Scientific activities in

service science and business

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VTT Technical Research Centre of Finland is a multi technology contract research organization under the auspices of the Ministry of Employment and Economy. VTT's mission is to provide research and innovation service to enhance the integration competitiveness of companies, society and other customers thereby creating prerequisites for growth, employment and wellbeing.

The main drivers behind all research at VTT are: a) rapid information and communication technology as an enabler of new products and business models; and b) the global need to reach sustainable development of the society. In addition, research is gradually changing from purely technology oriented R&D to more business-oriented and it covers also services and business processes.

Over the past couple of years, VTT's interests have extended to technology-based business and innovation research. Many research groups and teams at VTT have carried out relevant research - often without explicitly calling their work as service research. One of the target areas has been business cases with new commercial service innovations. Taking this path, VTT aimed to increase its front-running role, particularly as a developer of service enabling technologies and service business models.

All services are not business, but all businesses are about service

Service, the magic word, is suddenly everywhere. Transition from manufacturing economy to service economy and from goods-oriented hardware suppliers to service providers is ongoing and gaining momentum. This change does not touch only the industry but the society as a whole, influencing the everyday life of us all. Service, rather than goods, is the basis of economic and social exchange; service is exchanged for service. Essential concepts of service based business are: [1] understanding of customer value creation so that you know how to support it; [2] efficient service processes that utilise service provider and customer competencies; [3] value capture and benefit sharing.

Demand for service R&D during the last years has been on a growth curve, and signals indicate it to continue. For emphasising the increasing relevance of service research VTT has taken concrete steps. We have included service and technology business along with its drivers into our Technology and Innovation strategy for the years 2010 – 2014. We have included service science in the strategy as well. An even more visible step was the change of the name of our strategic research steering groups from *Technology in the Community* to *Services and the Built Environment*. Last but not least comes the well-received SSB network. Service Science and Business Network was set up in the spring of 2009, the initiative that was coming from our researchers.

In large research organizations there is a challenge how to combine research knowledge across the disciplines when studying and developing services both in the industry and public organizations. Driving success factors in this process were the following: first, it received sup-

Group work during the SSB network process.

port from the committed goals of VTT. Second, it benefited researchers' own work at hands. And third, it facilitated discussions with distinguished experts outside VTT. Today this network links over 30 people from 12 competence centres at VTT, is a cross- disciplinary approach for innovating and developing services and has increased internal awareness and confidence regarding the contents and topics of the work. Also new R&D initiatives have emerged.

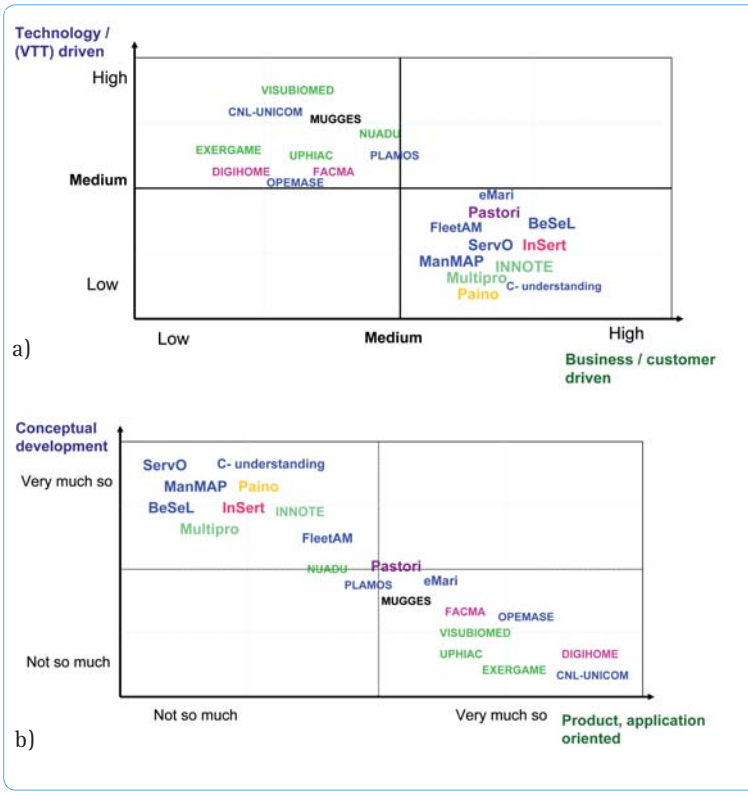
SSB network is for integrating knowledge and sharing information, for systematic development of competences in service research, and for commercialising and productising of our knowhow. Our R&D work is leaning on some central competence strongholds: 1) service business development, 2) service innovations and organisations, 2) service process system dynamic modelling, 4) benefits and value analysis of information services, 5) technology and human-centred design approach and 5) knowledge of application domains with performance and operational requirements. To respond to the demands of service science and business R&D, this outlook in your hand must be seen as an inter-disciplinary activity which attempts to unite various areas based on cross–disciplinary collaboration. Significance of services and related R&D as a part of technological and societal structural change is increasing, and increasing constantly.

RESEARCH SUPPORTING THE SERVICE SCIENCE AND SERVICE BUSINESS

Traditionally, VTT's main focus has been on the development and application of technology. But recently, technology based business and innovation research has come along. Many research groups and teams at VTT have carried out service-relevant research – often without explicitly calling their work as service research. Service research activities started with focus on telematic services for transport and logistics as well as evaluation of meteorological information services. Since then, VTT has invested in developing competencies in service research where one of the target areas has been business cases with new commercial service innovations.

However, to change the mindset from technology -oriented R&D to service business -oriented is not easily done and will take its time. This can be seen from the classification of our projects, where distinction is made between technology and customer –oriented projects, or between conceptual development projects and product/application development projects [see Figures a) and b) below, where the projects appear in abbreviations]. The technology driven projects in the left upper corner in Figure a) are mainly VTT initiated, whereas the customer driven ones in the low right corner are co-initiated with customers and are thus more business driven. On the time scale, the upper left corner ones are initiated and done earlier than those on the low right corner, thus the R&D service projects have moved from high technology / VTT driven projects towards high business or customer driven projects where the role of technology is lower. Classification on the conceptual development - product application oriented bases is given in Figure b). This classification describes the "mindset shift" and the today's tendency, too.

Currently (i.e. 2009) the annual volume of service research is about 25 person years, and in financial terms roughly 3 million € - and the figures are growing. In addition to this comes the direct contract work for industry and public sector, accounting about for same amount. Today's service R&D activities are diversifying from 1) industrial applications to 2) User-Driven Service Development, 3) Business Models and Business Operations, 4) Innovation Management, 5) Evaluation and Assessment, and 6) Networks and Systems Engineering for Services.



Classification of Service R&D projects.

INDUSTRIAL APPLICATIONS

In recent years, industrial companies have increasingly been aimed at extending their service business and increasing the share of their services regarding their total turnover. In the context of machine manufacturing industry this has meant enlarging business from producing products to cover also services that support these products - even beyond the traditional spares and wears during the product's life-cycle [1]. Recently customer centric models, like service dominant business logic has gained visibility. One of the driving motives has been the attempt to both stabilise and increase cash flows that tend to be volatile when deliveries to the customers are project-natured. This type of extension of business to cover the entire life span of the delivered asset was on a global scale started already in the 1990s. Those firms that succeeded in this effort, most likely significantly increased their shareholder value in the end.

One of the important events, when the importance of services for the production companies in the Finnish technology industry was realised, was in 2004 when an open innovation forum that facilitated innovative new service concepts and business was started. The forum networks companies, researchers and consultants. With respect to the industrial maintenance, there is an evident transition from pure in-house maintenance organisation models towards deep partnerships with service providers. In maintenance mobility is typical for field maintenance personnel requiring also the development of tools and methods supporting ubiquitous information, e.g. the use an augmented data access for field operation, maintenance and also for learning. In the near future, there will be many more embedded devices than there are mobile phones. Connecting these devices to the Internet, novel kinds of ubiquitous services will be enabled. The same applies to machines, actuators and sensors, the prospects for innovative services are multiplied.

An emerging application area is the construction and property management including renovations and repair. In fact there are similarities between the technology industry and that of construction and properties management. Both are keen in the exploitation of product life-cycle information in the maintenance. Research and development is breaking path towards more systematic approach in the context of asset life cycle services. These life cycle services can contribute to the customer value but they face challenges to produce the services efficiently. In pipe repair of housing companies the emphasises is on delivering total service models. Cooperation between planning and production is necessary to achieve the expectations of the co-operatives (housing company) and their residents. The perspectives of planning, new product solutions and the repair process are necessary for the development of new repair concepts. From the customers' point of view, it is urgent to significantly speed up the pipe repairs.

The following papers will describe services related to fleet asset management, nomadic use of plant model (nose) project, service product modelling as an approach for service industrialization in the construction sector, serviceable and adaptable building environments – a strategic perspective, facility management services collaborated with mobile it, ubiquitous machine-to-machine service networks, new services for pipe repairs, and the BestServ forum, an open innovation forum that facilitates innovative new service concepts and business.

USER-DRIVEN SERVICE DEVELOPMENT

User-driven service development focuses on exploiting users' experience in designing and experimenting services during the development process. In the future users demand to be involved in designing and experimenting services. For consumers the Internet has opened access to global commerce. However, e-shopping from home requires computer equipment, connection to the Internet, and usually skills or at least courage to use a variety of online shopping tools. There is a need to develop solutions that will both enhance and simplify consumer's shopping experience by unleashing modern mobile devices' capabilities into intelligent shopping assistants.

As said earlier, there is a shift from product type business models towards service type business models. At the same time, as industrial companies are extending their offering from product mode to service mode, they are also changing the way they do B2B procurement. The new service paradigm is changing the logic of buying. There is not enough knowledge about the criteria and there are no conventions related to procurement of new strategic services to support business processes. There is not enough understanding of the ways how to develop customership and partnership in this paradigm of service science and business.

Also in health care there is a need to better understand the business potential on one hand and good public service on the other. Therefore, a stakeholder analysis is required in order to understand the roles of different stakeholders in preventive health management solutions. In

occupational health care the customers are both the individual employees and the employers themselves, who participate in the "value co-creation" - the whole process seen as a joint effort between employee, employer, health service provider and other stakeholders.

Papers under this topic will describe services related to development of deeper customer understanding in strategic services, a location- and context- aware service for assisting consumers during their shopping time, NFC (Near Field Communication) enabled services, service technologies – concepts and user experiences, and stakeholder analysis for personal health services in occupational healthcare.

BUSINESS MODELS AND BUSINESS OPERATIONS

Services – as an "industry" – has become the engine of global business. Especially on western markets services have become the key asset to gain competitive advantage. Service business also provides a complimentary way to increase the value to customer in addition to the more traditional technological development of the products. The technological development is a must, but costly and rapidly copied by competitors. When manufacturing industry has substantially moved into the low-cost-high-growth market countries, service centric business models have enabled creating and maintaining successful business operations in matured markets. But, these business models are increasingly adopted on developing markets, requiring an even more thorough understanding of the complex challenges and potential of service centric business models. Moreover, business development through merger and acquisition has shaped industries and organisations for decades, but never has it been witnessed in such magnitude and volume as during the past decade. This trend calls for new practical methods and tools for corporate managers, who must take care of the process of recognising opportunities emerging from the technology, the novel service concepts and market developments. And utilise these opportunities while maintaining business continuity.

Communities have technical networks like transport networks and nodes, water and sewage networks, heating, electricity and energy, and telecommunications. On public sector the lack of public capital to finance and maintain technical networks has resulted in new approaches to organise, govern and finance the networks. Different project finance and PPP (public-private-partnerships) models have been deployed by municipalities and the government. Research is needed to investigate the pros and cons of different ownership and governance (O&G) models as well as finance options of technical networks.

Cloud computing related technologies are expected to penetrate within 2-5 years to the mainstream adoption by incorporating recent technology trends like Software as a Service (SaaS). As a special case of SaaS development, the Mobile SaaS has emerged. In this model of software deployment the application is hosted as a Service outside of the customer's site and delivered to customers across the Internet typically through a browser instead of the traditional client-server approach. Today, more software companies are putting their Web-based business applications (SaaS applications) on a widening number of mobile devices, and it is stated that SaaS will most likely be the way to making enterprise mobility a business commodity.

Topics in this part cover challenges and business potential of the service centric business models, governance, ownership and operation of communities' technical networks, how to manage the merge and acquisition process and how to deploy mobile software as a service. Research underway is in open SaaS for finding effective methods by using open source software and software-as-a-service –models, and for developing business and deployment solutions for location based travel and transport ICT services aimed at improving safety and reducing environmental impacts.

INNOVATION MANAGEMENT

The term innovation refers to a new way of doing something. But it also may refer to incremental and emergent or radical and revolutionary changes in thinking, products, processes, or organizations. A short definition of innovation is "transforming knowledge into benefit". This definition puts forth the big challenge for VTT and all the rest research and technology institutes. There is still a wide gap between the outcomes of research projects and their commercial business applications and not-for-profit utilisation. The issue for us at VTT is how to combine research knowledge across disciplines – especially when studying and developing services in industry and public organizations.

Innovation capability is considered also as organisation's ability to come up, consistently, with novel service business ideas, and sequentially, develop such ideas toward utilisation to deliver short and long term profits and benefits to the organisation. The mind set concerning in-

novation activity by companies has broadened in scope. Now we are considering issues such as organisational renewal, knowledge inputs, new service concepts, and the roles of users and demand in stimulating innovation. One method of managing innovations is forecasting - trying to foresee the future and recognize trends of significance. The word is roadmapping. Focus in a roadmap survey can be on drivers, markets, challenges and use of R&D services in different lines of business.

The papers in this section describe a mobile enterprise factory for developing tools and guidance with supporting material and catalysing mobile enterprise solutions, design concepts, define the priorities and finally to plan and implement the chosen service solutions. One paper is about the availability of high quality health care services at reasonable cost in the future, which is a tremendous challenge in the ageing Western societies. Clearly, renewing the intertwined system of health care services and technologies is needed. The paper dealing with service innovation capabilities considers organisation's ability to come up, consistently, with novel service business ideas, and sequentially, develop such ideas toward commercial utilisation to deliver short and long term profits to the organisation. Patterns of innovation and non-technological renewal across sectors is also dealt with in one presentation for broadening it into newly emerging directions and dimensions such as organisational renewal, knowledge inputs, new service concepts, and the roles of users and demand in stimulating innovation. Another paper presents a new kind of workshop process aiming at co-creation in a research network for combining research knowledge across disciplines. Finally a roadmap survey on service science and business is described focusing on drivers, markets, challenges and use of R&D services in different lines of business for recognizing significant trends and service opportunities.

EVALUATION AND ASSESSMENT

Evaluation and assessment can produce useful information for the development of new and more advanced services and to facilitate the launch of services needed by end-users and services beneficial to the whole society. The impact of information on societies' and firms' functions and decisions with economic dimensions has been recognised to have a wide scope. Services must be first seen to have potential positive impacts on the societies' functions, and only after that will the services be regarded for what they are, in fact, worth. Usually impact mechanisms are a combination of empirical experience and logical deduction.

Another type of example is the value of corporate security services. It is challenging to understand, describe and demonstrate such value for the client. The whole value creation processes needs to be clarified for the customers. Further, in the evaluation of industrial service culture and capability, there are several identified organisational challenges related to manufacturing traditions, different operational functions and managerial processes. Particularly the industry lacks concepts and methods in order to create personal and shared understanding.

In this review some of these evaluation challenges are considered. First the impacts of meteorological information services are analysed where the services of Finnish Meteorological Institute represent an empirical case. Research underway introduces cases dealing with value of security, service culture and lastly, an interesting case, ICT services in schools.

NETWORKS AND SYSTEMS ENGINEERING FOR SERVICES

Collaboration between organisations to access and share information and knowledge is a key to success. Enterprise collaboration and interoperability services will become an invisible, pervasive and self-adaptive knowledge and business utility between networked enterprises from any industrial sector and domain. To be innovative enterprises of different domains will need to be able to efficiently combine knowledge on a broad scale. Service is a process typically involving several partners – a network. Therefore service systems are complex due to the interaction of technical, economical and social factors characterised by each actor in the network. People's understanding of complex systems is limited; the consequences of different decisions and policies are difficult to foresee. Service processes are not as well understood as conventional production systems. Hence there is a definite need of systems engineering approach, a need for tools to model, simulate, and optimise different service concepts and processes. Methods to understand and convey the value generation in the network, especially the ultimate added value for customers, is the key factor in the production and selling of services.

In the coming years we will see low cost networked consumer electronics (CE) devices dominating the living room. ICT plays an increasingly important role in providing relevant information in an interesting way to specified target groups. Various applications will be offered. As an example mobility and digital home entertainment appliances have generated the desire to play not only in

front of a home PC, but everywhere inside the house and also on the go. For pervasive gaming in various environments like at home, hotels, or internet cafes, it is beneficial to run games also on mobile devices and modest performance CE devices. Games are executed in one or more servers and the game display and audio is captured and streamed to the end device, where the stream is rendered and the game is actually played.

In this section new approaches for social and collaborative internet based project management based on software services, distributed 3D gaming system and service process system dynamic modelling is described. Development of municipal well-being services towards a multiple supplier model research is underway.

THIS PUBLICATION

This review compiles a representative sample of our recent and ongoing service research. The topics cover the whole service and value chain and a wide spectrum of various types of businesses, from service providers to value-adding offerings of "hardware" providers. It is clearly seen that the content is diversifying from industrial applications to user-driven service development, business models and business operations, innovation management, evaluation and assessment and networks and systems engineering for services. The papers are grouped accordingly.

We thank all the contributors for their distinguished achievements in the field of service science. I trust that this collection, reviewing some of the results of VTT's service R&D activities, will be of interest to a wide variety of readers, whether they are business or civil service managers, experts in technology or service development, or researchers like us.

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Fleet Asset Management

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In recent years, industrial companies, including traditional manufacturing firms, have increasingly aimed to expand their service business and raise the share of total turnover accounted for by services. Thus, the importance of services for production companies is increasing. Our research project 'Fleet Asset Management' aims at the integration of important aspects in industrial service business development with a special interest in the exploitation of product lifecycle information in maintenance service development.

INTRODUCTION

As companies increasingly focus on their core business, they are showing greater interest in the utilization of external services provided by product manufacturers and service companies. With respect to the maintenance business, there is an evident transition from pure in-house maintenance organization models towards deep partnerships with complex company networks. The specific focus of our research is on supporting product manufacturers in their efforts to harness their potential in customer-centric service development.

Typically, a service provider needs to identify and utilize its success factors in business globally and be able to build a trusting and dynamic relationship with its customers. Furthermore, we hypothesize that a service provider needs to be able to exploit the benefits of asset fleets (wide globally installed machinery base) in product lifecycle management and in information- and knowledge-based new service concept development in order to succeed in the service business.

Figure 1 gives an overview of the aspects covered in our research.

METHODS

The objectives of the Fleet Asset Management project include developing and demonstrating methodology and tools for improving new service development (NSD), increasing exploitation of product lifecycle information in the development of industrial services and, in general, creating added value for the customer's value chain.

The variety of studies carried out during the project have for the most part adopted qualitative methodologies, such as interviews, literature studies and analyses of industrial cases.

RESULTS

Service provider's success factors in NSD and management risks in collaborative business relationships

Studies [1] have revealed the multi-dimensionality of success factors in relation to all the stages of new service development (NSD). For instance, deep understanding of the customer's production and business processes is emphasized especially in the 'search stage' of the NSD process, whereas the ability to network and build trust is important in 'all the stages'.

In service collaboration, both the customer organization and the manufacturer providing services face risks. From the customer's perspective, risks related to purchasing or outsourcing the services play a crucial role, whereas a service company that started out as a product manufacturer should pay attention to the risks of expanding into the service business. Risks related to cooperation involve both parties.

Management of lifetime information and maintenance business scenarios

New capabilities for lifetime information management are required to enable the service provider to create added value by converting data into knowledge for use in providing better services. For efficient utilization of information in customer collaboration, a certain level of information transparency and adjusted capabilities and mechanisms for information exchange are needed. Further-

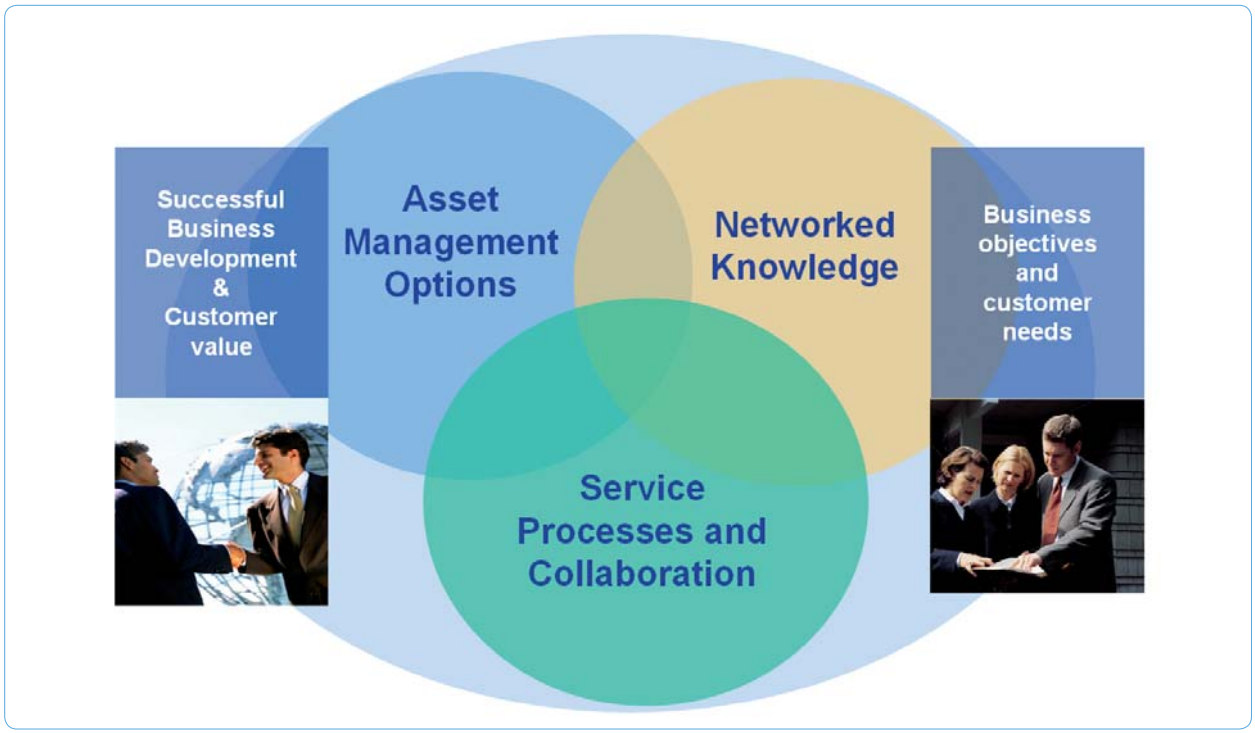

Figure 1. Fleet Asset Management aspects.

more, there is a need for greater understanding of openness, building of mutual trust, and promotion of systematized feedback and interaction mechanisms. Complex company networks providing services should be supported by dynamic operations models and modern tools for information management and communication.

DISCUSSION AND CONCLUSIONS

Maintenance service supply networks still lack methods, models and practical business scenarios that support the collaborative provision of maintenance services where a variety of services are integrated to maximize the value received by the customer. Challenges also exist in the development of a value proposition based on customer knowledge and the demonstration of the customer value. All these aspects are considered in our project.

EXPLOITATION POTENTIAL

Customer value can be demonstrated with the developed methods. Furthermore, they help formulate a basis for the value-based pricing of services and support the development of new business models. A service provider or a network of providers can use the enhanced processes when identifying their success factors, managing their life cycle information, implementing their business models, and optimizing their products and services from the technical and economic point of view.

