Fund and led by VTT. Other project partners were Elomatic Oy, EURENCO Vihtavuori Oy, Fortum Power and Heat Oy, Pöyry Finland Oy, Sachtleben Pigments Oy, and SWECO Industry Oy.

The USVA project's results have been compiled in a guidebook [1], which can be downloaded from the Internet (http://usva.vtt.fi). The guidebook begins by explaining in general terms the designers' role related to safety at a process plant. The role of the companies hiring external designers is also covered. The work gives insight into process safety principles – i.e., inherently safer design principles, passive and active safety measures, and operational safety options. Also, key points in Finnish legislation are covered and explained from an external engineering company's and the individual designer's viewpoint. The relevance of some non-technical standards is discussed too.

Safety responsibilities from a legal point of view

In Finland, most of the obligations of the EU's OSH Framework Directive can be found in the Occupational Safety and Health Act (738/2002). According to this act, employers are required to look after the safety and health of their employees while at work by taking the necessary measures [2]. However, the responsibility for the safety and health of the employees does not lie entirely with the
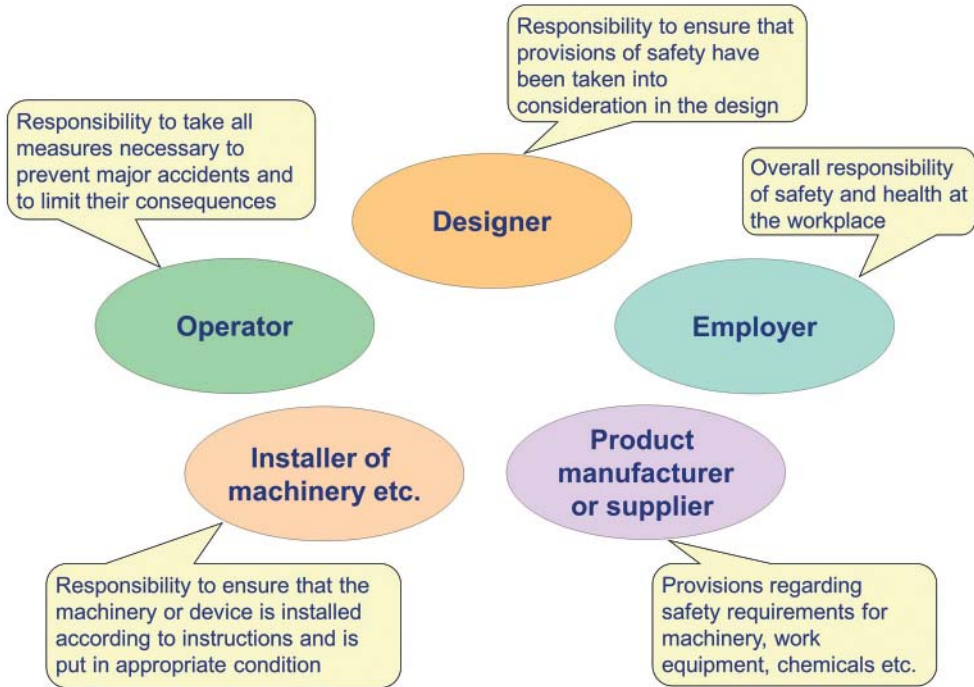
Figure 1. Responsibilities and roles of the various actors in an industrial design process [3].

employer. Chapter 7 of the Occupational Safety and Health Act, titled 'Obligations of other persons who affect safety and health at work', addresses the obligations of product manufacturers and suppliers; installers of machinery, work equipment, or other devices; and the designers. The main obligations and roles of various actors in process plant safety are shown in Figure 1.

When it comes to the safety issues associated with poor design at Finnish industrial plants, there are two distinct types of liabilities to be considered. On the one hand, the engineering company will have to correct possible mistakes related to the design contract and guarantee the quality of the design. On the other hand, individual engineers may be charged with an occupational-safety crime.

The first situation arises when a safety issue has been identified without people being injured. This generally leads to negotiations between the engineering and process-industry companies, in which the engineering contract signed between the two parties plays a central role. In the majority of cases, this dialogue leads to a solution and agreement on the basis of which the design-related safety problem can be rectified. However, if agreement cannot be reached, there is typically a clause in the engineering contract stating that the disagreements are to be settled in a court of arbitration – i.e., out of the public eye. In such situations, engineering companies normally take advantage of existing insurance. [3]

The second situation arises if an occupational accident has occurred. The injured person – or, in cases of fatalities, relatives – may initiate criminal proceedings, claiming that an occupational safety crime has been committed [3]. In Finland, however, only natural persons, not companies or other

organisations, can be charged for criminal offences. So it is quite common that in cases of occupational accidents members of the plant's management are convicted. Nonetheless, under the above-mentioned Chapter 7 of the Occupational Safety and Health Act, it is also possible to charge the engineers at the external engineering company that designed the system, if the design is found to be the cause of the accident. This is still not commonly recognised among the engineers working for companies offering engineering services in Finland [3]. The risk of designers being convicted for an occupational-safety crime is not unique to Finland. For instance, in the United Kingdom this issue was highlighted in the early 1990s in an annex to the Engineering Council's Code of Professional Practice on Engineers and Risk Issues [4].

The role of engineers in achieving safe process plants

External designers, regardless of their nationality, should be aware of the regulations and standards applied in Finland. Although many standards are international, differences still exist. In addition to the technical standards, there is another set of standards that are important in a safety context – quality-assurance standards. Instead of occupational health and safety standards applied by the operating companies, engineering companies assure the safety of their design by applying quality standards such as the ISO 9000 series and the ISO 10005 and ISO 10006 standards. Also, the risk assessment elements of the ISO 12100 standard on the safety of machinery are important.

In addition to standards, operation-licence applications include safety-related data. For example, large-scale production or storage of chemicals must be submitted for approval by the authorities (Tukes) prior to the start-up of such a facility. The main documents involving some type of documented safety assessments are [1]:

• Environmental Impact Assessment

• Licence application (for the large-scale production or storage of chemicals), in some cases including a safety report and an internal rescue plan
• Explosion Protection Document
• Hazard Assessment Document for Boiler Houses
• Occupational Risk Assessment Document.

It is clear that the external engineering company plays an important role in these licence-related processes even though the paperwork is sent in the name of the operating company. The authorities will either approve the design or require changes, in light of the documentation they receive, on a case-by-case basis.

In Finland, no quantitative threshold values for acceptable risk applicable to process-plant design exist; instead, the operator sets the risk targets for each design separately. Many companies rely on the experts in the engineering companies when setting the target levels. Calculations, models, and various methods of risk analysis are often used by the consultants, but the results are seldom evaluated or questioned by the client. For instance, consequence-modelling is a field wherein diverse software tools are applied – with a variety of outcomes. In some cases, companies may have their own set of risk-analysis tools that must be applied by the external engineers.

As specialists in risk analysis are becoming scarce in the actual operating companies, it is clear that today risk-analysis skills are needed more than ever before in engineering companies. Engineering companies usually have persons who have been trained to lead and document safety analyses, such as hazard and operability studies (HAZOP), but methods such as Layer of Protection Analysis (LOPA) and the establishment of Safety Integrity Levels (SILs) are not yet well known. The necessary expertise can be bought in from companies that specialise in these issues – for instance, from VTT.

The safety of a process installation is not entirely reliant on the design, so the design needs to be assessed in view of how the plant will be operated and maintained. Also, conflicting targets may exist within the design process itself. For example, overall site optimisation by pinch technology could be done to minimise the energy costs but would typically add to the complexity of the plant. As simplicity is one of the well-known inherent safety principles, pinch optimisation seldom yields the optimum from a safety perspective. Also, a HAZOP study may yield a vast amount of recommended changes, which normally increase both the cost of the design work and the costs of the plant itself. While recognising that risk data form only one input to business decisions, the individual designers must apply ethics requiring that cost be not the only reason for not accepting poor safety designs [3].

How to be safe

As mentioned above, companies providing external engineering services for process plants are, in reality, in charge of a large amount of the safety documentation and safety of design, even though according to Finnish legislation those should be the responsibility of the operating company. The Finnish Occupational Safety and Health Act also states that it is the duty of the employer to be aware of all risks in the workplace [2]. Therefore, the engineers who have designed the plant need to transfer all of their knowledge about the risks and the methods of their control to the operations staff. The designers cease to be liable only if the plant is operated and maintained outside the predefined limits of the design. In all other circumstances, the responsibility of the designers remains, even though their role will decrease with time, while that of the individuals responsible for operation and maintenance of the process plant increases.

The dissemination of safety-related information between the engineers and the other parties needing this information during later stages of a process plant's life cycle is critical in investment projects involving external designers. Even seemingly small changes to the design might influence the work of other designers and should therefore be communicated to all people concerned, regardless of the company for which they work. In addition to normal communication between engineers, risk analysis sessions involving the various parties have proved to be excellent opportunities for learning and the exchange of safety-related information. In the event of an accident, the torts applying to designers can involve failure to carry out a proper risk assessment, negligence of reasonable care, or deliberate misconduct. It is therefore essential that designers find in advance the means to demonstrate that they have carried out their professional responsibilities and have acted to eliminate the risks or reduce them to acceptable levels.

Even though many safety obligations set out in Finnish legislation are imposed on plant operators or employers, external designers should not take the attitude that process-plant risk management is someone else's business. Rather, they should 'own the problem' and make sure that hazardous situations are avoided as far as 'reasonably practicable'. Overall safety of the process plant is reached only if the safety features are properly taken care of in the design and construction phases and later supported by good plant operation. Consequently, it can be said that the fundamentals of safety rely on the behaviour and attitude of everyone involved in the life cycle of the process plant.

Acknowledgements

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Digital services

Digitalisation of interior design services and co-creation of new service concepts

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Introduction

This work presents two studies related to new digital technology, called augmented reality (AR), for the field of interior design [1–3]. The studies adopted premises from two distinct approaches: human-centred design of new technology development and the co-creation methodologies of business sciences. In this paper, attention is given, at first, to a case study that focused on the front-end co-design process. Then, the results of that study are demonstrated through exploration of how interior-design service technology experiences are pushed further via the means of science-fiction prototyping. Of the three approaches to user-based service innovations that Sundbo and Toivonen have introduced [4], these studies fall under the category of service design.

Focus on experiences

The connection between the two studies presented here is that both focus on user/customer experiences. In human-centred-design research, the term user experience has been considered comprehensively [5]. For example, according to the relevant ISO standard [6], user experience includes all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviours and accomplishments that occur before, during and after use. User experience is a result of the presentation, functionality, system performance, interactive behaviour, and assistive capabilities of the interactive system. According to Hassenzahl [7], user experience emphasises the need for products to support the hedonic needs of users, such as stimulation and self-expression, in addition to pragmatic needs when using the product or service. The holistic approach, required by the experience design, aims at extending the view beyond mere 'do' goals [8], which, for example, heuristic evaluation methods usually seek to highlight. Schmitt [9] explains further that no two experiences are exactly alike, and this leads to the conclusion that user experiences are highly situated. Hassenzahl decries the neglect for the subjective approach he perceives in human–computer interaction (HCI) studies, pointing out that the approach might lead to broader user feedback.

Co-creation strategy

Both studies were constructed around the co-creation process. In the first study, the interior design service concepts were co-created with critical users; then, in the second study, the results and requirements were used for construction of a new service through consideration of what kinds of business opportunities it provides. Prahalad and Ramaswamy [10] invented the term 'co-creation' to describe the emergent relationship between customers and companies. Co-creation starts with the focus on the entire ecosystem and attempts to imagine a new value chain that benefits all players, including, of course, the company itself. One premise of the co-creation approach is that, by sharing experiences, all parties involved
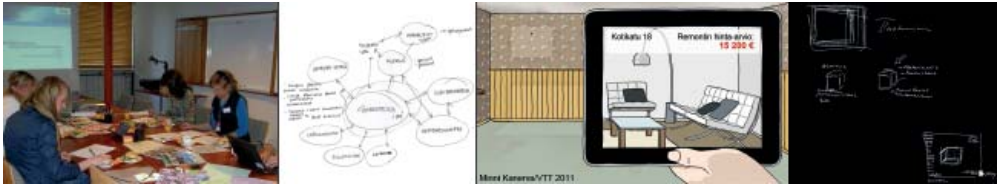
Figure 1. Co-creation of service concepts, in the Adfeed project.

will obtain a deeper understanding of what is happening on the other side of the interaction. To allow co-creation of experiences, Ramaswamy and Guillard [11] provide a framework for a co-creation strategy. They suggest identifying all stakeholders touched by the process, assessing and mapping out current interactions among the stakeholders, and organising workshops at which stakeholders share experiences and imagine ways to improve them. These three steps were carried out in the study that will be introduced first. As the fourth step, Ramaswamy and Guillard suggest building platforms for implementing the ideas for new interactions, and for continuing the dialogue among the stakeholders to generate further ideas. In this case, the platform will be the second study: the constructed science-fiction prototype.

