Strategic Research Agenda and Implementation Action Plan for Services

Contributing organizations:
VTT, TNO, Fraunhofer ISI, Fraunhofer IAO, Tecnalia, SINTEF, and SP

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Executive summary and foreword

This report presents a Strategic Research Agenda and Implementation Action Plan for Services (referred to as Services SRA). The report identifies and justifies important research and development themes in services, and issues recommendations for the organisation and funding of services-related research in Europe. The main purpose of this report is to provide input to the preparation of EU research programmes and calls, in particular the forthcoming 8th Framework Programme (Horizon 2020 – the Framework Programme for Research and Innovation). In addition, the aim is to provide guidance for national funding organisations.

The identified research and development themes have been divided into four broad categories and several subcategories. The themes are generic in nature, and most of them are relevant to a number of industries and application areas. The recommendations for the organisation and funding of research (implementation) have been specifically written for EU-funded research, though a separate chapter has been dedicated to national and regional funding.

The key recommendation of the report is that services should be nominated as a priority area with a dedicated budget in the forthcoming Horizon 2020. It is argued that the total amount of funding allocated to services, including theoretical research and applied research and development, should be commensurate to the budget allocations for other priority areas in Horizon 2020. The argument is the huge importance and future potential of services to European economies and societies as a whole.

The major socio-economic and technological trends that currently influence the development of services have also been identified. The trends constitute an integral part of the report, for they provided a logical starting-point for the work. In addition, the report provides an overview of the past EU Framework Programme performance and discusses the general challenges of, and prerequisites for, developing the effectiveness of EU-funded research.

The work proved exactly as difficult and hard as originally anticipated. No particular sectors of economy or society were emphasised or left outside the scope of the work. A need to limit the scope of the work in some way became soon evident. This led to the decision to focus on generic research and development themes and to omit the original plan to dedicate one section of the report to industry-specific issues. The second decision was to place special emphasis on
themes highlighted by the representatives of the participating organisations at the expense of other sources of information, such as public policy papers and research reports.

The work was conducted in association with AERTOs ERA-NET Coordination Action. The participating organisations included TNO (The Netherlands), Fraunhofer ISI and IAO (Germany), Tecnalia (Spain), SINTEF (Norway), SP (Sweden), and VTT (Finland). Also Tekes, the Finnish Funding Agency for Technology and Innovation, participated in the project. The representatives of these organisations also formed the project steering group. The project was managed by VTT Technical Research Centre of Finland. The project received financial support from Tekes.
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<tr>
<td>AERTO</td>
<td>Associated European Research and Technology Organisations</td>
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<td>B2B</td>
<td>Business to Business</td>
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<td>B2C</td>
<td>Business to Consumer</td>
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<tr>
<td>BRIC</td>
<td>Brazil, Russia, India, and China</td>
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<td>EARTO</td>
<td>European Association of Research and Technology Organisations</td>
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<td>EC</td>
<td>European Commission</td>
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<td>ECTP</td>
<td>European Construction Platform</td>
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<td>eMobility</td>
<td>Mobile and Wireless Communications</td>
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<td>EPISIS</td>
<td>European Policies and Instruments to Support Innovation in Services</td>
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<td>ERA-NET</td>
<td>European Research Area Net</td>
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<td>ERTRAC</td>
<td>European Road Transport Research Advisory Council</td>
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<td>EU</td>
<td>European Union</td>
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<td>FP</td>
<td>Framework Programme (funded by the EC)</td>
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<td>Fraunhofer IAO</td>
<td>Fraunhofer Institute for Industrial Engineering</td>
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<td>Fraunhofer ISI</td>
<td>Fraunhofer Institute for Systems and Innovation Research</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>ICT</td>
<td>Information and Communications Technology</td>
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<tr>
<td>MANUFUTURE</td>
<td>Future Manufacturing Technologies</td>
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<tr>
<td>NEM</td>
<td>Networked and Electronic Media</td>
</tr>
<tr>
<td>NESSI</td>
<td>Networked European Software and Services Initiative</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
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<tr>
<td>OPEC</td>
<td>Organization of the Petroleum Exporting Countries</td>
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<td>R&amp;D</td>
<td>Research and Development</td>
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<td>RTD</td>
<td>Research and Technology Development</td>
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<tr>
<td>Acronym</td>
<td>Name</td>
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<tr>
<td>RTO</td>
<td>Research and Technology Organisations</td>
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<tr>
<td>SINTEF</td>
<td>The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology</td>
</tr>
<tr>
<td>SME</td>
<td>Small and Medium-Sized Enterprises</td>
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<tr>
<td>SP</td>
<td>SP Technical Research Institute of Sweden</td>
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<td>SRA</td>
<td>Strategic Research Agenda</td>
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<tr>
<td>TECNALIA</td>
<td>Fundacion Tecnalia Research &amp; Innovation</td>
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<td>Tekes</td>
<td>The Finnish Funding Agency for Technology and Innovation</td>
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<td>TNO</td>
<td>Netherlands Organisation for Applied Scientific Research</td>
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<td>VTT</td>
<td>VTT Technical Research Centre of Finland</td>
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1 Introduction

Today services constitute an increasing part of EU’s economic activity, being around 70% of total employment as well as of the gross value-added generated by EU27 (Pro Inno Europe 2010). For the most part, the share of services of the GDP is growing everywhere in the world. The ongoing transition from a manufacturing economy to a service economy and from goods-oriented hardware suppliers to service providers is gaining momentum. This change does not concern only industry, but society as a whole. However, these developments do not automatically sustain a sound economic development.

Europe is currently facing a relative decline in manufacturing industries. This does not only result from the triumph of the service economy, but also from the emergence of Asia, and especially China, as the world’s major manufacturing base and growth centre. Europe’s competitive position is at stake, and so is its ability to generate enough economic wealth to secure a decent standard of living for its citizens. At the same time Europe is ageing fast, which means that the welfare of an increasing number of European citizens will have to be supported by a rapidly decreasing workforce. Notable reforms in the labour markets are needed to boost participation among older employees and to reduce unemployment among younger generations (Roxburgh et al. 2010) by strengthening employment in services (OECD, 2005). Most European economies are also heavily indebted, as a result of lax budget discipline in the past and the massive remedial actions necessitated by the recent financial crisis. Such challenges pose increasing demands on the Europe’s private sector.

Services do have real potential to contribute. Deloitte, a consultancy, concluded in its study of services in the manufacturing industry that “the average profitability of the service businesses benchmarked is more than 75 per cent higher than overall business unit profitability, and accounts for an estimated 46 per cent of total profits generated today” (Deloitte 2006). Deloitte also concluded that “in many manufacturing companies there would be little or no profitability without the service business”. By offering services companies are pursuing to facilitate product sales, to expand the scope and the life time of their customer accounts, to lengthen product life cycles, to create new growth possibilities on already partly saturated markets, and also to respond to customer demands.
Service research (or service science) aims at solving the complex problems of a service economy by applying an interdisciplinary approach to the analysis and development of services, often in collaboration with academia and practitioners. It seeks to bring together knowledge from diverse areas to tackle diverse academic and practical problems. One of the key challenges for service research and associated research disciplines is to develop precise concepts, methods and instruments that take into account the special requirements of service innovations, such as the important role played by customers and employees, as well as the immediate nature of service provisioning (e.g. Teboul 2006). In addition, the researchers will need to demonstrate how such methods can be applied in practice e.g. with respect to specific types of service and diverse contextual constraints.

But where should the focus of service research be set, and why? Or is there any well-founded reason to prioritize some particular topics more than others? Service research is an emerging theme. New conferences and journals are constantly founded, and the sheer volume of related research is rapidly increasing. In consequence, also the range of topics being researched under the headers ‘service research’ and ‘service science’ has expanded to cover all major aspects of business, technology and workplace development. The ten overreaching research priorities listed by Ostrom et al. (2010) provides a good example: it includes such themes as creating and maintaining a service culture, enhancing service design, optimizing service networks and value chains, effectively branding and selling services, and leveraging technology to advance services. The results summarize the views expressed by more than 200 academics around the world and by 95 mainly US-based business executives, so they must have general relevance. But the question of what themes in particular should be entitled to receiving significant public funding in Europe is far from trivial.

On the other hand, important research themes are also likely to contain the features of the wider socio-economic environment in which service innovation is expected to take place. Given the diverse nature of EU27 it is no wonder that European policy makers and representatives of EU-level and national funding agencies have stressed, e.g., the importance of effective networking and coordination, development of regional competence centres, small business support, public-private partnerships, and ‘platforms thinking’ to foster the creation and exchange of knowledge and knowledge-intensive products and services – just to mention a few examples (Pro Inno Europe 2010). It is self-evident that the European research agenda
to support service development must in one way or another also address such structural
issues, including the rules and arrangements surrounding the framework programmes.

The European Framework Programmes on research and development (FPs) have consistently
been dominated by the knowledge infrastructure of universities and research institutes. Arnold
(2005) has concluded that the quality of the science and technology undertaken in European
FPs is “broadly good”. The evaluation suggests that the FP is a useful and flexible device,
allowing the European Commission to pursue a wide range of RTD-related programmes.
Especially the low-level goals pursued as part of individual actions tended to be well-
grounded with the respective stakeholder communities, if not always with end users. Higher-
level goals, however, were typically so abstract that progress was difficult to verify. These
results converge with an earlier study carried out by the European Commission in 1998 which
concluded that compact project size and the clarity of objectives contribute to the success of
projects (EC 1998). In short: money can make a difference, but organizing matters, too.

The development of services is in the core of national and EU-level policies. However,
services have been largely neglected in the EU Framework Programmes. This has had a
concrete impact on the contents of EU-funded research. A recent study carried out by Tekes,
The Finnish Funding Agency for Technology and Innovation, revealed that only 2% of the
FP7 project summaries explicitly referred to service innovation. Furthermore, service
innovation was not the main topic in any project (Tekes 2011).

We want to argue that due to its dependence on services Europe needs to make sure that the
amount of money allocated to services research and development reflects the relative
importance of the area to European economies and citizens. Europe just cannot afford to fail
in its attempt to tap the full potential of the ‘service economy’ in the midst of tightening
international competition and prevailing economic uncertainty. The current level of service
productivity in Europe is on a suboptimal level compared to, e.g., that of the US (Roxburgh et
al. 2010). Europe’s output per hour is trailing behind that of the US. Main reason for Europe’s
disappointing productivity performance was that it failed to squeeze productivity gains from
its service sector (Smart work 2010). Second, to ensure the effectiveness of the investments to
be made in service research and development it is equally important to identify and justify the
research themes that deserve special emphasis in European and national research
programmes, to foster fruitful exchanges between academic and business communities, and to
Finally, Europe shall avoid creating excessively complex or abstract programmes and calls for proposals that blur the link between research and practice.

1.1 Objectives

The immediate objective of the project was to formulate and justify the most important research and development themes in services and to issue recommendations for the organisation and funding of services-related research in Europe. The key results of the project have been condensed in this report, Strategic Research Agenda and Implementation Action Plan for Services. The main purpose of the report is to strengthen the status of services in EU-funded research programmes and in particular to provide input to the preparation of the forthcoming 8th Framework Programme (Horizon 2020 – the Framework Programme for Research and Innovation). In addition, the aim is to guide national and regional funding organisations.

1.2 Scope and emphasis

The scope of the report is broad. No particular application area (industry branch) has been emphasised or left outside the scope of the study. Both theoretical (methodological, conceptual, etc.) and applied research and development themes have been addressed.

Due to the vast scope of the topic, however, setting of priorities proved necessary. In this report the greatest emphasis has been placed upon research themes that

- Are generic in nature and therefore potentially relevant for many application areas,
- Relate to major socio-economic challenges and/or objectives of Europe,
- Have to do with major technology trends especially in the field of ICT, or
- Were emphasized by the representatives of the participating RTOs.

1.3 Methods

The work was managed by VTT Technical Research Centre of Finland and was conducted in association with the following AERTOs member organisations (referred to as partners):

- Tecnalia (Spain),
VTT and its partners provided the main input to the process. Input was generated by means of on-site interviews and workshops (participants are listed in Appendix 1). Supporting methods included review of relevant research and policy papers, identification and review of selected technology platforms (Appendix 2), and exchange of information with the EPISIS network of national funding agencies. The partners also elicited comments from selected industry associations in their countries.

Workshops to support data acquisition and analysis:
- VTT, Finland: 3 Nov 2010 (RTO workshop)
- Tecnalia, Spain: 22-23 Nov 2010 (RTO workshop)
- TNO, Netherlands: 29-30 Nov 2010 (RTO workshop)
- Fraunhofer IAO, Germany: 8 Dec 2010 (RTO workshop)
- Fraunhofer ISI, Germany: 9 Dec 2010 (RTO workshop)
- Sintef, Norway: 20 Jan 2011 (RTO workshop)
- VTT, Finland: 26-27 Jan 2011 (Management group meeting and general workshop)
- TNO, Netherlands: 17-18 May 2011 (Management group meeting and general workshop)
2 EU innovation policies and Framework Programme performance: Implications

2.1 Policy considerations

A report by OECD (2005) underlines the importance of services in the further economic growth of developed countries. The report lists a number of issues hampering the development of service economy, including closeness due to anticompetitive legislation and hidden protectionism, barriers to foreign direct investment, high labour taxation, and rigid labour markets. According to OECD (2005) it is important to provide a fiscal environment which is conducive to the growth of services, as services will play an increasingly important part in the growth and prosperity of the world in the years to come. The statements of the report are in line with those of Roxburgh et al (2010). Both reports suggest reforming the labour market and opening international competition in trade and investment in services to unlock the potential in services and to boost economic growth (OECD, 2005; Roxburgh et al., 2010; Smart work 2010).