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Plant Model Based Services for Nomadic Users

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Outsourcing increases the need for mobile technology in industrial maintenance. Mobile users need intuitive mobile access to the heterogeneous plant information systems. A new approach developed by VTT utilizes live video streaming and augmented reality.

INTRODUCTION

The nomadic use of plant model (Nose) project conducts industrially driven applied research to study and analyse the methods and tools supporting ubiquitous information access in an industrial environment. A toolset called Simantics Mobile is introduced. Primarily, it implements augmented reality data access for mobile field operation, maintenance and mobile learning. Personnel will be supplied with information in an optimal manner. That is, the 'right' information is provided at the 'right' time and in the 'right' place.

METHODS

Nose realizes the relationship matrix of 'time', 'content', and 'location'. Augmented reality (AR) technology is exploited to enhance the input interface, enabling immediate response at the 'right time'. With AR, knowledge of equipment appearances is promptly extracted from the factory environment. Equipment identification is simplified; methodologically, it is based on the projection and detection of visual markers that are physically fastened to the equipment and logically link the equipment to their contents. Ease of access to the 'right content' is promised. In doing so, the ontology-orientated approach systematically describes the technological and methodical knowledge of equipment and processes used in a specific plant. In addition, a geographically positioning configuration serves as the spatial knowledge base for maintaining the concept of the space and the relative locations of the equipment and personnel. Interaction is performed in accordance with local observations. Instead of waiting for an explicit user request, the system initiates a service once a user approaches the 'right location'.

RESULTS

Simantics Mobile tool, developed as part of the Nose project, provides an application integration platform for ubiquitous access to plant information. The tool comprises two modules. Firstly, in Mobile Studio, the contents are coherently linked by means of ontology-based modelling. The augmented reality (AR) library of the Alvar toolkit © is imported, assigning meaningful and contextual information to a concrete object. Secondly, the Simantics Mobile module implements the front-end interface for mobile augmented reality, presenting the configured information to the personnel on a mobile device. The use case was carried out based on a practical test-run at Stora Enso Kvarnsveden, a paper mill in Sweden. The camera constantly augments and assembles the real perspectives of personnel, continually observing the presence and absence of ambient markers. The system deduces input requests from the continuously augmented views of the user. Afterwards, the corresponding information is displayed on a mobile screen.

DISCUSSION AND CONCLUSIONS

Nose takes into account that industrial information is extensively utilized during complex engineering tasks, such as installation, operation, maintenance and repairs. In Nose, the information flows maintain suitability for individualization and retain conformity with an engineering task assigned at a given point in time. The project makes an innovative contribution to corporate information management, envisioning interoperability between mobile user interactions and special content creation that optimizes the information over different stages of the lifecycle under a common interfacing model. The Simantics Mobile tool provides a feature-rich interfacing environment. Owing to mobile augmentation, interaction is intuitive and requires no skill set to operate the software. A user can be easily trained to use the application and the new plug-in facilities, especially during a familiarization stage.

A worker is freely moving around the paper mill.

A marker is recognised. The equipment is then identified accordingly.

Real time information of operational process

Information relevant to the equipment.

EXPLOITATION POTENTIAL

A number of advantages can be realized by adopting Nose services and the Simantics Mobile tool. For example, the individuals taking part in an enterprise are sometimes subcontractors from, for instance, a corporate training organization or maintenance consultancy. Outsourced computer applications are usually operated independently. This limits the ability to share and exchange information inside and outside the enterprise. Simantics Mobile enables the seamless transfer of information between the enterprise and outsourcers. In addition, the combination of an AR solution and mobile technology allows the personnel to independently and ubiquitously acquire the electronic materials of operational processes while walking around in a plant. This opens new possibilities for improving the manufacturing performance of field service technicians, leading to high-quality work. This makes it easy to reach business objectives, potentially yielding long-term financial benefits. Several types of companies are currently interested in applying the technology, e.g. design system vendors, control system vendors, equipment providers, maintenance system vendors, and end-user organizations.

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Service Product Modelling as an Approach for Service Industrialization in the Construction Sector

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Service industrialization requires systematic design, engineering and management of services. Service product models, together with service modularization and configuration, also called "serviguration" [1], can support this goal. This paper describes research and development towards a more systematic approach in the context of building lifecycle services.

INTRODUCTION

The ongoing European integrated project "Industrialized, Integrated, Intelligent Construction (I3CON)" [2] supports greater sustainability in construction, and the provision of lifecycle performance and value to users with industrially produced, integrated processes and intelligent building systems. Building lifecycle services can contribute to customer value, but efficient service provision poses challenges. These services must be industrialized to realize their value potential. This paper introduces the modelling of service products as an approach for service industrialization.

APPROACH TO SERVICE PRODUCT MODELLING

A service product model should include all the necessary information to specify a service product. Fähnrich & Meiren [3] envisage the product models of services as "a description of the characteristics of the service: in particular, a definition is required about the service content and outcomes". Modelling can be performed at different levels of generalization: as a meta-model or service ontology, as a reference model of a productized service (including the different options) and as a model instantiated for a specific case.

The main starting points for the development of building lifecycle service models in I3CON included [4]:

- Product modelling procedures used for physical products.
- Collection of descriptions of industrial services, modules and service categories.
- Utilizing existing service ontologies.
- Definition of quality criteria for facility management services.

The product modelling procedure used for physical products was adapted to service products. The main objects of a service element were identified and described as a meta-model (Figure 1). The main features, like service value, quality and productivity, were analysed. The models were applied in a construction context, namely in facility management services, with a more detailed reference model in place for the consumption monitoring service [4]. The model aims to present all the information and options needed to specify the service for a specific case.

SERVICE CONFIGURATION BASED ON PRODUCT MODELS

A service product model of a productized service can be used to configure a customer-specific service. The configuration can be supported with pre-defined service bundles (packages) created from service elements.

For example, a typical large facility management service company offers different service bundles:

- "Small-scale service package" includes the main maintenance services (formerly, janitorial work).
- "Medium-scale service package" also includes some repair services.
- "Extended service package" includes facility management and maintenance services extended with cleaning, waste disposal and building management services.

Additionally, the company may offer individual value-added services that are tailored for each customer and case, like reception services, transport services, catering services, care of greenery, etc. In addition to the selection of the service elements/bundles, the properties of the service elements and/or the bundles must be defined.

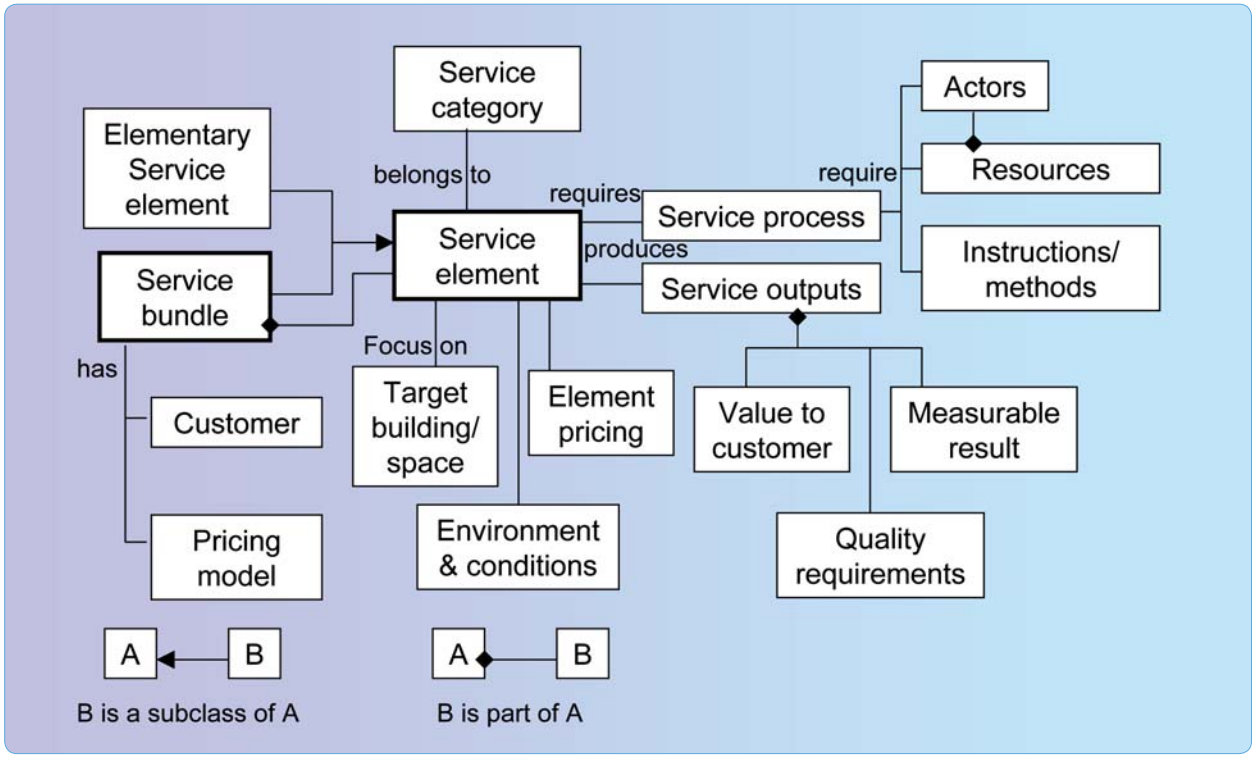

Figure 1. Main objects of service product.

CONCLUSIONS

Even though product modelling is a commonly used methodology for managing physical products, it is seldom applied for intangible products, like services. Efficient service production could also benefit from the definition and use of product models of services. Service product models can support the whole service lifecycle from service product development, through sales & marketing and engineering & delivery to maintenance and management of the delivered/sold service base.

Service product modelling and configuration approaches can be used when developing service configuration software, which is now under development in the I3CON project.

ACKNOWLEDGEMENTS

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Serviceable and Adaptable Building Environments – a Strategic Perspective

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Applications and solutions for monitoring of buildings are rarely standardized and even more rarely integrated as they are typically based on vendor-specificity using "dumb" devices. This research takes a strategic perspective to explore what types of technologies can be developed and applied to support true smart and intelligent building environments that are not only remotely serviceable, but also context-aware and seamlessly adaptable to the service needs of both building users and owners.

INTRODUCTION

The Strat-CON project [1, 2] was a strategic roadmapping initiative to identify key research and implementation actions to transform the construction industry through improved awareness, use, and exploitation of information and communications technologies (ICTs). One of the main roadmaps developed by Strat-CON was on "intelligent constructions" whose vision was that "*all objects within the home, the office or potentially any building will communicate and provide information ubiquitously, and will be able to 'understand' people circulating or living in the built environment so as to answer to their needs at any time*". A technology roadmap was developed to identify key interrelated actions to be undertaken in the short, medium, and long term with respect to industrial impact.

METHODS

Within this research, a simple roadmapping template was used to identify the current state and the corresponding vision (to-be state). A set of key topics in the form of strategic actions were defined corresponding to short, medium, and long-term take-up by the industry. These were supplemented with key business drivers, relevant business scenarios, and foreseen industrial impacts. (For details on the methodology, see [3]).

RESULTS

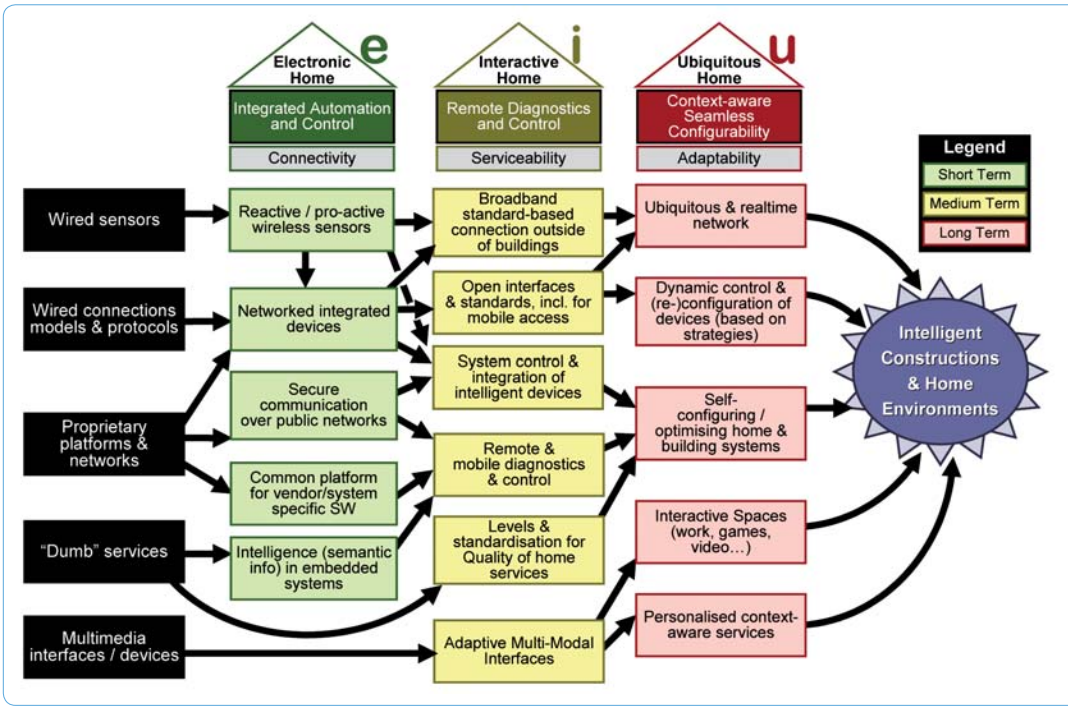
The main scientific results of the research were a technology roadmap and a series of supporting implementation actions for intelligent constructions. The different service scenarios that would be realized are of importance to building users and owners. Some examples follow:

- Sensors regularly monitor moisture content in walls. When there is extra moisture, water in the pipes in question is automatically switched off and a diagnostic report transmitted to maintenance services, which can then remotely inject adhesives to fix any leaks in pipes.
- All "systems" within the home are interconnected and can sense when a particular person exits or enters a room and configure the room environment to his/her needs (ventilation, lighting, etc.).
- Ambient assistance for the elderly whereby if someone falls and does not move for a while a message is sent to the relevant emergency services along with the temperature of the person.
- Through smart sensors, energy consumption can be optimized. As an example, if it is known that there are people in one room, the temperature can automatically be reduced in other rooms. The same can take place also on the basis of learnt usage patterns (inferred from usage habits) of building users.
- Users can "control" their space through a single device (e.g. through a remote control on a TV, mobile phone, or through an Internet terminal). As all devices communicate with each other, it is possible to also simulate (e.g. energy consumption) by exploring different usage scenarios and combinations of equipment (e.g. what is the most efficient time of day to use a washing machine and can a vacuum be used at the same time).

DISCUSSION AND CONCLUSIONS

The technology roadmap developed essentially covers three main stages of incremental evolution towards intelligent construction and home environments: integrated automation and control that would support connectivity (electronic home); support for remote diagnostics and control that would support serviceability (interac-

Figure !. Technology Roadmap.



tive home); and finally, context-aware seamless configurability that would support adaptability to given conditions (ubiquitous home). A building services platform is connected via the Internet to a hub of relevant remote services. These services in turn rely on factual as-designed, as-built, as-maintained and as-renovated information from a live building information model of the building. Such a system supports next generation services for smart and intelligent buildings through actualization of numerous user-centric services for comfort, use, monitoring, and maintenance of building environments.

EXPLOITATION POTENTIAL

The results of this research primarily serve as an identified basis for further research, development, and take-up of solutions to support services for smart and intelligent buildings. User-centric scenarios offer insights into what building users and owners can expect from the solutions. Some of the findings from this research are already under further research and development in projects on intelligent constructions and energy efficiency such as IntUBE (http://www.intube.eu/), I3CON (http://www.i3con.org), and REEB (www.ict-reeb.eu).

ACKNOWLEDGEMENTS

Partners involved in this research in addition to VTT included Centre Scientifique et Technique du Bâtiment, France, and Vienna University of Technology, Austria. VTT's participation in this research was partly funded by the Finnish Funding Agency for Technology and Innovation (TEKES).

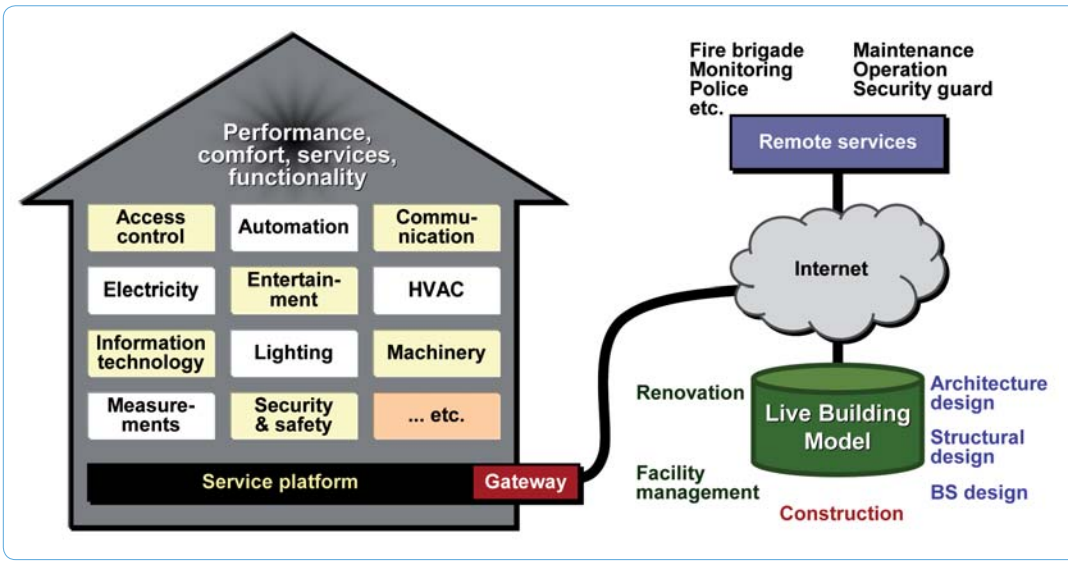


Figure 2. Services for Smart Buildings.

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Open Innovation Forum in Increasing the Significance of Industrial Service Business

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Industrial companies expect that services will have a growing significance as a part of their business and a source of growth, and are taking steps to expand their service business [see e.g. 1, 2, 3, 4, 5, 6, 7]. In a survey done by BestServ Forum in 2009 [8] it was found out that two-thirds of the companies that answered the survey thought that they would not fire or lay off any of their service employees – and 25% out of this two-thirds considered hiring new people. Further, these companies stated that the relative importance of their service business had grown during the recession. The respondents were 23 companies in the technology industry. These figures and findings imply that the service business is an opportunity for steady, long-term growth, and that it also diminishes the impact of economic fluctuations.

INTRODUCTION

In 2003 VTT and the Federation of Finnish Technology Industries conducted the BestServ Feasibility study, which showed that a number of companies in the technology industry considered industrial services as a potential source for growth. It was also noted that the field of industrial services is actually quite badly understood, there is no common framework to structure industrial services, and preparedness varies greatly between companies. Most advanced companies have already entered this field of business, but many companies are still providing favours instead of services – not to mention that they would be in the service business. Therefore, an open innovation forum that facilitates innovative new service concepts and business was started in 2004. The forum networks companies, researchers and consultants that are engaged in business, development or research

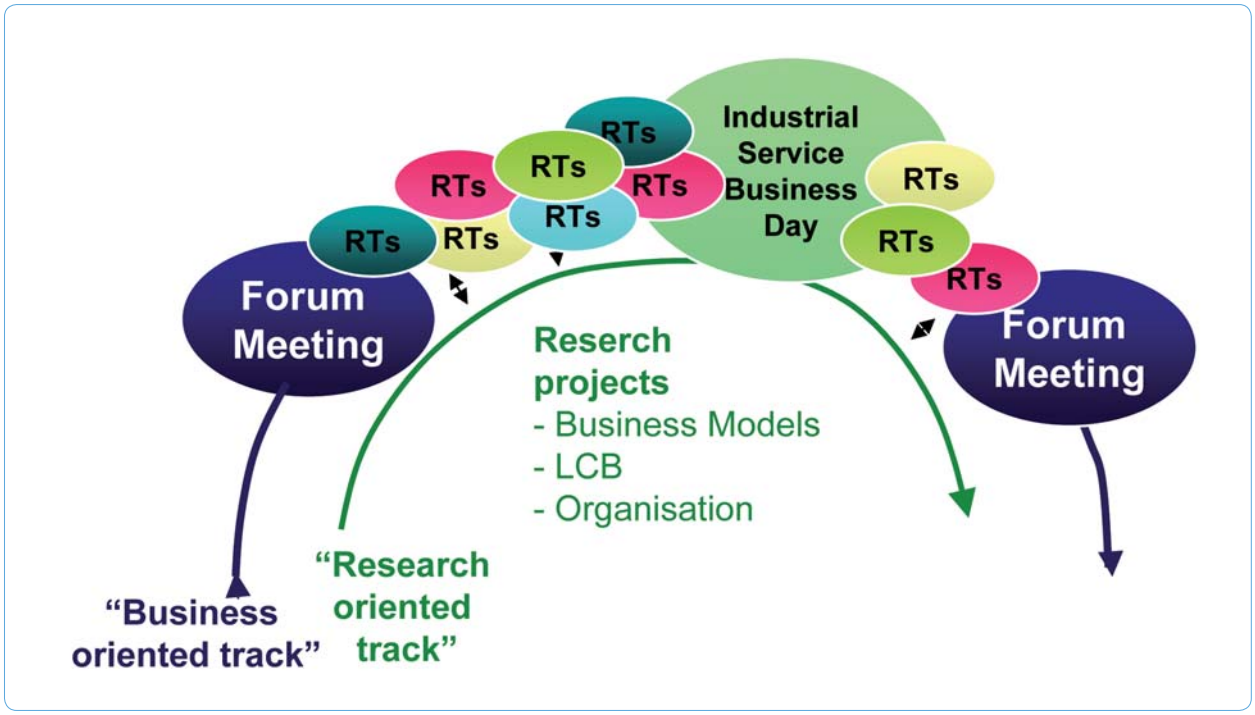

Figure 1. BestServ Forum's activities during a typical half year.

in the area of industrial services. The forum is owned by the Federation of Finnish Technology Industries. VTT acts as a coordinator in a strategic partnership with the forum owner.

MATERIALS AND METHODS

The forum has three main working methods: [1] Forum meetings, which resemble seminars, and often include a mini workshop; [2] Roundtable meetings, which are chaired by a company member and focus on solving a concrete problem in a small group; and [3] Industrial Service Business Day, which is a full-bodied seminar day. The working methods are considered to promote BestServ Forum as an easy collaboration forum with a low entry threshold. These three working models are depicted in figure 1, which represents a typical spring half of a "BestServ Forum year".

[1] Forum meetings typically include presentations by industry experts and researchers. The generic findings of previous roundtables are reported. Workshops are also integral parts of these forum days; the roundtable themes are selected and RT work started in these workshops. Forum meetings are open to all BestServ member companies.

[2] Roundtables are chaired by an industry member and they focus on analysing or building tools for a selected theme. Typically 6-10 companies participate in each RT, and all the information that is discussed remains confidential. The aim is that companies can share their solutions and approaches quite freely to enable other companies to learn from those who have already solved the problem. Of course, implementing a certain solution at another company will require a development project of its own – and that kind of development project requires dedicated resources well beyond the capacities of the RTs.

[3] Industrial Service Business Day is a seminar that is open to everyone who is willing to participate. For BestServ Members, participation is free of charge.