Co-creation of new service concepts

The aim was to study users' innovation capability in the early phase of the process by utilising co-sketching as a mean of obtaining user models of the interactive systems [1–2]. This was carried out through creation of interior-design concepts that exploited augmented reality [12], 3D models, and user-preferred content within the system framework (see figure 1). Two focus groups studied were composed of designers, bloggers, and interested amateurs in the field of interior design – who were expected to be the critical users [13] of the forthcoming service. The study was carried out within the Adfeed project, which was supported by Tekes in the context of the Next Media programme of TiViT (the Finnish strategic centre for sci-

ence, technology and innovation in the field of ICT). The research was expected to be an introductory front-end design study that as its output presented the requirements for the service system and several interface descriptions and use cases utilising AR technology. The development of the system was not taken further by VTT.

The process of the study falls within the methodological frame of participatory design, which generally aims at democratising design, for example so that the people who will be affected by the systems should also be able to participate in and influence the design process [14]. When user research is carried out at the front end of the process, the user's role may broaden from mere research subject commenting on ideas to active co-designer [5]. Participants may be involved in the process via means such as focus groups, scenarios, and early-phase sketching [15–17], all of which were applied in this study. The subjective feedback from the critical participants, as stipulated by Hassenzahl [8], was seen as contributing to construction of the underlying service.

In a preliminary online survey that preceded this study, data were collected from ordinary consumers (250 respondents) and from interior-design professionals and amateurs (36 respondents) [18]. The two focus groups utilised in this study were composed of volunteers from among the latter respondents, most of whom were interior designers or interested interior-design amateurs: students and bloggers in the field of interior design. The two groups consisted of 3–4 participants each, with 1–2 project participants in both groups and one evaluator leading the

two-hour co-creation session. The first focus-group session was held in May 2011 at VTT Technical Research Centre of Finland, Espoo, and the second at Alma Mediapartners facilities at Tampere, Finland. The interviewees were 27–49 years of age, all female.

A framework for co-creating service concepts

Focus-group evaluations and co-creation sessions provided adequately new information for further design and development of interactive interior-design services that utilise 3D and AR technology, but the most valuable result of the study was a framework that may be used for co-creating complex technology-driven service experiences. The framework was created for summarising the steps employed for the design in this particular case, and it has not been verified yet by other research. The following framework was extended from the Ramaswamy and Guillard elementary structure:

Pre-co-creation phase
• Definition of the concept, with all of the relevant stakeholders involved
• Collation of information about a specific context (e.g., by means of benchmarking applications)
• Meaningful specification of the information, with construction of stories and scenarios accordingly
• Determination of the various levels of users
• Gathering of quantitative information (e.g., by means of a preliminary online survey)
• Redefinition of the concept

Co-creation phase involving critical users
• Presentation of the information
  (In this study)
  * The concept definition
  * Predefined scenarios
  * Benchmarked applications
  * Results of a survey presenting wider sampling

• Co-creation of the conceptual models of the service
• Compilation and sharing of the new information and interpretation of the results
• Co-creation with a more specific objective (a specific-system/service)

Post-co-creation phase
• Definition of the criteria and provision of interpretation of the co-created material
• Redefinition of the concept

Co-creating the concept in the initial phase of the design process, with the contribution of all participants, assists in creating of an experience-based structure for a future service. For a successful co-creation process, the roles of each participant should be clarified explicitly; these sets of tasks in the framework determine the role of the facilitators but, at a more general level, the other stakeholders. The framework is intended to cover the front end of a service-innovation process, but due to the research agenda we did not actually carry out the post co creation phase in the first study. That was, however, carried out in the second study.

Consequent new service innovations

Human-centred design of new technology development and the co-creation methodologies of business sciences were combined to facilitate the second study that was aimed at constructing a science-fiction prototype [3]. That prototype was based on the co-created results and requirements of the first study. Also employed were ideas from theories of economics and business – namely, co-creation of value [19], customer experience [20], and the human assets of the firm [21]. The prototype presents a new service enterprise, 'Dreamnesting', that engages a user/customer deeply in the co-creation experience and introduces a new technology platform for the interior design task: augmented-reality technology in an intelligent environment. The

aim with the means of science fiction was to explore co-creative interactions and experiences by concentrating on the consumer experience and the service-provision function of the fictional firm.

The prototype was a design outcome of the co-creation process and exemplifies the post-co-creation phase in the framework. In science-fiction prototyping, a method introduced by Johnson [22]; the core methodology is the use of creative arts as a means to motivate and direct research into science and engineering. The main method is the use of science-fiction stories, grounded in existing science and engineering research, which are written for the explicit purpose of serving as prototypes that encourage people to explore a wide variety of futures [ibid.]. Narratives have been recognised also in organisational sciences and are appreciated particularly for the way they describe experiences. According to Smeds et al. [23], narratives play an important role in perspective-making, since the narrative capacity of humans is a fundamental cognitive process through which our cultural world and sense of self are constructed and maintained. Furthermore; 'the typical form of framing experience and our memory of it is in narrative form' [ibid.].

The construction of the prototype was based on an experience-environment approach suggested by Prahalad and Ramaswamy [10]. An experience environment is intended to be a framework that allows the company (internally) to facilitate diverse co-creation experiences with many consumers (who have varying interests, skill levels, needs, and desires). The science-fiction prototype was used as an experience environment, and the most important concepts in the framework were adopted to construct the story. The important concepts were the following: 1) The experience environment offers opportunities for consumers to co-construct their experiences on demand, in a specific context of space and time. 2) The personal meaning consists of the knowledge, insights, enjoyment, satisfaction, and excitement that the individual derives from the event. 3) The involvement of consumer communities engages the consumer emotionally and intellectually. 4) New opportunities afforded by the evolution of emerging technologies should be offered to the stakeholders.

Conclusion

Augmented-reality techniques can provide interior designers with opportunities for completely new services that can be difficult to envision with current knowledge. Human-centred design and co-creation in combination with science-fiction prototyping can provide service-concept innovators with new tools for envisioning novel services enabled by new digital tools.

The case studies described in this paper are examples of do-it-yourself culture as an approach to construction of smart experiences and environments and of the use of science-fiction prototyping as a design outcome of such processes.

Acknowledgement

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Future magazine service

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Background

There are many simultaneous forces shaping magazine markets and changing the core business logic applied. On one hand, we are experiencing media convergence, wherein the traditional media industry is becoming integrated with the telecommunications industry and information technology. This is shaping consumers' media-use habits and opening the markets to new competitors. At the same time, the advertising markets react to the changing economic climate and increasing amount of online media content. As a consequence of all of this, the power is shifting from media companies to people. Consumers have an ever increasing selection of content that they can consume when and where they want.

In his report on the changing media market, Snellman [1] states that the media industry has shifted from scarcity to an era of abundance where the supply of content is concerned. Thanks to the Internet, television content, radio programmes, music, and games are widely available. This challenges the traditional media-business models built on scarcity and permanently alters the market set-up. The vast majority of media revenue still is grounded in traditional businesses, such as subscriptions to printed newspapers and magazines, and advertising revenue [2, 3]. However, growing impact of the Internet seems inevitable. According to Snellman [1], we probably have seen only the beginning of a major change in communications services, with the most significant changes being yet to come. The field of competition, consumer trends, and technology are driving the continuous development of communication services toward more and more individualised service experiences, and the new services will take advantage of diverse new possibilities, such as large masses of data, positioning, and large variety in sensors.

Printed magazines as part of the magazine service

With the changing business environment, the value network for magazines has grown to include several actors who enable provision of magazine content for various platforms. Paper is one of these platforms, and the value network around printed magazines forms one part of the magazine service. When magazines are seen as a service as presented in Figure 1, the readers of the magazine take a central role as the customers of the magazine service, whereas the service providers form a network of networks. The magazine service is available via several platforms, both printed and digital, and the networks include user communities in which the users may also act as co-creators of content.

In this project, the overarching idea has been to look at the future of printed magazines through the theory of service-dominant logic (SDL), proposed by Vargo and Lusch [4, 5]. Traditionally, service business has played a minor role in the paper industry and very little research effort has been devoted to it. In addition, the services that paper producers provide to their customers have often been provided
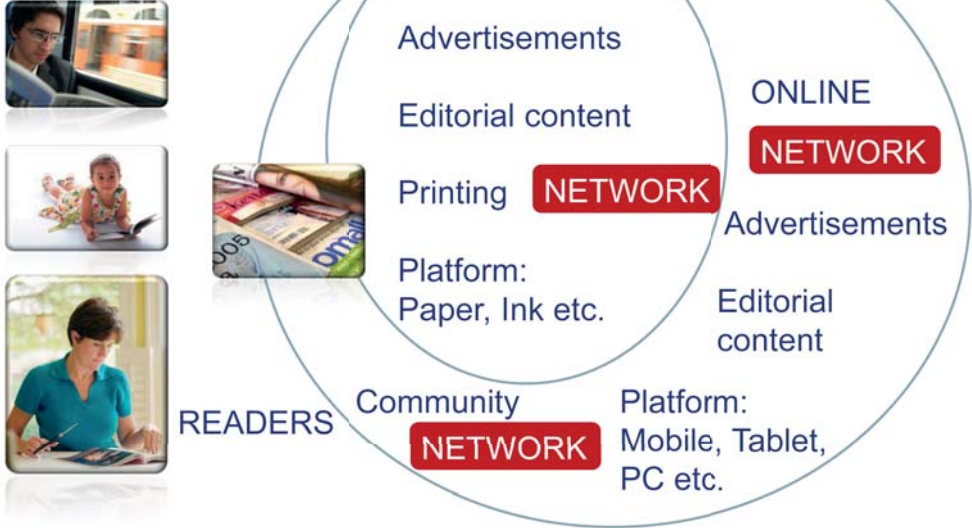
Figure 1. A magazine as a service.

free of charge. Producing paper, developing their properties, and selling the paper has been the main activity until recent times brought major changes in the business environment. Because of these changes, service business has become much more appealing also in the paper industry. This project was composed of four case studies examining possibilities for new services from very different standpoints. Common to the case studies was the aim of exploring the shift in mindset from traditional goods-dominant logic toward service-dominant logic by stressing i) the developing relationships with customers, ii) the view of goods as transmitters of operant resources (embedded knowledge), and iii) identification of specialist skills and knowledge that are needed for putting the learning from this project into practice. The case studies examined:

- Hybrid media applications in magazines – what are the possibilities for developing interactive services combining print and digital elements from the standpoint of the consumers who have the devices and skills for using various hybrids?

- New magazines' launch – what specific needs arise from the innovation and development of new magazines in which the printed-product value chain can be part of the collaboration?

- Brand experience – what kind of methodology can be applied to distinguish how the user experiences different communication channels used by the brand-owners?

- Service concepts for customers' processes – how can new service concepts for the customers' processes be developed and tested?

Results

Several technologies, such as 2D barcodes and augmented reality, already offer excellent possibilities for interactive services around magazines, and many publishers have experi-

ence of using them. In addition, devices such as smartphones and the ability to use various mobile applications exist among a large percentage of consumers. However, in-depth knowledge of what the actual benefits are for the readers and for the value network is still absent. Current studies at VTT (e.g., in the Next Media and Nordic co-operation project 'Customer perception of augmented reality in media applications – possibilities for new service innovations') aim at pointing out benefits from both the user-experience and the business perspective. It is very important for the whole value network to be aware of the development, gather knowledge, and be involved in the discussion of future service possibilities in this area. It is inevitable that, for hybrid-media solutions to succeed, several actors need to be involved as resource integrators. This means that, in mixing of content in printed and digital form, the traditional borders of value networks need to be crossed. This way, it is possible to benefit from the positive features of both print and digital elements and to provide experiences to the reader that would not be possible with one medium alone.