The overall approach to policy formulation should be holistic, encompassing industrial and economic policies, research policy and regional development policies to capture the complexity of the systemic issues at hand (Koch et al. 2003, Koch and Oksanen, 2003). For the industrial actors the departmental boundaries within and between governmental actors are of no interest; they just need to get things done. This view of Koch et al. (2003) found support in the industry interest group meetings. Policy objectives should not be reduced to reaching a certain level or figure on a particular scale, instead they should point towards the desired direction (Koch et al. 2003). Furthermore, Koch et al. (2003) state that innovation policies should support a systemic view on innovation with focus on increasing competence, not on producing inapplicable information. And finally, there is a need for interdisciplinary research despite the inherent challenges of interdisciplinary work, for there is broad consensus that the truly unique and most valuable insights will come from bringing together diverse expertise and perspectives around real world opportunities and challenges (CLS 2010).
2.2 EU Framework Programme performance

Since one of the major objectives of this SRA is to promote the stature of services research in Horizon 2020 and to issue recommendations for enhancing the effectiveness of research, it is important to understand how FPs in general perform. The findings reported in this chapter are based on two major sources. First, the evaluation report written by Arnold (2005) provides an excellent account of the performance of FP4, FP5 and partly FP6, based on a meta-analysis of impact reports covering the period of 1999 to 2004. Second, the Green Paper published by the European Commission in February 2011 (COM(2011) 48) summarizes the key findings from the evaluation of FP7, but also the Competitiveness and Innovation Framework Programme (CIP), European Institute of Innovation and Technology (EIT), and the use of the Structural Funds. In addition, we have made use of the feedback generated in industry workshops as well as personal experiences of researchers who have participated in EU-funded research projects.

2.2.1 Goals and impacts

Analysis of FP5 suggests that the activities and goals defined in research terms are broadly consistent with higher-level socioeconomic goals of the EC. The goal hierarchy is generally specified in terms of research and knowledge.

Technical goals at the bottom of the goals hierarchy are more clearly defined than socioeconomic goals at higher levels but the ‘intervention logic’ that should connect the two is not explicit. This means that the expected contribution of FPs to the socioeconomic goals has mainly been based on common beliefs rather than evidenced influence mechanisms.

This burden of proof has lately been assigned to the proposers. The project proposal shall contain a detailed assessment of the expected social and economic impacts of the project, as well as detailed dissemination and exploitation plans.

Socio-economic effects are the primary justification for the FPs, but are very hard to measure. The reasons for this are the methodological difficulties of doing so and, in many cases, the timing of the evaluation relative to the effects it would be desirable to measure. Arnold (2005) calls for a systems view of causality. Neither FPs nor their components can alone cause the major changes in the European Research and Innovation System that are envisaged e.g. in the
ERA, Lisbon and Barcelona agendas. FPs may be necessary, but they are unlikely to be sufficient alone. It is also important to pay attention to ‘portfolio impacts’, and not to imagine that individual project impacts have much meaning.

2.2.2 Incentives to participate, perceived benefits

The so called Knowledge Infrastructure participants, such as universities and research institutes, attach much higher importance to FP participation than do industrial participants. For research institutions, the FP is an important source of operating revenue. Other important motives to participate include opportunities to establish new networks and to achieve knowledge-oriented objectives. For companies, participation is a means to other ends. Unlike members of the Knowledge Infrastructure, companies tended to regard the FP as a more marginal source of funding.

An important as well interesting question is how different stakeholders, such as research institutes and companies, perceive to have benefitted from their participation in FPs. Generally, participants say that the benefits of participation outweigh the costs, though the academic community is consistently more positive about this trade off than industry.

The FP5 Finnish University Impact study found, however, that respondents representing more application-oriented fields were more satisfied with EU programmes than the respondents from more basic research-oriented fields. This suggests that either the so called research and technology organizations or RTOs that operate in the field of applied R&D are best equipped to take advantage of the FPs or, alternatively, the research programmes and calls of proposals get tailored to the specific needs and expectations of RTOs.

On the other hand, Arnold (2005) found that SME participation is less successful than that of big companies and produces smaller impacts. In general, the role of SMEs in the FPs remains problematic. There has been long-standing concern that SMEs are disadvantaged in the FPs and derive fewer benefits than big companies. Involving SMEs and large firms in RTD programmes involves different kinds of risk. The economic fragility and often limited managerial capacities of SMEs bring about a significant project risk. Luukkonen (2002) argues that big companies are in the FPs to get knowledge, while SMEs are looking for markets. In much of the FP, SMEs fare worse than larger companies.
Taken together, Arnold’s (2005) findings suggest that FPs are better at delivering the ‘softer’ knowledge and networking benefits sought most by the universities and public research institutes, and is less able to deliver the more concrete, commercially-oriented outputs and benefits desired by some parts of industry, especially SMEs.

2.2.3 Identified success factors, dissemination of results

The FP5 Impact Growth study found that there were two groups of successful projects. One was moderately ambitious, close to market and product-oriented. The other was technically complex, high risk, long term and involved a high proportion of large companies.

Two earlier evaluations suggest that larger networks such as those promoted by FP6 may be less effective than smaller networks. The FP4 Impact Biomed2 assessment states that scientific quality in the programme was negatively related to the number of partners in a project, and that the quality of the larger network projects was problematic. The FP5 Impact Growth study also found that larger networks (averaging 16 partners) generated limited impacts, compared with smaller ones.

RTD programmes like the FPs are often criticised for inadequate dissemination of results, and some such criticisms appear in the FP evaluations. Arnold (2005) points out that in part this criticism arises from a misunderstanding, based on the popular ‘linear model’ idea that research produces results, which necessarily (should) lead to development and commercial exploitation. The implication of this model is that results should be broadcast widely, so that they have a high probability of reaching those who can use them. However, the experience of RTD programmes over the past twenty or more years shows that this is a misunderstanding. “There is little point in such ‘broadcasting’ because most research results are irrelevant to most people most of the time” (Arnold, 2005, p. 20). Some evaluations therefore stress the importance of ensuring that end users and other ‘problem owners’ play a role in project definition, linking the production of research results directly to those able to use them.
2.2.4 Remaining challenges and development needs

The Green Paper published by the European Commission in February 2011 (COM(2011) 48) was devised to launch a public debate on the key issues to be taken into account for future EU research and innovation funding programmes.

The Green Paper summarizes the key findings from the evaluation of the key EU instruments to support research and innovation in Europe, including 7th Framework Programme, but also the Competitiveness and Innovation Framework Programme (CIP), European Institute of Innovation and Technology (EIT), and the use of the Structural Funds. The reported results are mainly positive. However, a number of shortcomings and deficiencies were also identified. The Commission argues for the following improvements for future programmes:

- Clarifying objectives and how they are translated into the supported activities, while maintaining flexibility to respond to emerging policy needs.

- Reducing complexity. Over time, EU research and innovation programmes have expanded the set of instruments leaving an impression of catering to too many objectives and spreading funding too thinly.

- Increasing added value and leverage and avoiding duplication and fragmentation.

- Simplifying participation by lowering administrative burdens, reducing time to grant and time to payment and achieving a better balance between cost and trust based approaches.

- Broadening participation in EU programmes. While there is important SME participation in the CIP, the FP7 interim evaluation highlighted the need to further stimulate industry and SME involvement.

- Increasing the competitiveness and societal impact from EU support. This would require better uptake and use of results by companies, investors, public authorities, other researchers and policy makers.
In addition, we want to highlight two additional challenges, or at least big question marks. The first one relates to the competition logic that applies to EU funded research programs and calls for proposals. During the industry workshops it was pointed out that EU should introduce more flexibility into the whole process. In particular, it should not define the contents of calls for proposals too precisely or evaluate incoming proposals too rigidly, because that blocks up the road from interesting proposals that do not exactly fulfil the predefined criteria. Instead of the match between the proposal and the predefined criteria, the particular strengths of each application should guide funding decisions. This should also encourage research community representatives apply creative thinking, seize topical issues that have not yet found their way to the calls for proposals, and diminish the perceived need to ‘play safe’ (i.e. to maximise the hit ratio). Currently far too much time, money and energy is invested in activities that do not contribute to the quality or applicability of research.

The second phenomenon that deserves much more attention is ‘project economy’. European RTOs and to a large extent also universities and polytechnics are increasingly dependent on external (both private and public) project funding. The consequences are diverse. One of them is that a project is no more merely a way of organizing work. Instead, it has become RTOs’ core offering, and fund-raising constitutes an ever-increasing proportion of their activities. While part of this money and related work contribute to the quality of proposals and perhaps also to the quality of the final outcome, it is equally important to acknowledge that the costs of this marketing work are effectively assigned to other ongoing projects. Arnold (2005) states that almost no work has been done to estimate the aggregate cost of FP calls to proposers but refers to FP4 Impact Germany report according to which such costs are equal to about 25% of the FP budget. In consequence, the time spent on actual project work decreases, at least in relative terms. This may severely diminish the project partners’ incentives as well as ability to engage into any activity that does not directly contribute to their own (project) business, such as dissemination of the proceeds of the work outside the project framework.

### 2.3 Common Strategic Framework for research and innovation

The Budget Review identified a way forward in this respect through the development of a Common Strategic Framework. This would cover all relevant EU research and innovation funding currently provided through FP7, CIP and EU innovation initiatives such as the EIT on the basis of coherent goals and shared strategic objectives (COM(2011) 48).
The Common Strategic Framework aims at making EU funding more attractive and easy to access for participants. It also strives for administrative simplification. Flexibility and speed of delivery are also essential to attract business stakeholders (in particular SMEs).

The three core elements of the framework are tackling societal challenges, creating industrial leadership and competitive frameworks, and securing excellence in the science base. The most important societal challenges identified by the Commission are health, demographics and wellbeing, food security and sustainable bio-resources, secure, clean and efficient energy, smart, green and integrated transport, resource efficiency and climate change, and inclusive, innovative and secure societies. In all these areas the development of both private and public services is a prerequisite for harvesting the potential of new technologies.

The High-Level Expert Group on Key Enabling Technologies has recently expressed its concern on the long-term competitiveness of Europe and the difficulty of translating new ideas and knowledge into marketable products and services (KET 2011). The Expert Group has identified six key enabling technologies (KETs) that are perceived to be central for Europe’s industrial innovation, competitiveness and growth potential: nanotechnology, micro and nanoelectronics, advanced materials, photonics, industrial biotechnology and advanced manufacturing systems. In addition to particular technology areas the Commission pays increasing attention to the functioning of the European business ecosystem. Especially innovation in SMEs, enhanced access to risk finance, support for crossing the valley of death, intellectual property rights governing EU research and innovation funding, and the use of public procurement to stimulate innovation have been emphasized (COM(2011) 48, KET 2011).
3 Trends affecting services and research needs

It is important to identify and understand the socio-economic and technological trends that impact upon the development of services both directly and indirectly, and to acknowledge what is actually happening in various service sectors today. The trends will help us anticipate, to a certain degree, what is going to happen in the foreseeable future. Since the time spans in research and development are long, the recommendations given today shall also address the realities of the future that may not yet be visible or may not yet play any major role in today’s economic landscape.

The identified trends have been divided in the following categories:

1) Megatrends in global economy and production,
2) Megatrends in private consumption,
3) Megatrends in ICT and services and
4) Generic service-related trends.

Most of the trends in the first two categories have been condensed and further processed from Ahola and Palkamo (2009). The trends in categories three and four have been identified and formulated by the project team in association with AERTOs partner organizations.

We have tried to illustrate the identified trends by means of four fictional stories. The stories lean on some of today’s most visible trends, especially in ICT, but take them a bit further to an unknown territory.

3.1 Megatrends in global economy and production

The major trends in this category relate to the growth of world economy, deepening division of labour and fragmentation of value chains, rising prices of energy and raw materials, ownership of infrastructure, insecurity in the job markets, changing allocation of R&D investments, and pressing environmental problems.

<table>
<thead>
<tr>
<th>Trend</th>
<th>Relevance for services</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1. World economy continues to grow. The</td>
<td>The ability to export services / to serve</td>
</tr>
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</table>
growth is generated mainly by China, the other BRIC countries and rest of Asia, but the pace of growth will gradually decrease. customers globally becomes a prerequisite for success for European service providers. Services are more difficult to copy than technologies or products, which may strengthen the competitive position of European companies in China.