RESULTS

The results of the BestServ Forum include:

- Starting three research projects (involving altogether around 15 companies)
  - o BeSeL (Value Creation, Earning Logic and Business Models in Service Innovations)
  - o LCB (LifeCycle Business)
  - o ServO (Management and Organizing Service Business)
- Several service business development projects started among BestServ Forum companies.
- Roundtables on 31 topics since 2005.
- Internal reports for the Forum community.
- Three generic reports are published (available: www.bestserv.fi). One of these reports contains the BestServ Framework for industrial services. The framework has been largely adopted by companies.
- Six Industrial Service Business Days (presentations available: www.bestserv.fi)
- Intranet for community members with a lot of case material, presentations and a database of the RT results.
- Internet site for distributing published material.

CONCLUSIONS

Through its concrete results, BestServ Forum has had a substantial impact on service business development in industry. While the Forum was on the cutting edge in driving service business research in 2005, it now seeks to renew its activities. Also, the prevailing working practices are assessed critically and it seems most probable that the Forum will expand its scope by opening up towards universities and Fimecc's Service Business theme. The roundtables aim to take their work to the next level by shifting from benchmarking orientation towards searching also for new topics with a view to making a greater contribution as seeds to research.

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Facility Management Services Collaborated with Mobile IT

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Mobility is a characteristic of Facility Management (FM) work and hence mobile phones and personal digital assistants (PDA) are heavily used for speech and text messaging (SMS) communications, whereas the use of other mobile phone services has not become an established part of operational processes, according to study [1]. However, the usage of mobile phones for sending and receiving e-mails is increasing. Today, RFID is one of the promising technologies that will change service deliveries and also generate new business for both FM and construction site applications.

INTRODUCTION

New mobile technology enablers such as location-based services, vastly improved web technologies and accelerated mobile telecommunications have ushered in new ways of working. This paper presents new facility services that harness the possibilities of mobile systems in facility management as well as the benefits and obstacles of the utilization of said systems. Several potential application areas for RFID technology have been identified in the FM sectors, including component tracking, inventory management and equipment monitoring [2]. In general, RFID utilization in construction and the FM industry is slight due to the fragmented market, which does not have a dominant actor to enforce ICT solutions [3]. However, FM is one of the fastest growing service sectors. It is obvious that cost-effective applications will be those that offer exploitable technology and services throughout the whole service life of the building and not just during construction. In this paper, RFID technology is briefly reviewed, including near field communication (NFC), which evolved from a combination of earlier RFID contactless identification technologies.

METHOD

Elaboration of service concepts requires co-innovation with service providers and potential customers, and hence interviews and workshops were used. Thanks to its strong competence in IC technology and know-how in the Facility Management (FM) domain, VTT was able to introduce and demonstrate new innovative ways of providing services. These co-innovations yielded several pilots that were made in cooperation with service providers, building owners and building users (customers). The used applications are very generic and hence widely usable.

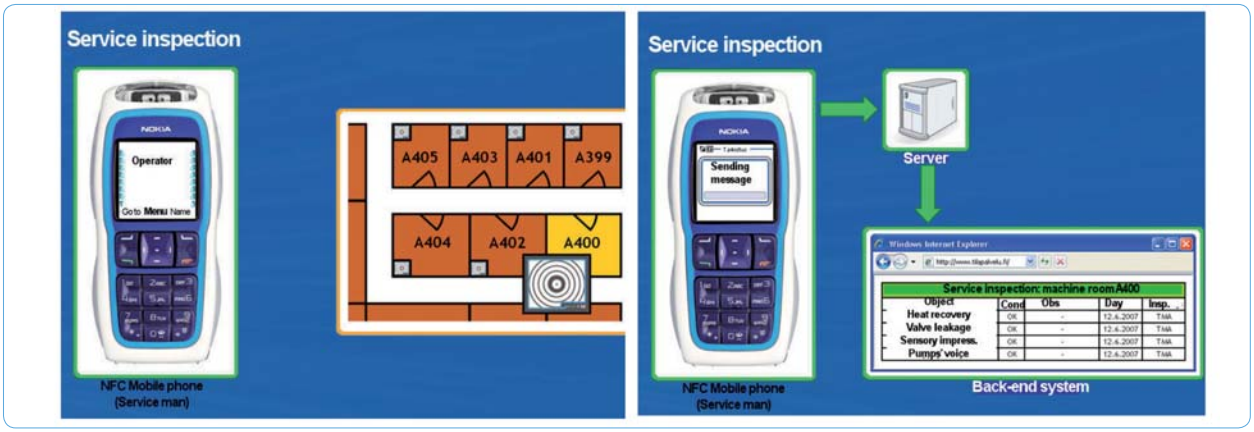

Figure 1. Principle of service and quality management of maintenance work using mobile application (e.g. cleaning and building maintenance).

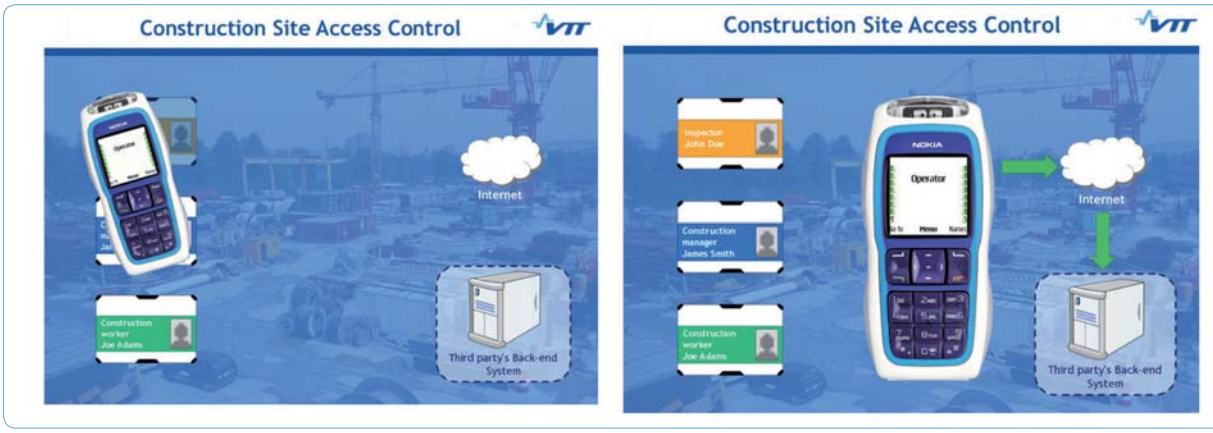

Figure 2. Principle of construction site access control.

RESULTS

The study resulted in state-of-the art mobile FM applications as well as several mobile concepts and building blocks to be utilized in implementing FM and construction site services utilizing NFC/RFID, Internet and mobile technology. Demonstrated concepts included management of maintenance work with a mobile application and mobile access rights management for construction sites and quality control of facility services. The solutions were flexible and easy to use, enabling the management of information in real time. In the maintenance case, the personnel could both receive and give information by using a mobile phone equipped with an add-on RFID reader to touch an RFID tag in the place or room related to the service task. The user interface could be kept very simple: after touching the RFID tag, the user ticks the start or completed box shown on the phone screen, after which the phone connects to the server and updates the information (Figure 1). In the access rights management model, permission to enter and work on a work site was controlled by utilizing NFC/RFID, Internet and mobile technology [1, 4]. The solution allowed adding or updating site access authorizations and work passes (Figure 2).

CONCLUSIONS

Today, new mobile and wireless communication technologies provide platforms for advanced communications. For short-range communications, RFID is one of the promising technologies to be used with human operator. New technology will change service deliveries and also generate new business for the service sector. Although RFID utilization in the FM industry is still slight, its potential is so great that it will certainly be introduced on a broader scale.

EXPLOITATION

The benefits of FM applications mainly result from time and cost savings and therefore they also provide great opportunities for increasing productivity. By exploiting RFID tags and mobile technology with access to updated information in the server, the owner, service provider and tenant can strengthen mutual communication and confidence, and thereby improve the customer experience and increase satisfaction.

ACKNOWLEDGEMENT

We would like to acknowledge cooperation with service providers, building owners and building users for inspiring discussions, and VTT as a source of funding.

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Ubiquitous Machine-to-Machine Service Networks

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In the near future, embedded devices will outnumber mobile phones. Connecting these devices to the Internet will enable many novel kinds of ubiquitous services.

INTRODUCTION

It has been estimated that in 2010, the number of communicating devices will be a thousand times greater than the number of mobile phones, which is already more than one billion. Connecting devices such as various machines, actuators and sensors to the Internet will enable novel types of services. Previously, such devices communicated with services using technologies such as SMS. The applications were vendor- or domain-specific closed systems, for which achieving interoperability with other vendor/domain systems was challenging. Currently, no universally applicable M2M service infrastructure exists that would allow interoperation between devices and their enabled applications in wired and wireless systems, regardless of the supplier. Information technology applications usually operate as separate M2M solutions that are unaware of each other. As a result, a number of business opportunities remain unexploited, as the services provided by the devices cannot be offered on the Internet.

METHODS OF THE USENET PROJECT

The Usenet (Ubiquitous M2M Service Networks) project aims to enable ubiquitous machine-to-machine (M2M) service networks in which the M2M infrastructure is able to connect and combine services produced in different domains in an interoperable way (see Figure 1).

The three-year Usenet project is developing a service concept for solving the above interoperability problems resulting from information collection, transmission and processing, and establishing an interactive system with the remote devices that are ultimately integrated within a managed M2M software system. The project has generated new types of M2M service scenarios that are related to ubiquitous building infrastructure, machine tools, consumer devices, home automation and telematics. The primary goal is to specify a universally applicable M2M concept that will enable the interoperation of sophisticated M2M applications through heterogeneous wired and wireless IP communication networks.

RESULTS

Traditionally, M2M solutions have applied vertical architecture and closed solutions. Therefore a horizontal M2M architecture has been developed with a view to improving possibilities to boost the M2M market. It is expected that horizontal architecture will make it easier for different players to be part of the M2M value network. For example, an M2M asset devices manufacturer can offer control and administration services for its products. Telecommunications manufacturers and service providers can connect these devices to the communication infrastructure. Service platforms can utilize several communication infrastructures for collecting data and controlling M2M devices. Smart services can be based on information collected from several service platforms. Horizontal systems face related challenges; e.g. the overall quality of end-user services and security inevitably requires the existence of vertical interfaces.

Home surveillance – an M2M application scenario – has been implemented to demonstrate the Private Space M2M system for residential homes. The purpose of the system is to provide smart surveillance services for private spaces. Various sensors measure quantities such as humidity, temperature, light levels and consumption of water or electricity, and the premises are monitored with a video camera. The user is able to follow what is happening in the system via the home user interface, and can control the space with sensors and actuators connected to the space. For example, users can track the outside and inside temperatures and are provided with alarms and warnings of water leaks, unex-

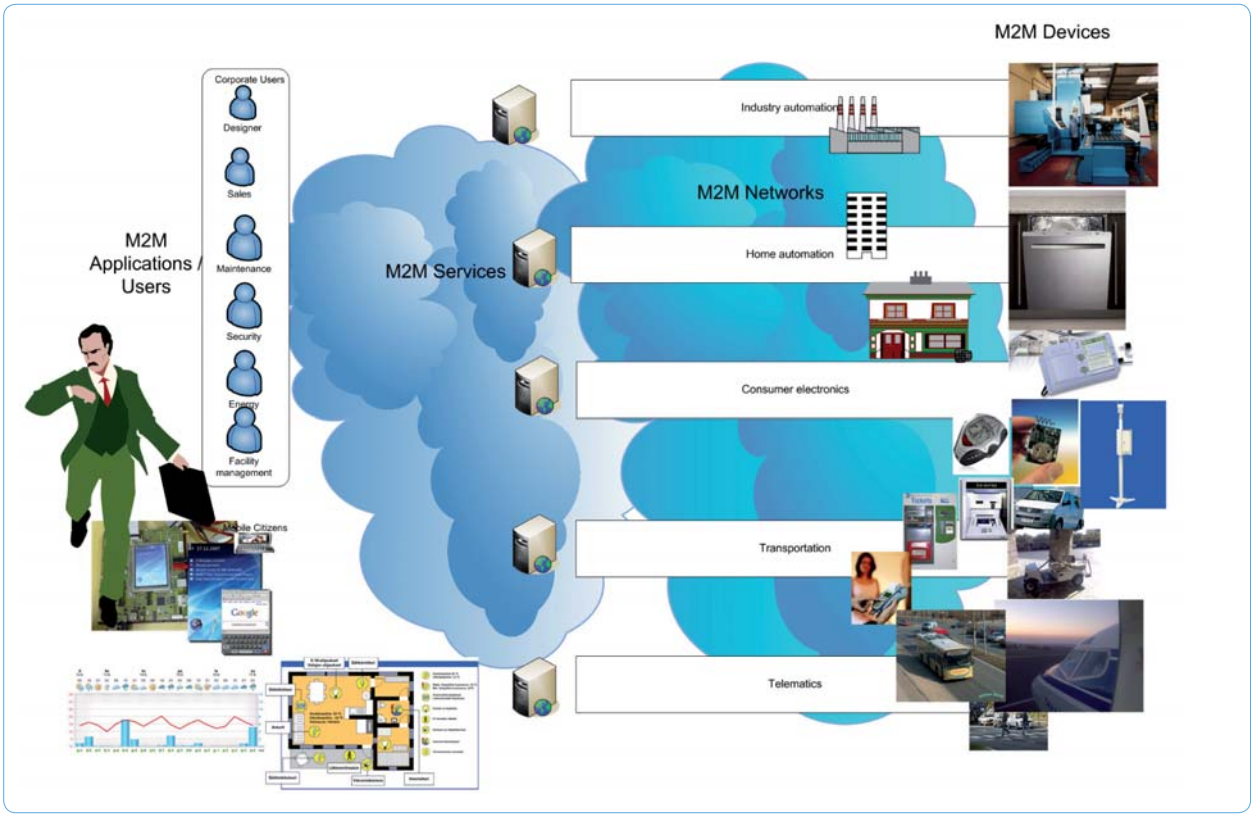

Figure 1. Ubiquitous M2M service networks.

pected weather or the presence of a housebreaker. They also have control over the lights, heating and so on. Automatic services related to control operations can also be included.

EXPLOITATION POTENTIAL OF M2M SYSTEMS

M2M systems will provide essential business opportunities and advantages for companies, especially when the information systems controlling their core processes utilize the real-time information produced by an M2M system. As a consequence, a company can increase the quality of its services, reduce costs and increase customer satisfaction. This fundamental change, which will bring new business opportunities for companies, can be already seen in the market. The aim is to help companies to take advantage of this rapidly growing M2M market.

PARTNERS

The three-year Usenet project is funded by the Eureka/ITEA2 programme and involves seventeen partners. The international Usenet consortium focuses on M2M research enabling ubiquitous M2M service networks. The project consortium is led by VTT and includes industrial, SME and research partners from Finland, Belgium, France and Spain.

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https://usenet.erve.vtt.fi/

New Services for Pipe Repairs

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The study emphasized the use of total service models in the pipe repairs of housing cooperatives. Co-operation between planning and production is necessary to achieve the key objectives of the housing cooperative and residents. The perspectives of planning, new product solutions and the repair process are necessary for the development of new repair concepts. From the customers' point of view, it must be possible to significantly speed up pipe repairs. The repair methods must be improved to produce fewer negative effects. The planning must be both customer-oriented and production-oriented. Customer-orientation makes it possible to respond to the actual service needs. Production-orientation enables the management of quality and yields cost-effective results.

INTRODUCTION

In Finland, large numbers of terraced houses were built from the mid-1970s until the early 1990s. Pipe repairs will have to be carried out in many of these terraced houses after 2020. Blocks of flats have been built since the 19th century in small numbers. Pipe repairs have been carried out in blocks of flats for decades. But the need to perform pipe repairs on blocks of flats will grow by another order of magnitude, however, because after 2010, the buildings built during the construction boom of the late 1960s and 1970s will reach the age in which pipe repairs are necessary [1].

METHODS

The focus of this research was on pipe repair services rather than on pipe repair methods. For that purpose, the current pipe repair practices were studied using both interviews and by observing pipe repairs being carried out using different methods at various sites. Service needs arising from practical perspectives were utilized in the development of repair services [1]. Several repair methods like coating, insertion of new pipes inside old pipes, insertion of soft sleeves that harden inside old pipes, con-

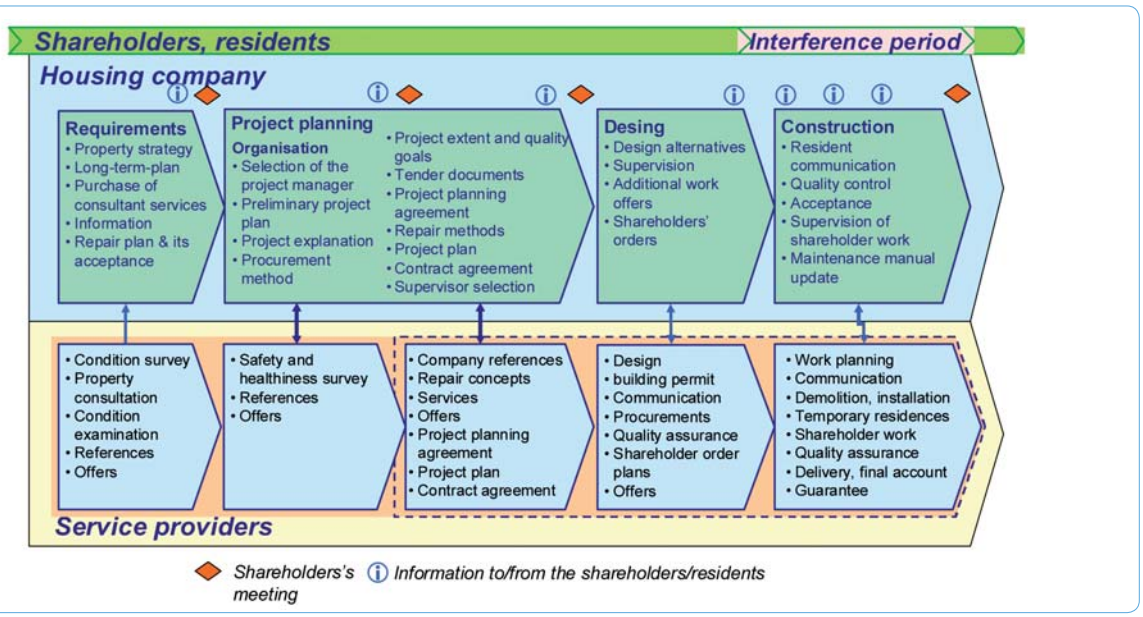

Figure 1. The procurement model for an overall pipe repair service.

Figure 2. Bathroom in a photo (left) and as a model (right).

struction of new pipes along old or new routes, and combinations of the above were used.

RESULTS

The essential elements of the overall pipe repair service are planning and repair services, which include – in addition to implementation – communication, services that protect habitation, temporary residences, property protection services, cleaning services, guarding services, and planning and implementation services provided to owners for their own renovations. The range of services can also include project planning services and services to determine the condition of properties. The study presents a business model for comprehensive pipe repair services and a process description – including stages and roles – of the corresponding procurement model (Figure 1) [1].

The clarification of repair alternatives and the worksite process, dissemination of information to residents, and decision-making by residents can be supported through various communication services throughout the whole pipe repair process. Actual three-dimensional moving image material – which is viewed using a 3D television – was developed in the study (Figure 2) [1].

DISCUSSION AND CONCLUSIONS

Many problems can be avoided during the implementation stage if the condition of the pipes is determined before the repairs and project planning is performed carefully [1]. A well-prepared project plan is the starting point for the drawing up of procurement documents and a method of setting targets for planning and implementation.

In order to improve the service development capabilities of companies the services should be procured : as packages from one group of companies. This creates service networks in the market. The opportunity for networking is open to both small and large companies. The networks compete with each other for renovation customers. And thanks to a relationship of continuous cooperation, they can develop planning, construction, and service processes in a multifaceted way [1].

EXPLOITATION POTENTIAL

Based on the results, the companies can develop new customer-oriented and production-oriented services for pipe repairs. The business potential is huge, as the market will see rapid growth in the coming years.

ACKNOWLEDGEMENTS

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Customer Understanding in Strategic Services

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Both providing and receiving services has become a strategic issue for industry. There is a shift from product type business models towards service type business models. At the same time as industrial companies are extending their offering from products to services, they are also changing the way they make purchases from each other. There is a transition in how companies define the contents and value of exchange. This raises the question of what are the true needs and factors behind the buying behaviour of customers. Servitization challenges industrial companies to better understand their customer companies. The new paradigm calls for new models about customer value, buying behaviour, development and selling of services.

INTRODUCTION

Consumer buying behaviour has been studied extensively in the case of both services and traditional products. There is also a great deal of knowledge about companies' buying behaviour with regard to investment goods as well as normal parts and products within the purchasing function. The new service paradigm is changing the logic of buying. There is not enough knowledge about the criteria and conventions related to buying new kinds of strategic services to support business processes.

Customers are expected to buy services whose benefits outweigh their cost and that have a short payback time. However, this is a simplistic view. Services often involve different kinds of indirect drawbacks, risks and uncertainties. The consequences of services are often systemic, making them difficult to perceive. Furthermore, the buying processes and actors taking part in the buying processes are different in different kinds of services and customer companies.

OBJECTIVES

The research project "C-Understanding – Development of customer understanding in strategic industrial services" aims to deepen knowledge about ways to develop customerships and customer insight in the service business. The project focuses on the buying behaviour of customers and on industrial b2b services that have strategic value to customers. The project searches for factors affecting customers' buying decisions with a special emphasis on the factors inhibiting affirmative buying decisions. This knowledge is needed both for service development and for supporting sales and marketing.

METHODS

The research is done as a case study in nine participating companies and their customers. The following research methods are used:

- Literature review
- Thematic interviews with participating companies, chosen customers of the participating companies and other experts
- An international survey of a wider customer base
- Roundtable discussions

The industrial services and customers for research were selected by the participating companies. The criteria for service selection were as follows:

1) The service is strategic to the customer, i.e. it is part of the customer's core process or supports the customer's core process and/or is important to the customer's customer.
2) The service is new to the company or to the customer or group of customers.

RESULTS AND EXPLOITATION POTENTIAL

The result of the research study will be a conceptual model describing major factors affecting service buying behaviour and the mechanisms through which these factors influence the decision making process in different situations. Different kinds of buying logics and their context are described. The participating companies also receive more information about their custom-

ers and how their customers' buying logics compare to the buying logics of other companies' customers.

The general results of the study benefit all industrial companies planning their overall service buying, selling and development strategies within a b2b context. The participating companies can employ the more detailed information they gain from the study in the development of specific customerships and services.

ACKNOWLEDGEMENTS

The project is financed by Serve Programme of Tekes, VTT, and the nine participating companies: Cargotec Oyj, Fastems Oy Ab, KONE Oyj, Kontram Oy, Lassila & Tikanoja Oyj, Metso Paper Oy, Outotec Oyj, Oy Rauma Stevedoring Ltd and Trafomic Oy.

The research described here is carried out by VTT Technical Research Centre of Finland. VTT also coordinates a collaborative project by the Turku School of Economics. The C-Understanding project is also collaborating with the Product-Service System Value project by Cranfield University.

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A Location- and Context- Aware Service for Assisting Consumers During their Shopping Time

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The Internet has opened boundaries between consumer markets, leading towards open and global commerce. However, e-shopping from home requires computer equipment, a connection to the Internet, and usually some kinds of skills or at least the courage to use a variety of online shopping tools. The social characteristics of shopping are also lost, since people often enjoy shopping with their friends. Traditional shop owners' and retailers' competition against large online merchants requires them to consider tools enabling services that online merchants cannot offer. Open-minded enterprises are looking at the ways in which emerging technologies can contribute to future business success.

INTRODUCTION

The main objective of the ShoppingMate project is to develop a solution that will enhance consumers' shopping experiences by unleashing the capabilities of modern mobile devices to turn them into intelligent shopping assistants. The mobile user agent may, for example, provide location-based services so that the agent may give location-specific information for spontaneous shopping needs. The device may, for example, recommend nearby stores and items that are on sale in a specific area. It may also provide recommendations by utilizing information about the customer's shopping habits.