In the new-title-launch case study, the aim was to take a Nordic perspective on the process that publishers employ for launching new magazine titles, in order to gain an understanding of their service needs. When the magazine is seen as a service and SDL is used as a key theoretical framework, one of the most important issues to focus on is that the customers/readers are always the primary co-creator of value. In the magazine service, readers can also be members of a community and take an active role there to interact with the service providers. Also, value is always uniquely and phenomenologically determined by the beneficiary, meaning that value is very much experiential and contextual. Having a close relationship with the customers/readers makes it possible for the networks creating the service to benefit from the knowledge. The operating environment of magazine publishers has seen radical change. Therefore, our

findings suggest that the key activity has been to change the way in which products and services are developed. Increasingly, media brands with strong value propositions are being commercialised both online and offline. There is a fundamental change in mindset: media products and services are being co-created in collaboration with several market segments – both consumer- and business-oriented. Communities are formed around media brands, in which people create by engaging. Alliances are formed within and outside the publishing ecosystem, to create something new, which provides an opportunity that the printed-magazine value network can exploit. However, proactivity is required from all actors to build relationships that make it possible to create innovative services wherein printed products have a central role.

The case studies related to brand experience and service concepts for customers' processes were carried out in close collaboration with the paper companies involved in the project. The main focus in these was on the development of methodology that would be in line with the SDL mindset – i.e., aimed at co-creation of value and at service development alongside the customer. The approach chosen in the brand-experience case makes it possible to look at print products and, especially, consumer magazines as part of a large media mix. The objective of visualising brand experience from several communication channels was approached by way of further development of the multisensory experience map [6]. Hence, all communication channels have been depicted in the same model as the impressions and experiences that consumers associate with them. Since consumers very rarely use only one medium, it is possible to gain a better understanding of the actual role of printed magazines by looking at the big picture. Even though understanding consumer experience of value with the brand is the very essence of this approach, from the SDL viewpoint it is also important to see that the service provider cannot deliver value and only offers

value propositions. Therefore, interacting with the consumers makes it possible to compare how the message from the brand-owner is received through various channels, see whether it matches the brand-owner's expectations, and find out whether action should be taken to fulfil the consumers' expectations. Here the printed-customer-magazine value network can have an important role in providing knowledge of how to direct the print product toward bringing the desired user experience.

The aim with the service concepts for the customer-processes case was to look at the innovation of new services as a co-creation process. This very much took SDL as its starting point. Customer needs and inputs are essential elements already from the early stages of service development and design. The research approach was adapted from that used in user-centred product-concept development processes [7], entailing an iterative procedure in which the users (in this case, the publisher's representatives) are involved throughout the development process. Unlike product concepts, a service concept is intangible, and, accordingly, the service-concept pilots were narratives describing the current situation and the future solution making use of the service concept. From the experiences obtained in this case study, it has been shown to be possible to test potential new services with the customer even before they actually exist and receive feedback for further development. The discussion also offers an excellent foundation for building long-term relationships with the customers. For the future, it would also seem beneficial to broaden the discussion such that several actors in the network are included in the innovation process.

Conclusions

The magazine business is set to change dramatically over the next decade. Not only will the publishers meet increasing competition from other media (including user-generated content); the demand for content that targets specific reader groups and for offering advertisers a better way of reaching their customers will force publishers to develop their products continuously. The Internet has already had a tremendous effect on consumers' media-use habits. In addition, new digital gadgets reaching the market create completely new possibilities along with threats to the publishers. At the moment, the profits from the print business are still many times those of digital business. However, in order for the printed magazine to remain competitive, it is important that the entire value network be involved in the process of innovating and testing new possibilities to provide better service for the various players in the magazine value network as well as better service for the readers.

In this project, development of new services was examined mainly from the angle of the paper producers' move away from their traditional goods-dominant-logic-based way of operating and toward service-dominant logic. In practice, this meant interacting with the customers and the customers' customers with the aim of generating services that would enable co-creation of value. As a process-industry sector, paper producers cannot apply a stepwise servitisation process. Instead, these manufacturers have to develop services that respond to much more demanding requirements, right from the start: to identify, in collaboration with various actors in the value chain, possibilities for innovative uses of printed products and to facilitate the development and utilisation of these new possibilities. In other words, paper manufacturers have to move from pure manufacturing to knowledge-intensive business services (KIBS), of which mutual learning between the service provider and the client is a core characteristic [8]. Another direction of development is a move toward integrated solutions that are bundles of physical products, services, and information, seamlessly combined to provide more value than these components do on their own [9]. Case stud-

ies were used to gain experience and develop methodology with which new services can be created and tested.

The move from a product (GDL) to service (SDL) focus involves several transitional shifts. According to Kowalkowski [10], a transition to SDL implies much more than increased emphasis on the firm's product–service systems: it implies a reframing of the purpose of the firm and its collaborative role in value co-creation. With the case studies carried out in this project, we were able to uncover and highlight possibilities for collaboration within the value network of printed magazines. These can be used as a basis for future work in which the dialogue within the network continues and new services are designed.

Acknowledgements

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Exploring commercialisation challenges of digital services – looking at ambient assisted living, health care, and well-being services

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In recent years, there has been strong pressure to restructure health- and wellness-related services into new forms to promote quality of life, people's well-being, and the way we live best with those who need care – such as ageing adults or others with special needs. Digital services are increasingly used as one enabler to support people in everyday life so that they could lead healthier lives in their own homes.

There has been a great deal of R&D&I effort put toward developing solutions for ambient assisted living (AAL) to support older adults' living independently in their own homes, telemedicine solutions to provide clinical health care at a distance, etc. However, taking up of these digital opportunities has not yet reached a level matching the expectations set.

One way of exploring the barriers to adoption of digital services in the care domain is to look at commercialisation challenges in this context. Commercialisation of technology, often explored in the realm of *technology transfer,* has commonly been recognised as risky and often failing [1]. Especially in the domain explored here, commercialisation process is challenging because the institutional health-care service infrastructures are well established and difficult to change, and the ambient assisted living market is a relatively new market that lacks common standards and regulation.

Exploring commercialisation challenges via analysis of business-development activities

This work summarises two case studies that have explored the commercialisation challenges that digital services face in the domain of ambient assisted living, health care, and well-being. Both studies concentrate on analysing the challenges in business development in this specific domain. In this context, we use the term 'business development' to describe the entrepreneurial process of discovering, creating, and exploiting opportunities in selected markets. Both case studies used Osterwalder's business model canvas [2] to identify and analyse the challenges faced by companies in business-development activities.

In the first case study, the case environment was the AAL joint programme, which is a European funding framework for projects in the domain of ambient assisted living. The main method for collecting data was a series of five workshops. The second case study was done in the working context of EIT ICT Labs and Tivit programmes. This case study involved 13 companies. Themed interviews were used as the main data collection mechanism. The companies represented in the interviews were selected for the study on the basis of the following criteria: 1) they function in the wellness domain, 2) they are small- and medium sized

enterprises (i.e., turnover of under 50 million euros a year and fewer than 250 employees), and 3) they have their own product or service that they sell to customers. Most of the people interviewed were CEOs of small- and medium-sized enterprises in Finland. During the interview, the interviewees were asked to analyse their company in terms of Osterwalder's business model canvas. From the interviews, a business model canvas for each company was drafted and sent to the person interviewed, for discussion and validation.

Findings

Our findings from the first case study indicate that companies in this sector face a wide range of commercialisation challenges; some obstacles are specific to this market but some are very generic and faced in all sectors.

The AAL market can be characterised as an emerging market with no dominant design and lots of technological and market uncertainties. The market holds promise of high expectations because of the growing number of older adults, and the market opportunities created by their economic resources and needs that are not yet properly addressed by current product or service offerings. Older adults are seen as a growing market with a large amount of economic power and a great number of unmet needs.

On the other hand, the market is now facing severe problems in addressing their growing and changing needs of older adults. For example, public-sector actors are suffering from a lack of the resources necessary for scaling their current service offering to a growing user population, and for providing the service level expected by society. These pressures are already starting to become so severe that occasionally public sector organisations face challenges in fulfilling their service expectations, and therefore their resources for innovation can be limited.

In the second case study, it was found that enterprises in this sector are often willing to move from the business-to-business (B2B) sector to the business-to-consumer (B2C) sector because of the increased market potential. However, market fragmentation makes it difficult for companies to **understand end-user needs and to co-create value** together with them and, therefore, to create more user-driven digital services for the market. The majority of the people interviewed said that they will in the future focus on easy usability of their solutions and on increasing the integration of nurses and consumers into development of the systems.

Novel **service ecosystem (value network)** creation, especially with partners from other countries, was identified as a strategic direction in many of the enterprises evaluated. In fact, it was discovered that it is not possible for small and medium-sized companies to develop ICT services alone in the health and wellness market. For example, one subject stated: 'Our strategy is to use others' technology solutions as much as possible – that is definitely our strength. It is not possible to do everything by ourselves.'

Many enterprises identified **applying for and getting research funding** as being relatively difficult. The dilemma is related not so much to obtaining funding for the research pilot development as to getting money to implement the piloted services in active use by various stakeholders, such as care homes, hospitals, and consumers. This is crucial for business development – without real-world validation, the value proposition cannot be reliably validated and evidence for the value of the service created for different stakeholders remains unclear.

According to our study, one of the assumptions in Finland is that the government should pay the costs of the health and wellness services, but in reality this is not the case. In some cases, elderly people or their loved ones would really like to pay for services that help to improve the quality of their life, but often in these situations **information about the existing digital services is not available** to consumers.

Service quality was identified as a differentiator between the ICT solutions in Finland and those in foreign countries. *'We used to think that a Finnish SME does not have any possibilities for being successful in India, but our differentiator in the Indian market is Finnish quality'*, according to one interviewee. This was a major reason many of the CEOs identified certification and quality improvements as one of the strategically important actions for the future.

It was shown that the **creation of novel value networks** is not easy for small- and medium-sized enterprises. As one interviewee explained, *'[o]ften, small and medium-sized enterprises do not understand their own value proposition in order to sell it to possible partners in the value network'.* SMEs also feel that the big players often overrule the small and mid-sized players in Finnish decision-making. Additionally, it was identified as **difficult** for the evaluated enterprises **to reallocate resources** from continuous customer maintenance activities to identification of potential partners, future value networks, and innovations.

Summary

Our experience from these two case studies shows that analysing business-development activities is a useful way to characterise challenges faced by companies in getting the results of their R&D&I activities to the market. Addressing these specific challenges can help companies in targeting their innovation resources. If commercialisation targets are set, business-development activities are needed. Creation of a commercialisation strategy for the results of innovation activity requires 1) iterative development of the offering and related business model, 2) agility to change plans as knowledge and understanding develop over the course of the process, 3) commitment to taking responsibility, and 4) the long-term investment needed to bring the results to market. We also need more transparent system interfaces, greater user involvement, and more input into the implementation phase of the systems.

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Three complementary perspectives in service science: service-dominant logic, systems thinking, and service design

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Introduction – need for a new way of thinking

For the last 50 years, we have been witnessing increasing growth of what traditional economists refer to as the services sector [1]. An important driver of this prevailing service phenomenon is the development of information and communication technologies (ICT). Both ICT and digitalisation are stimulating growth in new types of services and enabling global service delivery [2]. The rise of the services sector, and economic growth associated with it, has triggered interest especially in those who are attempting to cope with increasing global competition and who seek a new source of competitive advantage. In consequence, many companies have been moving their focus from products to services. However, the transition toward service business has often been viewed very narrowly, as for example, development of new services. Moreover, many of these services are still tied up with traditional models of value creation in which the focus is on the firm's outputs as 'containers' of value [3].