<p>| G2. Newest phase of globalisation will deepen the global division of labour. Value chains get increasingly fragmented. Economic profitability will dictate the geography of the specialised know-how. Scale advantages will be significant in the global network. | Increased demand for various coordination and support services and supporting ICT. |
| G3. Rising energy prices pave the way for alternative energy technologies. Alternative technologies which have been developed for a long time but have not been profitable so far, will gain momentum. The demand for energy saving products and services exceeds the supply. This may lead to a stock market bubble similar to IT bubble of 1995-2000. | ICT will enable industry sectors to be connected smartly (smart grids, smart manufacturing, smart buildings and smart lighting) to provide sustainable energy services by combining dynamic tariffs, smart metering, consumption forecasts and energy trading. |
| G4. Infrastructure slides away from national ownership in many countries. Internationalisation of the ownership of strategically important companies has improved companies’ efficiency, but also risen uncertainty about how important sectors of society will function in times of crises. | Contingency planning to assure social robustness in case of a major crisis or system failure will call for cooperation with public and private actors. |
| G5. Insecurity in the job market, temporary assignments, risk-sharing with the employer. | Those who can market their capabilities as services will benefit. Better possibilities for SMEs to sneak into the market. |</p>
<table>
<thead>
<tr>
<th>G6. Developed countries’ share of the world’s R&amp;D investments decreases. Developing countries invest more in R&amp;D, and an increasing share of the R&amp;D investments made by companies headquartered in the developed world will be made in developing countries. This is because of tax incentives and the generally lower cost of skilled labour.</th>
<th>This poses a development challenge for Western R&amp;D people and institutes. They need to develop their competitiveness in the eyes of their present and potential future customers in terms of the breadth and depth of their skills, as well as effectiveness as a business partner (i.e. service provider). International R&amp;D management becomes a sought after skill.</th>
</tr>
</thead>
<tbody>
<tr>
<td>G7. Part of production returns to the developed countries. Some EU member countries, the USA and Japan can stay competitive in selected industrial sectors by continuously investing in technology development and in smart production systems. This has already been seen in ICT services, and the trend will accelerate in manufacturing once product prices will better reflect the costs associated with the environmental impact of production.</td>
<td>Role of industrial services will strengthen: the marketing, commissioning, maintenance and operation of industrial goods that are produced in Europe but brought into service increasingly elsewhere will require a well-functioning service infrastructure.</td>
</tr>
<tr>
<td>G8. Environmental problems will limit the growth in developing countries. The economic growth based both on cheap labour and neglecting environmental charges will face the limit. Accumulation of environmental problems will force the authorities to tackle the problem in China and elsewhere. This decreases their competitive edge in the short term and boosts the necessity for smart production systems.</td>
<td>The relative importance of sustainability as a purchase criterion and business planning premise will increase. There is a need for common metrics for sustainability as well as related research and services. Businesses incorporating sustainability in value creation and capture gain advantage.</td>
</tr>
</tbody>
</table>
3.2 Megatrends in private consumption

The major trends in this category relate to growth of population, consumption as a lifestyle, geographically separated production and consumption, the conflict between mass production and individualism, digital communalism and the power of peer opinion, shortening economic life-cycles of and the increasing demand for electronic devices, the diminishing role of the public sector as a service provider, increasing value of spare time, and the polarization of markets.

Selected megatrends in global economy and private consumption and their mutual interconnections have been illustrated in Figure 1. Please note that the model is only indicative and that it many important factors and influence mechanisms have been omitted.

<table>
<thead>
<tr>
<th>Trend</th>
<th>Relevance for services</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1. Growth of population.</td>
<td>The overall demand for products and services will continue to increase, but development is uneven. In emerging economies demand is growing fast, while in the developed countries growth is slow or stagnant. Major global firms increasingly target the emerging middle classes of the emerging countries.</td>
</tr>
<tr>
<td>P2. Consumption as a lifestyle expands everywhere. Almost all human existence and activities can be analysed and interpreted through consumption. Global information networks and people’s mobility promote the dispersion of commodities and influences.</td>
<td>Boost for retail, transport, e-commerce and personal banking and finance (e.g. consumer credit) services.</td>
</tr>
<tr>
<td>P3. Production and consumption are (increasingly) geographically separated. National and local characteristic are difficult to take into consideration in this kind of production model. At the same time, both This trade-off between effectiveness and efficiency boost a range of economic activity, including market research, product design (to support configurability), aggregation of global and localised content</td>
<td></td>
</tr>
<tr>
<td>CORPORATE AND INDIVIDUAL CUSTOMERS WANT</td>
<td>(ICT-BASED PRODUCTS), LOCALISED MARKETING, ETC. GENERATING PROFIT FROM SERVING THE LONG TAIL OF CUSTOMERS CALLS FOR EFFICIENT SALES, PAYMENT AND LOGISTICS SYSTEMS.</td>
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<td>----------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
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<tr>
<td>PRODUCTS AND SERVICES THAT CAN BE TAILORED TO THEIR OWN NEEDS. PRIVATE CONSUMPTION IS STRONGLY DIFFERENTIATED AND FRAGMENTED.</td>
<td>P4. CONSUMERS WANT NEW KIND OF COMMUNALITY. HUMAN BEINGS CONTINUE TO BE SOCIAL ANIMALS DESIRING TO BE PART OF A GROUP. GLOBAL VIRTUAL COMMUNITIES BASED ON SHARED INTERESTS AND MAINTAINED OVER THE INTERNET ARE REPLACING LOCAL COMMUNITIES BASED ON THE GEOGRAPHY.</td>
</tr>
<tr>
<td>P4. CONSUMERS WANT NEW KIND OF COMMUNALITY. HUMAN BEINGS CONTINUE TO BE SOCIAL ANIMALS DESIRING TO BE PART OF A GROUP. GLOBAL VIRTUAL COMMUNITIES BASED ON SHARED INTERESTS AND MAINTAINED OVER THE INTERNET ARE REPLACING LOCAL COMMUNITIES BASED ON THE GEOGRAPHY.</td>
<td>SOCIAL MEDIA FUNCTIONS / CAN BE USED AS A MARKETING CHANNEL FOR NEW PRODUCTS, A RECRUITMENT SITE, A SOURCE OF NEWS AND INFORMATION ON TOPICAL POLITICAL AND SOCIAL TRENDS AND PHENOMENA, ETC. ISSUES REGARDING FREEDOM OF EXPRESSION, SECURITY, PRIVACY, OWNERSHIP OF CONTENT, ETC. WILL EMERGE.</td>
</tr>
<tr>
<td>P5. OTHER CONSUMERS’ VIEWS ARE USED AS A REFERENCE. INTERNET HAS A GREAT IMPACT ON CONSUMERISM. ITS FORMS AND METHODS ARE CHANGING. AN INDIVIDUAL CONSUMER BECOMES A SIGNIFICANT INFORMANT TO OTHER CONSUMERS. GLOBAL DISSEMINATION ON INFORMATION AND TENDENCIES ACCELERATES.</td>
<td>PEER REVIEW IS GRADUALLY EMERGING AS DE FACTO EVALUATION METHOD FOR A NUMBER OF PRODUCT AND SERVICE CATEGORIES, INCL. HOTELS, RESTAURANTS, INTERNET BROKERS, NURSING HOMES, BOOKS, ETC. SERVICE PROVIDERS NEED TO TAKE PUBLISHED REVIEWS SERIOUSLY. FALSIFIED REVIEWS TO BOOST OWN SERVICE OR TO DEFAME THE COMPETITOR’S BECOME COMMON.</td>
</tr>
<tr>
<td>P6. IMMATERIAL CONSUMPTION INCREASES THE OVERALL CONSUMPTION. IN PARTICULAR, THE CONSUMPTION OF IMMATERIAL PRODUCTS AND SERVICES (DIGITAL CONTENT, TOURISM, ETC.) BOOSTS THE DEMAND FOR NEW DEVICES, INFRASTRUCTURE AND ENERGY.</td>
<td>THE DISTINCTION BETWEEN GOODS OR MATERIAL PRODUCTS AND SERVICES OR IMMATERIAL PRODUCTS INCLUDING TECHNOLOGY (IPR) BECOMES FUZZIER AND ARTIFICIAL. THE SALES OF MATERIAL PRODUCTS, SUCH AS MOBILE PHONES, BECOME INCREASINGLY DEPENDENT ON THE SUPPLY OF SERVICES THAT CAN MAKE USE OF THAT PRODUCT.</td>
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services, causing interoperability problems. Consumption as a lifestyle adds to this trend. the impact on GDP and employment will be positive. Sustainability-wise the question is: how can we generate economic growth without increasing the consumption of raw materials or energy?

<table>
<thead>
<tr>
<th>P8. Public sector’s share of service provision decreases. Private sector, third sector and the households will cover part of the services provided by the public sector. Especially the cutting down of public health care services leads to self-care and voluntary work.</th>
<th>Exploitation of automation and remote consultation for providing services will increase. Increased supply and demand for private sector offerings and various public-private partnership arrangements.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P9. Spare time becomes an increasingly valuable asset.</td>
<td>More money is spent for spare time activities. Expenditure for leisure has increased even though the amount of effective spare time has remained stable. Households buy housework and cleaning services. This has a positive impact on GDP.</td>
</tr>
<tr>
<td>P10. Increasing differences in the standard of living combined with the increasing economic insecurity of the middle class (stagnant or decreasing purchasing power).</td>
<td>Product and service markets will polarize further into 1) tailored, flexible premium services that are available for premium price, and 2) standardized, automated bulk services that cater for the cost conscious, i.e. the majority of the people. The divide is most evident in industries where personal service and professionalism have traditionally made the difference between a ‘good’ and a ‘bad’ service, e.g. in health care, legal services, banking, hospitality, and construction.</td>
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</table>
3.3 Megatrends in ICT and ICT-enabled services

Information and communication technologies have had and are continuing to have a profound impact on the development of services in almost every sector of society. ICT can enable completely new services, boost the efficiency of service production, enhance the availability of services, and increase the profitability of service business in domains characterised by knowledge-intensiveness or routine work. The identified trends were divided into six subcategories: data intensiveness, decentralized system architectures, fusion of ‘real’ and ‘virtual’, disappearing (or hiding) human interface, web-based organization of work and life, and increasing need to manage social robustness.
Selected megatrends in ICT and ICT-enabled services and their mutual interconnections have been illustrated in Figure 2. Please note that the model is only indicative and that it many important factors and influence mechanisms have been omitted.

### 3.3.1 Data intensiveness (I1)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Relevance for services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service providers can automatically collect and analyse a lot of customer/process data.</td>
<td>In the B2B sector this enables e.g. services based on preventive diagnostics, proactive maintenance, and operational guidance. Both in the B2B and B2C sectors accumulating information may be used to support adaptation, customization, personalization, and individualization of services. It also helps develop new offerings. Data becomes a valuable asset and as a result data ownership, privacy and security issues emerge (especially in case of social media). Security and privacy are very relevant factors affecting the adoption of ICT based services. Demands for perceived security and privacy of sensitive personal information are becoming essential for new business models.</td>
</tr>
<tr>
<td>A lot of unfiltered data available free of charge.</td>
<td>As there are fewer data monopolies, it gets harder to charge for information. However, filtering data takes time, and its reliability can be questionable. This opens new business opportunities for related services, such as data mining and analysis, validation, compression, archiving and publication services (concrete examples: business intelligence and market research businesses).</td>
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</table>
### 3.3.2 Decentralized system architectures (I2)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Relevance for services</th>
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<tbody>
<tr>
<td>Various cloud-computing frameworks, systems consisting of other systems, services</td>
<td>Increasing complexity adds to the challenge of ensuring interoperability of various systems, devices and application, and raises concerns for quality of service, especially in case of mission critical applications. The big question is: who sees a business opportunity in solving the emerging problems, i.e. packaging the ‘product’ for the customer? Service-oriented architectures and modelling language tools are likely to emerge to help solution building.</td>
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<tr>
<td>built on other services, and the semantic web become common. At the same time, the decomposition of applications, platforms, devices and services proceeds. The underlying drivers include fragmentation of value chains in many lines of business, as well as development of competing technologies and applications.</td>
<td></td>
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### 3.3.3 Fusion of ‘real’ and ‘virtual’ (I3)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Relevance for services</th>
</tr>
</thead>
<tbody>
<tr>
<td>We are proceeding towards the Internet of Things: sensors and processors are being installed in many products, paving the way for ubiquitous computing.</td>
<td>Enhanced capabilities for virtualization and augmented reality enable a range of business and entertainment applications. New technologies are increasingly applied to combining live, recorded and computer-generated materials (e.g. in broadcast media, such as TV), as well as commercial and non-commercial content (a practice that has traditionally been typical of film and print media), and to creating immersive digital environments (artificial, interactive, computer generated worlds) e.g. for professional training, product demonstrations and entertainment.</td>
</tr>
</tbody>
</table>

Exponential development of computing                                                                                                           | The gap between the feel and touch of real                                                                                                                                                                                                 |
power. and virtual gradually vanishes in some application areas.