Some of the requirements set for the ShoppingMate service:

- Attractive and easy to use
- Flexible, scalable, extensible and secure, network and terminal independent
- Efficient in terms of the quality of the search results, response time and navigation performance
- Profitable for all the parties involved, i.e. service providers, consumers and shop owners

METHODS AND PARTNERS

VTT is developing the user-end interface, which will fit a range of devices from small screen mobile devices to laptops and desktop screens. Experiences in prototyping software with the general public have shown that web-based mobile services are easier to adopt than installed applications. There is a way to enable easy adoption and scalability: a web interface with an optional installable application.

Modern web browsers already enable application-like online mobile software development. However, mobile browsers still require an application for accessing mobile phone hardware, such as locationing API. Such a solution retrieves the user position, and stores it in a database. The stored position can then be used in building a location-specific web site for mobile browsing.

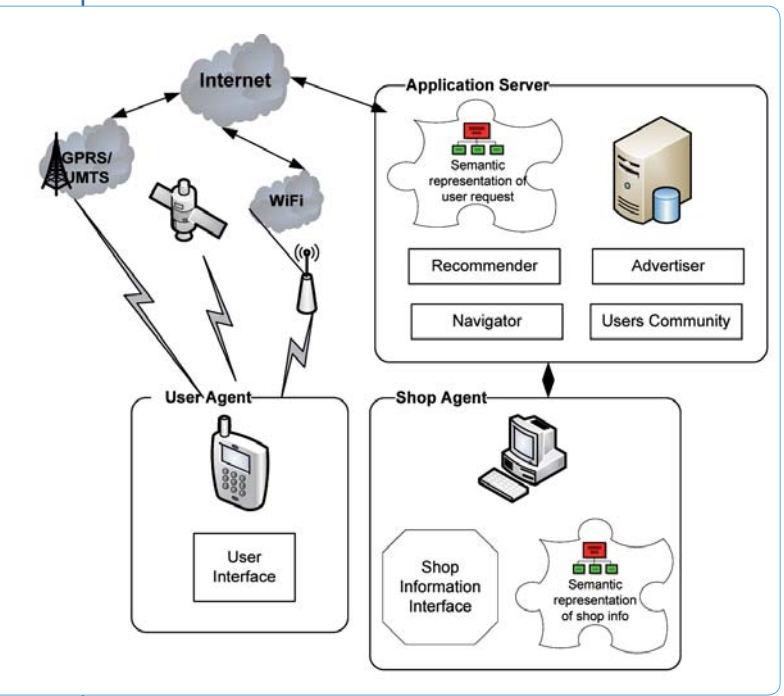

Figure 1. Interacting system entities.

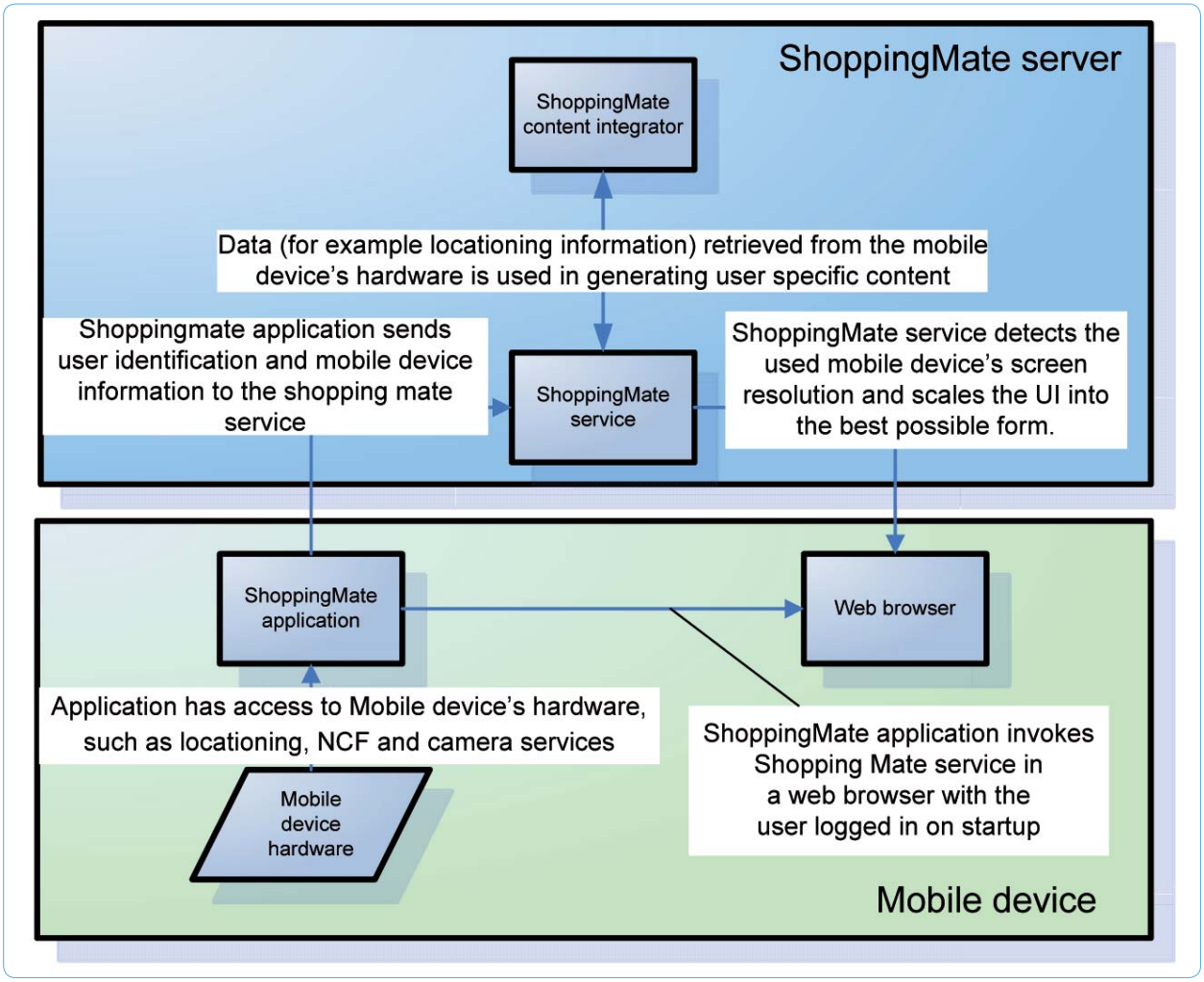

Figure 2. ShoppingMate content integration.

The project consortium and roles of the participants:

Link Technologies S.A.	Project coordinator
Mobics	RTD (Research and technological development) participant
VTT	RTD Participant
CSEM	RTD Participant
Fraunhofer	RTD Participant
Fonella Oy	SME (Small and medium enterprises) participant
Neos Srl	SME participant
Novasys S.A.	SME participant
AEDA (Municipality of Athens Development Agency)	Other enterprises or end-users

New Service Concepts with Contactless Technologies

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Digital services have become common in virtually all areas of business and everyday life. Most current digital service concepts rely on fixed computers and fixed Internet access. However, during the past few years there has been growing interest in enhancing digital service concepts with the possibilities of mobile communication and ubiquitous computing infrastructures. Especially, contactless technologies have emerged as an enabler for reconsidering the use of services. One of these technologies is Near Field Communication (NFC), which provides digital service discovery and access through mobile devices in mobile contexts.

INTRODUCTION

The Service Technologies team at VTT does research on (1) designing services from concepts and scenarios, (2) composing services through advanced integration of ubiquitous computing interaction mechanisms and lightweight service platforms for trial use in Living Lab environments where (3) value creation, user experience and ecosystem building can be studied. Near Field Communication (NFC) is an emerging enabler for constructing ubiquitous computing service infrastructures. NFC is a close proximity technology based on RFID. It can provide solutions for service discovery and bring new perspectives to designing service platforms. Currently, NFC technology is under specification by the NFC Forum and becoming a global standard for device communication. When integrated with mobile phones, NFC makes mobile payment and ticketing possible. VTT and the Service Technologies team have been actively involved with the work of the NFC Forum. VTT is a non-profit member.

One of the initiatives for advancing NFC-based services has been the SmartTouch project (www.smarttouch.org) coordinated by VTT from 2006 to 2009. SmartTouch has been the largest European effort to develop and validate the possibilities of NFC in service concepts in real-life conditions. The project explored NFC-based services in homes and city life, and for improving health and wellbeing.

METHODS

Our approach to service research has been based on methods that deploy the technology and research concepts in expose the technology and research concepts into use in realistic usage settings and environments. Services become visible and observable only through use. Thus, it is important to examine them in the real context of use. Realistic evaluation settings often require high integration of business actors and innovative construction of value creation networks enabling the offering of services. Therefore, networking and co-operation between research partners, business actors and public authorities is needed.

The research methods must cover methods from scenario and concept visualization, modelling, and evaluation to actual service implementations that can be evaluated in real-world contexts. In all phases, high end-user involvement is needed to complement innovative solutions for establishing and building novel value creation networks.

RESULTS

The results of the SmartTouch project provide insight into the possibilities and challenges of constructing and adopting versatile service concepts with contactless technologies. The services include, for example, services for elderly care [1], school environments [2] and mobile social media.

One of the concepts developed in the SmartTouch project is the SeeingEyePhone concept: a concept and prototype implementation to help visually impaired people at home and shops. In this scenario, a mobile phone can read a well-positioned tag and match the tag to a voice explanation of the target. This allows, for example, the

user to hear the content of a product through audio. Another SmartTouch result is the Hot in the City concept, which is the first mobile social media concept in the world that uses NFC for creating friend connections; this service is now available for everyone in the net and Facebook. When two NFC phones are brought into close proximity, our service connects those persons as friends. Furthermore, Hot in the City allows the creation of hotspots, location or status tags, which take their power of operation from the phone. For more information, see http://hic.vtt.fi.

NFC has been found to be a promising technological enabler from the user experience point of view. Our experiences show that touch-based interfaces using NFC are easy to learn and use [2]. Touching with a mobile phone does not require good eyesight or precise hand-eye coordination – both of which would render mobile interfaces challenging for elderly users, for example. Also, NFC combined with a mobile phone can provide users with a cheap, easy, quick and lightweight technology for creating user-generated ubiquitous service interfaces.

DISCUSSION AND CONCLUSIONS

The Service Technologies team has been in a unique position to see how NFC technology is emerging and to study the implications of creating NFC-based services and service ecosystems. Time will tell how quickly NFC technology will penetrate the markets and become ubiquitously accessible for all mobile users, or if it will make it at all. In general, contactless technologies are here to stay in the form of smart cards. In the future we will see how interoperable the services from service providers and different technologies will be. The Service Technologies team is involved in the development and coordination of the Finnish contribution to the ITEA2 effort on Smart Urban Spaces that seeks to make contactless services interoperable within the EU. This project includes 9 European cities and 29 technology partners that are working together to make the dream come true.

ACKNOWLEDGEMENTS

This work was done in the SmartTouch (www.smarttouch.org) project (ITEA 05024) within ITEA 2 (Information Technology for European Advancement), a EUREKA strategic cluster. The project has been partly funded by Tekes, the Finnish Funding Agency for Technology and Innovation.

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Stakeholder Analysis for Personal Health Services in Occupational Healthcare

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The Nuadu project is concerned with developing and evaluating technology to allow people to maintain or improve their personal health. In Finland, the main focus of the project is on health promotion and the utilization of personal health systems in occupational health care. In order to better understand the business potential of these preventive health management solutions, a stakeholder analysis was conducted related to the Finnish occupational health care system. The roles of different stakeholders were analysed using a power-interest matrix. Opportunities and roadblocks to a preventive health strategy in occupational health care were identified.

METHODS

The work method included desk research and structured, thematic interviews with representatives of key stakeholders. The positions and views of various stakeholders were analysed and presented as a power-interest matrix.

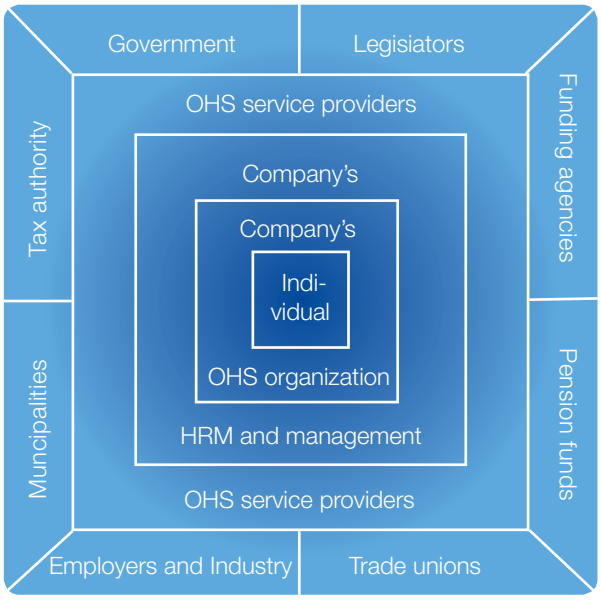


Figure 1. Key stakeholders in occupational health care.

RESULTS

Figure 2 summarizes the findings of the stakeholder analysis in a two-dimensional power-interest matrix. Stakeholders are divided into four groups: policy makers and implementers (marked with the symbol 0), service providers (1), technology/tool providers (2) and customers (3). The stakeholders in the upper right corner (high/medium power and interest) are key players in driving the change towards proactive occupational health care.

In occupational health care the customers (and thus the direct beneficiaries of its operations) are both the individual employees as well as the employer itself. However, well-organized occupational health care also creates value for public health in general and other indirect stakeholders like pension funds (e.g. through longer working careers of the employees) and insurance companies (e.g. through fewer work-related insurance claims).

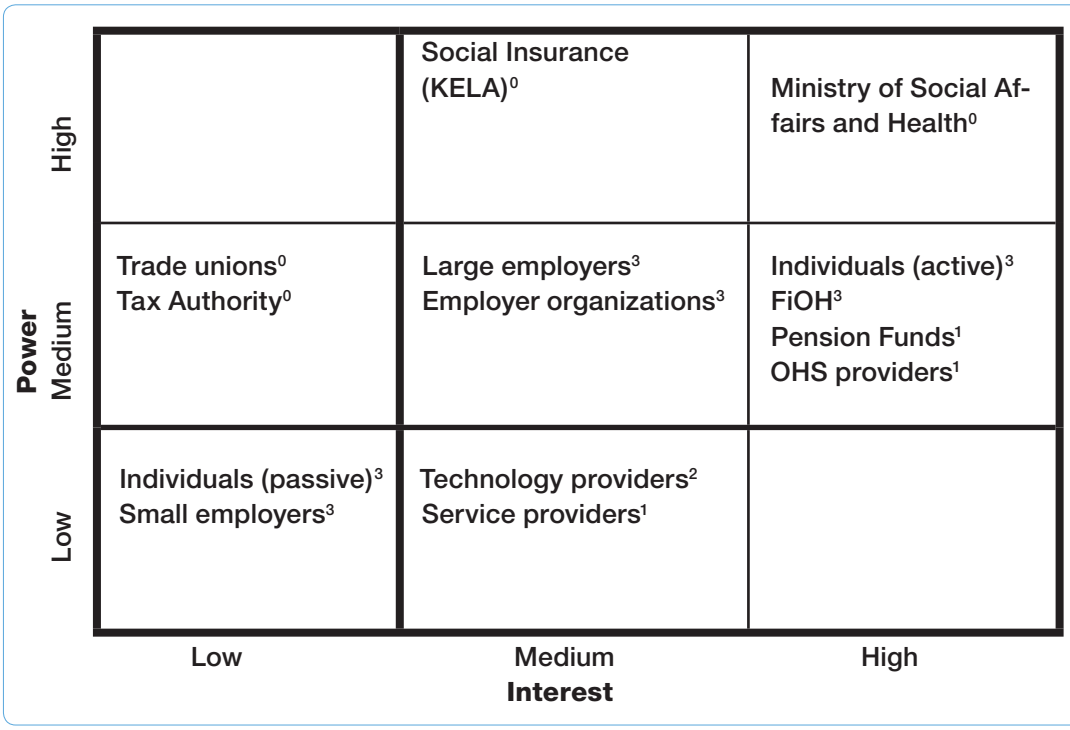
In the context of occupational health services, an individual actively participates in "value co-creation", seen as a joint effort of an employee, employer, health service providers and other stakeholders. There are, however, large disparities among individuals in their motivation to take care of their personal health.

DISCUSSION AND CONCLUSIONS

Health promotion is a very fragmented market, and no single stakeholder is ultimately responsible for its results. The implementation of personal health systems in this kind of a value network, in which the parties are interconnected in many different ways, would require an orchestrator, or "service integrator" that would compose appropriate value proposals to customers from the existing provision in the market. These integrators are currently largely lacking.

The Ministry of Social Affairs and Health, together with the Social Insurance Institution (KELA), is in a position to initiate the necessary policy changes and practic-

Figure 2. Power Interest Matrix.



es affecting the occupational health system. Some of the direct beneficiaries, such as pension funds and OHS providers, could be the driving force behind the strategy implementation. It is also crucial for success to keep other stakeholders (most notably trade unions, employer organizations and tax authorities) well informed and involved in the preparation of this proactive health strategy. Finally, selected forerunner organizations (including OHS service providers, technology and service providers and large employers) are needed to serve as pioneers in the adoption of the new approach.

EXPLOITATION POTENTIAL

Innovations that require the collaboration of many stakeholders are slow to reach their full potential, and it is important to refrain from promising too much too soon. It seems inevitable that in the long run the use of ICT will become widespread in workplace health promotion. In the interim, developers need to find niches where they can profitably refine their technologies, build interoperability, and gain credibility in the eyes of the incumbents.

EXPLOITATION POTENTIAL

Occupational health system provides a unique access to individuals who are still relatively healthy, but who are at risk of future diseases because of an unhealthy lifestyle.

The benefits of preventive measures of the occupational health system can be seen, not only by the employer, but also widely in the society. However, it is challenging to find methods to measure this efficiency and use it as an incentive for the occupational health provider. The matter is further complicated by the fact that the buyer, user and payer can be separate entities with disparate interests.

Therefore, it is essential to find the parties who have the power and motivation to act as pioneers for this strategic change in occupational health promotion. One of the observations made in this study is the important role of service integrators, who can compose technical and existing service components into an appropriate value proposal. These integrators are currently largely lacking.

Innovations that require the collaboration of many stakeholders are slow to reach their full potential, and it is important to refrain from promising too much too soon. It seems inevitable that in the long run the use of ICT will become widespread in workplace health promotion. In the interim, developers need to find niches where they can profitably refine their technologies, build interoperability, and gain credibility in the eyes of the incumbents.

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Towards Service Centric Business Models

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Industrial companies' transition from a product-centric business to a service-centric business has gained momentum over the last decades. The BestServ Business Models II project – BeSeL II – focuses on understanding how this transition really affects companies, customer relations, management, processes, supplier networks, etc.

INTRODUCTION

Services – as an "industry" – have become the engine of global business. Especially in western markets, services have become the key asset for gaining competitive advantage. When the manufacturing industry has substantially moved into low-cost and growing market countries, service-centric business models have enabled creating and maintaining successful businesses in developed countries. However, as always in global business, these business models are quickly emerging in developing markets as well.

The BeSeL II project has aimed to understand the complex challenges and business potential of service-centric business models. The project was initiated by the BestServ Forum (http://www.bestserv.fi/). The first phase, BeSeL I, started in 2005 and the second phase in 2007, ending in December 2009. In BeSeL I, HANKEN and TKK-BIT Research Centre were also members of the research consortium. LTT-Research had a parallel research project that collaborated closely with BeSeL I.

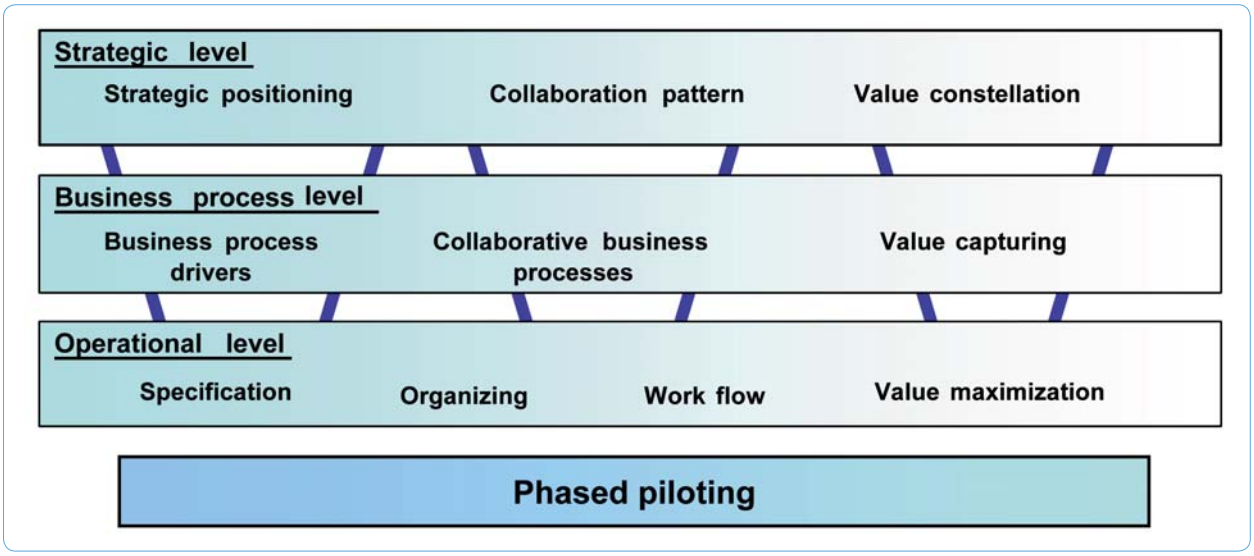
METHOD

Several research methods and theories have been put to use in both phases of the BeSeL project, e.g. value creation and capture, economic modelling, process and system theories, innovation theories, service classification (e.g. SPA-matrix), relationship marketing, service management and knowledge management.

Research material has been collected by means of interviews and collaborative group work. Qualitative analysis has then been applied.

RESULT

Several methods and tools have been developed. They have been published in research papers, seminar papers and publications. One example of a model from BeSeL I is a relationship framework that pinpoints the most important topics that should be focused on in customer rela-



tionships when developing new industrial services (Figure 1). This work still continues and the final results will be published at the beginning of 2010. A list of the project results will be published on the project web pages at http://www.vtt.fi/proj/besel/index.jsp

CONCLUSIONS

Over this four-year period, it has become quite clear that though many companies have decided to opt for service-centric business models, practical implementation and real operational changes take time. Service business requires systemic innovations and an iterative learning process not only within a company but also across the business network.

The service business approach makes it possible for a company to pursue new revenue streams and customer segments by delivering total solutions. Value creation through service-based customership provides a competitive edge that many system suppliers in particular need when a low-cost strategy leads companies to move their business into areas specialized in manufacturing or close to the end customer.

EXPLOITATION

Dissemination enables industry to benefit from the BeSeL results. Several articles and seminar papers have been published. A book on the topic was published by Teknova: "From Industrial Favours to Industrial Services – Profitable Growth as a Challenge", Grönroos et al., 2007 (in Finnish). A second book is planned to be published in English in 2010. Its working title is "Seven Steps to Services".

ACKNOWLEDGEMENTS

We would like to acknowledge the participating companies, TEKES and VTT Technical Research Centre of Finland for funding, participating in and supporting this work. The companies participating in the BeSeL I or Besel II projects are: Vaisala Oyj, M-real Oyj, Fastems Oy, Oninen Oy, Lappset Group Oy, Hydnum Oy, Wärtsilä Oyj, Oy International Business Machines Ab (IBM), Altia 1888 and Nordea Markets Finland.