This paper highlights an alternative perspective on this traditional view and claims that when firms seek to realise the full potential of the service phenomenon, they must fundamentally challenge their current ways of thinking about what constitutes service and how value is created. The paper is based on findings of several research projects, such as Proform, Cloud Software, WeCare,

and ModuServ, studying service innovations and success factors in the service business. Based on our experiences, we claim that firms aiming to understand and develop their existing service, create new service innovations, and succeed in a turbulent business environment can benefit significantly by adopting emerging service-oriented thinking. This service-oriented thinking is based on an interdisciplinary field called service science, which adopts service-dominant logic [4, 5] as a worldview and philosophical foundation, with the service system as the main theoretical construct [6, 7]. Furthermore, we propose that service design thinking [8] can bring service science to a more concrete and more easily approachable level for practitioners.

Digitalisation creates demand for service science

A great contributor to the development of the prevailing service phenomenon is ICT, which, in combination with increased global exchange and specialisation, can be seen as a key driver of the global service phenomenon [2, 9]. The two main mechanisms of ICT's contribution to the service phenomenon are ICT stimulated growth of new types of service offerings and ICT-enabled global service delivery [2]. Digitalisation of service and global delivery have already initiated massive transformations in some industries (e.g., the music, banking, travel, and book industries), and many other industries are increasingly

being reshaped by this phenomenon. Digitalisation has now also permanently penetrated many of the service areas that have traditionally been seen as more physical in nature (e.g., ticketing in public transport), and it is rapidly changing markets that can be viewed as part of the traditional services sector (as with digital retail of physical goods). As a result, most of today's service provision has some digital elements and it is becoming more and more difficult to differentiate physical and digital services from each other.

One of the key factors limiting our understanding of the potential and impact of ICT and digitalisation on human society is the awkward division drawn between products and services. Service science has the ability to overcome this challenge by adopting a more transcending and integrative view of service as introduced by service-dominant logic [4]. Under this paradigm, the singular term 'service' is defined as application of specialised knowledge and skills for the benefit of another entity. In adoption of this worldview, service provisioning should be seen as a joint effort of multiple actors who have complementary specialised competencies and are linked to each other either directly or indirectly in the globally networked economy. In addition, customers (service beneficiaries), along with all the other actors involved, should be seen as resource-integrators who combine new resources and competencies from several sources with their existing skills and other resources in order to co-create value for themselves.

The ICT-enabled global exchange and specialisation has dramatically increased the complexity of the dynamic and networked value co-creation processes. Therefore, it has become very challenging to understand and improve the value co-creation among the various actors in the network. For example, during the purchase of a new game console, a customer may combine information on the solutions available from many, very different sources, such as local brick-and-mortar stores, Internet forums, specialist magazines, and peers. The customer may end up buying the console via the Internet, from a retailer on the other side of the world, from whom it is delivered by a courier to the buyer's door. Additionally, digital games bought and downloaded over the Internet, just as much as other players and friends who join the relevant game network, have a crucial part in the service provisioning (gaming). Thereby, each of these actors who have contributed to the buyer's understanding of what kind of console is suitable for his or her context of use, and who participate in playing games together over the Internet, can be seen as a contributor to the actual service experience of gaming and the value co-creation process.

In summary, value co-creation in a digitalised and globalised economy is often a highly complex phenomenon. Hence, value should be viewed not as embedded in physical products but as something co created, in the process of which numerous actors have their role to play. Because of this complexity, we need a systematic and holistic scientific approach to studying digitalisation in service – we need service science.

Service science

The primary objective of service science is to study value co-creation among interacting service system entities [10]. Service systems are dynamic configurations of people, technology, and other resources that can create value with other service systems through shared information [6]. The main difference between service systems and computational systems is people. People's behaviour increases the complexity and unpredictability of service systems significantly [11]. Because of many aspects (physical, mental, and social) of people's behaviour, it is fundamental for service science to combine organisational and human understanding with business and technological understanding [7, 11]. Without a multidisciplinary perspective of this type, it
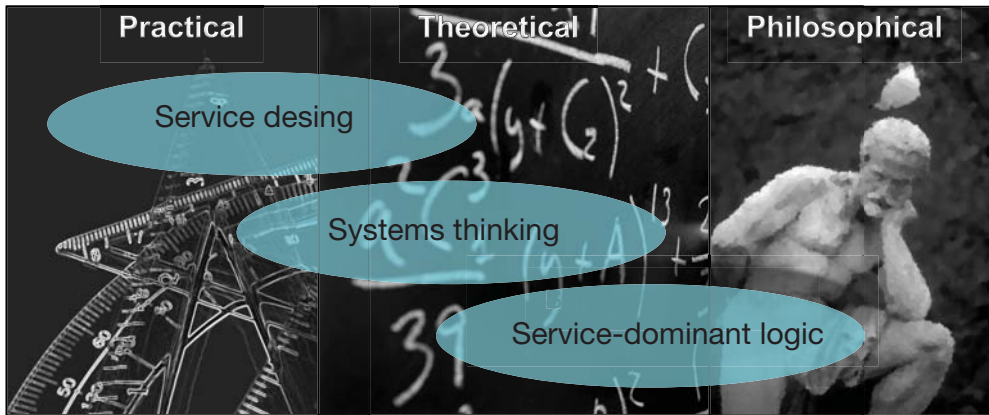
Figure 1. Three complementary perspectives in service science.

is impossible to study service systems holistically.

The main purpose of service science is to advance the ability to design, improve, and scale service systems and to create service innovations [7]. Despite its very practical purpose, service science has been seen sometimes as too abstract, and its full potential is not yet thoroughly utilised. This paper is aimed at describing three different perspectives in service science (see Figure 1) and how they complement each other. Firstly, a service-dominant mindset needs to be adopted if one is to understand the true nature of the service phenomenon and change the current worldview, which in principle is still trapped in the era of the Industrial Revolution and company- or product-centric logic. Secondly, systems thinking provides a theoretical foundation for understanding and developing the central construct of service science, the complex service systems. Thirdly, service-design thinking enables a more practically oriented approach to service design and innovation. Even separately, these perspectives can be very helpful. However, through combination of the three views, it is really possible to approach the main purpose of service science.

The following sections of the paper present the three complementary perspectives contributing to service science in more detail.

Service-dominant logic

Service-dominant logic (or 'S-D logic'), introduced by Vargo and Lusch [4], calls for an alternative logic for understanding market exchange – a logic that abandons the dominating company-centric view and brings the customer in as an endogenous participant in the process of value co-creation. Hence, value is seen as something co-created by multiple actors and always uniquely and phenomenologically determined by the beneficiary (e.g., the customer) [5]. In other words, companies cannot deliver value for their customers. Instead, they can offer value propositions and participate in the customer's value co-creation process [4]. Hence, from an S-D logic perspective, value co-creation is built on service provision rather than on goods production [12], and thereby it departs radically from the traditionally dominating view, the goods-dominant (G-D) logic. In the G-D view, value is seen as embedded in physical products, and services are treated either as an add-on to the core product or as something more residual in nature [12].

One of the key goals behind the development of service-dominant logic was to overcome the products/services divide upheld by the G-D logic [4]. This dichotomy is unnecessary and causes a lot of problems for example in the case of ICT as an ICT solution

usually encompasses both tangible elements (characterised as products by G-D logic) and intangible elements (characterised as services by G-D logic). As a solution, the singular term 'service', defined as *the application of specialised competencies (such as knowledge and skills) for the benefit of another entity* [4], was introduced in S-D logic. This transcending concept focuses on the processes of serving rather than on the output or the form of the offering. Hence, it can be applied in all offerings. Due to the transcending view, there are no services in S-D logic. However, products still remain important, but as vehicles for providing a service rather than as containers of value [12].

Systems thinking

Systems thinking is based on the study of a set of elements that are connected together as a 'whole', with the whole showing properties that belong to the whole, not its components [13]. Service science has adopted systems thinking to understand complex service systems, which are interconnected and display highly complex relationships between entities [14]. Systems thinking is needed because the understanding of individual elements does not explain the behaviour of the whole service system.

Service system entities (also known as actors, agents, or resource-integrators) are the most fundamental abstractions of service science [15]. An entity is a dynamic configuration of resources consisting of at least one resource with legal rights (e.g., a person or organisation) and other resources, such as information and technologies [15, 16]. These entities interact with other entities *via value propositions*, communicating a mutually agreeable plan to collaborate and co-create value [16]. Trust can be seen as an important mechanism to ensure that value propositions work as agreed; when value propositions fail, trust begins to diminish [2].

The patterns of interaction among multiple entities can be viewed as *service (system)*

networks. The customer–provider interaction is the simplest form of service network. However, isolated dyadic relationships of this nature are simplifications of real life, and interactions between value co-creating entities are almost always more complex. From the business perspective, customers are the most essential entities in service networks. If the customer is an organisation, it is a complex service system that itself often has several sub-systems (e.g., departments). Even individual persons within the organisation (such as an end user, purchaser, or manager) can be seen as separate service system entities.

Customers integrate resources, including technologies and information accessible to them, with resources deployed by other service system entities (e.g., other customers and service providers) [14]. The customer's role as resource-integrator can be described by the example of video-enabled telehealth service. In the service, a customer combines various technologies available at his or her home (e.g., a blood-pressure meter, a thermometer, Internet access, and a computer) and competencies (e.g., knowing how to use the computer and ability to measure and describe physical condition) with service providers' resources and skills (e.g., medical expertise and access to the customer's medical data). Service providers too are resource-integrators, and in this example, numerous interactions behind the actual service encounter with the customer can be recognised (e.g., accessing the medical-information database, IT support, and consulting a specialist). Consequently, the complexity of digitalised service in real-world context is often so great that focusing only on one element (e.g., the medical-information system) may blur the whole picture. Therefore, systems thinking is critical for ability to develop and optimise service systems holistically.

Service design thinking

Traditionally, design has been taken to refer to design of products or spaces, but more levels have emerged as the shift from prod-

uct-based thinking to service thinking has taken place. The wider view includes also the design of customer experience, processes, and systems as well as strategy, philosophy, policy, or ideology [17]. S-D logic's transcending conceptualisation of service provides a good perspective for designing service as an entirety consisting of several service systems. Game design with a more product-centric logic would be just to concentrate on the game, whereas a more service-dominant logic based view would involve trying to understand the experience of playing a game as well as the integrated resources related to the value co-creation process. The practical approach and methods that are needed then, in the realisation, can be drawn from service design. Approaching service as design thinkers and understanding both customers' and the service provider's perspectives helps the service provider to create a 'clear strategic positioning for the service' [18].

Design thinking is about the designers' effort and methods to match people's needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity [19]. As the concentration is no longer on a single product or service offering but on the entire service from pre-service period through the service period to the post-service period, there is no one person who can design the service alone. Even a group of service designers with their own subjective views on how the service should be is not enough to tell how the customers will react. In addition, it can be quite easy to forget the effects on the whole service and direct effort in only one direction. All this complexity requires design thinking.

A design thinker steps into the customer's shoes to observe the service as a whole. In the game example presented above, the customer combines information from multiple sources before making the purchase. It is not enough to design a wonderful game and console if the online store's realisation is poor

and repels the potential buyers. The services available today are numerous and changing service provider is fairly easy. Design thinking is needed also in designing a service that convinces the customer to stay. This requires an understanding of customers' context, motivations, expectations, and values.

In addition to stepping into the customers' shoes, the designers seek for expertise and interdisciplinary viewpoints by trying to involve all the stakeholders in the design process. The practical means to designing services in an interdisciplinary way may involve drama methods, models and prototypes [20]. These make the intangible tangible, increase communication, and aid in detecting problems in the early stages. The ideas emerging can be evaluated collaboratively and integrated into the design with a goal of creating superior service experiences.

Opportunities and challenges of studying digitalisation from the service-oriented perspective

This paper has briefly presented the emerging field of service science and three complementary perspectives that can be seen as some of the fundamental lenses for viewing the service phenomenon. We believe service-oriented thinking built on these approaches will be crucial in the globally networked society of today and tomorrow. Our goal is to continue to contribute to the dialogue begun among the three perspectives presented and apply them in studying digitalisation. We invite both academics and practitioners to work with us toward building a broader understanding of the impacts and opportunities of digitalisation from the service-oriented perspective and of how to apply the resulting insights in creation of successful innovations.