### 3.3.4 The human interface goes into hiding (I4)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Relevance for services</th>
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<tbody>
<tr>
<td>Striving for productivity means more automation and less personal service.</td>
<td>Almost everything possible gets automated. This is characterized by a transition from ‘service’ to ‘self-service’, from shopping to on-line shopping, etc. During transition periods customer service agents will help the customers adapt to the new systems. In the future perhaps only privileged customers (i.e. those who are most profitable to the service provider and who demand personal service) may have access to personal service. For service providers this is a strategic question determining the potential customer base and profitability for years to come.</td>
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| The systems get more advanced and complex, and system development and maintenance will require increasing investments from service providers. | The development of easy-to-use and robust systems will remain a major challenge. There is a trade-off between development costs and opportunity costs (the costs caused by non-functioning service, e.g. lost revenue or damaged brand reputation). IT service providers are likely to benefit. |

### 3.3.5 Web-based organization of work and life (I5)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Relevance for services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to all relevant information, products, private and public services and ‘players’ is</td>
<td>Private and business networks are increasingly formed and maintained on the</td>
</tr>
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</table>
generally possible over the Internet. Internet, too. Businesses harness user/consumer communities to generate content (open innovation, crowd sourcing). The line between business and private gets increasingly blurred.

Mobility increases. Mobile (wireless) use of Internet services combined with high bandwidth, robust connections, automated networking and a range of terminal devices suitable for mobile Internet use, becomes a norm. This will and is already having a profound impact on the organization of work and consumption of Internet services. The need for permanent office space decreases, while working in flexible virtual offices, in the customer’s premises, at home and in trains and airplanes increases. This also creates new challenges for IT support.

### 3.3.6 Increasing need to manage social robustness (I6)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Relevance for services</th>
</tr>
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<tbody>
<tr>
<td>Dependence on ICT increases the risk of system failures that may paralyze essential societal functions.</td>
<td>Regulation for social robustness, security and privacy may become a necessity. This boosts / necessitates the creation of new services that are designed to be more robust or help cope with increasing uncertainty and possible blackout situations.</td>
</tr>
</tbody>
</table>
Figure 2. Selected megatrends in ICT and ICT-enabled services.

3.4 Generic service-related trends

Generic service-related trends encompass a shift from “operand resources” (value in property) to “operant resources” (value in use) meaning that service, rather than goods, will be the basis of economic and social exchange. The trends identified in this section relate to the
characteristics of services business in general, reflecting the ‘fundamentals’ or ‘logics’ that are perceived to guide the development of services for the foreseeable future. The key words are service-dominant business logic, sustainability (as a sales argument and a customer requirement), flexibility and efficiency, and marketing imperative.

3.4.1 Service-dominant business logic gains ground (S1)

- Customers demand value-in-use, while service providers struggle to develop pricing models based on the value delivered.

- Especially B2B offerings become more complex. The vendor is often expected to take more responsibility for the functioning of the product/service sold, especially in case of expensive investment goods and IT system deliveries. In general, (physical) goods are more often perceived as elements of the offering, instead of service being perceived as a supplement to the physical product. Example: technology/software/infrastructure as a service.

- The underlying root cause is dynamic value chain: There is a lot of intra-company trade, head-and-tail type of companies (manufacturing outsourced), etc.

- Example: A power plant sold to the customer, e.g. a utility company, using the build-operate-transfer model. The supplier builds the plant and brings it into service, operates and maintains the plant, and charges the customer on the basis of MWhs generated. The supplier would feel the strain caused by possible delays or outages directly in its own purse, since the customer wouldn’t pay for the work but for the results. After a certain period of time, during which the supplier must earn enough to make a profit, the plant is transferred to the utility company. After the transfer the supplier may continue maintaining the plant, and the charge would correspond to the service level agreement.

3.4.2 Sustainability becomes a necessity (S2)

- The concept of sustainability has gradually evolved to cover not only environmental but also social, economic and cultural sustainability. On the one hand, market demands for sustainability are increasing. Sustainability can be expected to emerge as an important feature of most products and services in the mid-term future. Also regulation affects the situation: non-sustainable products and operating modes become gradually expensive or illegal (at least in the West).
Sustainability is not yet core driver for service innovation (the exception being sustainability-supporting services). Moreover, economic cycles and standard of living influence market demands and regulatory approaches. Many developing countries have different market dynamics: sustainability is luxury, and only few are willing to pay for it.

Example: The striving for the reduction of CO₂ emissions has spawned a range of R&D projects aiming at commercial applications, including the neutralisation of carbon dioxide using feldspar (WO/2010/000937). The underlying idea of this Finnish invention is to introduce a much more affordable alternative to the relative expensive carbon storage technologies, and to turn coal-fired power plants into environmentally friendly units – without replacing coal! Service plays a crucial role in the commercialisation process: if you can provide the customer with a solution instead of a technology, your chances of success are manifold. Also the convergence of the electric grid, metering and home automation will open new markets for energy service companies. They can optimize the purchase and consumption of electricity for their customers.

3.4.3 Flexibility in service development and provisioning (S3)

– ICT can be used to increase the productivity of service development and provisioning by various means. Widely applied technologies include e.g. modelling, simulation, and modularisation.

– In B2B markets the trend is towards tailoring service packages according to actual customer needs and offering different terms of contract for different customers. This is a must for industrial customers, who also expect scalability and swift response.

– In B2C markets the trend is towards standardized mass offerings due to profitability challenges. Flexibility can be offered on the condition it can be built in automated systems; otherwise flexibility will cost a hefty premium.

– The striving for increased flexibility and cost effectiveness calls for increasing attention to measurement and optimization of the value of the service (cost/benefit ratio).

– Example: Many Internet service providers offer virtual server and web hotel services that are easy to purchase, configure and maintain over the Internet using an ordinary web browser and standard Microsoft utility applications, such as Remote Desktop Connection. The price depends upon the characteristics and performance of the system, determined by
the operating system, processor, amount of memory, disk space, backup runs, and so forth. Web hotels typically offer domain registration, and the package typically contains several mailboxes. If the customer needs more or less resources, he/she can typically upgrade or downgrade the package online by pushing radio buttons and pressing the ‘purchase’ or ‘confirm changes’ button. The same flexible subscription management logic is applied in many other businesses, too, e.g. dating and networking sites, and market data and news sites.

3.4.4 Marketing imperative (S4)

- Everyone is into services. Getting visibility is becoming increasingly difficult. Companies can be expected to invest time and money in marketing and differentiation.

- Facilitating the purchase decision is important and may be supported by various means, such as virtualization, testability, ‘gamification’, etc.

- Service providers fiercely look for ‘lock-ins’, making it difficult/expensive for the customer to change the service provider.

- The situation has resulted in opportunistic utilization of buzz words and ‘marketing norms’ (e.g. ‘green’) irrespective of real substance.

- Example: Telecom operators are fiercely fighting for the market share. Differentiation is difficult because the core product, mobile connectivity, is immaterial and bulk. Typically there are no notable differences in bandwidth, price or other terms of contract. All major operators also provide a range of Internet services, including TV channels, movies and online games, they lease and sell computers and provide additional disk space on their servers, just to mention a few examples. But how do they compete? They invest heavily in commercials. In Finland, for instance, you may see two-minute-long TV ads at prime time. No effort has been spared to capture the viewers’ attention: the viewers can see Miami Vice type-of-guys and girls shovelling banknotes into the fireplace, nutty professor look-alike types coaching llamas on the agility track, and men in black suit diving into the swamp somewhere in Finland and popping up somewhere in Nepal. Just to catch the attention of and to create a good feeling for active people. For customer retention reductions offered for packages and long-term subscriptions play an important role.
3.5 Trends and people – What does all this mean in the longer term?

Peter – An ordinary knowledge worker

Peter, an energetic knowledge worker employed by a government research agency, has for a long time had a secret dream: to find a job and work outside his home country for a while. He has scanned for open vacations, but has not found anything interesting so far. One day he decides to upload his CV on an international recruitment site and describes what sort of work he is actually looking for. The service will automatically search for suitable open positions and inform Peter on possible matches. Meanwhile, he continues his work at his current position.

One day he receives a notice on several open vacancies that match his criteria. One which really draws his attention is far away in the North. He contacts the company and gets an invitation for an interview. Peter starts looking for an affordable and sustainable travel mode. Since the travel and accommodation costs are closely related to the associated environmental strain, such as the length of the trip, use of fossil fuels and resulting CO₂ emissions, careful consideration may save a lot of money. He uses a dedicated service to compare alternative travel plans and finally selects the most advantageous one, books the trip and pays it over the Internet.

Instead of taking a taxi to the airport he hires a car from the local car pool - as he was advised to do by UniversalTravelPlanner, a service provided by a company that is owned by the leading importers of Chinese cars. En route to the North he suddenly reckons that he had left his house unattended. Since he is living in an area where crime is rampant, he picks up his mobile phone, opens the browser and starts looking for companies offering home security services.

Web services were very developed, so it is easy to compile a comprehensive list of service providers in almost any line of business. He first chooses a promising company, then checks the company background and credentials using a dedicated service, ConDetector, and after receiving a clearance makes an agreement and sends the electric key code to the security company – still using his mobile phone. The security company had now have access to his home and could install the necessary control and monitoring systems to enable automated surveillance of the house.

The service provider also provided Peter with a remote access to the installed security systems. Now Peter can, for example, monitor his home using his personal laptop and view live footage from the installed security cameras. He also decided to pay a small extra fee to get rid of the annoying commercials that filled the screen 25% of the time.

Peter shines in the interview and gets the job. He is very happy, and he lets all his friends to share his happiness through a social networking site (a famous service among expats, foreign students and other international travellers called BaseBook). However, happiness soon gives away as Peter realizes that there are many things that he urgently needs to deal with, such as opening a bank account, arranging long-term accommodation, understanding tax regulations, and clarifying his rights to use publicly-funded medical services. His new
employer, who had never before hired a foreigner, could not really help him much. All he learned from his new employers was that the administrative department will deduct the income tax directly from his salary.

To Peter’s surprise an info desk at a local supermarket proved the most useful source of information for him. The local authorities had set up the service a few years ago to assist foreign students, and had not yet axed its allowance despite mounting cost-cutting pressures. The law students behind the desk knew pretty much everything Peter wanted to know, and they even invited him to their party. “Nothing beats personal contacts” he mumbled joyfully while walking back to his not-so-luxurious but affordable downtown hotel.

Peter was not enjoying the benefits of an expat, since he had concluded an ordinary local employment contract. However, his salary was relatively good, and he had just inherited his aunt, so he decided to look for a nice house in a nice area. The only question was whether to rent or buy (there were no restrictions on foreign ownership of residential property). A consultation with a local real estate agent swiftly convinced him about the benefits of purchasing property: he would avoid paying excessive rents and could easily sell the house whenever he wanted – on a much higher price.

The agent helped Peter find a conveniently located house allowing him to use public transportation when commuting between his house and his office. The agent also provided evidence on the energy rating and emissions of the building, affecting the level of the Sustainability Promotion Tax that was passed by the Parliament a few years ago to promote energy efficiency and the use of renewable energy sources in the country. The house was equipped with electric heating, but the agent provided much information on alternative energy systems, such as heat pumps, wood, solar and geothermal energy, that could also be applied to heating and lighting.

Everything went well. After a few hectic weeks Peter could congratulate himself about his new job, that had proved rewarding, and his new home, that was nice and in a nice area. Only one thing was missing and that was Internet connection. The local operator, FastFone, had promised deliver it within six weeks’ time. It still took more than 10 weeks before he got it.

**An advanced grand mom**

An advanced grand mom takes a biking tour with the other members of the family who live 500 km apart. This happens in a virtual environment which is created around an exercise bike in the grand mom’s living room. The year is 2020, but in the virtual environment the year is 2050. This was the special request of the grand mom’s two grandchildren who attend the biking tour with their parents.

The virtual environment contains familiar elements from the grand mom’s and her relatives’ personal lives. The customer may upload personal data, such as photos, videos and text documents but also verbal information, into the system. Users of the premium version of the program are interviewed by the representative of the service provider, SuperReal, either over the phone or in person.
The service provider also purchases customer data from other commercial players, i.e. big companies such as PASSPORT International, a credit card company, for product development and marketing purposes. In the future they will know everything we have done in the past, can successfully predict what we are likely to do in the future, and can also profit from that information in various ways. Based on that data plus artificial intelligence, the program can easily generate plausible future scenarios for its users.

The pedalling grand mom also generates the electricity for the system. Excess electricity can be stored and used to power other household devices.

The biking tour proceeds through the futuristic city of Delft in the Netherlands. The city has changed in many respects but some things are here to stay. They come across Mr Gourmand’s, a famous eatery, and the grandchildren persuade their parents and the grand mom to stop for a ShowStopper meal. The meals are made and served by robots, but the outlet feels otherwise familiar. The decoration includes the rear seat of Oldsmobile 88 Holiday Sedan from 1958 which is hanging from the ceiling.

There is a lot of overt and covert commercial material in the virtual environment. Commercial material is introduced into the system both legally and illegally. Some companies, such as Mr Gourmand’s, purchase advertising space from the service provider, while sometimes hackers and ‘rogue companies’ manage to break into the system and to use it for free to promote their products. In a premium version of the biking program, no added commercials would be shown, barring those introduced by the hackers.

The episodes generated by the program feel very real, and all of them are not very pleasant for the grand mom. Especially recklessly driven and noisy rocket cars make her heart beat nervously. Porn adds can be seen everywhere. And off-putting beggars seem to do their best to besiege unwary passers-by (in the future people belonging to the higher socioeconomic strata just won’t walk or bicycle around, and our grand mom had forgotten to tick the ‘no beggars’ box when starting the program).