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Communities' Technical Networks – Their Governance, Ownership and Operation

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The lack of public capital to finance and maintain technical networks has resulted in new approaches to organizing, governing and financing such networks. Municipalities and the government have deployed different project finance and PPP (public-private-partnerships) models. Novel lines of research have emerged in step with these trends.

INTRODUCTION

The "C-Business" project aims to investigate the pros and cons of different ownership and governance (O&G) models of technical networks of communities. Technical networks include, but are not limited to, transport networks and nodes, water and sewage networks, heating, electricity and energy, and telecommunications. The project assesses the public and business risks of different O&G models and defines a common frame – business architecture – for these models. It further attempts to point out the weak and strong points of both market-oriented and public models of the networks, and to identify prospective business potential in operating and owning the networks. The first phase of the project is carried out in Finland, where practically all the O&G model variants are already employed today.

APPROACH

The approach of the research is first of all descriptive when it comes to descriptions and qualitative analysis of O&G model variants. The descriptive elements are taken from the existing theories of economics, public management, corporate finance, industrial engineering and systems engineering. The systems view is needed when the network architecture in terms of key actors and their roles is described. Basically, the result is a conceptual map or process describing the arrangement of ownership and governance for the particular network (e.g. water supply)

The number of empirical cases is around 20 (public roads, 2-3 communal transport networks, national rail network, 2-3 harbours, 2-3 water utilities, 1-2 energy utilities, national electricity grid and 1-2 local grids). For the analysis of the strengthts and weaknesses of different models, the research will rely mainly on interviews of owners, operators, regulators and customers of the networks. These interviews are designed to be in-depth and semi-structured. The researchers will carry out the final assessment.

RESULTS

The research will produce the following results:

1. The typification of network ownership and governance models and descriptive architecture of the models; the different actors and their roles; the type of good that is delivered and the market characteristics.
2. The logic and value added of the models for different actors (users of the good, owners, operators, regulators, investors, externalities). Who would gain and with what risk in different O&G frameworks?
3. A SWOT or similar analysis on the strong and weak points of different O&G models; also, the prospective business and investment potentials are pointed out.
4. O&G model evaluation framework – how to choose some preliminary O&G models on the basis of the market context, type of good that is delivered and the risks assigned to particular models.

EXPLOITATION POTENTIAL

The whole project has a strong business and market orientation. Hence, the business community, e.g. large construction and service companies, should find the results useful in their business planning and development. Public sector organizations, e.g. municipal councils and management of utilities should find the results usable when assessing their restructuring needs and options for future ownership, governance and management structures.

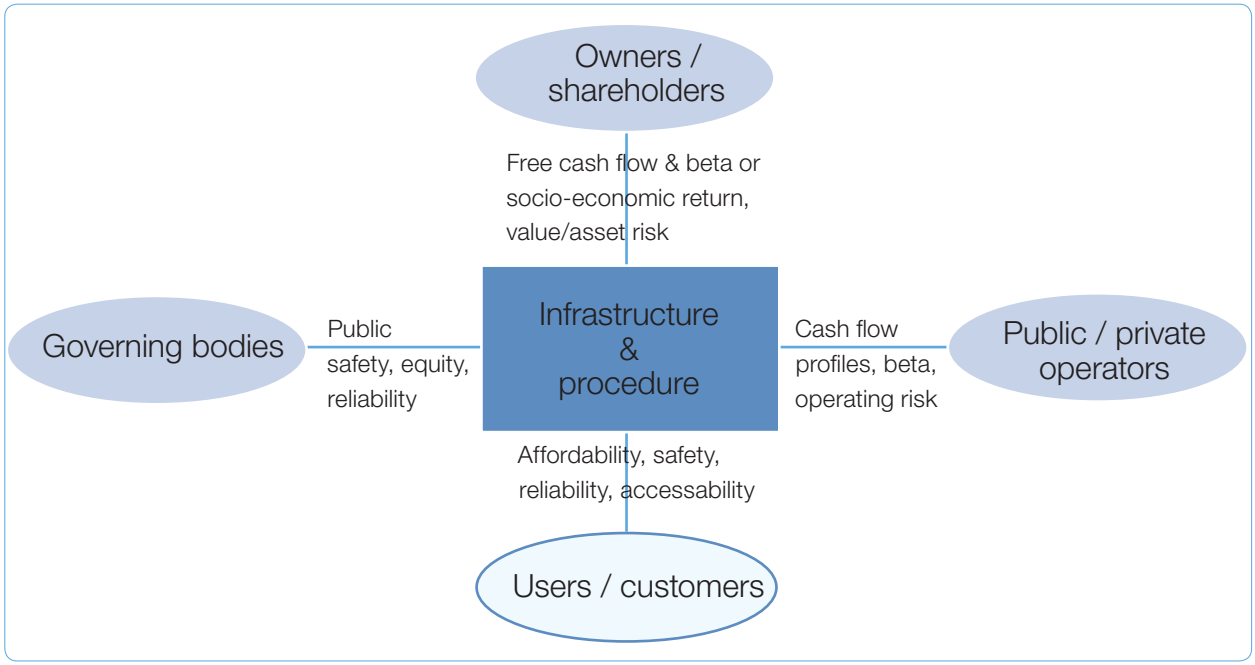

Figure 1. "C-Business" - risks in business and social aspects.

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Managing the Mergers and Acquisitions (M&A) Process – From Opportunities to New Service Business Creation

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Although business renewal through acquisition activity has shaped industries and organizations for decades, never has it been pursued so intensely as during the past decade. This trend calls for new practical methods and tools for managing the process, from recognizing opportunities emerging from dynamic market situation and technology & service developments to ensuring business continuity. The ManMAP research project [1] focuses directly on this goal.

INTRODUCTION

Business renewal is the key to the long-term success of companies. Acquisitions as a means for achieving business growth and success have become common also in industries and markets which until recently have been left relatively untouched by such restructuring. The link between acquisitions and the exploration of emerging business opportunities – i.e. new products, services and markets – and the current and future strategic harnessing of recognized opportunities has become more salient. The introduction of new service business concepts also needs to be based on sustainable strategic choices, not only case-based needs. However, new business creation always involves taking steps towards an unknown future and decisions involve uncertainty and risk. That is one reason why most mergers and acquisitions (M&A) will not achieve success.

The aim of the research project is to develop a strategy-oriented M&A approach, ranging from recognizing opportunities emerging from changes in the market and the technology & service business environment to ensuring business continuity. The project seeks and develops methods and tools for the process of new business creation through M&A activity (see Figure 1).

METHODS

The research will be carried out in an interdisciplinary consortium that brings together expertise in M&A, cor-

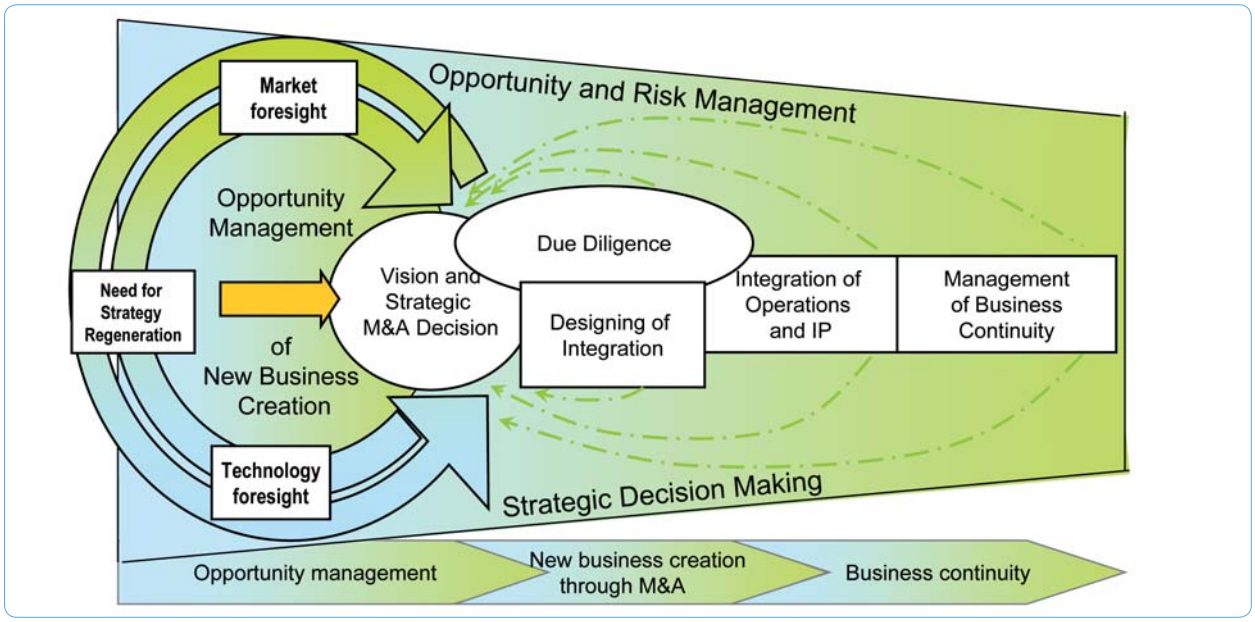

Figure 1. Framework for strategy-oriented M&A process of new business creation.

porate venturing, risk and innovation management, market and technology foresight as well as strategic decision making and investment assessment.

In the first phase of the research, state-of-the-art analyses and interviews will be carried out. In the model development phase, risk assessment, future-oriented technology and market analysis methods as well as decision-making modelling and investment evaluation approaches are utilized to develop a strategy-oriented M&A approach and related tools. During the case studies, the developed tools will be tested by companies participating in the research consortium.

RESULTS

The main results will provide an integrated model of the entire M&A process, from strategic decision making to business continuity and the evaluation of the acquisition. The following key outcomes can be defined within the two working packages as follows:

Opportunity management of new business creation

Strategic management: strategy and new business creation

- Identification of new business opportunities and risks (market and technology foresight)
- framework for integrated strategy and M&A process

Strategic M&A decisions: risk-concious decision making process of new business

- assessment and evaluation of identified business opportunities (alternatives)
- management of uncertainty in strategic M&A decision making

New business integration and continuity management

- M&A capability (internal and external resources)
- analyzing the integration process and identifying the best practices, bench marking
- leading and managing the M&A process as well as planning continuity
- feedback and M&A evaluation

EXPLOITATION POTENTIAL

The developed approaches and tools support managing the strategy-oriented M&A process and simultaneously increase the success of new business creation and overall business profitability and continuity. The main target groups are technology and product-oriented companies seeking new growth opportunities from the service business and mature industries searching for new markets with future strategic relevance. The results can also be applied e.g. in a turbulent business environment where traditional structures and player roles are in flux or converging. The tools and methods resulting from the project are of immediate use for the case companies.

In addition to the two workshops organized during the research, the project includes an introductory kick-off meeting and a final concluding seminar for the core research team, the actual case companies and the selected group of peer companies. Other means for result dissemination and exploitation are articles, reports and presentations in international conferences.

ACKNOWLEDGEMENTS

The research is funded by Tekes, VTT, TSE and the participating companies Outokumpu Oyj and Tieto Oyj. The project consortium also consists of 10 peer companies and an international research network. The work will be completed in December 2010. The contributions of all the project members are acknowledged.

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Mobile Software as a Service

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According to "Hype Cycle for Emerging Technologies 2008" from Gartner Inc [1], cloud computing-related technologies have about 2-5 years to mainstream adoption. Cloud computing incorporates recent technology trends like Software as a Service (SaaS). Mobile SaaS has emerged as a special case of SaaS development. Today, more software companies are putting their web-based business applications (SaaS applications) on a growing number of mobile devices. Tekes (the Finnish Funding Agency for Technology and Innovation) has stated that SaaS will most likely be the way to turn enterprise mobility into a business commodity [2].

INTRODUCTION

Mobile Software as a Service (Mobile SaaS) is a model of software deployment where an application is hosted as a service outside of the customer's site and delivered to customers across the Internet, typically through a browser. The traditional client-server approach requires an application to have a client for each specific operating system (OS), which has to be updated with every OS tweak. There is also the issue of scalability on the server side. For companies with hundreds or thousands of users, the prospect of serving mobile applications to a diverse set of devices requires a significant investment in back-end integration, IT development, maintenance and support resources. For most enterprises, mobile infrastructure implementation and management is not a core business function. Mobile SaaS offers enterprises the ability to rapidly test the validity of mobile applications without the need to procure, test and deploy a complicated mobile infrastructure. In addition to lower costs, companies want software that is easier to use and maintain, which increases the demand for software offered as a service.

METHODS

As Mobile Software as a Service is still quite a new and unknown research topic, research methods included the use of Internet-based software for information gathering from companies, direct interviews of potential customers and state-of-the-art type literature research for the currently available applications and technical aspects related to service enablement. The gathered information and knowledge were used to identify research needs and more focused application areas and to activate more concrete research on the selected application areas.

RESULTS

Today the rise of Software as a Service (SaaS) and the deployment of 3G cellular networks with faster browsing speeds have spurred device manufacturers to revamp the quality of their browsers. Cell phones sporting fully functional browsers will be a boost to Mobile SaaS. Browsers can now deliver enterprise software to smartphones through web-based applications. Some examples of the currently available Mobile SaaS applications that could be mentioned include Customer Relationship Management (CRM), productivity, collaboration and field force solutions. Developing SaaS for the mobile environment will be an example of providing SaaS solutions for specific needs. The results of this project were utilized in another ongoing research project called Mobile Support for e-Maintenance, which is focused on field service-related activities and their mobile support. This application area shows that only few Mobile SaaS solutions need a fully compliant browser to be useful. New and modern Mobile Web Technologies can be utilized to give access to core application functionality in a quick, no-frills fashion. These technologies make it possible to build small, browser-type applications based on standard web technologies that typically serve as front ends to services or Internet content. Applications can have access to information, such as a device's location, and share it with a web server to offer unprecedented levels of relevance in web content.

DISCUSSION AND CONCLUSIONS

When businesses do not want to manage the Mobile Architecture-related IT and personnel but still need the

Figure 1. Enterprises operating in multiple geographies with users in remote locations tend to benefit from SaaS.

flexibility to get their job done, Mobile SaaS offerings can look very attractive. Mobility is currently widely accepted as one of the key tools available within the enterprise to increase productivity, enhance customer service, reduce operational costs and increase revenue. SaaS in general has made both small-scale organizations and large corporations recognize that there are other options to approach the software and technology aspect of their businesses.

EXPLOITATION POTENTIAL

Mobile SaaS solutions present a significant opportunity for companies looking to introduce a mobility strategy in their business, enabling them to quickly and cost-effectively extend mobile services to employees, customers and business partners globally, figure 1. Via Mobile SaaS solutions it is possible to achieve cost savings and there are also great opportunities for increasing productivity and operational efficiency, resulting in increased customer satisfaction. New innovative solutions can boost new service business.

ACKNOWLEDGEMENTS

The author would like to acknowledge cooperation with companies and colleagues for inspiring discussions and VTT as a source of funding.

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Open SaaS – The Emerge of New Software Development and Business Models

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The amount of software developed as Open Source is increasing because companies are searching for ways to lower the costs of purchasing software. Plenty of open software is available, but non-experts sometimes encounter difficulties in implementing them. Customers require lower costs as well as software that is easier to use and maintain. SaaS has changed the way in which applications are developed and delivered to users, making it the potential solution for bridging the gap between the availability and usability of OSS. The capabilities of the Open Source Software (OSS) and Software as a Service (SaaS) models can be realized not only for cutting the development costs of applications, but also for improving e.g. the quality of service. The Open SaaS project aims at finding effective methods of using open source software and software-as-a-service models. Open SaaS is an ITEA2 project in the FPP phase (autumn 2009).

GOALS OF THE PROJECT

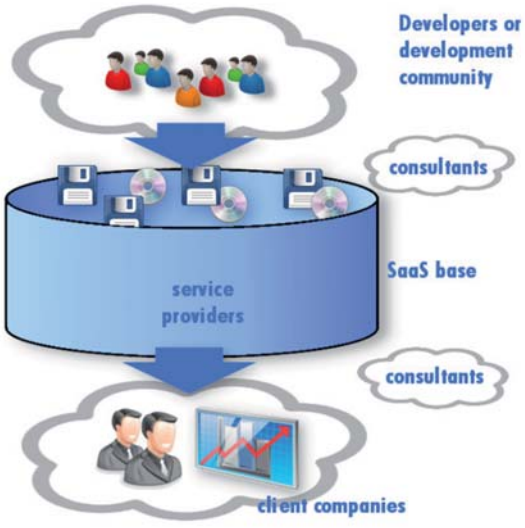
- To study and support the transformation from the development of traditional on-premise applications to SaaS-based applications and services.
- To study and support Mobile SaaS application and service development and special requirements related to mobile use.
- To develop enhanced next generation SaaS technologies, processes and business models.
- To pilot SaaS applications and to share and learn from the experiences gained from these pilots.
- To create an Open SaaS community that will go beyond the project timeframe.
- To explore different open source hybrid licensing models suitable for the SaaS ecosystem.

CONSORTIUM OVERVIEW

The Open SaaS project has a consortium comprising academic and industrial partners from Egypt, Finland, France, Spain, Sweden and Turkey. The Finnish partners are: F-Secure, Jaicom, Koodiviidakko, Rosendahl Digital Networks, EfiCode, Eurostep, Netum, Flowman, Verago and VTT.

Proposition of the Open SaaS ecosystem.

- In the future, customers can purchase open source software as a service over the Internet through web-browsers.
- Consulting services assist them in finding the appropriate software and in shifting from existing proprietary software to Open SaaS.
- Software providers (in this case the OS development community) need assistance in getting their products to fit into the Open SaaS concept.
- Software and service providers also need business models for getting the money out of the Open SaaS concept.



Business Models and Implementation Solutions for Location Based Transport Services

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Although the technological basic elements of location-based intelligent transport services already mainly exist (such as satellite positioning, digital maps, mobile equipment), these services have not been implemented on a large scale, with the exception of navigation. The greatest challenges are the lack of functional business models and the unclear roles and responsibilities of the different actors in the service value network. There is a need for open business and implementation solutions on which to base large-scale and profitable global business.

GOALS

The goal of the Pastori project is to develop business and deployment solutions for location-based travel and transport ICT services aimed at improving safety and reducing environmental impacts. The solutions are meant to enhance the large-scale deployment of these services in Finland and globally. The project focuses on the roll-out and deployment of eCall public emergency services (a pan-European in-vehicle emergency call), commercial eCall+ services (emergency, safety and security) and intelligent road user charging services.

The project produces the necessary functional specifications, business models, legal and institutional frameworks, and open service architectures for the key services. The results will be exploited immediately in the Suntio project, which is run in parallel by a company consortium with the aim of producing the specifications and framework for a pilot.

APPROACH AND METHODS

The project has been divided into the work packages described below. The essential connections between them are shown in Figure 1.

WP1 - Service benchmarking. The essential current services and concepts will be surveyed and their business models, development needs and other experiences will be studied. Work package 1 is implemented as a literature study, expert interviews and research co-operation.

WP2 - Study of the service framework. The situation of the premises and requirements of the business models and implementation solutions and the service framework development needs are studied. The studied frameworks include at least 1) satellite positioning and its development alternatives, 2) standardization, 3) legal issues and 4) political goals. Work package 2 is implemented mainly through a literature study and expert interviews.

WP3 - User needs. The essential user groups of case services are identified, after which the case-specific needs of the groups are studied through literature studies, research co-operation and interviews.

WP4 - Functional architecture of case services. The drawing up of the architectures utilizes e.g. the Finnish Telemark architecture of transport telematics and the service model of the EVASERVE meta-tool. Special attention is paid to architecture enabling the service to also function outside Finland in the global market.

WP5 - General business models of services. The results – mainly of WP1 (Service benchmarking) and WP4 (functional architectures of case services) – are utilized in the compilation of general level business models for case services.

WP6 - Functional requirements of case services. The results of the earlier work packages – especially WP3 (User needs), WP4 (Functional architectures of case services) and WP5 (General business models of services) – are used in drafting the functional requirements of case services.

WP7 - General functional architecture of LBS for transport. The results of WP4 (Functional architectures of

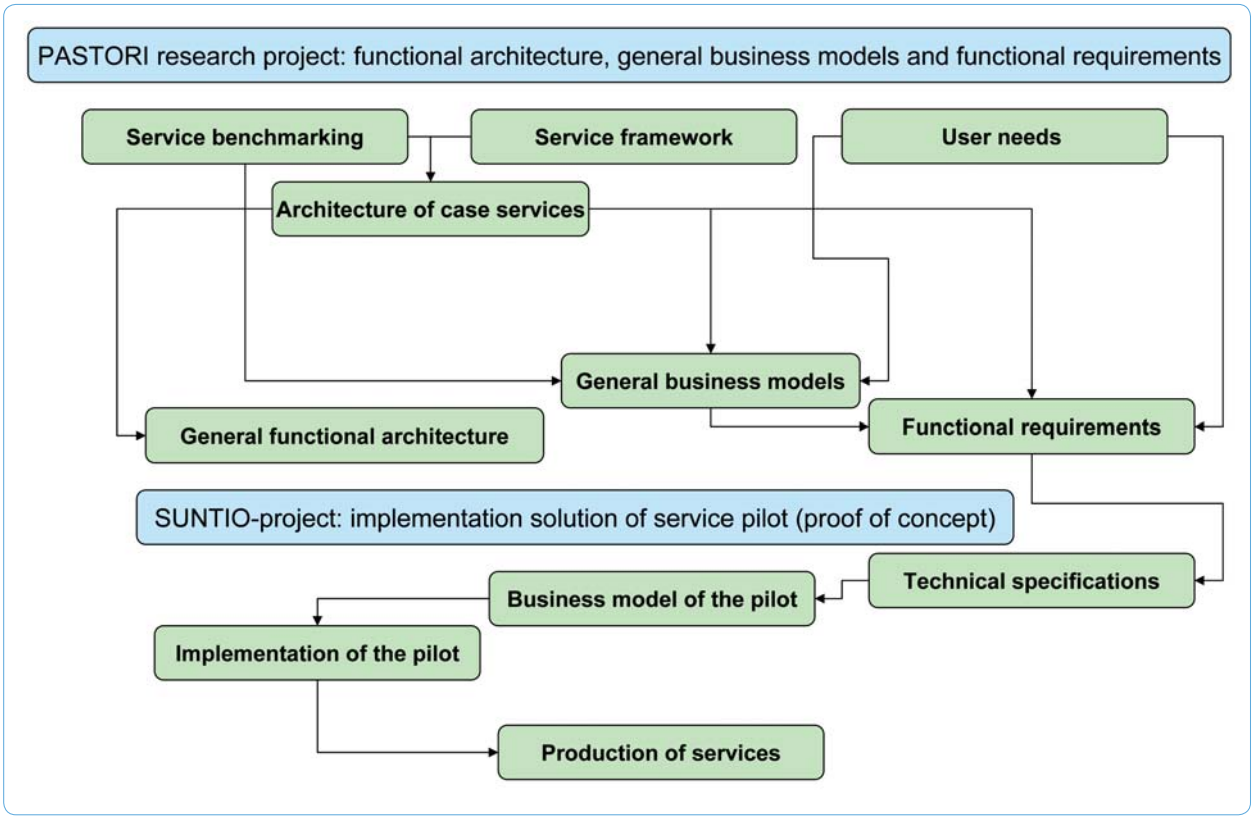

Figure 1. The implementation principle of the project entity and connections.

case services) are used in drafting the first version of the general functional architecture, which is tested for other applications as well before the compilation of the first public version. This version is used as the basis for an open workshop whose results are used in finalizing the general functional architecture of location-based transport services.

PARTNERS

The research is funded by Tekes (Finnish Funding Agency for Technology and Innovation), Destia, Elisa, IBM, Indagon, Logica, Semel, Tapiola, Finnish Vehicle Administration, Ministry of Transport and Communications Finland and VTT. The research is coordinated by VTT and involves international co-operation, especially with EU R&D projects (Transport ICT) and the University of California Berkeley.