As a multidisciplinary field, service science is by no means restricted to only these three perspectives. For example, engineering and psychology bring many other interesting insights to this new field of science. In fact, all of the views presented highlight the multifac-

eted nature of service. Although great potential is seen with such cross-cutting approaches for service innovations and business, practical realisation has turned out to be quite challenging. One of the main reasons is that professionals are often experts in only one discipline and only one system (e.g., health-care information systems). Therefore, even finding a common language for the diverse population of professionals needed to develop the service holistically is often difficult [21].

One solution for which service science aims, is the establishment of common concepts (such as service and service system) that aid in communication between disciplines. Moreover, service science highlights the importance of developing 'T-shaped professionals', who have deep problem solving skills in one area (in at least one discipline and one system) but who also have communication skills extending across many disciplines and systems [10]. We claim that such service professionals who have adopted the new service oriented mindset can have a significant impact on companies' ability to design, improve, and scale service systems for their business purposes.

Acknowledgements

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Value in experience: a design and evaluation framework based on case studies of novel mobile services

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We live with technology

'You cannot NOT have a user experience' (Lou Carbone)

As McCarthy and Wright [1] put it, we do not just use technology; we live with it. Human–computer interaction (HCI) to an ever greater extent is occupying diverse domains of our everyday lives. In particular, mobile devices that we carry with us all the time and related multifaceted mobile services have increasingly occupied our life from work to leisure and from private to public. The shift of focus in HCI research has been from the traditional usability-centred view toward researching and designing for enjoyable and engaging experiences by highlighting the non-utilitarian aspects of interaction. The difference between usability and user experience is said to be about emotions: while good usability means lack of discomfort, good user experience means delighting the user [2]. Today the HCI field emphasises an approach to research and design for enjoyable and engaging experiences: *'Now it is no longer adequate just to avoid bad experiences; we have to find methods for designing good ones'* [2].

Technology as a means of bringing value to our lives

In other words, technology-driven ways of thinking are being deserted. Technology should be seen not as existing for its own sake – i.e., as an end in itself – but, rather, as a means for bringing value to people's lives, as a means to an end. The service experi-ence does not exist until the user perceives it, and, therefore, the company will never be able to create the experiences or offer pre-determined value [3]. Value should not be seen as embedded in the object and rec-ognised by the user. As Frow and Payne [4] emphasise, value resides not in the object of consumption itself but in the experience of the consumption. Good outcomes are a vital element of user experience [5]. Value is seen as 'happy endings'; i.e., the focus should be on outcomes and lasting impacts that endure beyond interactions, not on the qualities of user experience during interaction [6].

However, despite extensive research into user experience, in both industry and academia, there is still a lack of systematic research addressing how to evaluate and measure user experience (UX). What makes UX evaluation especially challenging is that no-one can experience exactly what another has; experience cannot be truly shared. Only the individual directly involved can know and feel his or her own experience, and we out-siders can only analyse and interpret them. There is always a part of user experience and value that will remain a mystery to research-ers.

We need to understand the user, rather than technology

'People's behavior makes sense if you think about it in terms of their goals, needs, and motives.' (Nobel Laureate Thomas Mann)

Given the foregoing, for understanding what motivates users to use a service, it is important to understand and identify what is important to them. Design work should not be based on generic models of the users [7], yet understanding about users still often remains at the level of only very basic user characteristics. Such an approach does not help designers develop insights or identify the linkage of users' in-depth service needs, motivations, and values to technology features [8], and, as a consequence, detail-level and fundamental design decisions are made without an explicit understanding of the relevant values the users assign to the service. Therefore, one of the greatest challenges is to incorporate the 'voice of the customer' into the design of new products and services [9]. The involvement of users and gaining a deeper understanding of them can ensure that the service will be suitable for its intended purpose in the environment in which it will be used [7].

We all have personal values

'We do not see things as they are; we see things as we are.' (The Talmud)

Values are often understood as intrinsic, lasting, and relatively steady beliefs and desirable goals that serve as guiding principles in people's lives [10]. Each of us holds numerous values that are ordered by importance relative to one another, and these value 'priorities' or 'hierarchies' characterise us as individuals [11]. As Friedman [12] points out, we can say that any human activity reflects human values. Accordingly, individuals show their values through their acquisition of services [13]. User values are users' internal conceptions of what is important in a certain usage context. Perceived value is a user's overall assessment of the user experience on the basis of the sense of what is achieved in terms of his or her own, personal values [14]. The use of a service can be a way to act upon and demonstrate one's personal values [14].

But it is challenging to determine and measure the value, since it is evaluated so individually and personally. A single 'value label' means different things to different people. People do not usually think about their values and may, accordingly, have difficulties in articulating them verbally [15]. Users may not even recognise their own values, and the underlying values behind seemingly self-explanatory values might remain hidden.

We can understand the users through their values

Nonetheless, gaining an understanding of users' personal values and acting on them are seen as a powerful tool for better comprehending user behaviour and reaching potential users [16]. Furthermore, understanding of user values could be seen as offering a stable basis for designing for 'enjoyable experiences', as values are relatively general and enduring tendencies, and valuations of objects that guide humans also in other areas of life [10]. Values can be used to predict or explain the acceptance and attractiveness of new systems or products in organisations or by the masses or groups of consumers [8]. In line with this, a fairly recent development in HCI work can be seen in the growing interest in, and concentration on, value-centred design. Cockton [17] states that any foundation for design of worthwhile systems demands a value-centred focus if it is to serve as a stable structure for HCI, with the system, the user, the context, and the intended value as the 'legs' at the four corners.

But even though the concept of value has attracted extensive interest in the research, there is still complexity and a lack of consensus with respect to this research subject [18]. The field is plagued by vaguely defined terminological constructs related to value and user experience, and by confusion and inconsistency in use of the terms. Moreover, the relationship between user experience and value has not been explicitly defined in the literature. User experiences are the basis for user value perceptions, which

Table 1. Summary of the case studies.

Case study	User group	Where and when
Mobile campus intranet	University students (N=67)	Raahe, Finlad, 2007
"Amazing NFC" mobile learning	Teenagers (N=228)	Oulu, Finland, 2008
Touch-based access to Mobile Intenet	General public (N=238)	Oulu, Finland, 2007
NFC-supported school attendance supervision	Children (N=23)	Oulu, Finland, 2008
"BlindNFC" medication management	Vision-impaired older people (N=39)	Finland and Spain, 2009
Mobile phones as seismic sensors	University students (N=59)	California, USA, 2011
Multimodal wayfinding aid	Memory-impaired older people (N=9)	Pyhäjärvi, Finland, 2009-2010

have a cognitive-affective multidimensional nature [19]. Helkkula and Kelleher [19] state that investigation of the relationship between the user experience and value is vitally important, as customer-perceived value and the meanings of service experiences are no longer seen as fixed and linked to service attributes and characteristics. Also, more research is needed for identifying the important dimensions of value as experienced by various user groups in order to close the gap between what developers and service providers believe that the users value and what the users actually value.

Moreover, a user may derive value at any time during the user experience [20]. It is essential to look beyond the static aspects of user experience, beyond short-term experiences, and investigate the temporal aspects of UX – i.e., how UX changes over time [21]. However, there has been little research for development of an empirically based understanding of value across the full scope of user experience, on all time spans.

Case studies enabled an illuminating research approach

The focus in this paper is on user-perceived value rather than economic value or business value (as assigned by a customer) for an organisation. The perspective of individual users who experience value is adopted. User experiences need to be followed for a relatively long time when people use the service in everyday life, if one is to obtain the most reliable possible picture of the value-formation. Only through personal experience can the user describe the value experienced. The focus and interest here are directed toward cumulative user experience that evolves over time, not on single experience episodes. In this study was investigated how users' subjective descriptions of experienced value can be categorised, processed, and utilised in the design and evaluation processes for novel services.

The specific context for undertaking this research was the mobile service case studies conducted in technology research projects

between 2007 and 2011 [32–38]. The individual case studies of novel mobile services in varying usage contexts (see Table 1) involved several distinct user groups: children, teenagers, university students, and vision- and memory -impaired older people.

The approach employed for evaluating the value provided to the user was based on the information on subjective user experiences already collected and analysed in these case studies. Consisting of distinct case studies with different user groups and application domains, the original fieldwork material was obtained from diverse viewpoints and service approaches. The starting point for this work was the finding that the original research material collected on user experience provided new insights with regard to the question of experienced value. The main finding was that the value priorities of the users become evident from their subjective descriptions of the user experience. Users interpret their user experiences on the basis of their internal values. They have a preference for specific value dimensions, consequences linked to goals for user experience.

An initial value framework was developed as a synthesis from the literature, and, by adapting this framework to particular mobile service case study contexts and utilising it, the empirical user experience findings were re-examined from the value perspective on a case-by-case basis. The framework was used as a foundation for interpreting, structuring, and categorising the values visible from users' subjective descriptions of their user experience. Focus was placed on the value the users themselves experienced and interpreted, and only on values that were relevant for the users in the context of the given service. In addition to capturing user experienced value, the value framework was used for identifying the expected designer value, the value the end users were expected or assumed to gain by adopting the new service – that is, the intended value [cf. 17] – to allow further examination of the interesting congruencies

and discrepancies between designer value and user experienced value.

In the framework developed, the value dimensions were divided into two abstract categories, drawn from a classification applied by authors such as Lee et al. [22]: those of service value (SV) and user value (UV). *User values (UVs)* are defined as personal user-specific values that reflect what the user desires to achieve in consequence of UX [8]. User values guide the users when they interpret the user experience; i.e., the user evaluates the user experience in light of his or her own value hierarchy [cf. 20]. They are appreciated and aspired to as ends in themselves (see, e.g., [5]). What distinguishes one value from another is the type of goal or motivation that the value expresses. *Service values (SVs)* are instrumental values that refer to the values the user derives through service qualities and performance; i.e., they occur especially during the interaction between user and service [cf. 23]. They act as a means to the end of achieving something else, fulfilling the personal values [cf. 24].

In view of this new analysis, value parameters from individual mobile service case studies were interpreted and categorised. The initial framework was complemented with support from the value parameters identified in the case studies. All of the case studies thus iteratively contributed to the development of the value framework by validating (by making more concrete) and extending (through sub-categories) the values in the initial value framework. The complemented value design and evaluation framework is presented in Table 2.

Value in experience emerged as a useful construct

In this work was accumulated deeper understanding of experienced value and its key elements through the above mentioned empirical case studies. User experienced value was investigated through the user experiences that users themselves interpret and evaluate. The

Table 2. Value design and evaluation framework.

Category	Value dimension		Value parameters
SERVICE VALUES (SV)	**Functional value**	Convenience	Ease of adoption, Ease of use, Availability, Discoverability, Flexibility, Appropriateness, Technology suitability, Superiority
		Quality and performance	Reliability, Durability, Efficiency
	Personalisation value		Adaptation, Relevance
	Localisation value		Context-sensitiveness, Up-to-dateness, Integrated usage experience
USER VALUES (UV)	Social value		Social recognition, Social approval, Social comparison, Achievement, Status, Respect
	Hedonic value		Enjoyment, Play
	Stimulation and epistemic value		Learning, Novelty, Challenge, Variety
	Growth and self-actualisation value		Independence, Self-esteem, Empowerment
	Socialisation value		Social interaction, Belonging, Participation
	Traditional value		Compatibility, Conformity
	Safety value		Security, Freedom from fear, Awareness
	Benevolence value		Resposibility, Value creation

insights gained lead to propose the concept of value in experience (ViE) to describe **the user's iterative (conscious and subconscious) interpretation and evaluation of user experience, according to how qualities and consequences of experience assist or hinder the user in fulfilling his or her personal values in the prevailing contexts**.

The key elements of the concept are proposed as follows:

- **Closely tied in with UX:** What people actually desire are not services but the experiences services provide, the main stimulus for use of the term 'value in experience'. Thus value and user experience are closely linked and dynamically interrelated [cf. 19].