It is the biking system that first detects that everything is not ok. Before the grand mom notices the problem by herself, the system concludes that she is about to get a heart attack. As a result, the system automatically launches a series of remedial actions. The system retrieves her medical records from the databases of all public as well as private health clinics and hospitals that the grand mom has visited during the past ten years. The records and the physiological measurement data recorded by the exercise bike are sent to a remote medical diagnosis centre, the local (nearest) heath station is informed about a potential emergency case, and a live connection is created to a doctor on duty.

The doctor contacts the grand mom in the virtual world, tells her the news and requests her to slow down while the diagnosis is ready. The grand mom, however, is not sure whether this happens for real or is generated by the program. Finally she believes the doctor, informs the other family members, and terminates the program. But the events triggered by the tour proceed in the ‘real’ world.
A doctor from the local health station pays a visit to the grand mom. Based on the diagnosis completed by medical computers in India and his own inspections at the grand mom’s bedroom, where she is now having a well-deserved break after the tour, the doctor concludes that there is no immediate danger. Anyways, she gets a referral to a cardiologist for further inspections. The inspection will take place at a private hospital. There are no other options: the public Dutch health care system had proven uncompetitive and was consequently dismantled a few years ago in connection with other cost-cutting measures. The grand mom will have to pay this from her own purse, for she has forgotten to upgrade her health insurance to cover treatments provided by level A+ medical professionals, such as cardiologists. A fraction of the hospital bill will find its way to the service provider, SuperReal, as a commission for customer traction. Such commissions account for around 25% of the service provider’s revenues.

The other family members are relaxing at their home in Paris. While they fell relived after having heard that the situation is under control, they immediately start planning for their next real trip to Delft – in 2020 and not in the distant future. Suddenly the door bell rings. It is a courier from Mr Gourmand’s:

“Excuse-moi Monsieur van den Kieboom, mais il y a une heure quand vous visitez notre restaurant à Delft? Bien, ici les pommes frites que vous avez déjà paye mais oublieriez de prendre, s’il vous plait”.

**The trendy and well-connected**

A single guy in his early thirties, Jürgen, travels around with his friends by car. They are on their way to a concert where they are to meet other people. The car is brand new but nevertheless it breaks down in the middle of nowhere.

However, the car is well-connected, so within a few milliseconds it is already contacting car services and drafting alternative transport plans for its young and restless passengers. The transport plan may be based on either private or public transport – depending on the criteria specified by the user, such as the scheduled arrival to the destination, ability to carry goods, carbon footprint, or sheer comfort. Whichever option is chosen, the car makes the necessary arrangements, for example, calls a taxi, books or changes tickets and reservations, and so forth. So, the breakdown did not flatten out the atmosphere in the car.

The challenges begin if the car’s advanced total communications system, TransOrganiser, fails. In such a case the passengers may even need to resort to their own personal communication devices. In any case, the road authorities already know that the car is on the road side, presumably due to an engine failure. Their system has generated an alarm, indicating that a car has been stopped on a dual carriageway where parking is strictly prohibited.

There has been a lot of talk about the road authorities’ ability to automatically monitor traffic. Many people are irritated because it also enables automated speed surveillance and route tracking. Police occasionally purchases such data – data is not provided free of charge since the road authority and police are separate profit centres.
Many cars may be set to follow speed limits automatically, but the system may fail...or the driver may switch it off by purpose.

Anyway, Jürgen and his friends received full support from their car – even though the guys were travelling outside their home country. They decided to opt for an environmentally friendly contingency plan, so the car booked them to the next InterCity train and provided them with detailed instructions on how to reach the nearest station that was comfortably located just a few kilometres north of their current location. All the guys received tickets to their mobile phones.

Also the insurance company was automatically contacted. The insurance company had recently introduced shared processes and systems with a pan-European car service chain to enable effective customer service and information exchange – initially to support invoicing and claims management. They would immediately start their inspection to determine to what extent they should cover the related expenses, including car tow and repair and the continuation of the trip by other means.

Jürgen and his friends will be late from their appointment. This does not prevent them from being in contact with the people they are about to meet. They are virtually represented by avatars – in the car, but also when they are wading thru a vast swamp to the nearest railway station. This is made possible by the latest WalkMad technology, based on data glasses, Dolby Surround audio, high-bandwidth 4G connectivity, and cloud computing compatibility.

Over the trip our friends also need to eat. Being environmentally conscious they want to eat ecologically produced food. There is a self-service restaurant in the train, where the quality of the food is good although the customer interface is completely automated (it is, however, commonly believed that a very skilled and high moral chef is working in the kitchen). There is a short code for every meal. Customers may check, pointing their mobile phone to the code, how the food has been produced.

Despite the engine failure and other delays Jürgen and his friends manage to arrive at the concert on time. The band represents the predominant music genre which is BedBullTechnoPop, characterized by technology, fancy effects, and energy. Jürgen, like all European trendy and successful people, preferred BedBullTechnoPop – the sole exception being Finland where BedBullRoughGuitar was the dominant music genre.

The music industry in general had undergone a major transformation. Nobody paid for music any more. The bands and artists were completely dependent on advertising revenue and the on-line sales of merchandise. Merchandise was easy for bands and artists to produce, market and distribute, and for consumers to purchase: everything was conveniently managed by BedBullSociety services. There were already more than 2.3 billion BedBullSociety account holders who had chosen the service to develop their unique lifestyles, or almost 2.5 billion successful stars as BedBull Group plc, a Cambodian linen manufacturer and brand management company, wanted to express it. No wonder that BedBull Group plc was currently the world’s most valuable company by market capitalization.
Meanwhile, the professionals in the repair shop are working on Jürgen’s car. It emerges that Jürgen had not maintained the car in accordance with the manufacturer’s maintenance programme. As a result, the car’s control system finally disabled the use of the car to eliminate the distant possibility of engine damage. All this was automatically diagnosed within a matter of seconds. It was also confirmed that no damage had resulted from the postponed maintenance. In way Jürgen was lucky. He had to pay for the car tow and check and for the train tickets as well, and received no compensation from the insurance company. On the other hand, he avoided a much more expensive repair that he also should have paid from his own pocket had the engine failed as a result of his negligence. He also learned an important lesson: not to assume that everything gets fixed automatically!

When the car was serviced and ready for use, it was delivered to the hotel where Jürgen was staying with his friends. The car found its way to the right hotel, although the travellers had moved to another hotel due to water damage in the hotel where the car had first booked them – thanks to the BedBullSociety’s PalLocator service.

Luigi - An elderly craftsman
An elderly craftsman Luigi, a good representative of the aging Europe, is still working although he has already turned 65 – and why not? He is healthy and in a good condition, and he likes his job. Luigi works for EuroMan, a globally-operating manufacturing company headquartered in Italy. It manufactures and sells high-end drilling machines for the mining and excavation industry, and also provides a range of services from repairs to operational support.

EuroMan has made a strategic decision no to outsource production outside Europe. They firmly believe in the competitive advantage of ‘Old Europe’ in the field of high-end manufacturing and industrial services. In consequence, they are running more than a dozen R&D centres and manufacturing plants in Italy and in five other EU member countries.

First of all, Luigi was eager to continue his career instead of retiring when the employer told him that his health and wellness would be supported on-line on 24/7 basis. In case of emergency, he was told, the health monitoring system would automatically contact an appropriate medical services provider. Depending on the case, he would be advised either virtually or, if necessary, a doctor would be despatched to meet him personally where ever he might be on his business travels.

The craftsman likes his job for two main reasons. First, his employer is really customer focused, trying to understand and solve the customer’s business problems instead of just selling and installing the machines they were manufacturing. This is something that made the craftsman’s heart really, really glad, since he believed that commitment to good quality and customer satisfaction form the backbone of a successful enterprise. Moreover, most customer representatives are also his personal friends.

The second reason why he likes his job is that they can make good use of ICT-based applications. Only in the most demanding cases it was necessary for him to go and inspect the machine personally. For the most part he
could do the service work remotely by controlling maintenance robots from his home or office. They were using e.g. remote diagnostics, artificial intelligence based on neural networks, augmented reality, lightweight head-mounted displays, and data gloves. Although Luigi loves travelling in exotic locations, he has realized that the robots can be very handy for an aging craftsman: he can avoid places that are detrimental to health, inconvenient, or difficult to access. Furthermore, he can also resort to the virtual community he is involved in and chat with other elderly craftsmen when ever he might need assistance.

EuroMan is very pleased in having experienced elderly workers on its payroll. By taking care of challenging customers - as well as challenging machines - over the long-term they have helped EuroMan make more money. Knowledgeable workers, state-of-the art products, effective tools and processes, and a profound understanding of their customers’ business environment has enabled a world class service business that has made the company market leader in its branch. And not only market leader, but also sustainable.

Sustainability is deeply built in EuroMan’s business model. First, remotely controllable robots help reduce travelling, and therefore also emissions. But at the same time, they reduce EuroMan’s operating costs. Secondly, the advanced life-cycle management programme, which according to warranty terms must be applied to all EuroMan products, has been designed to minimize the long-term environmental impact. The programme does not maximize the machines’ capacity factor or the customer’s return on investment. Some EuroMan’s customers have not been particularly happy with this but most of them have admitted, however, that marketing-wise it sounded good. EuroMan has been clever enough to provide their customers with active marketing support, too.

To make this profitable, EuroMan has concluded revenue and risk-sharing agreements with most of its major customers. The contract stipulates that when ever their customer wins a major contract in a competitive bidding where the contractor’s ability to demonstrate commitment to environmental sustainability accounts for at least 10% of the maximum score, EuroMan’s commission will be 2,5% of the total size of the contract. However, if their customer does not win the contract, then EuroMan must pay a penalty fee equal to 0,5% of the value of the winning offer. So far EuroMan has performed well, but they reckoned that some of their customers had submitted ill-prepared offers solely for the purpose of pocketing the penalty fee. Luigi and company lawyers are working hard to develop better model contracts to block such behaviour.
4 Important research and development themes in services

This chapter defines the proposed research and development themes in services. The themes have been classified into four broad categories: markets and business logic, operations and enabling technologies, socio-economic environment and regulation, and conceptual and methodological issues. The themes are mostly generic in nature: particular lines of business have not been emphasised above others.

The underlying motivation of research may be applied, academic, or both. We want to argue that this is not determined by the theme itself, but the interests and objectives of the research team. This is why the proposed research themes have not been classified along the (somewhat artificial) applied-academic axis. Most of the proposed themes do have both practical and academic relevance.

Due to the vast scope of the topic, however, setting of priorities proved necessary. In this report the greatest emphasis has been placed upon research themes that are generic in nature and therefore potentially relevant for many application areas, relate to major socio-economic challenges and/or objectives of Europe (thus having potential to contribute to growth, employment, and the wellbeing of citizens), have to do with major technology trends especially in the field of ICT, and/or were emphasized by the representatives of the participating RTOs. Please note that the recommendations for organisation and funding of research are presented in chapter 5.

4.1 Markets and business logic

4.1.1 Market creation and growth

Price competitions are typical of mature, saturated markets. Everyone offers pretty much the same, the offerings become commodities, and the one with the cheapest offering wins the game. The prevailing market logic is often cost driven. In such a situation only companies with the most cost efficient global value chains may survive. This is especially challenging for SME’s: development of international operations and benefiting from large scale global procurement and distribution calls for cash and other resources that SMEs often lack.
Services provide an opportunity for a change and new market creation – to move outside the known market space, or the ‘red ocean’ of fierce competition as referred to by Kim and Mauborgne (2005). New services renew the vertical value chains and they also create new horizontal value networks. It is characteristic to these new value chains and networks that they cross the traditional lines of business and actually reshape the businesses – as well as public sector services. Services also emphasise the role of the customer as an actor in the value chain. Especially in industrial services the customer’s role is pivotal: without the customer’s input to the value creation process the value just will not realise in the first place.

When a new value chain or network emerges, the integrator is likely to occupy a very influential position in that market. The integrator provides useful services for other market participants, and may come from outside the traditional product-centric value chain. There are many examples. For instance, the companies that reshaped the camera industry were into electronics, not traditional camera or film manufacturers. Suddenly, Nokia emerged as the world’s biggest camera manufacturer. On the other hand, Apple and Google set new rules for the mobile phones and services industry and superseded Nokia in the smart phone market. Apple introduced Appstore in order to create a global platform for applications, which typically came from third parties (often individuals or SMEs). Google’s earning logic is based on providing access to a large customer base through different routes, namely the search engine, Android operating system and Google Earth. Taking proactive role in building new markets, value networks and introducing services increases the opportunity to have a central role in the renewed markets.

The creation of new markets can either take place incrementally or in a radical manner. In industrial goods life-cycle services have provided a way for incremental market creation. The value chain has changed over time when different stakeholders have gradually developed new capabilities, services and also expectations on what a good service should or could entail. In some other domains, process industries for example, where the product is often a commodity, the same kind of incremental transformation does not seem so self-evident. This is because the end product does not need life-cycle services. Here, the change may be more radical by its nature.

The mounting public debt combined with slow GDP growth in EU27 (2009: -4.2%, 2010: 1.8%, 2011: 1.7%(f) by Eurostat) provides an additional incentive for supporting the
development of services thru dedicated public research grants. Services can contribute to the
growth of economy, but only if an increasing number of European companies will be able to
develop competitive offerings and to open up new markets in an effective way.