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Mobile Enterprise Factory – Catalyst for Mobile Enterprise Solutions

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The tools and guidance of Mobile Enterprise Factory (MEF) empower companies to identify and structurally design mobile solutions for their needs. MEF Guidebook, MEF Wizard, and the supporting material help enterprises to analyse their development needs, design mobile concepts, define their priorities and mobile roadmap, and finally set up a project to plan and implement the chosen mobile solution. MEF is a catalyst for the deployment of mobile enterprise solutions. The tools can be used by customers in various industries, by technology providers, and by mobile solution consultants.

INTRODUCTION

Although Finland was highly successful in developing mobile consumer technology and taking it to market this achievement could not be duplicated in mobile enterprise solutions at the beginning of the millennium. Companies were slow to deploy mobile technologies even though their great productivity potential was recognized. Tekes (Finnish Funding Agency for Technology and Innovation) stated in 2004: "the existing ICT and mobile know-how, markets and networks can be utilized to improve productivity and create new international business and service industry also in the other industry sectors". Tekes initiated the programme *Value added mobile services (VAMOS)* to improve utilization in different industries.

Mobile Enterprise Factory was the spearhead project of VAMOS. Its main target was to plan, implement, and coordinate activities to widely support the utilization of mobile solutions by Finnish industries and to create new business based on the latest research.

METHODS

MEF started working on the actual enterprise cases and developing the methodology simultaneously at the beginning of 2007. The early method was based on VTT's "*Idea Movement*", a version of *Open Innovation* combined with the rapid conceptualization of the best ideas supported by demos and prototypes. The customers' needs and requirements were mapped and communicated in MEF workshops. Sometimes the workshops addressed the problems of a value chain or a whole industry sector; sometimes they concentrated on an individual organization. As the first results were not satisfactory, two major questions were raised:

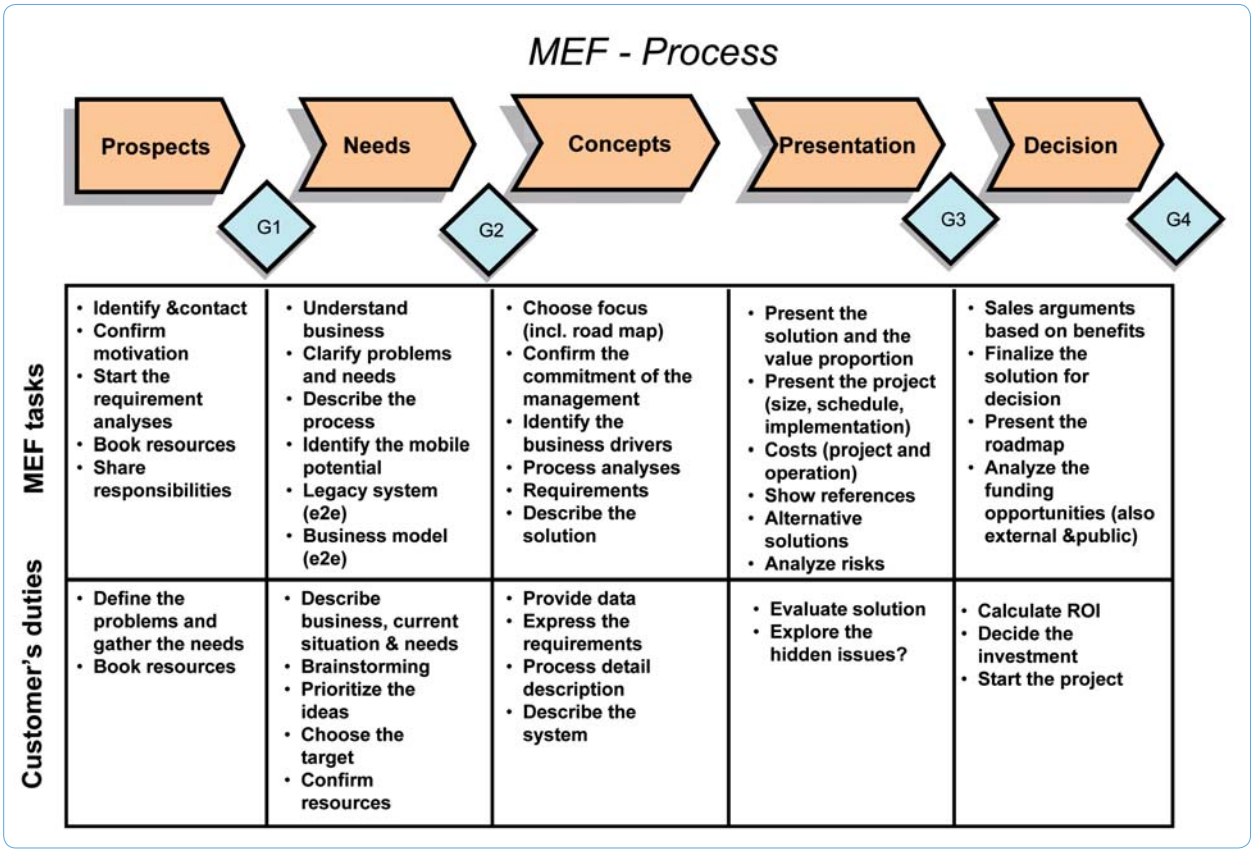
1) How should the values and benefits of mobile enterprise solutions be identified and how can decision makers be convinced about them?
2) What are the main obstacles in mobile enterprise development processes?

MEF analysed the experiences and bottlenecks, and carried out a deeper survey of mobile enterprise studies and developed a methodology of its own.

RESULTS

MEF carried out more than 50 enterprise cases with 170 companies, working in 75 workshops and 90 other design meetings. The experiences are encapsulated in the MEF tools: the Guidebook, Wizard and supporting material. With these tools, MEF accelerates the first steps of the development process: needs → ideas → prioritization (road map), solution → profitability → investment decision.

An enterprise mobilizing its processes can use the MEF Guidebook to structurally design new solutions. The method can be used independently if the necessary know-how is available in the company, or it may be applied together with a solution provider. Experienced MEF consultants can also customize and carry out the mobile design process. The course and phases of the MEF process can be seen in the chart below. The web-based MEF Wizard is a tool for facilitators supervising the design process step by step. The wizard guides the facilitator throughout the design process. It describes the tasks of each phase of the process, provides check-



lists, gives useful links and includes all the document templates needed in the different phases. The gate question, at the end of the phase, helps the facilitator to ensure the soundness of the plan before advancing from one phase to another.

DISCUSSION AND CONCLUSIONS

MEF by VTT combines deep insight into industry processes with expertise on mobile technologies and solutions in a unique way. The practical process is based on know-how gained during dozens of workshops. The academic discussion and methodologies are analysed and refined for practical purposes. The challenge for the business model is its novel approach. The sales channels for MEF are not well-established yet even though the cooperation network is strong.

EXPLOITATION POTENTIAL

There is a clear need for realizing the productivity potential of mobile enterprise solutions. Demand and supply do not meet effectively on the market. Well-defined MEF tools with experienced consultancy are the right way to speed up the mobile enterprise process. This can be done by VTT as an impartial actor, or by mobile service providers and consultants in cooperation with VTT.

ACKNOWLEDGEMENTS

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Enhancing System Innovation in Welfare and Health Care

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VTT creates deeper understanding of how to enhance system innovation in welfare and health care service delivery. It is involved in the societal embedding of innovations to enhance innovations that address societal concerns.

INTRODUCTION

Concern for the future availability of high-quality health care services at reasonable cost has become a tremendous challenge in ageing Western societies. Clearly, the intertwined system of health care services and technologies must be renewed. But how can favourable conditions be created for sustainable system innovation?

METHODS

The multi-level perspective (Geels 2002) has been used as an analytical tool for understanding the dynamics of system innovation processes. This perspective suggests that change takes place as the outcome of linkages between developments at multiple levels, i.e. pressures to the current regime, policy measures, and local initiatives.

VTT aims at facilitating the development and introduction of new sustainable innovations. We use the approach of societal embedding of innovation [1,2] in this process. The primary aim of societal embedding is to improve the societal quality of innovation (Fig.1). When developing system innovation to address societal concerns, it is not enough to include only the providers' and users' perspectives in the process. Societal needs and requirements must also be considered. The societal quality of the system innovation is co-constructed in a multi-actor network. By opening up the perspectives of the different actors, we aim to produce mutual learning.

Based on case strategy, we have analysed various endeavours to develop new system innovations for welfare and health care [3,4]. Currently, our research focuses on analysing the development and diffusion of two innovation embryos [5]: a municipal management model for purchaser-provider constellations, and a new pattern of regional ophthalmology services.

RESULTS

The scaling up of experiments is a critical phase in system innovation. Our research illustrates that various hybrid actors moving between various network settings play an important role in anchoring the niche- and regime-level actors together. We have identified different types of hybrid actors that promote critical interaction between niche- and regime-level processes, and analysed the potential and limits of their action. Sometimes widening the scale of innovation from local experiments to a national-level system innovation calls for establishing a new kind of agency in the network of service providers, users, and policy makers at various levels [5].

It seems that system innovation is enhanced by the willingness of active hybrid actors to change their own positions as they carry the innovation embryo from one phase to another. Our case showed how a local-level actor transformed itself into an entrepreneur with the support of a policy maker. It also indicated that, at the beginning, a certain degree of incompleteness of the innovation embryo is an advantage as this enables *co-creation of the users*. Transforming a complex system is battle against old ways of operating, in which several stakeholders need to take persistent action.

DISCUSSION AND CONCLUSIONS

Health care is shaped by complex dynamics relating to national and regional policies and goals, municipal politics and professional interests. The conclusions from the analysis of system innovation processes in multi-actor networks highlight the need for mediators linking processes at different levels and the importance of creating a shared understanding of the scale of the problem and its solution.

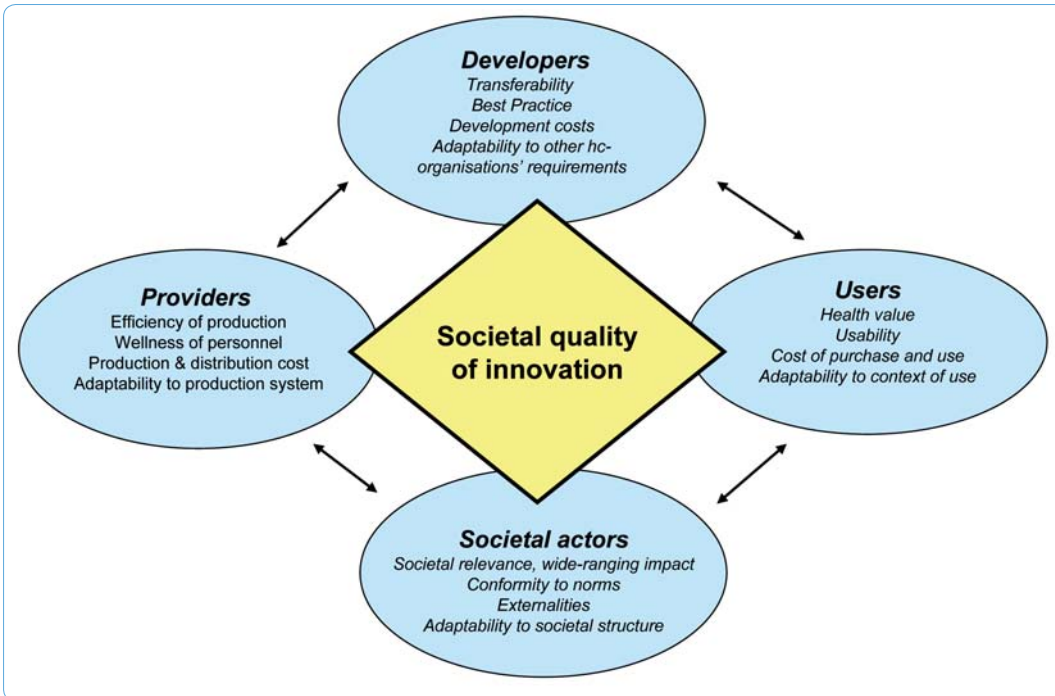

Figure 1. Societal Embedding of Innovation: key actors and perspectives to innovation.

The cases highlight the critical importance of *coalition building*. Creating and maintaining innovation capability calls for dialogue and negotiation between multiple stakeholders. In this process, the innovation embryo may *need to be co-constructed several times* to meet various local and societal needs and to become politically accepted.

EXPLOITATION POTENTIAL

Societal embedding has proved to be a relevant tool in cases where there is a strong public interest in solving a societal problem and where innovative solutions from private companies are needed. The approach has been geared towards supporting innovative collaboration between public and private actors.

The process offers participating *private companies* a deeper insight into the needs and interests of the key actors of their market network. Their benefits of participation relate to decreasing innovation risks and to increasing business management competence in the health sector. A special characteristic of this approach is that it points out the role of *public decision makers* in market building and includes them in the process. Through their involvement they gain a deeper understanding of market creation dynamics, the barriers for new technology diffusion, and the contributions of different policy instruments to innovation diffusion. This may enable them to fine-tune government support policies and to change the frame conditions for enhancing sustainable development.

ACKNOWLEDGEMENTS

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Developing Service Innovation Capabilities in R&D Organisations: A Mid-study Review of Results at VTT

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A short definition of innovation is "transforming knowledge into benefits". By that definition, research and technology institutes have huge potential for innovation. In spite of this, there is still a wide gap between the outcomes of research projects and their commercial business applications. This paper provides a description of strategic development activities at VTT Technical Research Centre of Finland for enhancing its service innovation capabilities. Here we present a mid-study review of results relating to a currently ongoing project called "From research knowledge to business services".

INTRODUCTION

In this paper, innovation capability is considered as an organization's ability to consistently come up with novel service business ideas and sequentially develop such ideas towards commercial utilization to deliver short- and long-term profits to the organization.

According to the theory of absorptive capacity (Cohen and Levinthal, 1990) the ability of an organization to recognize the value of new external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities. Zahra and George (2002) have complemented the theory of Cohen and Levinthal and specified the four dimensions of absorptive capacity: acquisition, assimilation, transformation and exploitation. These theories and the conventional concepts of technology push and market pull hold great relevance to our efforts in studying and developing the effectiveness of service innovation capabilities at VTT.

The goal of the project is to promote VTT's organizational capabilities for better identifying the business potential of research-based knowledge and technology, determining effective ways to develop technology-focused business services in line with the identified business potential, and bringing the services to market where the offering best matches the customer demand (Figure 1).

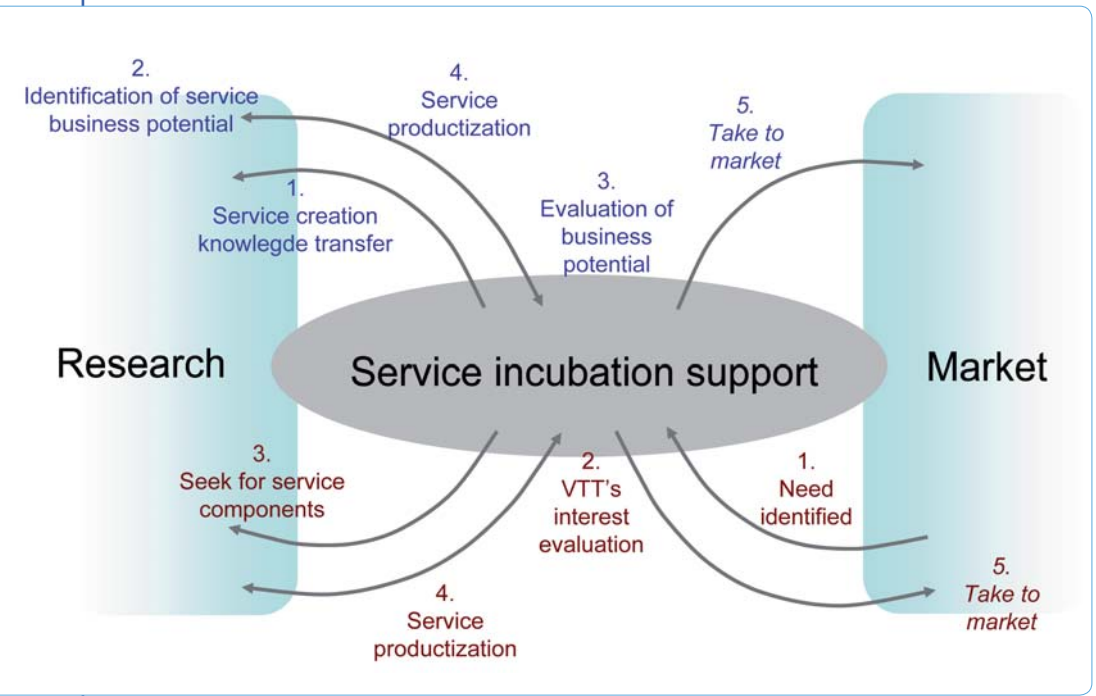

Figure 1. Focus on both perspectives; technology push and market pull.

A research and technology institute plays a multifaceted role in an innovation ecosystem. Depending on the nature of the organization, the responsibilities in the technology transfer value chain range from research and technology policy to new business incubation (Figure 2).

VTT is a state-owned institute operating under the regime of the Ministry of Employment

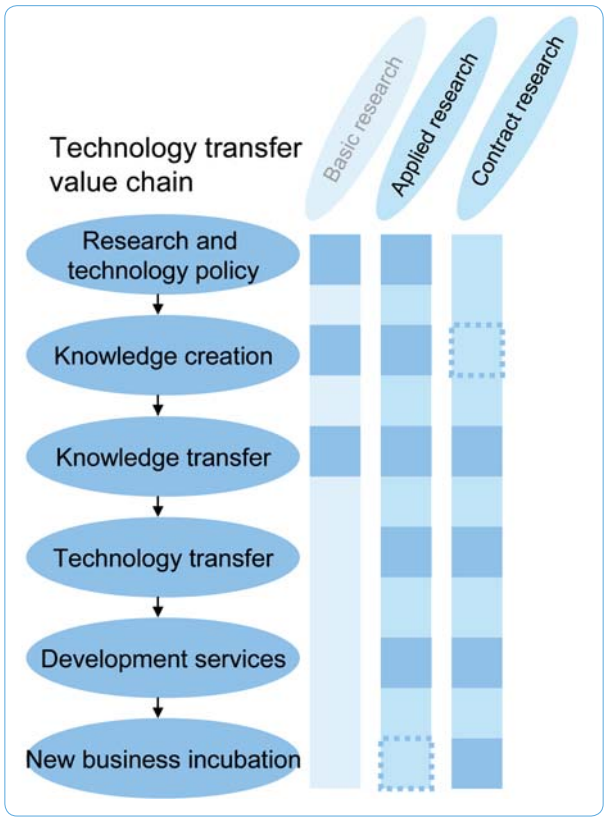

Figure 2. Technology transfer value chain of a research and technology institute (edited from Arthur D. Little 2000). VTT's role is in the field of applied research and contract research.

Figure 3. VTT Services.

and the Economy. In return for its investment, the state-owner expects VTT's research and development work to have an impact on national industry and commerce. In addition, VTT has set itself the strategic target of generating significant growth in the share of private sector income and profitability. These aims and expectations impose demands to make the technology and knowledge transfer processes more effective.

METHODS

The study and the development work are carried out as action research. Action research is an interactive and reflective process of problem solving. It pursues action and understanding at the same time and therefore it is usually a participative method. The action research method can be used in organizations to improve strategies, practices, and knowledge of the business environment (Dick 1999).

The selected method is conducted by developing several technology- and/or research-based service concepts from different research areas by means of piloting. The pilot cases represent all the stages of the innovation process and they include both technology-pushed and market-pulled signals. The versatility of the pilot cases is considered to be vital due to the observing- and learning-related targets of the project.

RESULTS

Prior to this project, the service offering was first outlined on the VTT scale (Figure 3). All of VTT's offerings are determined by this service triangle. Different service sections carry different weight in VTT's overall offering depending on the nature of the research.

The outcomes of the ongoing project will be expected to have a significant long-term impact on the business performance of the whole organization.

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Patterns of Innovation and Non-technological Renewal Across Sectors

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The ways in which companies think about innovation activity have broadened into newly emerging directions and dimensions such as organizational renewal, knowledge inputs, new service concepts, and the roles of users and demand in stimulating innovation. Several reasons behind this situation have been identified:

- *Innovation activities are undergoing profound changes, and take on whole new forms that are more complex and frequently intangible, even in sectors that were recently considered 'traditional' or 'low-tech'.*
- *'Services' comprise a strongly heterogeneous, but voluminous set of activities in the economy, which is hard to grasp systematically.*
- *'Service innovations' are multidimensional in nature, involving e.g. organizational, operational, delivery system, customer interaction and technological elements, and it is challenging to obtain a systematic overview of them.*

These observed changes in the innovation environment have also had an impact on the outlining of new public innovation strategies and policies by the Finnish government actors. Because the international scientific research on the phenomenon of service innovation and non-technological innovative activity by companies is still in a relatively early stage when compared to technological innovation, fundamental information available from the Finnish innovation environment is still in rather short supply as well. In addition, the notions of user-driven and demand-driven innovation have recently entered the public innovation policy discussion. As a consequence of these developments, there are challenges in developing a long-term national innovation strategy and policy that supports companies in renewing their business in these areas.

This study has two main objectives. Firstly, to help alleviate this problem by filling the existing knowledge gaps outlined above by evidence-based investigation, and by doing so supporting policy-making in Finland. The second main objective is to utilize the created knowledge in interaction with different stakeholders to arrive at concrete policy recommendations based on the new knowledge.

DATA AND METHODS

Because most of the existing information available to policy-makers derives from measurement instruments that are historically based on the traditional, technological perception of 'innovation', this project makes use of two different instruments to capture innovation activity by companies in the light of the more recent, broader notions of innovation sketched out above. The first part of the research is carried out with help of the renewed SFINNO™ database of Finnish innovation and is compiled by VTT's Innovation Systems and Innovation Policy team. Here, single innovations made by Finnish companies that include a significant service element are recorded systematically from technical and trade journals. The advantage of this "innovation-level approach" is that we can observe the technical and non-technical characteristics of these innovations across many industries, and examine the nature of their individual innovation processes in more detail than is possible with other indicators.

The second part of the study looks in more detail at the Finnish manufacturing sectors, and utilizes the Finnish part of the European Manufacturing Survey. This survey was especially designed to capture the mix of technical and non-technical renewal taking place in individual manufacturing plants. The advantage of this survey instrument is that we can observe the interdependencies and drivers of renewal in products, services, processes and organizational practice across all manufacturing sectors (see Figure 1).