- **Guided by user values:** User values guide the users when they interpret the user experience; i.e., the users evaluate subjective user experience on the grounds of their own value hierarchy. Accordingly, value in experience is uniquely interpreted and determined by the individual and cannot be predefined by the service provider.

- **Iterative:** Value in experience is not constructed in a linear chain of sensemaking. Instead, users experience value in dynamic processes of experiencing

and interpreting user experience in an ongoing, iterative way based on understanding and sensemaking between previous, current, and future experiences.

- **Evolves over time:** The idea of value in experience emphasises the user's perception of value over the entire course of user experience [cf. 25]. Thus the user may derive value at any time during the user experience [20], and value in experience may vary over time as users' level of experience with a service changes.
- **Properties of UX reflected in ViE:** The complete user experience of a service cannot be limited to a single usage episode, as it is a continuum taking shape as a result of a series of smaller user experience units; i.e., the focus here is on cumulative user experience [cf. 25]. User experience is a dynamic and continuous phenomenon that evolves and changes over time.
- **Conscious and subconscious:** Users are constantly, both consciously and subconsciously, evaluating and modifying their value in experience.
- **Context-dependent:** Value in experience may vary across evaluation contexts [cf. 26]. Changing external contextual factors may cause users to revise, revisit, and reinterpret their user experiences and thus modify value in experience. Users' interpretation of the relative importance of certain values depends on the context.

Value design and evaluation framework for understanding value in experience

A value design and evaluation framework was presented and demonstrated via individual case studies through analysis of how the value in experience of the novel service corresponded to the value priorities of the users. The complemented framework (Table 2) presents a rich description of value dimensions relevant to specific user groups and service domains in varying usage contexts. The value dimensions contributed to value in experience in user specific combinations, with varying emphasis. The value framework developed provides a foundation for understanding and examining the value priorities of different user groups with regard to novel mobile services. It could be helpful in collection of data on users' value priorities, as it structures the discussion and may help the user to verbalise tacit knowledge related to phenomena. So this framework can be harnessed to investigate a more extensive and complete set of desired elements of value from the user's perspective, especially those related to preferred consequences, as the desired service attributes are likely to be more readily visible and easily communicated. The framework can be utilised to interpret which specific values in various usage contexts and situations provide the greatest potential for maximising the value in experience for users. There is often a gap between what developers and services providers believe users value and what the users actually value. The value framework could be directed toward shrinking this gap.

Design and evaluation implications arise for different user groups

The different approaches to taking into account values in design work are not yet associated with clearly established activities or methods for identifying user values and integrating them into practical design processes [8]. Nevertheless, identifying values, incorporating them into design work, and evaluating the success of this implementation can be seen as essential activities. Value-oriented segmentation has proved to be better than the traditional approaches, such as demographics, in segmenting the set of users [27]. In addition, evaluation of value in experience cannot be restricted to individual user experience episodes. The most reliable understanding of experienced value is gained if it is treated as an on-going evaluation with the full scope of user experience as its domain.

Identifying users' relevant values and focusing on them from very early in the design phase helps to focus the design on the most essential issues and on key features of the service that are appreciated by the users. It is not enough to map finished-product attributes to user values; user values should be taken as the basis for user-centred design from the very earliest stages. Research methods that require people to evaluate their experience of using a service do not adequately capture the perceptions of non-users or prospective users of the service in question [28]. Users should be able to direct the focus of the future product and not just react to existing designs [8], as such potential experiences [28] might result in service innovations and development ideas. However, people may not be able to name or otherwise articulate what they might value, as opposed to only what they have found to be worthwhile [6].

One cannot have a blueprint for how an experience will unfold. People possess an enormous tendency and capacity to accord value to services that sometimes have nothing to do with the intentions of the developers. The work done here may aid in early identification of values that otherwise are difficult to envision during the design phase. Relevant user values need to be communicated for service development in such a way that designers can understand even better what kinds of features users appreciate and why, and in what kinds of situations and contexts the service is used. Design decisions could then be directed toward the prioritised value dimensions. Such integration of values into design processes requires understanding of user value structures in a specific context, and the value framework developed in this study can help with this.

However, difficulties arise if a respondent is prompted to consider a pre-determined set of values that cannot be perfectly related to the usage context at hand. Analysis should not be restricted to pre-formulated values; one should enquire also about the values that appear and are relevant in specific usage contexts. Therefore, pre-defined values in the value framework and interpretive methods for context-specific description of values should be used in combination.

Conclusion

We cannot design an experience, but with a sensitive and skilled way of understanding users, we can design for an experience [29]. We can design the elements that influence user experience [30]. Boztepe [23] states that claiming that design creates value might perhaps be an overstatement, but design starts with the intention to generate value. Developing the capacity of objects for value is suggested as a better definition of design's role in value creation. Designers need to know what kind of experience they are aiming to achieve and use that as a starting point for identifying the kinds of design solutions that need to be used for reaching those goals (ibid.). As stated by Cockton [31], the right question is this 'What do users really want?'

The empirical data provided a rich and broad tapestry from which to examine and clarify the understanding of value in experience and offered a rich basis for building an overall understanding of how value manifests itself for various user groups across services' boundaries, and also for extracting different aspects of the phenomenon. The individual findings from the case studies and the value design and evaluation framework developed aid in identifying, describing, and categorising the key dimensions of value that contribute to users' value in experience. However, even though the research work done in this study is related only to mobile services, the values revealed are also expected to arise in other types of digital services in personal use. Therefore, the value framework developed can be seen as a good basis for a generally applicable value framework. The work presented here

has been published in a doctoral dissertation [39], and plenty of avenues for further research remain.

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Building and construction services

Energy-renovation services for single-family houses

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Introduction

The Nordic SuccessFamilies project, with participants from Denmark, Finland, Norway, and Sweden, dealt with development of business models for full-service energy-efficient renovation of detached houses in the Nordic countries (see Figure 1). The background to this project is that most of these houses are more than 30 years old and have a need to be renovated, which provides opportunities for implementation of energy-efficiency measures.

Energy-related renovation of existing buildings has huge potential for cost-effective energy savings. Residential buildings are responsible for 70% of the energy use of buildings in the Nordic countries. Single-family houses are responsible for more than 50% of this. There is a substantial shortage of business concepts for renovation services for single-family houses. [1]

The solution to the lack of business concepts for renovation services for single-family houses is that, first of all, renovation service packages should be developed to include standard technical solutions for energy-efficiency improvements applicable for different building systems and ages of building. Secondly, all other necessary services should be included, providing overall renovation solutions for those people living in single-family houses. The new services must be supported with new features, such as better visualisation, guaranteed prices, and funding services. [1]

To create such new services, Nordic co-operation was initiated in 2009. The main objective of the SuccessFamilies project was to change the business environment in order to speed up the implementation of sustainable renovation of single-family houses. The resulting new service concepts combine

Figure 1. The logo of the project is intended to express the connection between better energy-efficiency, higher indoor-environment quality, and lower costs for energy and the direction where the project is leading.

technical solutions; financing services; and other means of overcoming the behavioural, organisational, legal, and social barriers to sustainable renovation. [1]

Methods

Work toward the objective included analysis of existing sustainable-renovation concepts; forming of new concepts on the basis of the analysis; development of marketing strategies for sustainable renovation through determination of the barriers to, and opportunities for, sustainable-renovation concepts; and finally description of the new, successful service models in view of information from the analyses and marketing strategies. The project period was three years, 2009–2012. [1]

The project team summarised statistics on the Nordic building stock; estimated the energy-efficiency potential of typical single-family houses; identified target groups for energy-efficiency renovations; and analysed stakeholder interests, marketing strategies, financing schemes, and emerging one stop-shop business models. The outcome of the project, in the form of eight reports, is based on literature reviews, techno-economic analysis, workshops, input from industry representatives, and project participants' experience and judgement. [2]

Evident need for full-service concepts

The first findings of the project showed that detached single-family houses account for a large proportion of the total number of dwellings in the Nordic region, about 40%. The typical single family houses identified as having great primary energy-saving potential are largely from the same era, the 1960s–1970s, in all four countries or either pre-war (in Denmark, Norway, and Sweden) or post-war (in Finland). The calculations showed that energy-efficiency measures carried out in connection with renovation of single-family houses have potential for very large energy savings. Typical single-family houses can be renovated to the level of energy performance required for new houses today and even, in some cases, to low-energy level. [3]

The studies also revealed that good technical solutions exist for sustainable renovation. The current renovation market, however, is dominated by a craftsmanship-based approach with individual solutions, traditional warehouses, 'do-it-yourself shops', and some actors marketing single products. Many house-owners choose to perform the renovation themselves. Full-service renovation concepts in the Nordic countries have only recently entered the market. [3]

There is a need for one-stop-shop business models wherein a general contractor offers full-service renovation packages that include consulting, an independent energy audit, renovation work, independent quality control and commissioning, and financing. There is significant business potential for such a model, as the volume of the renovation market for single-family houses may reach the hundreds of millions of euros per year in each Nordic country.

Homeowners will get a high-quality renovated house with little of the risk and responsibility that usually accompany traditional handicraft renovations. The energy cost will be reduced, the market value of the house will most probably increase, mortgage banks will have a safer asset, and there are societal benefits in terms of reduced energy use and greenhouse-gas emissions.

The ideal business model

Through analysis of the existing full-service concepts, some possibilities for improvements were found, and a new full-service concept was suggested by Tommerup et al. [4] (see Figure 2). It represents an ideal process of implementation of a one-stop-shop business model. The process consists of five phases: investigation of the house, extensive analyses, a proposal for renovation, the actual renovation, and commissioning after renovation. The process was later expanded
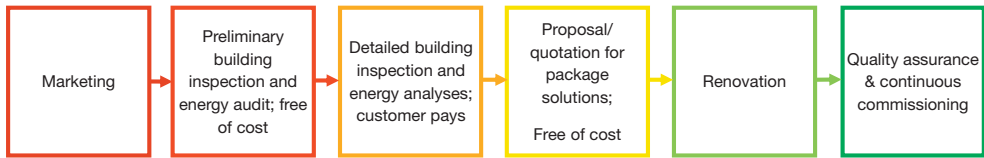
Figure 2. Implementation process for a general one-stop-shop model for energy-efficient renovation [5].

to six phases, to include 'marketing' to attract customers. The steps are further described below.

Marketing
Marketing may include advertisement via mass media, warehouse displays, interpersonal communication such as local area meetings, and information from estate agents or energy auditors for a newly bought house. Typically, mass-media advertisement is useful to inform consumers, while interpersonal communication is important to convince consumers to adopt a product or service.

Preliminary building inspection and energy audit
Homeowners interested in the full-service concept will contact the one-stop-shop service provider. In a similar way as in a traditional renovation process, the service provider should visit the house to be renovated, conduct a free-of-charge preliminary building inspection and energy audit, and discuss the renovation requirements and the availability of subsidies with the homeowner. This is an opportunity for the service provider to offer the possibility of a more comprehensive building inspection and detailed energy analyses by an independent actor.

Detailed building inspection and energy analyses
The outcome of the preliminary analysis may lead some homeowners to opt for a traditional renovation process and avoid more detailed energy analysis. If a homeowner is interested in knowing more about the condition of the building and the opportunities to improve its energy efficiency, the service provider could arrange for an independent company to perform a more detailed inspection of the building and in-depth energy analysis. This service should be carried out by the independent company in dialogue with the homeowner and be paid for by the homeowner but be subject to refund if a renovation-package solution is bought from the company. The extensive analyses also give the company knowledge that provides a safe foundation for convincing the homeowner of the benefits of energy-renovation packages and for offering fixed-price quotations.

Proposal for package solutions
In the next phase, proposals for renovation-package solutions are prepared, including a quotation for the work and addressing the financing and management of the contract work. The main point is that the typical homeowner needs help in the design and decision-making process. The company should be able to complete this phase within a few hours, provided that the right system for configuration of technical standard solutions is in place, including simplified but accurate calculation models. The company should provide fixed prices for various packages, including visualisation or documentation of the effect on cost (total and annualised investment cost versus savings on energy costs), household economy (short- and long-term, including the effect of increased value of the house etc.), indoor

environment (e.g., indoor temperatures, draught, air quality, and daylight), other durability and maintenance issues, alternative housing for the family if they need to vacate the house during the renovation, the timeline for the renovation work, and possibilities for installation of energy feedback instruments (e.g., an 'energy clock' and hot-water-consumption meters).