Key research and development themes

– Service and integrated solution marketing. Identifying and assessing market potential for
  new services, building customer understanding, involving the customer in the process, and
developing the role of the sales function.

– Proactive renewal of markets and value chains. Identifying the key stakeholders and their
  interests and business models, understanding the prerequisites for and the mechanisms of
  both incremental and radical change, and developing the role of the integrator.

– Renewal of business logic in value networks. Development of products and services into
  integrated solutions, division of responsibilities and liabilities in the network,
development of business models to support the sharing of risks, costs and revenue
  between the market participants, practices and tools of co-operation.

– Removing structural barriers to new market creation. Identifying and dismantling
  unnecessary regulatory barriers to free trade in services, facilitating SME access to
  finance, facilitate the creation of various service business platforms and standards to
  support service marketing, partner search, exchange of confidential information,
  conclusion of agreements, management and logistics, payments, dispute resolution, etc.

– Managing uncertainty and risks in market creation in service business context.

4.1.2 Value-in-use and value capture

Evan today some professional purchasers of industrial goods and equipment indicate that they
do not want to pay for ‘air’, being annoyed at their suppliers’ eagerness to generate additional
revenue by offering (chargeable) services to complement the (physical) core product.
However, they still expect that effective support is available on demand, both before and after
the purchase of the equipment. This is a very interesting manifestation of the remnants of the
goods-based industrial culture, where ‘value’ was embodied in material, especially in manufactured goods, and where service belonged to the sphere of public relations.

Nowadays services are widely used and their value is widely acknowledged. However, the legacy of the goods-based industrial culture continues to shape the behaviour of professional buyers in many industry branches. For some reason it is often psychologically easier to pay for the service when it has been factored in the price of the physical product – as if services were provided free of charge. Especially service offerings that are about assuring availability and/or performance instead of operations involving observable, measurable and cost-incurring labour might be difficult to sell for old school buyers for whom ‘cost plus’ pricing is the only plausible reference model. “Why should I pay for the supplier for not having his men on site and maintaining the machine?” are many old-hands wondering in their mind.

There are also other contributing factors. One of them is the division of labour and responsibilities in large industrial companies. Maintenance managers are typically working within a predetermined cost budget, while professional purchasers are typically after the lowest item costs. They will have no incentive (and perhaps no authority either) to invest in add-on services that might yield other benefits, such as improved capacity factor or new revenue-generating potential, if that entails increased spending or more paperwork. To have that incentive one should be responsible for the revenue side of the equation, too. Therefore arrangements to reinforce administrative and financial controls may actually result in poorer operative and/or financial performance if they are applied in a mechanistic fashion without sound business logic guidance.

Expensive capital goods may turn out to be really bad investments if they cannot be brought into service in a timely manner or if they lie idle due to technical problems. This is where industrial services may easily prove their business value. The tricky point, however, is the increasing interconnectedness of the service provider’s and the customer’s processes and dependence on the customer’s own work inputs. The service provider can seldom, if ever, alone deliver value to the customer. Instead, the customer often plays a key role in the value creation process. This further complicates the marketing and pricing of industrial services. “First I paid for the machine. Now I am being charged a hefty premium for what the supplier calls a service although I am supposed to do the work. What’s the point”? 
This joint value creation process is also referred to as value co-creation (Grönroos 2007). The characteristics of the process determine the extent to which the value embedded in industrial goods is actually delivered to the customer, i.e. transformed in value-in-use. This is the key proposition of present business research on service dominant logic (e.g. Vargo and Lush, 2004). Good results call for a successful definition of objectives and mutual responsibilities, and the integration of the service provider’s and the customer’s processes. For the service provider it is of utmost importance to understand how the customer operates and which factors determine the customer’s success in business. This also forms the basis for successful value capture, i.e. the development of feasible pricing and revenue models to share the risks and proceeds of co-created value between the customer and the service provider.

Key research and development themes

- Understanding value-in-use. Identifying, defining and measuring different constituents of perceived customer value in services. Understanding the linkages between such constituents and traditional measures of operational and economic performance (in case they do not overlap), using the concept of value-in-use in service marketing.

- Effective value co-creation mechanisms. Understanding how the definition of the scope and objectives of co-operation, allocation of mutual responsibilities and applied co-operation practices affect value co-creation. Special questions include the feasible level of process and IT systems integration, alignment of service design approaches with organisational structures and management systems, and the significance of applied value capture mechanisms for value creation (see below).

- Value capture (revenue) models. Value capture refers to the mechanisms through which the service provider generates revenue and profits from business. There are open question regarding the suitability of alternative pricing models and risk and revenue-sharing schemes for different situations and contexts, assessing compliance with terms of contract, measuring the effectiveness of service when there are several non-controllable factors having an impact on the used performance measures, and managing profitability.
– Brand, experience and IPR management in services. Customer, employee, business partner and/or citizen experience related to the service, integrating “design thinking” into service practices, processes, and systems, and determining intellectual property rights in co-created services.

4.1.3 Verification and validation

Service providers come close to their customers and often integrate into customer processes. As a result, they collect large amounts of customer data. They may maintain or operate business critical customer systems. Service providers typically know quite a bit about their customers’ customers, too, as well as suppliers and other partners. This brings about a particular challenge, namely trustworthiness of the partners of the value network.

Can the service provider be trusted? If I sign the contract, am I likely to get what I think I should get? And what else will the service do that is not disclosed, e.g. where else and for what purpose may the confidential information be used? For example, could my R&D partner or contract manufacturer take advantage of confidential product development data before the product reaches the market or before the patent application gets filed? Or could my credit card issuer or bank sell my customer profile to an advertising agency?

Online services constitute a specific area of concern. First, the service provider may be harder to identify. If the owners prefer anonymity, the service might be managed through a small subsidiary company established in some secretive tax haven. There would be no office to visit, and no access to company information. Second, even if the service provider were a respectable business above all suspicion, reliance on complex web-based systems is a risk in itself. The service may become unavailable for a number of reasons, and the availability of timely support is typically a rare luxury. This, of course, depends on the type of business and the type of one’s account (i.e. ‘premium’ vs. ‘basic’).

The customer, institutional or private, has not been left on its own, however. In the same way the classification societies certify vessels in operation, also some services are being assessed and classified by independent organisations: e.g. IT service providers (CMMI levels), government debt (Standard & Poor’s, Moody’s and Fitch’s ratings), and restaurants (Michelin stars). Perhaps the most important trend in the field of independent validation is the
emergence of (online) peer reviews. This method that has been the cornerstone of scientific publishing has found new application areas, e.g. hotels, movies and online brokers. But there are still difficult questions to be answered. For example, who and using which methodology can validate schools, health stations and hospitals?

Key research and development themes

- Concepts and technologies to support the verification and validation of services. Important areas include e.g. terms of contract, vendor background, functionality, robustness, data privacy and security, etc. Special attention should be paid to online services (both mobile and Internet), services offered to retail customers, and services in some particular lines of business, such as health care and finance.

- Peer review as a validation method. Increasing understanding of the peer review process and factors influencing its outcome. Development of guidelines for peer reviews to ensure fairness, transparency and reliability.

- Regulation of verification and validation services. It is important to establish whether and under which circumstances regulation could be justifiable, what should be the validator’s sphere of responsibilities, and what is the role of the public sector.

- Verification and validation for internal use. Collaborative piloting, testing and ramp-up of a new service, business models for managing uncertainty related to service network partners and service content.

4.2 Operations and enabling technologies

4.2.1 Efficiency and productivity

Since 1995 the productivity of work, when measured by GDP per hour worked, has been growing faster in the USA than in Europe. McKinsey has concluded that 2/3 of this difference can be attributed to lower productivity of local services in Europe, such as retail and wholesale services (see Smart work, 2010). Heavy regulation and protection against international competition were named as main culprits. Other contributing factors that were
identified in the article included Europe’s smaller service markets and smaller investments in
business development and application of ICT. The authors also pointed out that many policy-
driven initiatives to foster innovation and productivity via “exciting high-tech breakthroughs”
often miss a key element of innovation: the diffusion of better business processes and
management methods.

Efficiency and productivity are fundamental enablers of competitiveness and therefore also
profitability in most B2C and B2B service sectors. From the business development point of
view one of the key challenges of service business in comparison to manufacturing and
process industries is that the processes are more open and shared between the service provider
and the customer. Different practices, systems and also management cultures get intertwined.
This complicates the development and day-to-day management of services. Additionally,
higher supplier-customer relationship dependency in services impede ‘productization’ efforts,
thus making productivity development challenging. The trade-off between effectiveness
(capability to fulfil customer expectations) and efficiency (internal efficiency in service
provisioning) may prove difficult to solve if customer expectations are non-standard and the
firm’s competitive advantage is based on its ability to provide tailored solutions. These unique
characteristics of service business justify further research on the theme.

Key research and development themes

- Developing feasible, both practical and theoretically sound indicators for the efficiency
  and productivity of services. Linking operational indicators to financial ones and
  understanding the relationships between productivity of labour, operational excellence,
  return on investment, and profitability. Developing indicators for individual firms and for
  enterprise networks.

- Modelling and analysis of complex service systems. Understanding how the overall
  performance of the service system develops as a function of firm-level actions and market
  changes, understanding the characteristics of processes that extend beyond contractual
  relationships, assessing the performance and overall cost-effectiveness of systemic service
  processes in comparison to vertically integrated value chains, and developing models and
  ICT-based tools to support the analysis and development of service systems.
– Design for service system performance. Creating and enhancing tools for capturing the value in use for services and communicating value to customers and throughout the firm, integrating service value and the costs of service delivery into joint optimization models, managing the trade-off between effectiveness and efficiency, and measuring the value and return on investment from service.

– Developing effective approaches for practical development of service processes and systems. Specific questions include e.g. process integration, customer involvement, and management oversight.

### 4.2.2 Utilization of new technologies

The application of information and communication technologies (ICT) in different sectors of society has brought about a profound change in the way both physical products and services are developed, produced, sold, distributed and consumed. In general, the business logic behind investing in ICT has been threefold. First, it has been the means of increasing efficiency and productivity. Second, although there are diverging views on the actual productivity impacts of ICT investments when the costs are taken into account (large enterprise systems may cost dozens or hundreds of millions of euros to purchase, implement and maintain) a developed ICT infrastructure has become a de facto requirement for most businesses. Third, ICT has enabled the development of completely new kinds of offerings and patterns of operation that would not have been possible before.

Often the three above-mentioned areas overlap to such degree that they become inseparable. A good example is Internet banking: the service could not exist without a developed ICT infrastructure, it has become a must for each banking group that wants to expand its customer base, and it contributes to cost-effectiveness, too.

While service development is increasingly ICT-driven, ICT itself and especially computing architectures are undergoing a major change. The current trend is away from monolithic, centralised enterprise systems built around a centralised database towards distributed web-based computing environments, often referred to as cloud computing. The underlying drivers include fragmentation of value chains and increasing demand for flexibility in many lines of business, as well as development of competing technologies and applications.
Wikipedia defines cloud computing as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction”. This entails a paradigm shift in systems engineering. The design of systems consisting of other systems, services built on other services, and reliance on web services (methods of communication between electronic devices over a network) translate into significant challenges, notably in the areas of technical and semantic interoperability and quality of service. Add wireless use of Internet services combined with requirements for sufficient bandwidth and robust connections across networks that are based on different technologies and are managed by competing telecom operators, and the proportions of the challenge ahead will emerge.

It will take some time before service providers will sign service level agreements containing high availability requirements and strict penalty clauses for substandard performance on hosting mission-critical applications on a cloud computing environment. At the same time the number of end customers being either capable of or interested in assuming responsibility for managing their ICT infrastructure or applications is decreasing. This may result in disruptive changes in the value networks of IT and telecom services.

**Key research and development themes**

- Technologies for enhanced interoperability and quality of service. Development of technologies, methods and standards to facilitate systems integration and technical and semantic interoperability and to support monitoring, assessment and development of quality of service in distributed computing environments.

- Design and validation guidelines for ICT-based services in distributed computing environments. Understanding the strengths and opportunities as well as the weaknesses and threats that such an environment exhibits for different types of services and applications, including mission-critical applications.

- Business models for technology and service providers. Anticipating the likely changes in the value network and the emergence of new markets and possibilities for new
‘integrators’. Understanding the dynamics of business in different parts of the evolving value network, e.g. ‘who sells what to whom’ and who does the ‘packaging’ for the end customer. Supporting market participants to come up with feasible contract models as well as cost, risk and revenue-sharing schemes.

4.2.3 Data management

ICT gradually reshapes service provisioning where ever enhanced data acquisition, storage, processing and communication capacity may contribute to value creation or capture. The users of ICT-based services are not just using them – they (we!) are also generating, deliberately or unconsciously, vast amounts of data. This data is being stored in various systems and may be used for the benefit of the user or to pursue some other goals.