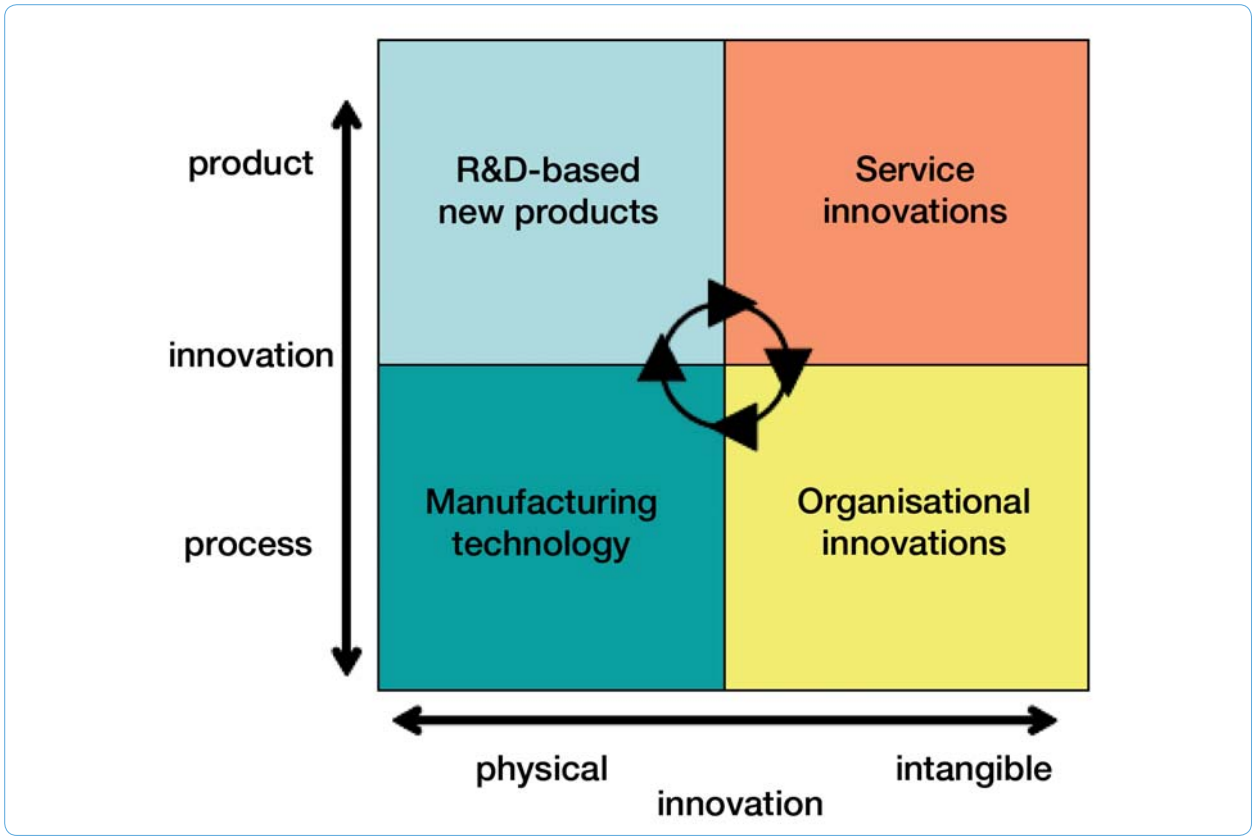

Figure 1. The holistic approach of the European Manufacturing Survey.

In order to provide more systemic overviews that are suitable for policy-makers and which have possible practical implications for policy-making, the studies apply descriptive and statistical analysis with special attention to different types of innovations, companies and sectors. Secondly, interactive workshops involving various stakeholders from the business, policy and academic communities are organized to stimulate discussion and ensure that the project work has practical relevance.

EXPLOITATION POTENTIAL

The project results have the potential for implementation through public policy-making aiming at enhancing the competitiveness of Finnish companies. It is foreseen that looking at patterns of different dimensions of innovation activity simultaneously will generate new impetus for implementation. In addition, facilitating discussion among different stakeholders will also indirectly result in an increase in mutual awareness of the issues faced by businesses and public policy actors in Finland.

The PAINO project is currently ongoing and scheduled to be completed in March 2010.

ACKNOWLEDGEMENTS

The authors wish to thank the following colleagues for their contribution to this work: Marja Toivonen and Tiina Tuominen of Helsinki University of Technology, and all the participants of the first PAINO workshop. The research has been funded by Tekes (Finnish Funding Agency for Technology and Innovation) and VTT.

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Roadmap on Service Business

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Services – both as a business and as a science – are a rapidly growing sector, and they have remarkable influences on processes and operations in companies and other organizations. This change does not touch only industry, but also society as a whole. Therefore, a roadmap survey was carried out focusing on drivers, markets, challenges and use of R&D services in different lines of business in order to recognize significant trends and service opportunities and define a common vision of service science and service business.

INTRODUCTION

Today, more and more attention is paid to the service sector of the economy, whose rapid growth has led it to outstrip the two other sectors, agriculture and industry. Services now dominate the economy; they represent about 70 per cent of the economy in OECD countries and 80 per cent in the U.S. This trend also affects the developing world, albeit to a lesser degree. For companies, the goods era profit and growth model no longer delivers the results it once did. Transforming businesses towards greater service orientation seems to be much more profitable; when new capital goods are not being bought, services may provide a new and often steadier source of revenue. Profits are also higher and investments smaller in after-sales services (after markets) than in manufacturing.

Information and communication technology (ICT) is a key driving force shaping the field and profoundly influencing service practices. ICT is also radically changing how services are delivered and enabling both customers and employees to get and provide better, more efficient customized services. Although ICT is developing rapidly, thereby enabling new opportunities, services are elaborated and implemented at a notably slower pace. In order to recognize significant trends and service opportunities and define a common vision of service science and service business, a roadmap survey was carried out focusing on drivers, markets, challenges and use of R&D services. This roadmap draws up a general and wide survey on services progression and new possibilities focusing on trends and future visions in different industries, which are:

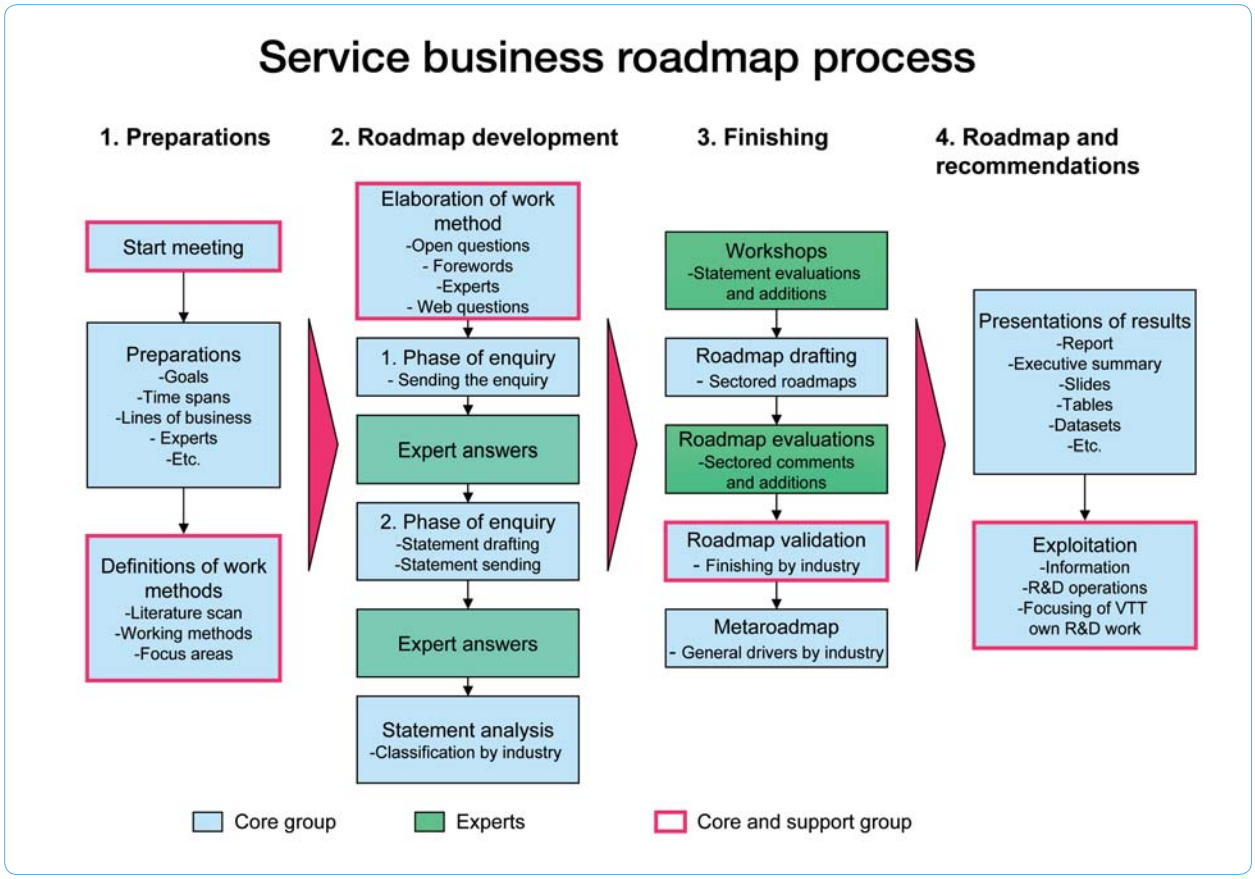
1. Forest and Paper
2. Energy and the Environment
3. ICT and Electronics
4. Engineering and Metal Products Industry
5. Construction and Real Estate Business
6. Biotechnology Applications in Food and Pharmaceuticals
7. Transport and Logistics
8. Entertainment, Travel and Leisure,
9. Retail and Wholesale
10. Health and Social Services
11. Research Development and Consultation
12. National Economy, Technology and Innovation Policy

METHOD

A two-round questionnaire was used to collect the material for the roadmap. Inquiries were sent to both domestic and international experts via the Internet. Open questions were used in the first phase for collecting information from different lines of business. In the second phase respondents were asked to evaluate, on a scale of one to five, the probabilities of the statements that were drafted on the bases of their answers in the first phase. Time spans were defined as: current time (0-2 years), short term (3-5 years) and long term (over 10 years). In this inquiry respondents answered questions regarding their own line of business. Also, internal workshops were used to verify the results and elaborate visions, Figure 1.

RESULT – SERVICE BUSINESS ROADMAP

In the analysis of the answers from the survey and workshops it was noticed that several general drivers touch all the business lines. The following general drivers were identified:



1. Globalization of the economy and China phenomena
2. Demographic change and the weakening of the welfare ratio in developed countries
3. Increasing consumption and economic availability of energy
4. Ecological factors and climate change
5. Digitalization and possibilities enabled by technology

In addition, of course, different lines of business involve their own characteristic drivers, markets and challenges, and have different approaches to the use of R&D services.

CONCLUSIONS

Services – both as a business and as a science – are a rapidly growing sector influencing processes and operations in companies and other organizations. Despite the rapid development of ICT, the elaboration and implementation of services take place at a remarkably slower pace. The roadmap describes the general drivers touching all the business lines and the drivers, markets, challenges and R&D service usage that are characteristic of each of the different lines.

EXPLOITATION

The results of this foresight will be used to recognize significant service trends and opportunities as well as to create a big picture about services both as a science and as a business.

ACKNOWLEDGEMENTS

We would like to acknowledge VTT Technical Research Centre of Finland for funding, inspiring and supporting this work.

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Towards Co-creation of Service Research Projects – A Method for Learning in the Network

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How to combine research knowledge across disciplines is a big question when studying and developing services in industry and public organizations. This paper presents a new kind of workshop process aiming at co-creation in a research network. We piloted the process at VTT Technical Research Centre of Finland during January – May 2009.

INTRODUCTION

In large research organizations there is a tendency that new research projects originate in research groups or in knowledge silos. Applied research faces the specific challenges of how to consider the needs of the customers, scientific knowledge and societally relevant questions in research projects. Large organizations may also have a communication gap between managers and employees. We claim that collaboration across "the silos", hierarchical levels, disciplines and different actors does not emerge easily. New interdisciplinary research networks require tools and methods for initiating learning, synergy and collaboration.

Services, both as a business and as a science, are a rapidly growing sector, and they have a remarkable influence on processes and operations in companies and other organizations. VTT has traditionally focused on the development and application of technology. However, over the past couple of years, VTT's interests have extended to technology-based services, service business and service innovation research. In order to create VTT's Service Science and Business network we combined foresight and organizational learning methods, namely roadmapping and developmental impact evaluation, in a workshop process.

METHODS

This paper presents a process called learning by foresighting and evaluating (LIFE). LIFE enables the management of future-oriented networking across organizational borders as a basis for continuous learning and innovation. The process is a potential embryo for a new kind of research culture that fosters learning in the network as well as the shared and transparent planning of project proposals.

The process derives from the theories and methods of expansive learning, developmental impact evaluation and roadmapping (Engeström 1987, Saari et al. 2008, Ahlqvist et al. 2008). The acronym LIFE evokes the vivid and interactive process that takes place between different stakeholders during the workshops. The process enhances new face-to-face contacts inside and across organizations and hierarchical positions. It creates new "life" for the research area and disperses it in the organization.

In the process, five workshops were organized in which the current state of service research was first analysed. Two past projects were used as mirrors and samples to identify the strengths of the pioneer research projects and to question the monodisciplinary approach to research. Every workshop was an effort "to cross a border" and help the participants see their research in a new context and in a wider horizon.

RESULTS

The process developed the service research network and produced new project initiatives as an immediate result. The participants had an opportunity to engage in dialogue across hierarchical boundaries. Furthermore, the process built up a network and its embryonic research strategy from below, from above and together with customers and collaborators. In order to continue this way of learning in the networks, the process needs to be adopted as a continuous way of planning and organizing research. Our previous intervention processes (Kallio & Saari, 2008) have proved how important the middle managers' role is in continuing and spreading this way of operating.

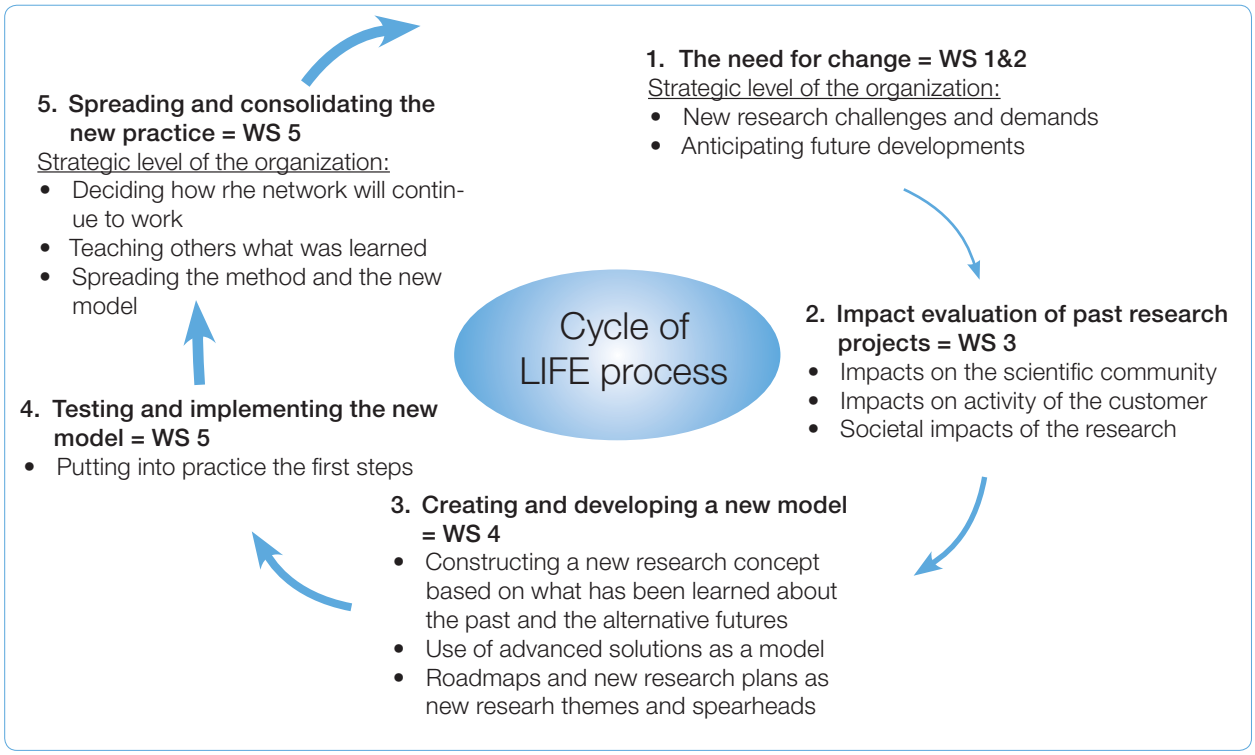

Figure 1. The cycle of LIFE as a learning process.

DISCUSSION, CONCLUSIONS AND EXPLOITATION POTENTIAL

The first pilot has proved how fruitful it is to combine the analysis of the past with the construction of the future in the same process. Typically, the impact evaluations only identify the strengths, problems and hindrances that should be improved in the organization. They do not give tools or construct the first learning actions for future activity. Likewise, the roadmapping and foresighting methods help participants think and plan their future vision and actions without using lessons learnt from the past as a starting point. By combining these methods we create an opportunity for people to learn and move between these horizons – from the past to the future. In addition, the LIFE process itself is a promising service concept, which may be marketed to expert and research organizations.

ACKNOWLEDGEMENTS

The authors wish to thank the participants of the process for their enthusiasm and broadmindedness in launching into this new, challenging experience. We also want to thank the management of VTT for the trust and the financial resources given to the network. We are grateful to the highly qualified scholars and professionals who accepted our invitation to share their insights on service research and did so in an exceptionally open spirit.

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Benefit and Value Assessment of Met-information Services

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The benefits of meteorological information services have been studied widely, but a coherent view of the impacts of the services has remained elusive. Met-information services must be first seen as a service with potential positive impacts on the functions of society; only then will the services be regarded for what they are in fact worth. Our research looked into the value of the services to society as a whole [1]. In addition to the methodological contribution to met-services value assessment, the services of the Finnish Meteorological Institute represent an empirical case [2]. The results of the empirical case were explicit. The total value of benefits well exceeded the annual budget allocated for the Institute.

INTRODUCTION

Met-information provision must first and foremost be seen as a service, and not as a function in its own right. This service should have potential positive impacts on the functioning of society; only then will the services be regarded for what they are in fact worth. The impacts of meteorological information services were analysed for

- all modes of transportation; road, rail, marine and inland waterways, aviation and light traffic (pedestrians, cycling)
- construction and facilities management, i.e. the building phase of physical infrastructures and the operating and maintenance phases
- energy production and distribution
- agricultural production.

METHODS

The benefits and/or negative impacts of the information service are due to mechanisms that are often very hard to assess because of the interlinkages of the variables involved. Usually the impact mechanisms are a combination of empirical experience and logical deduction. In the best cases, empirical observations have been modelled to enable the analysis of different scenarios, e.g. the marginal impacts of increased, improved or better utilized information. Such empirical models are extensively found in engineering (e.g. safety impacts of road improvements), health care (e.g. impacts of smoking) and economics (e.g. impacts of tax reductions).

RESULTS

The total value of the benefits generated each year by the Finnish Meteorological Institute (FMI) exceeded the annual budget of the Institute many times over. The benefits were calculated for the current situation with existing services. The theoretical maximum potential of the benefits was then assessed, assuming perfect information. This projection was done simply by assuming that all potential users of met-information have access to it, are using it and are adjusting their behaviour and decisions accordingly.

Current services generate roughly 260 M€ in annual benefits for the analysed sectors, when assuming conservative impact scenarios, and it was estimated that by enhancing the distribution systems and availability of service and improving service quality, benefits of up to 430 M€ can be accrued per year. As the annual budget of FMI is around 50-60 M€, the estimate for the annual benefit to cost ratio for existing services is at least 5/1 and potentially up to 10/1. These benefit-cost ratios are calculated yearly, i.e. [annual budget of FMI] / [annual benefits], and thus no discounted cash flow approach is applied.

CONCLUSION AND EXPLOITATION PROSPECTS

Judging from the FMI case, it seems evident that the value of information will play an increasing role when societies grow more and more information intensive. Value starts to play a serious role: private sector actors must consider their business development efforts and the public sector their own information services and the services they procure from the private sector from this particular angle – will the information be of value in financial and economic terms? The FMI case showed clearly that

Table I. The benefits of met-information services per year (conservative estimates).

Sector	Principal impacts and benefits	Value of current benefits with current information	Additional potential benefits with perfect information
Road transport	Reduction in number of accidents	11 M€	9 M€
Pedestrians and cyclists	Reduction in number of slipping accidents	113 M€	122 M€
Waterways and marine transport	Reduction in number of accidents and environmental damage	25 M€	Not calculated
Aviation	Reduction in number of accidents and emissions, fuel savings, more efficient operations	54 M€	4 M€
Rail transport	Passenger and freight time savings	0.3 M€	0.2 M€
Logistics, supply chain	Reduction in storage costs and risks (accidents, damage)	Not calculated	5 M€ in total
Construction, facilities management	Prevention of mould and mildew damage, more efficient maintenance	15 M€	15 M€
Energy production and distribution	Energy production capacity and availability predictions, prevention of damage and interruptions	10 M€	8 M€
Agriculture	Crop protection from damage, pest control and damage reduction, harvest timing	34 M€	3 M€
Total		**262 M€**	**166 M€**

the value was there, and moreover, well above the initial expectations.

The methodology of the value and benefit assessment is generic and applicable to a variety of fields. Hence similar assessment projects were carried out to assess met-services in the Balkan region and in a number of other corporate cases. We expect that our approach will also be applied to educational services and activities.

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The Value of Corporate Security Services

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This abstract concerns the ongoing research project The Value of Corporate Security Services (ValueSSe). The focus is on understanding and describing corporate security-related value and earning principles.

INTRODUCTION

It is a challenge to understand, describe and demonstrate the value of security for the client. In order to understand that value, service providers need to evaluate the effects of security on client organizations' core business. In addition, the value creation processes should be more transparent for customers. If this can be done successfully, the role of value-based pricing might be increased in the security business. Collaboration and partner-based relationships between different service providers and clients might provide an opportunity to create common understanding and shift the nature of the business towards value-based thinking instead of merely selling "manpower" and technical devices. The primary aim of the ValueSSe project is to develop and demonstrate methodology and tools for defining and describing the value of corporate security services, creating business network concepts, supporting the consideration of earning principles and logic of pricing related to corporate security.

METHODS AND PARTNERS

The ValueSSe project consists of two parts: a research study and a development project carried out with a group of 11 companies. The duration is three years (April 2009 – May 2012). Project implementation is separated into the following work packages related to corporate security services: 1) Value perceptions, 2) Risk management, 3) Earning principles and logic of pricing, 4) Models of value creation, 5) Business network concepts, and 6) Developing and testing methods and tools. Group interviews are used as research methods in work packages 1, 2 and 3. Lettering and methods for qualitative analysis are used when interview data is analysed. Development work on models, methods and tools is based on interview data, group work, case studies and utilizing reported models used in other business branches.

The research partner is Helsinki School of Economics (HSE) and the main business partners are Innovation Research Development Tamlink, Finnsecurity, G4S Security Services, Granite Partners, Niscayah, Outokumpu, Verifi, Palmia, City of Espoo, Pelco Finland, Otso Palvelut and Flexim Security. The international collaborative parties will be e.g. Technische Universitat Berlin (DE), Manchester Business School (UK) and Tohuku Fukushi University (JP). The research has been funded by the Finnish Funding Agency for Technology and Innovation, VTT and HSE.

Educational Technology at School's Everyday Life – Evaluation Framework for ICT Services

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The project implemented by VTT is a part of larger-scale research on identifying, developing and modelling pedagogical technology innovations for widespread distribution to Finnish schools. The research generates new know-how and operation models for the incorporation and establishment of technology as a part of the study and learning environment. The results of the research are e.g. public-private co-operation models and service concepts that utilize education technology. The research is a part of the "ICT in school's everyday life" project coordinated by the Ministry of Transport and Communications. The project is included in the government platform and will be implemented in cooperation with the Ministry of Education, the Finnish National Board of Education, universities and business.

GOALS

The goals of the VTT project are:

1) To implement a framework for the evaluation of the impacts of the "Educational Technology in School's Everyday Life" pilot projects. The framework for evaluating educationl technology information services includes the studied criteria, instruments and methods for the identification, grouping and evaluation of the main economic and qualitative impacts. The framework also requires the composition of an impact mechanism architecture. The framework is mainly limited to technical solutions and their implementation methods, service networks, user needs and usability and possibly also political goals.
2) To evaluate an example case from a school participating in the "Educational Technology in School's Everyday Life" project and study the generalization and scalability of the case results. In the example case solution the ICT needs of the school system are met through net-based open technology and a new acquisition model. This model is compared to the traditional closed model. The emphasis of the evaluation is on assessing socio-economic impacts. The definition of the evaluation means that the impacts are linked to hardware and software costs, work and energy costs, user needs, usability, technical performance and service networks.