Co-ordinated execution of the renovation work

The homeowner evaluates the packages, and if he or she chooses to accept any of the proposals, any remaining economic and financing issues are clarified and a renovation-work contract is signed. A detailed work description, including timeline, is established; any drawings needed are prepared; and the contract work is carried out. The company obtains the necessary renovation permissions from the authorities and helps the homeowner apply for any loans and/or governmental subsidies. The quality of the renovation work should be checked continuously to allow corrections that ensure that the requirements set are met. At the end of this phase, the renovated house is ready for use.

Quality assurance and continuous commissioning

The renovated house is inspected by an independent agency, which checks the quality of the work. A certified energy consultant prepares an energy-performance certificate. The heating and ventilation systems are commissioned for at least two years. One important issue is to check that the energy performance requirements are continuously met. The energy performance of the building is regularly recorded and compared with the estimated energy savings potential. The homeowner is presented with a user manual on how to operate the building and supplied with information on the consequences for energy use and indoor environment if the house is not used as prescribed.

Emerging service business

The project team analysed emerging business models for offering of full-service renovation packages in the Nordic countries. A comparative assessment shows that actors of various types (renovation company, insulation company, energy utility, building product warehouse, etc.) can provide such a service. There are differences in how customers are contacted, while the similarities are more in how the service is provided. One major challenge is how to secure independent advising. From the customer's point of view, there are major limitations of such a concept, related to the trustworthiness of the actors. It seems that established companies with a strong financial background (e.g., an insulation company in Norway or a hardware-store chain in Finland) can start such a business. Still, policy instruments are needed to support market formation, at least in the initial phases. [5]

Solutions to promote one-stop-shop renovation service

Even though there is strong business potential for a one-stop-shop energy-renovation concept, it has been somewhat difficult to start or run such a business. The project team suggested various options for overcoming the barriers to promotion of energy-efficient renovation of detached houses. These include a national goal for energy-efficiency improvements in existing buildings and specific actions needed for reaching that goal. Incentives can then be tailored such that they consistently support the plan. Better support should be given to those actions supporting a whole-building solution instead of smaller individual solutions. For the owner of a single-family house, the goal could be set by energy-certificate, and then a one-stop-shop service would provide the plan and actions for reaching the goal. Solutions further include a guarantee of energy savings, information campaigns highlighting the benefits of energy-efficiency improvements, and

availability of economic incentives. Also, public funding for a few demonstration projects is needed to bring together actors interested in the one-stop-shop concept and gather important experience. Advertisement of results of successful demonstration projects may attract more customers and entrepreneurs. [5]

The first step in development of a new and innovative business model is to understand the customers' real needs. With respect to renovation, a house-owner might not know his or her needs, as he or she has no knowledge about what can be done to make the house more energy-efficient. The decision-making process in this situation is, therefore, a 'learning process'. To 'teach' and guide the house-owner through this process, credibility and trustworthiness are prerequisites. [6]

Marketing strategies

In the final report [5], the project team present guidelines on how to develop efficient marketing strategies for one-stop-shop renovation service. Independent of the business model, the responsible company needs to make some strategic choices, which may vary in view of the company and individual market involved. Each company also has to take into account the current regime of regulations and incentives. This may, therefore, differ from country to country.

During the development of marketing strategies, important decisions have to be made about the definition of the target group, determination of the service and differentiation factors, how to build credibility, partnerships, communication strategy, and the marketing mix. [5]

Acknowledgements

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Feasible frameworks and value models for development of value-oriented service

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Industry-wide problems in moving toward value-oriented integrated project practices and participatory procurement were the point of departure for the international Value Driven Procurement in Building and Real Estate (ValPro) research project, which was part of the European Eracobuild programme (Value Driven Processes call) and involved research and industry partners from six countries: Finland, Denmark, Norway, France, Cyprus, and Sweden.

The objectives of the ValPro project (2010–2012) were to develop concepts, methods, and tools to support value-based procurement, addressing RTD issues at all levels in the 'value pyramid' (see Figure 1), the top three levels of which have not yet been intensely studied in the building and real estate sector. Accordingly, the ValPro research outcomes are expected to bring novelty. The three bottom levels have been addressed in recent RTD efforts and some results already applied in industry (e.g., via BIM tools and process guidelines). Since the total life cycle value driven approach has not yet been considered, ValPro delivered valuable new knowledge in this domain as well.

Special consideration was given to the development of methodology and services to measure and evaluate the performance and value of a building throughout its life cycle, based on targets to reach or achieved, taking into account of user profiles. The ValPro results were validated with participating and supporting companies in selected case studies, with a focus on well-defined business cases. The findings have been communicated to relevant stakeholders, both clients and providers, as well as to policymakers and legislators.

There is lack of good methods for addressing value and value configuration in the building and real estate sector. Some of
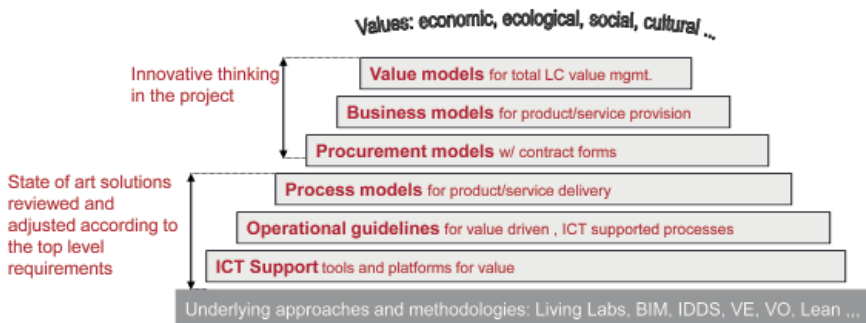

Figure 1. Value pyramid with the areas of focus of the project shown.

the tricky problems that the industry's stakeholders face when producing value for their customers at project level in service business practices are listed below:

- The value to the customer is not known in detail; customers may hold quite divergent senses of value.
- There may be fragmentation along the whole value chain, with numerous stakeholders.
- Value management problems readily arise:
  * Horizontal value flow (from one phase of the process to another) is not secure.
  * Vertical value flow (between disciplines in any given project) is not integrated.
- Contractual relations do not satisfactorily provide the total value outcome of the business solutions.
- The services are performed on the basis of work tasks instead of being performance or value based.

The ValPro project tackled these problems in the case studies. As state-of-the-art-knowledge we refer to a series of research projects in the field of value metrics for the building industry [1]. Our approach to the problems of the industrial stakeholders focuses on development of frameworks and description methods that take into account the aspect of value. The co-development addressed specific challenging issues specified by each industry partner. In case studies with the Finnish partners (Senate Properties, Ruukki Construction, and Skanska), the following opportunities for business in the areas of customer-orientation, networks of services, and use value of products were noted, in view of the benefits of using the 'Value Dial' as a service process and development framework:

- services and offerings that are more customer-oriented
- easy development of integration with service providers (stakeholders) toward partnering
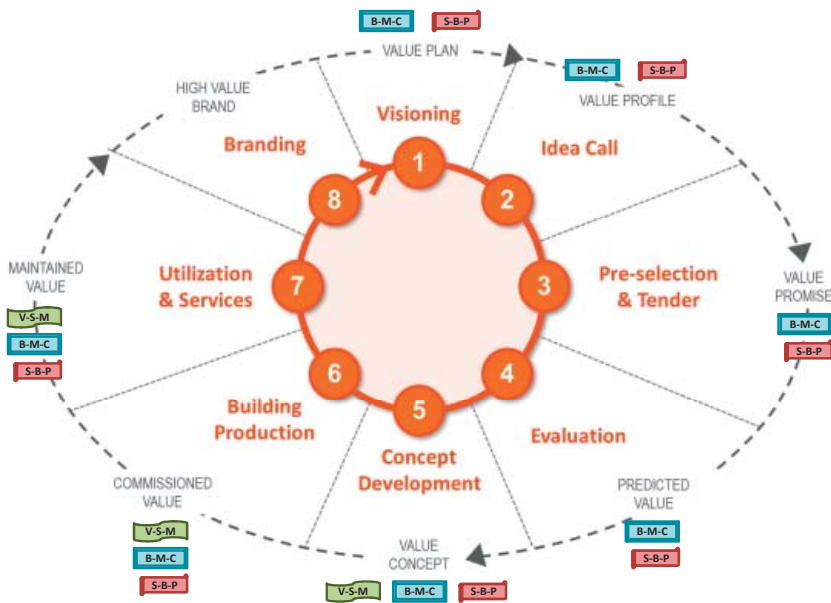

Figure 2. ValPro Value Dial model and ValPro case-study activities with descriptions methods of Value-State-Mapping (V-S-M), Business-Model-Canvas (B-M-C) and Service business-Blueprinting (S-B-P).

- greater capability to produce quality and added value through adoption of promise based procurement with measurable and verified value configuration
- facilities and spaces where performance and characteristics are well defined and can be managed with the aid of organisation level business model value metrics (key service criteria)
- –the assessment and follow-up of the characteristics of facilities.

The models and methods listed below have been tested and co-developed with the industry partners of the research project:

1. Development of the ValPro Value Dial, which serves as a framework for value-oriented procurement and a tool for supporting value output and input from one dial sector to another. The Value Dial in the picture below is illustrated in the form of eight steps, where the inner circle describes an activity and the outer circle summarises its outcome. It can be 'dialled' from any point – e.g., from utili-
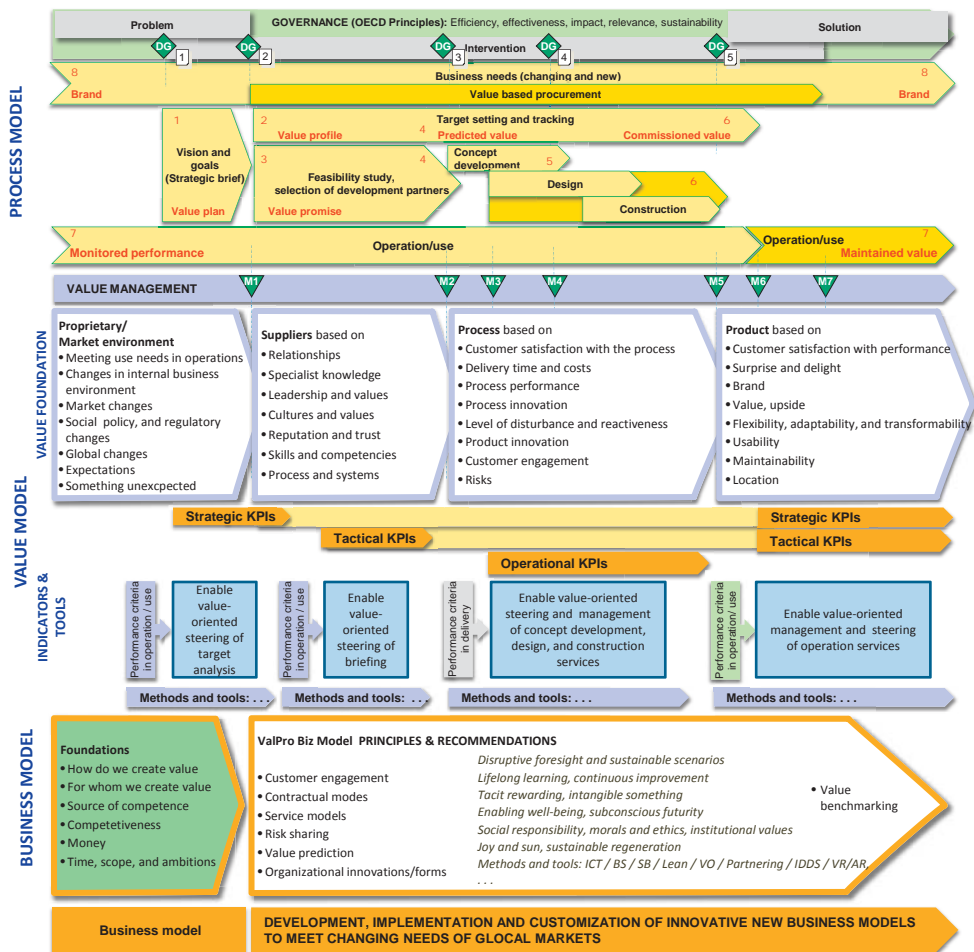
Figure 3. ValPro value governance framework.

sation and services (7), branding (8), or visioning (1). Intentionally, the Value Dial focuses on 'new steps', points where value generation opportunities could have great potential – for example, early in the process of the idea call (2) or the pre-selection and tender phase (3) – whereas the traditionally emphasised delivery process is squeezed into one phase, called building production (6) (see Figure 2).