In consumer business this is characterised by increasing investments in the analysis of customer behaviour, targeted marketing and the development of systems and services that track and adapt to user preferences, and introduction of business models based on (free) user-generated content and advertising revenue. Whenever you switch on your cell phone or make an Internet search you also end up submitting data to your service provider on your whereabouts and interests – without having much to say how to use it. On the other hand, cost-effective data management has revolutionised the sales and distribution of immaterial (digital) content, making it economically viable to maintain a large number of articles for sale (enabling the so called long tail marketing, see e.g. Anderson 2006).

In industrial context ICT-based process control systems generate enormous amounts of data on the use and performance of systems and equipment, enabling e.g. remote diagnostics, condition-based maintenance, and optimisation of operations. That data can also be used to support the development of technology and new offerings, application of use or performance-based billing models, and claims management (allowing the service provider judge whether the equipment have been used in accordance with user instructions). In many lines of business resources management is completely built on the premise that data is always up-to-date: airlines, retail chains or car manufacturers could not function without reliable enterprise systems and databases, not to mention stock and derivative exchanges. In this respect experimenting with new technologies, e.g. cloud computing, cannot justify poor performance.
The challenges are manifold. On the one hand, there is a constant thirst for more effective data mining and analysis techniques. Intelligent diagnostic methods, use pattern recognition and decision making tools are among key areas to be studied. In technical terms the question is about formal semantics, which may entail development of methods to support (automated) codification and search of content. On the other hand, the development has highlighted the need for clear and enforceable rules for data ownership, security and privacy. This includes issues of legislation and regulation, but is likely to require technical solutions to enable implementation.

**Key research and development themes**

- Data and media mining. Further development of methodologies and services for intelligent search, combination and interpretation of information from large databases containing different data types (e.g. text, voice and pictures) and recording formats (e.g. .html, .mp3, and .jpg). Development of user-friendly interfaces for such systems e.g. to support the use of natural languages.

- Use pattern recognition. Development of theories and methodologies for analysing the use patterns of different systems and services to help determine what the user is trying to achieve, to what extent the user managed achieved what he/she tried to achieve, and how to develop the system.

- Data privacy, security and ownership. Development of rules and technologies to provide end users with enhanced control over the data that their service providers actively collect or otherwise receive as a result of the use of the service. The terms and conditions under which service providers may commercially exploit such customer data, especially if the customers have not knowingly ceded the data to be commercially exploited.

**4.3 Socio-economic environment and regulation**

**4.3.1 Sustainability-in-practice**

Sustainable development consists of at least three domains: ecological, economic, and socio-cultural. Although sustainable development can be defined in terms of each of these domains
alone, it is commonly believed that none of them can be omitted. Most often they are also closely interrelated. For instance, excessive logging does not only cause erosion and increase the likelihood of devastating floods, but may also endanger the traditional means of livelihood of the people who are dependent on the forest ecosystem.

But what is sustainable development? Pim Martens (2006) has given the following definitions:

- “In sustainable ecological development the controlled use and protection of natural systems is the main focus of concern and the maintenance of our natural resources is of primary importance.”

- “In sustainable economic development, the focus is on the development of the economic infrastructure and on an efficient management of natural and social resources.”

- “The aim of sustainable social development is to influence the development of people and societies in such a way that justice, living conditions, and health play an important role.”

While Mr. Marten’s views are easy to endorse, the real challenge, however, is to make sustainable development economically more attractive for national states, companies and individuals. If the economic incentives are missing, development will be slow and dependent on broad international agreements which are difficult to conclude and enforce. However, legislation, taxation and international co-operation are likely to play an important role in the change process, for they shape firms’ operating environment and market drivers.

The role of services can be paramount. First, sustainability-enhancing planning, consulting and implementation services should be broadly available, especially for industries with a significant carbon footprint, reliance on natural resources and large-scale operations in developing countries. Securing and developing the necessary know-how for such services deserves ample public funding. It is also important that the business planning aspects are not overlooked. Helping firms develop and market sustainable, yet profitable offerings and modes of operation will contribute to sustainability more efficiently than any policy paper can ever do.
Second, when industries develop, the relative importance of the immaterial assets and services also tends to increase. This is characterised by the increasing GDP share of services in most developed as well as developing countries. This in turn may loosen, if not break, the linkage between the consumption of raw materials and energy and economic growth and therefore also contribute to ecological sustainability. Although the rising consumption of immaterial products and services is also likely to boost material consumption, as noted in chapter 3.2, the relationship does not have to be linear. A clear sign of this opportunity is the gradually diminishing need for physical delivery mechanisms (such as newspapers, CD disks) for digital content, and the broadening use range of various terminal devices, such as smartphones and tablet computers. If, however, future business models in will be firmly based on the development and sales of new devices instead of content, applications and services – which is a plausible scenario, think e.g. the range of different kinds of devices that have been introduced to the market during the last few years – then this opportunity may well be lost.

**Key research and development themes**

- Legislation and tax incentives to promote sustainability. Understanding the possibilities, limitations and influence mechanisms of laws and taxation in promoting ecological, economic and socio-cultural sustainability, active review and development of related policies, fostering EU-level and international co-ordination of related activities.

- Metrics for sustainability. Despite a lot of work has been made in the field of ecological sustainability, there is a need to develop and lobby for clear and commonly acceptable metrics. Development of sustainability criteria and metrics for economic and socio-cultural sustainability.

- Sustainability-promoting business models. Helping companies create, market and benefit from new sustainable offerings, understanding customer preferences and possible trade-offs between short-term financial performance and long-term competitiveness, anticipating changes in legislation and market conditions, and concluding the implications for business and technology development.
4.3.2 EU internal market

There are many de facto barriers to trade within the EU, including official monopolies but also hidden protectionism that makes it difficult for new entrants and foreign enterprises to establish presence in the EU internal market. This applies especially to services. 70% of the EU’s GDP is generated by services but only 20% of those services cross borders (Smart work 2010). These barriers take many forms, such as quotas, high license fees, or tenders that have been tailored to effectively – if not explicitly – block foreign participation.

Such restrictions may have been put in place in good faith to protect the citizen, but they often benefit only a small number of well-connected interest groups, inflate prices, discourage entrepreneurship and innovation, and contribute to the ‘productivity gap’ in services between the USA and Europe, the former being ahead of the latter (Smart work 2010). The topic is important, since competitive pressures from outside the EU combined with dire public finances do not leave much room for economically unsound structures or policies. Especially RTOs could play a meaningful role here, because they typically possess a good understanding of the public as well as the private sector and are experiences in carrying out targeted development activities.

First of all, a critical review of national and EU-level regulation of international trade in services is needed. In addition to the letter of the law it is important to pay attention to practice – in particular to barriers to free trade that hinder entrepreneurship and cannot be properly justified e.g. on grounds of strategic national interests or public safety. Sectors with heavy government involvement, limited international participation and/or only few (or missing) small to medium-sized enterprises should be targeted first. Evidence-based regulation in general should be promoted in tandem with the development of practical indicators for the effectiveness of regulation.

Key research and development themes

- The functioning of the EU internal market for services. A critical review of national and EU-level regulation of international trade in services, identification of both formal and informal barriers to free trade (including state monopolies, rules of public procurement and difficulties faced by foreign companies), identification of areas where restrictions may
be justified e.g. on grounds of public or national safety (including methods for implementing such restrictions) and where not, understanding the scope and nature of criminal activity in cross-border services, and issuing recommendations for the development of laws and regulation to promote fair competition and to suppress crime.

- The economics of regulation and deregulation in services. Understanding the economic ramifications of active regulation as well as deregulation of trade and services in particular lines of business and in the context of national economies on growth, tax revenues, public expenditure, competitiveness, employment, purchasing power, etc.

- Facilitating SME participation in cross-border trade in services. Understanding the particular challenges of small and medium-sized enterprises, providing guidance for SMEs, and developing the supportive role of public financiers, RTOs, trade associations and export-promotion organisations.

4.3.3 Securing vital ICT infrastructure and social robustness

Management of social robustness in case of a major failure in one or several important support systems of the society, such as the electric grid, communication networks or financial institutions, deserves more attention. This does not concern authorities only, since an increasing part of these systems and related services are privately owned and managed. Effective prevention and mitigation strategies can be based on a number of different technologies and organising models, but the risks and possible emergency scenarios should be identified, understood and acted upon well in advance. Due to the pervasive nature of ICT as a backbone of a modern society especially ICT-related societal risks should be highlighted in future research agendas.

A particular feature of ICT-based systems is their complexity created by modularity and interconnectedness. An error in one module of the system, or an unexpected external event, may change the behavior of the whole system unexpectedly – or crash it down completely. The ongoing trend of increasing decentralization of computing environments and the networked business environment where adds to the challenge. The consequences can be far-reaching, if the trunk network or the main grid gets damaged, for they support an innumerable amount of other systems and services. The prevention of major system failures and the
development of plausible contingency plans for the worst case scenarios call for dedicated R&D efforts, as well as coordination and strategy development at the highest levels of public administration and the corporate world. Countermeasures are likely to include legislative, financial, organizational and technical arrangements.

**Key research and development themes**

- Risk assessment. Identification of the major ICT-related societal risks, their possible root causes, development mechanisms and consequences, review of existing risk scenarios.

- Contingency planning. Review and development of existing risk management plans for government and municipal agencies and key industries, such as power generation, telecommunications, media, transportation, health care and financial services, drills to strengthen co-operation and operative readiness. Review of related laws and ordinances.

**4.4 Conceptual and methodological issues**

Service science (or research) is a relatively young field of study. Service researchers harbour both academic and practical objectives, and apply a range of different theories and methodologies. Many of them have originally been developed within other disciplines, such as marketing, psychology, operations research, and computer science. In a way service science is an umbrella concept. At the same time, however, demands for developing a general theory of service with well-defined questions, concepts, tools, methods, and practical implications for society are emerging (e.g. Spohrer et. al., 2007). Especially theoretically-oriented researchers have been keen to develop service science as an independent discipline.

New approaches are required in the cooperation between science and practice. This is also necessary because the links between science and practice in the service sector have not reached anything like the intensity that is evident in the domain of production research (Spath et. al., 2008). Our view is that a good theory can contribute to practice and vice versa. Service science can best defend its *raison d'être* by demonstrating uncompromising commitment to developing conceptual clarity, consistence of argumentation, and respect for the complexities of the real world that time after time successfully defy our categorisation attempts.
4.4.1 Product vs. service

The farrago of terms and concepts is a key feature of the current service discourse. This is natural – when the development stage of service research is taken into account – as well as annoying. In the same way than the term ‘innovation’ is (wrongly) used to describe everything possible from a vague product or business idea to a ground-breaking, successfully commercialised therapy, the term ‘service’ may refer to everything between a machine-to-machine communications protocol to legal counselling, and from the sales of spare parts to the operation of a power plant. In other words, the nature, scale or scope of the value creation process does not explicitly distinguish services from non-services.

An extremely interesting aspect of this service discourse is the confrontation between ‘services’ and ‘products’, and consequently between ‘service dominant logic’ and the economy based on the exchange of goods (e.g. Vargo & Lusch, 2004; Vargo 2009). For some people the term ‘service’ represents the immaterial elements of an offering that in case of a physical ‘core’ product merely supplement the core. Others regard service as the fundamental basis of exchange, which implies that possible material elements of an offering are not ‘products’ in the traditional sense of the word but delivery mechanisms for value.

It is somewhat unclear whether the distinction between ‘services’ and ‘products’ should be made along the material-immaterial axis, or on grounds of the nature of the value creation process, or whether the whole concept of ‘product’ will prove outdated and deserves to be forgotten. This seems unlikely, because both terms have consolidated their position in the general parlance. While service development is clearly gaining ground among traditional manufacturing and product companies, services are being ‘productized’ and referred to as products in many other lines of business, especially in consulting and financial services.

4.4.2 Value of a service and its constituents

Many authors tend to agree that it is characteristic of services that they are produced and consumed simultaneously and that value is co-created in supplier-customer interaction (e.g. Teboul, 2006). Both premises imply, at least indirectly, the importance of human labour in service provisioning. Traditionally direct human involvement in the process has been self-evident, and as we know, work inputs are difficult to store otherwise than in the form of
manufactured goods. But when it comes to ICT-based services the situation is different: they exhibit both product and service characteristics.

A bank may serve its customer 24 hours a day over the Internet without putting its clerks on a night shift. Also the customer may be represented by a computer program if the bank’s services can be accessed through an application programming interface or API. Complex transaction may take place without any direct human involvement. This leads us to interesting theoretical considerations. For example, are automated (ICT-based) services produced while being consumed, or can they be interpreted to have been produced in advance like physical products that can be placed on a shelf for sale? And is the resulting value essentially co-created in supplier-customer interaction, or is it embedded in the system in a similar fashion as the value of manufactured goods, such as consumer products, and realised when used?

If we presume that it makes sense to draw a distinction between product-based and service-oriented types of business, that they are in some respect fundamentally different and that different theoretical frameworks and practical approaches are therefore needed to understand and develop them, then the above-defined question may deserve further attention. The answers would determine whether ICT-based offerings should be researched and developed mainly as ‘products’ or as ‘services’. However, drawing such a distinction may prove difficult and the question may be irrelevant, too. Perhaps the key issue here is to identify the key constituents of value creation and capture, such as use of human labour and application of ICT, rather than wondering what is product and what is service. This attitude appears to be dominant among company representatives across different industries as well.