APPROACH AND METHODS

The data required for the evaluation will be gathered by means of expert interviews and questionnaires or a literature study. Workshops will be arranged as the work continues in order to utilize the know-how of different parties, consolidate different opinions/needs and validate the results.

The evaluation framework will be compiled by applying the open and modular EVASERVE information service evaluation tool developed by VTT in 2006-2008. The framework will be compiled and tested using an interactive development process with the concrete case example. The framework will be supplemented according to the experiences of the evaluation and expert views so that it can also be applied to the other objects of the "Educational Technology in School's Everyday Life" project.

PARTNERS

The project is funded by Tekes (Finnish Funding Agency for Technology and Innovation), Aronet-Esitysyhtiö Ltd, Arcturia Ltd, IBM, the Ministry of Transport and Communications Finland, the Ministry of Education and VTT. The project is planned to involve international cooperation, especially with the Singapore National Institute of Education.

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How to Evaluate Industrial Service Culture and Capability

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INTRODUCTION

Industrial services are drawing more and more attention both in manufacturing industries and within the research community. There are several identified organizational challenges in developing industrial services. These challenges are related to manufacturing traditions, different operational functions and managerial processes. Particularly the industry lacks concepts and methods in order to create personal and shared understanding of 1) why change is needed: motives and commitment, 2) what kind of organizational change is needed and 3) how targeted change could be supported and managed in practice. Our approach views the transition towards service business as a process of developing organizational service capability and culture [1;2].

The purpose of this article is to present the *conceptual evaluation frame* and the *practical procedure for evaluating the collective mindset of the organization concerning service business development* and illustrate its use in the case study. The participative evaluation procedure provides systematic means to create shared understanding of complex, ongoing change and manage it more purposefully. The approach was applied and developed further with Vaisala, a global company providing a comprehensive range of innovative observation and measurement products and services for meteorology, weather critical operations and controlled environments. Vaisala took part as the piloting company in the ServO research project, which focuses on organizational changes and interactive management in the industrial service business. The company was involved in the project from August 2008 till February 2009. During this period, the company restructured its service business The aims of the cooperation project were to support the ongoing change process by providing research-based information about the development state of the organizational service capability, and to facilitate the formation of a service-oriented culture and collaborative working practices in the organization. In addition, it was expected that the project would raise staff awareness and enhance key personnel's commitment to service business development. Finally, it was agreed that the development actions would be laid out in a development plan.

METHODS

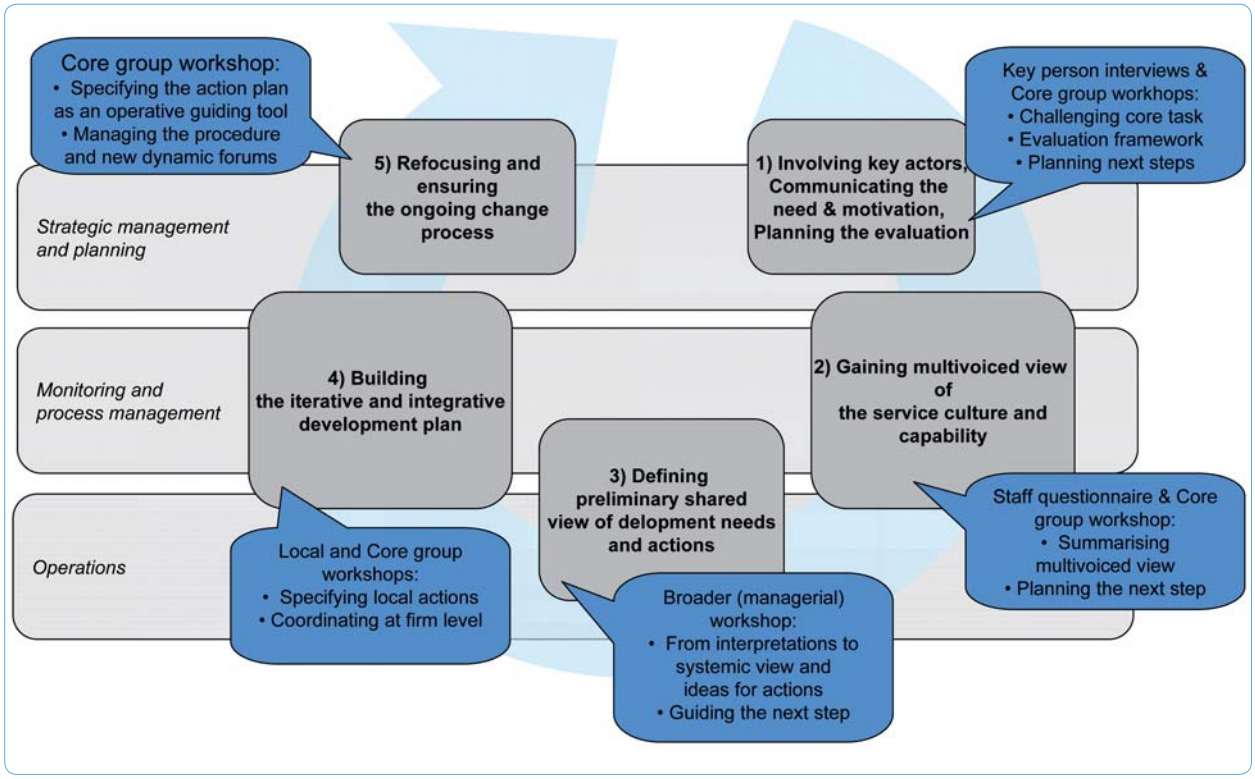
The evaluation was conducted as a collective learning process that was modified to the specific needs of the company. The main phases of the evaluation process, including the data gathering methods and working practices, are described in Picture 1. The evaluation was based on VTT's theoretical work to define organizational service capability and culture in industrial companies. The frame provides five basic elements: 1) Service culture, 2) Understanding of a service business, 3) Management practices, 4) Development practices and 5) Customer relations. Each of the elements has a criterion for assessing change towards a customer- and service-business-oriented organization. These five main elements are overlapping and interconnected, and should be analysed on several levels, taking into account strategic management, process management and operations. Theoretical backgrounds for these concepts are based on research into organizational capabilities, service quality, service management and assessing organizational culture [1;2;3;4].

RESULTS

As a result of the collaborative evaluation process facilitated by VTT researchers, the company achieved better common awareness of the development state of its service culture and capability, which was discussed and worked on further on a number of levels and cross-functionally in the organization. Finally, in the development plan, the project group summarized the evaluation process, main results, development needs and actions, as well as their connections to service business change as a whole. Based on the evaluation, a greater emphasis could be placed on some development issues in order to facilitate further transformation in the service business. Consequently, the concrete actions described in the development plan will support continuous improvements in service capability and cultural transition towards a more service-oriented culture in which the company serves as a life cycle service partner.

DISCUSSION AND CONCLUSIONS

According to the feedback given by the project group at the company, the evaluation of service culture and capa-



Picture 1. The evaluation as a collective learning process: phases and methods.

bility first provided the conceptual framework for personal and collective reflection concerning the development stage of its service business. Thus it contributed to the creation of a shared understanding of attained progress and further development potential, needs and means in the service business. Secondly the procedure enabled a systematic and collective learning process, which on one hand refocused the ongoing change process and on the other hand enabled a regular evaluation process and cross-functional, dynamic forums to strengthen service-oriented culture. The main needs for improvements concerned establishing criteria for clarifying the conceptual framework of evaluation elements and involving the staff even more in the evaluation process. To conclude, our approach to analysing and supporting industrial service capability and culture shows promise, but needs further research and development.

EXPLOITATION POTENTIAL

The approach provides an essential, but typically absent, perspective with practical tools that enable industrial companies to understand and improve the management of complex and dynamic change processes when pursuing growth with services. Furthermore, when adding the perspectives of customers and external service providers into the evaluation, the approach would support even more comprehensively networked service business development.

ACKNOWLEDGEMENTS

The authors wish to thank especially Vaisala for inspiring cooperation and also their colleague Katri Kallio at VTT for her contribution to this work. The research has been funded by Tekes (Finnish Funding Agency for Technology and Innovation), the participating companies and VTT.

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Service Process System Dynamic Moldeling

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In today's world, where conventional production is moving to cheaper areas, service business is becoming increasingly important in high-cost western countries. However, the research of service processes and practices is a relatively untouched area.

In many cases these new service systems are not critically evaluated and planned, and consequently have serious problems in their operation and management. This paper will give a brief introduction to the system dynamics approach for developing tools to control, optimize and analyse service processes.

INTRODUCTION

Service systems are typically complex due to the interaction of technical, economical and social factors. Since people have a limited understanding of complex systems, the consequences of different decisions and policies are difficult to anticipate.

The service theory is still in its infancy, and service processes are not as well understood as conventional production systems. This is why there is a need for tools to model, simulate, and optimize different service concepts and processes. Methods to understand and convey the value chain, especially the added value for customers, comprise the key factor in selling services.

METHODS

System dynamics is an approach to solving problems in dynamically complex management systems. The idea is to model organizations' structures as well as practices and study system behaviour with computer simulations. Typically, the problematic behaviour arises from the dynamics of technical, economical and social factors. Hence, model boundaries must be broad and cover different disciplines. The models also involve complexity and non-linearity in a way that makes analytic solutions inapplicable.

Once a simulation model is constructed, a vast selection of mathematical methods become available – optimization, control, sensitivity analysis, to name but a few.

RESULTS

The potential application field of dynamic modelling is vast. Consequently, the type of results achieved in these projects varies from application to application. Let us consider a couple of practical examples.

A tool for formulating robust service practices was developed for a company in the field of special product manufacturing. The fact that individual customers have their own unpredictable requirements makes project manufacturing complex. It was common for the initial requirements of individual customers to be elicited over a period of between four to six weeks through at least three interactions.

A typical case simulation is presented in fig.1 with ten special product projects in series. In fig. 2 three different strategies were tested under this scenario. The first strategy (leftmost column) describes an over-optimistic strategy, the second one (middle column) depicts a deterministic strategy in which the cumulative profit is maximized and the third strategy (right column) presents a robust strategy based on probability distributions of uncertainties.

DISCUSSION AND CONCLUSIONS

With the help of this tool, different scenarios can be optimized and analysed under different conditions and uncertainties. It can be used for pricing different services, selling a service to a customer and conveying the importance of key elements in the process, e.g. the schedule, quality and financial implications if the customer does not provide the plans and specs in time.

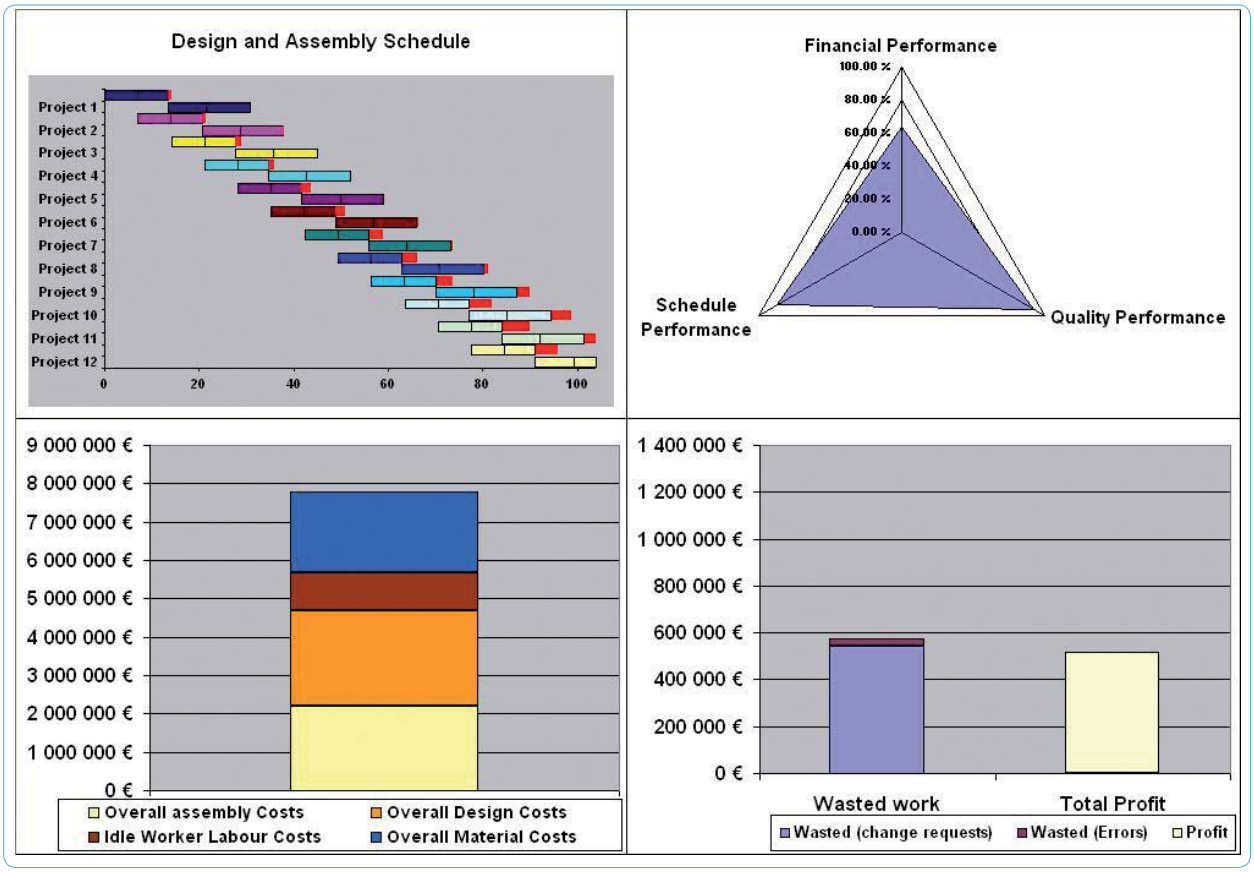

Figure 1. Example of system dynamic model using interface.

EXPLOITATION POTENTIAL

In several companies these tools and methods have become an essential means for making better decisions. When the models, simulators and tools are implemented directly into ERP and CRM systems, they will become part of everyday operations. They are continuously updated – all the results are based on relevant information instead of static paper reports on old situations collecting dust on a shelf.

The business potential of these methods and tools is exceptionally large as they can be used for risk management, optimization, as well as strategic and tactical planning.

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Entertainment Services - Distributed 3D Gaming System

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In the coming years we will see low-cost networked consumer electronics (CE) devices dominating the living room. Various applications will be offered, including IPTV, VoIP, VoD, PVR and games. On the other hand the requirements of computer games in terms of CPU and graphics performance are continuously growing. With regards to gaming, the need to compete with traditional game consoles will require a radical change in the system architecture. For pervasive gaming in various environments like at home, hotels, or Internet cafes one should be able to also run games on mobile devices and modest performance CE devices. The EU IST Games@Large project is developing a new cross-platform approach for distributed 3D gaming in wired/wireless local networks. It introduces novel system architecture and protocols for transferring the game graphics data across the network to end devices. Simultaneous execution of video games on a central server and a novel streaming approach to output 3D graphics on multiple end devices enable access to games on low-cost set-top boxes and handheld devices that natively lack the power to execute games with high-quality graphical output.

INTRODUCTION

Home computers have already brought Ethernet and WLAN as standard equipment to homes. It is envisioned that the home of the future will be an always-on connected digital environment with a wide variety of appliances. Computer gaming has been utilizing this infrastructure for a long time. Modern games have become highly realistic and are consumed by a wide population, not only youngsters. As the games have turned into realistic connected virtual worlds they have set even greater demands on computer hardware. High CPU processing power and graphics performance is required to play these games.

At the same time, mobility and digital home entertainment appliances have generated the desire to play not only in front of a home PC, but everywhere inside the house and also on the go. As the result of TV digitalization, simple set-top boxes (SsTBs) have entered homes. Also, several low-cost consumer electronic end devices (CE) are already available at home. Although these devices are capable of executing software, modern 3D computer games are too demanding for them. The Games@Large project is developing a novel system for gaming in both homes and enterprise environments, like hotels, Internet cafés and elderly homes. In the Games@Large system, the key concepts are execution distribution, audio and graphic streaming and rendering, and decoupling of input control commands. Games are executed in one or more servers and the game display and audio are captured and streamed to the end device, where the stream is rendered and the game is actually played. Game control is captured at the end device and streamed back to the server and injected into the game. It is important to note that no special game adaptation is required; almost any commercial game can be played via the Games@Large platform.

METHODS AND WORK IN PROGRESS

The project has chosen an iterative "spiral-like workflow" model as its work model. In the first phase we started with the requirements gathering. In this phase, we analysed the market and the users' and stakeholders' needs and expectations in order to elicit the requirements for the system (e.g. in terms of costs and performance). The requirements for the platform and the tools were specified based on the needs of the targeted cross media and the scenarios/business cases chosen. According to a participatory design criterion, scenarios were prepared and validated by experts and users. Requirements also quantitatively specified usability issues (e.g. maximum time to learn how to use the interface, maximum number of steps to perform a task, etc.) in order to keep systematically under control the overall usability of the system.

The second phase was the concept design. First, we translated the user requirements into technological specifi-

cations. Then we analysed the match between the user requirements and the available technologies. We thereby identified and selected the most suitable technologies to achieve the goals. This involved the selection of off-the-shelf components, or the specification of new modules for the functionalities that we considered more appropriate to develop ourselves. Finally, we designed the platform, modules and tools that were needed to implement the Games@Large platform according to the user requirements.

The third phase is the development of the Games@Large platform and tools. This phase is currently ongoing in the project.

The fourth phase is dedicated to testing/validation and the evaluation of business perspectives, which has also started for the first focus area. Beyond the major iteration cycles, which we describe below, continuous lab testing has been the rule of thumb for good development.

The project involves three main iteration cycles, which will cover all the four business domains or focus areas for Games@Large.

CONCLUSIONS AND EXPLOITATION POTENTIAL

Games@Large is implementing an innovative architecture, transparent to legacy game code, that allows distribution of cross-platform gaming and entertainment on a variety of low-cost networked devices. Virtually extending the capabilities of such devices, the Games@Large system is opening up important opportunities for new services and experiences in a variety of fields and in particular for entertainment in the home and other popular environments.

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Project Management Based on Software Services - New Approaches for Social and Collaborative Internet Based Project Management

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To be successful, enterprises need to engage in a continuous process of innovation that generates products and services that add value to their customers. Technology is, in general, available to everybody everywhere. Thus the main comparative advantage an enterprise will have is the process of innovation. To be innovative, enterprises need to be able to efficiently combine a broad range of knowledge from different domains. Collaboration is the key to success; it is the ability to access and share information and knowledge between organizations.

"By 2020 enterprise collaboration and interoperability services will become an invisible, pervasive and self-adaptive knowledge and business utility at the disposal of European networked enterprises from any industrial sector and domain, enabling them to rapidly set up, efficiently manage and effectively operate different forms of business collaborations, from the most traditional supply chains to the most advanced and dynamic business ecosystems."

The above vision statement is from the COIN Integrated Project. Its objective is to study, design, develop and prototype an open, self-adaptive, generic ICT-integrated solution to support the 2020 vision. The project develops services for Enterprise Collaboration and Interoperability.

APPROACH

Software as a Service (SaaS) is a model of software deployment whereby a provider offers an application that customers can use on demand. SaaS software vendors may host the application on their own web servers or download the application to the consumer device, disabling it after use.

COLLABORATIVE PROJECT MANAGEMENT

Today, many business activities are performed collaboratively in networks. Dispersed partners come together to perform a specific task. The projects consist of partners from a wide variety of organizations collaborating towards a common goal, despite the differences in their backgrounds, cultures and business behaviours. The success of the project depends heavily on their collaborative performance.

PROJECT MANAGEMENT 2.0

Project Management 2.0 (PM2.0), also referred to as Social Project Management, is an evolution of project management practices and software built on Web 2.0 technologies. Such applications include blogs, wikis and other collaborative and social software, and share characteristics like open APIs (Application Programming Interface), service-oriented design and the ability to upload data and media as well as the ability to collaborate, share and communicate.

Traditional project management is based on the project manager's control. The new generation of project management tools enables the creation of a collaborative space, where everyone involved in the project is able to contribute to the project work. A project can be to some extent led and developed by the whole team, giving each team member access to the full information on the project. The project manager has a more visionary role, choosing the right direction for project development. Table 1 gives a summary of the key differences between Project Management 2.0 and traditional project management.

In PM2.0, the vision is that with insight and collaboration driving a project, people and businesses accomplish much more than they did with traditional project management rules that build work around a project management system. As a member of the COIN consortium, VTT is developing the following functionalities through the SaaS paradigm in order to support the vision.

PROJECT ALIGNMENT

Project alignment is the process of ensuring that the key stakeholders in a geographically distribut-

Table 1 – Comparison of project management approaches.

Traditional Project Management	Project Management 2.0
Centralization of control	Decentralization of control
Top-down planning	Bottom-up planning
Authoritarian, strictly controlled environment	Collaborative environment
Implied structure, pre-defined structure and tasks	Emergent structures, tasking
Limited / restricted access to the plan	Organized / unlimited access to the plan
Local access to information, strict user restrictions	Universal access to information, very few restrictions
Limited communications within team, separate tools	Enhanced communications within team, e.g. shared project e-mails, chats
Separate projects	Holistic approach, resource pools
Often complex tools	Easy to use tools
Rigidity of tools	Flexibility of tools

ed project share a common understanding of project work processes, operational procedure, objectives and plans. The ideal situation is a totally unified project work process. Project alignment is even more important in a Collaborative Project. Alignment is not just a matter of agreeing on certain project working habits, norms and styles. Often it requires participation in a learning process.

To build and increase the project alignment level, the working and experience level of the project partners must be analysed and measured. Based on the alignment capabilities a suitable learning environment can be established. Consequently the measurement of partners' alignment status and an interactive learning environment are the two building blocks in boosting project alignment. The functions of the Participative Project Alignment Booster, currently under development, are implemented as web services.

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Development of Municipal Well-being Services towards a Multiple Supplier Model

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The ongoing municipal service structure reform towards adopting a multiple supplier model calls for developing new innovative service and operation models and introducing a new management approach. Adopting the model is a complex process of change. The management of this process requires in particular a process- and player-based development approach that takes customers, users and personnel groups into consideration, and a systematic scheme for assessing and monitoring the quality and cost-effectiveness of services. Thus comprehensive assessment work is needed in order to compare and develop new and different service models. These were the starting points of the two-year Multipro development project, which was launched in May 2009 with the aim of improving the productivity and quality of municipal well-being services and promoting the introduction of multiple supplier models.

METHODS AND GOALS

Combining multidisciplinary expertise, the project sets out to assess and develop well-being services comprehensively with a view to different player groups. The approach roughly consists of four key elements, their criteria and methods: 1) a strategic service model, 2) cost and pricing models, 3) networked service processes and management models, and 4) the personnel's service capabilities and culture. Development-oriented assessment work makes use of quantitative and qualitative data collection methods. Participative service assessment and development methods are introduced in order to commit the key player groups to the change processes. In addition to the results generated by municipal development projects, the project aims to 1) provide a more in-depth understanding of multiple-supplier models in municipal well-being services and of the management of the ongoing service structure reform as a complex phenomenon, 2) further develop and disseminate best practices as well as assessment and development models for use by different players in municipal services, and 3) collect and strengthen expertise in the field within VTT and between external partners.

EXECUTION OF THE PROJECT

The project consists of two municipal development projects and workshop-based steering group work for coordinating the project. The project of the City of Tampere is targeted at developing the productivity and quality of public health centre services. The project of the City of Pori is focused on two intensive residential service units for the elderly. They consist of different service models, reflecting the ongoing change towards multiple supplier models.

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