2. Changing the typical process phase description used in the construction into a holistic view of corporate project governance. The corporate project governance is seen as a necessary driver for creation of value for the client and user organisation in projects. Understanding building projects as critical enablers for realising operational goals in the short run and creating corporate success and sustainable values in the long term is essential if one is to consolidate strate-

gic value creation related project goals. Establishing a business and value model for a building project means establishing a project context wherein corporate strategies and long term value creation are stressed (see Figure 3).

3. Defining the business areas as value streams: 1) relationships (current and future markets), 2) specialist knowledge (products and services), 3) leadership and communication (people), 4) culture and values (innovation and change), 5) reputation and trust (strategy, planning, and execution), 6) skills and competencies (financing and investments), and 7) processes and systems (risk, uncertainties, and reward). The value streams form a basis for business thinking in which value configuration has the focus.

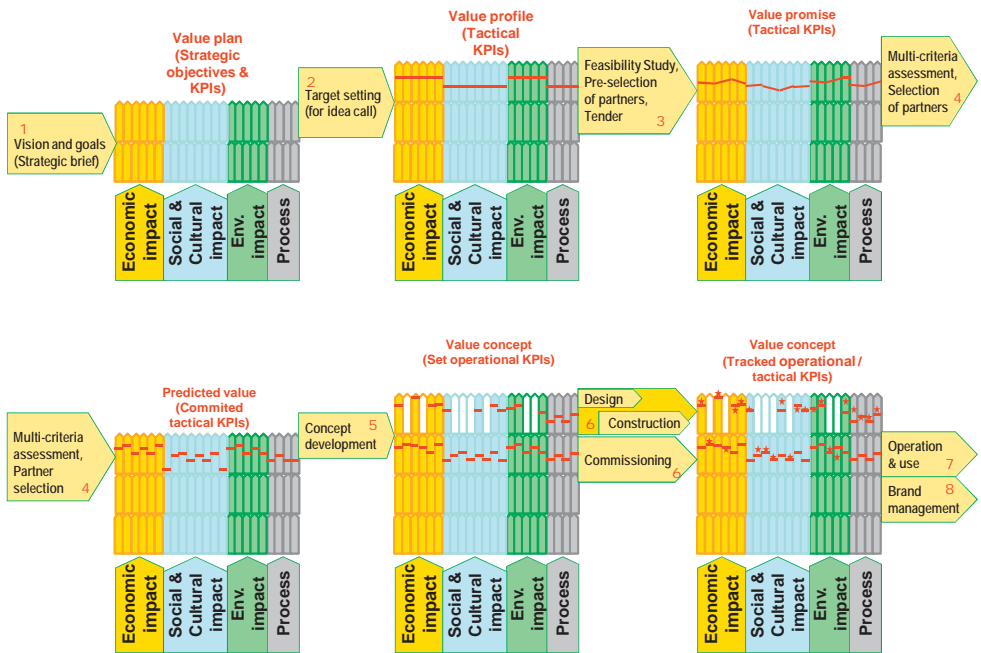4. Showing the value configuration with the aid of a value model and set of indica-

Figure 4. Process chart and KPIs in the same illustration as ValPro Value Dial phases (numbered 1–8).

tors for the course of the service journey through the Value Dial (see Figure 4).

5. Upgrading of the known value development description and service description methods by functions that take value-oriented thinking into consideration (see Figure 5).

   a. Value chain mapping with analyses of the critical values and relations in the value network.

   b. Value-oriented service business description (based on a 'Business Model Canvas'), including connection to the value model and Value Dial.

   c. Service blueprinting in each sector of the Value Dial and interfaces of the customer and the customer's customer (for understanding of their value preferences and value profile).

Results

The feasibility study with three industry partners in Finland gave a clear indication that the frameworks and description methods are usable for value-oriented service development. They are valid in connection with practical service business and its challenges. With the support of the frameworks, it is possible to take into account the aspects of value configuration (with the value net, value chain, and value shops) [2] as well as aspects of total value management along the service path and customer interactions as part of a value oriented service business model.

When one is describing the practices and services with the aid of the frameworks developed, it is possible to apply the value model for negotiation in terms of the value and quality achieved instead of the price of a product and to divide the value delivered across integrated
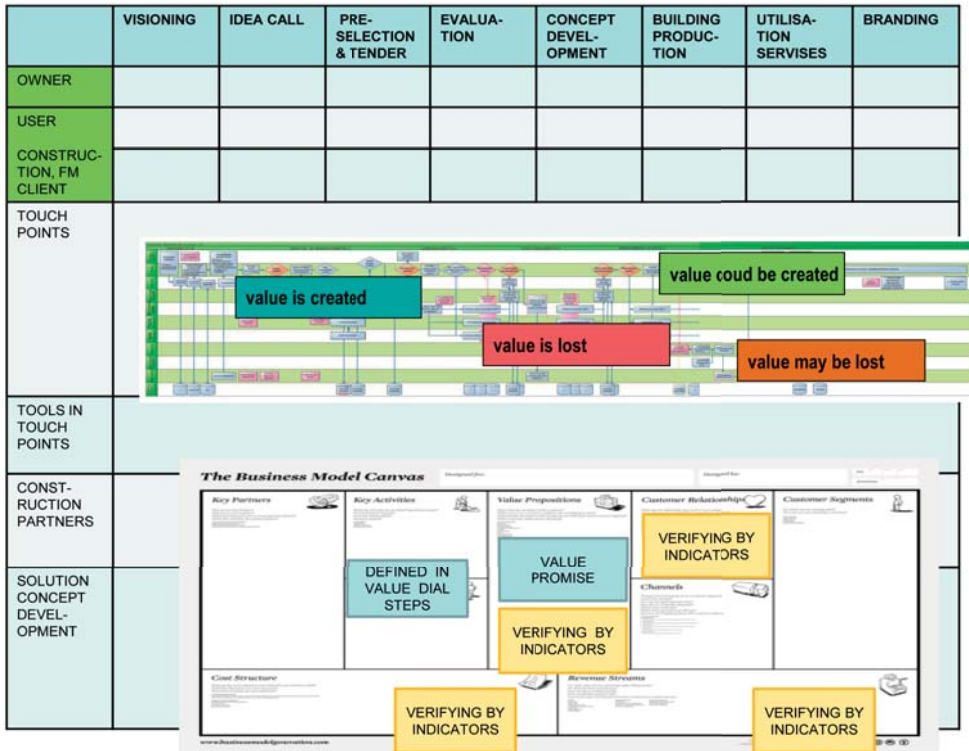

Figure 5. Description methods upgraded for value-oriented thinking.

service ecosystems. The value model analyses include reviewing the content of value offerings and value promises (produced by means of value concepts) for the other side and value profile for the other side.

The value model has a linkage to the approach of service dominant logic and especially to further development of the management principles introduced by Vargo and Lusch [3, 4]. Some of the open questions lie in the development of efficiency and profitability. Even though it is reasonable to argue that efficiency (from the provider's standpoint) is best achieved through effectiveness (from the customer's viewpoint), it is a long way from this insight to actual development and implementation. The core questions are how to measure the various aspects of use value (economic, experiential, social, etc.) and specify the market value on that basis [5, 6].

The value model and the set of indicators it consists of together explain a way of measuring the use value of a design and delivery service as well as of maintenance and operation services. The approach includes product, process, and organisational aspects and the relevant areas of impact (e.g., aspects of use value) in design and construction projects as well as throughout the life cycle of a facility; these are economic impact, social impact, environmental impact, process values, and company specific values (see Figure 6).

Novelty

The value model as described through seven value streams, the eight step Value Dial, and the value model framework with a small number of core indicators described in detail together formed a novel basis for development of a value promise that can be fulfilled
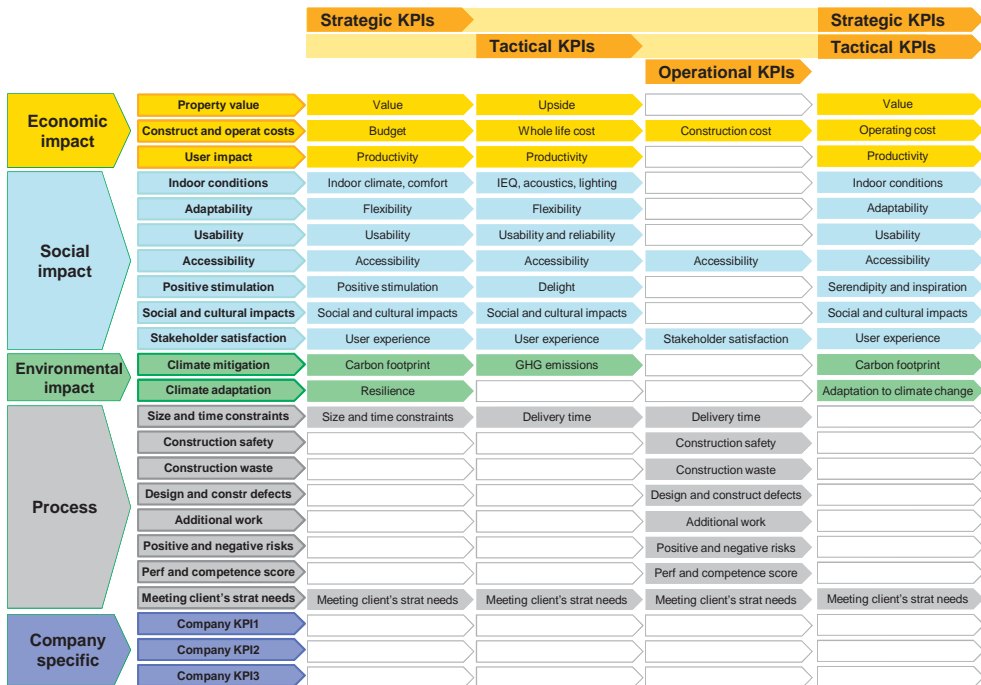

Figure 6. ValPro value model framework and an example of strategic, tactical, and operations related key performance indicators.

through a value concept. The value streams can be linked with the business model, the tools can be positioned on the value dial, and the value model framework with core indicators can serve as an interoperable basis across process or organisational boundaries. Even though the value model was not tested in all cases studied, the approach and initial results were encouraging, and implementation appears to be continuing with some partners of the ValPro project.

More results and presentation of the cases can be found in the ValPro final report [7], ValPro deliverables [8] and ValPro publications [9].

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Title	Highlights in service research
Author(s)	Minna Isomursu, Marja Toivonen, Matti Kokkala and Pasi Pussinen (Eds.)
Abstract	Services have rapidly become a central topic of both concern and interest in research and business. Both the public and the private sector are facing increasing demand, cost, and quality challenges in their attempts to deliver services effectively and efficiently. The changing structure of the population, growing competition and mobility through globalisation, and new opportunities for services' digitalisation are among the factors forcing us to re-knit the web of services needed for enabling a sustainable operation environment for companies, providing citizens with adequate conditions for good quality of life, and protecting our environment from overload caused by human activity. This collection of highlights of VTT's service research illustrates the versatility of service research. Service research has become a theme under which synthesis of traditionally separate research domains thrives. These range from industrial manufacturing to safety and security, from information and communication technologies to the building sector, and from media studies to public-sector innovations. Service research brings researchers from many disciplines together to discuss innovation, design, development, and adoption of services in diverse domains, enabled by emerging technological breakthroughs.
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