The concept of value in itself is very challenging, too. Above we have already referred to potential (or embedded) value, and value-in-use (see chapter 4.1.2). The former has to do with the features of a product or service that are expected to make it useful for a particular purpose of use, while the latter refers to the realisation of that potential value e.g. when the product or service is actually used (or when the service provider and the customer co-operate and thus co-create value). But there are other manifestations of value that do not comfortably fit into these two categories.

The real value of a service contract can largely derive from a reliable, swift access to the service provider’s resources when needed, or an ability to reallocate scarce management
resources from maintenance to new business development. The real value of an investment may not be based on its present yield, but on the option to expand to a new sector or to scale up production fast in response to changing demand conditions. And it is good to have e.g. a screwdriver, effective pain killers and some food at home because easy availability when needed is valuable per se. And who wouldn’t like to own a nice sports car and to have it parked in front of one’s house (provided that the opportunity costs won’t be too high)?? That sort of value-in-possession cannot be fully reduced to the characteristics of embedded value or value-in-use, though all these modalities of value are of course closely interrelated. A field of research called real options theory can provide relevant concepts and insights.

4.4.3 Strengthening the theoretical foundations of service science

The following themes deserve to have a central position in the academic study of services. Note that we have used the term ‘product-service system’ to refer to offerings and value creation and delivery systems that exhibit both product and service characteristics and therefore cannot – in the dominant research parlance – be comfortably classified as ‘products’ or ‘pure service’.

– Service science should, above all, strive for conceptual clarity. That would help accumulate knowledge and to apply it to practical business development problems.

– A constructive treatment of the concepts of ‘product’ and ‘service’ is needed. The long legacy of manufactured goods-based economic thinking since Adam Smith’s The Wealth of Nations (originally published in 1776), where labour and services were perceived valuable only if they directly contribute to manufacturing of goods¹, cannot be disregarded even if we wanted. The legacy is here to stay. The trick is to harness the best proceeds of that legacy for the benefit of services research. In practice many offerings exhibit both product and service characteristics in the traditional sense of the two terms, and what applies to the efficient production of physical goods may selectively apply to the efficient development and provisioning of services, too.

¹ “Thus the labour of a manufacturer adds, generally, to the value of the materials which he works upon, that of his own maintenance, and of his master’s profit. The labour of a menial servant, on the contrary, adds to the value of nothing...The labour of some of the most respectable orders in the society is, like that of menial servants, unproductive of any value, and does not fix or realize itself in any permanent subject; or vendible commodity, which endures after that labour is past.” (Smith 1776, Book II, Chapter III, paragraphs 1-2, see References for a link to the webpage).
The pervasive nature of the use of information and communication technologies (ICT) in services may necessitate the review and redefinition of what characterises ‘a service’ in service science. This is because of the fact that the built-in (often implicit) assumption of direct human involvement as a key feature of the value creation process does not hold any more. The emergence of such concepts as software as a service (SAAS) and infrastructure as a service (IAAS) are examples.

Understanding the different modalities of ‘value’ and the mechanisms through which value in effect is being or can be created. An ambitious objective would be the development of a generic conceptual framework to support the analysis of perceived value and value creation in different product-service systems, ranging from ‘pure products’ (do they exist?!?) to ‘pure services’.

Applied service research and development would benefit from a better conception of how to select the analysis framework as a function of the key features of the product-service system to be analysed / developed. Such features are likely to include e.g. use of labour, application of ICT, customer segment (industrial vs. consumer), customer industry, product/service type (tailored vs. bulk), and the need to manage material flows.

Due to the multi-disciplinary nature of the field the range of applied theories, concepts and research methodologies is likely to remain diverse for the foreseeable future. We are not in a position to pick up the ‘right’ ones, but would like to promote the application of systems thinking and theories to modelling and analysis of complex product-service systems involving different technologies and levels of abstraction (e.g. Ng et al. 2009).
5 Implementation

5.1 EU-funded research and development

5.1.1 General findings and recommendations

The evaluation results of EU Framework Programmes (e.g. COM(2011) 48, Arnold 2005, Luukkonen 2002) suggest that successful EU-funded projects are typically either moderately ambitious, close to market and product-oriented, or technically complex, of high risk, for long term and involving a high proportion of large companies. In addition, evaluations suggest that smaller project networks may be more effective than larger ones.

In general, project participants reckon that the benefits of participation outweigh the costs, though the academic community is consistently more positive about this trade off than industry. It has been stated that research organisations representing more application-oriented fields are more satisfied with EU-funded projects than those representing more basic research-oriented fields. This suggests that either the so called research and technology organizations or RTOs that operate in the field of applied R&D are best equipped to take advantage of the FPs or, alternatively, the research programmes and calls of proposals get tailored to the specific needs and expectations of RTOs.

It has been found that SME participation is generally less successful than that of big companies and produces smaller impacts. There is a logical explanation for this finding. Bigger companies have simply more resources to process the intermediate results produced by EU projects (mostly new knowledge and contacts) and therefore to leverage their investment in the project work. Correspondingly, for a SME with limited financial, managerial and knowledge resources this is much more difficult.

Some industry representatives have challenged the competition logic for EU research funding. When the calls for proposals are precisely defined in advance and the proposals are rigidly evaluated against the predefined criteria, also the possibilities to apply and to allocate funding for new topical issues diminish. There is a real danger that as a result of increasing economic pressures and dependence on external project finance many research community representatives will decide to ‘play safe’ to secure the much needed funding at the cost of creative thinking.
The general recommendations for developing EU-funded research and development are as follows:

1. **Pursue real effectiveness.** Concise project consortia with clear, focused and mutually shared objectives should be favoured. The objectives can be ambitious, but the proposers should not be expected to present a solution to each and every foreseeable problem or to tackle all EU policy issues. For example, technology commercialisation is a highly uncertain business and is influenced by many factors over which the project consortium will exercise no control.

2. **Maintain flexibility.** Develop readiness to respond to emerging policy needs (COM(2011) 48) and to support new innovative research and development initiatives. Acknowledge that different project types and funding instruments are needed to achieve different objectives.

3. **Reduce complexity.** Over time, EU research and innovation programmes have expanded the set of instruments leaving an impression of catering to too many objectives and spreading funding too thinly (COM(2011) 48). Different instruments are needed, but creation of complex structures (institutes, communities, platforms, etc.) should be stopped. The perceived complexity can be reduced and the usability of the existing instruments can be enhanced by developing guidance.

4. **Facilitate SME participation in EU research programmes.** The FP7 interim evaluation highlighted the need to further stimulate industry and SME involvement (COM(2011) 48). Concrete measures to foster SME participation can include, for example, market-oriented programmes and calls for proposals, limited project size and length, reduced administrative requirements, and greater financial support.

5.1.2 **Organising for research and development in services**

Currently there is no service-specific programme or action within FP7 (FP7 2006). In consequence, EU-funded research on industrial, knowledge-intensive and consumer services, when conducted, is typically embedded in technology-driven projects that receive funding
from the Cooperation programme, especially the ICT action. When the relative importance of 
services and service innovation for the European economic development is taken into 
account, it can be safely stated that services research has not received the level of attention it 
deserves.

For example, a recent study carried out by The Finnish Funding Agency for Technology and 
Innovation revealed that only 2% of the FP7 project summaries explicitly referred to service 
innovation and that service innovation was not the main topic in any FP7 project (Tekes 
2011). This does not imply that there is no interest in service innovation related research 
within academia or industry. Instead, the results demonstrate that the present EU funding 
mechanisms cannot fully cope with changing economic realities and research needs.

The main problem of the traditional EU project types like Integrated Project (IP), Specific 
Targeted Research Project (STREP) and Coordination and Support Action (CSA) is that they 
are typically built around specific technology themes. This suits well for technology 
developers but does not provide a fruitful starting point for the research and development of 
services or value networks. Especially practical service development is very much context 
dependent, and the industry or line of business concerned typically determines what is 
relevant and what is not. This is not to say that technology would be irrelevant. It means that 
the applied technologies are chosen on grounds of the targeted applications rather than vice 
versa.

Service development is characterized by close co-operation with the present or targeted 
customers. Especially industrial services are typically co-specified and co-produced, the 
division responsibilities and liabilities shall be clearly defined, and the management and 
operative processes need to be well aligned. In comparison to technology development 
customer involvement is much more important, in effect mandatory in case of a practical 
development project. On the other hand, the integration of potential customers in the project 
brings about a multitude of question relating to confidentiality, level of commitment, terms of 
contract, and in general the alignment of business interests. This may necessitate the 
development of new project types, participation criteria and model contracts.

In some respects the challenges as well as enablers of successful technology and service 
development are congruent. The general aim should be to pursue companies and research
units to work in close cooperation, carrying out research and development work that has been jointly defined and, if possible, also jointly applied. Experimentation and iterative working methods in general are to be favoured. They are needed to gauge market expectations, to support technology, product and service concept validation, to speed up the development process, and to foster the exploitation of various intermediate results generated as part of the project. The increasing role of ICT as a platform for service development and provisioning also translates into common problems and solution models. This means that the research and development of services and technology should not be artificially separated. Instead, the objective should be to develop the research infrastructure and related instruments in such a way that they can effectively contribute to the development of services.

Services research and service science are undergoing a rapid and dynamic development phase. In Europe, however, services research is still fragmented, lacks international orientation and is generally poorly integrated in industry and commerce in comparison to technology-focused R&D (Ganz 2008). As a result there is a danger that European services research will remain in the margin as a peculiar academic exercise. It is therefore essential that special attention is given to fostering fruitful, mutually beneficial interactions between different sectors of industry and public administration, and the research community.

The recommendations for developing EU-funded research programmes for services are as follows:

1. **Nominate services as a priority area with a dedicated budget in the forthcoming Horizon 2020.** The total amount of funding allocated to services, including service science (or fundamental service studies) and applied research and development, should reflect the relative socio-economic importance and potential of services for Europe. This means that the budget for services should be commensurate to the budget allocations for other priority areas in Horizon 2020.

2. **Programme structure and funding criteria should reflect the interdisciplinary and dynamic nature of services.** Fundamental and applied research on services should be mainly funded from a dedicated Services programme. The programme could also finance limited service-related R&D efforts conducted within projects that receive funding from other programmes, e.g. technology or industry-specific calls. Part of the budget should be
reserved for ‘open calls’ to fund frontier research and development on new emerging themes not specified in this agenda.

3. Different project types are needed for industry/market-driven and for research institute-driven R&D in services. Industrial R&D projects would be shorter (duration 1-3 years) and business-oriented, focusing on practical development of services and related technologies, capabilities and practices in the private or public sector. The service providers (e.g. companies) should have a central role in the project. Scientific R&D projects would be longer (duration 2-4 years) and research-oriented, focusing on the development and validation of generic knowledge and methodologies on services to support industrial R&D in the longer term. Publishing in applicable (both scientific and industry-oriented) domains should be expected. Industry participation is should be strongly encouraged.

4. Develop readiness to consult on and provide hybrid funding to support cross-border commercialisation activities. The development and commercial implementation of international service concepts is very demanding and therefore deserves special attention and support. The Commission, the European Investment Bank (EIB) and Investment Fund (EIF) and national funding agencies should co-operate to develop better guidance on how to combine R&D grants with other forms of financing, including debt, debt guarantees and equity investments, using private, national and EC/EIB{EIF-supported funding instruments. Commercialisation projects that are supported by one or several national funding agencies and which extend to several member states should have a privileged access to complementary EU funding and also legal advisory services.

5.2 National and regional funding

National and regional funding agencies as well as research institutes and universities having access to direct government funding shall naturally play an important role in the funding of services research. First, they should be capable of addressing the specific local interests and needs in an effective manner. Second, then may secure the essential basic funding for research when suitable EU calls are not available. In an ideal case local funding may leverage EU funding and vice versa. Also the Commission should expect a strong national and/or regional contribution to issues that are of national and/or regional significance.
Such local (national, regional, etc.) interests and needs are of course diverse. Often they have to do with developing the capabilities of local service providers, supporting their specific business development initiatives, or developing the business environment into a more favourable direction e.g. with respect to small business support, infrastructure or regulation. Favoured lines of business vary from country to country depending on their perceived economic importance. Supported initiatives may also have an international dimension if the value chain extends beyond national borders, which is often the case.

Especially research institutes, or the so called research and technology organisations (RTOs, see below), do have several roles. For national states they are instruments to support the specification and implementation of national technology, industrial, innovation and/or research policies. Industry and commerce, on the other hand, expect support to their specific needs – often with a subsidised price. RTOs are also autonomous actors with their own research strategies and priorities. Increasing dependence on project finance implies that research organisations shall perform a demanding balancing act between the diverse expectations of various external interest groups and their own interests.

There has been quite a lot of talk about the need to avoid duplication and fragmentation of research efforts and to build a critical mass of funding and capabilities around important research themes thru strategic alignment and pooling of national and regional funds (COM(2011) 48). In practice this is a difficult target. The major European research and development hubs certainly want to define their priority areas autonomously. In a way the situation resembles that of food production where striving for reasonable self-sufficiency ultimately results in overproduction and suboptimal allocation of resources (under normal market conditions). However, this does not exclude co-operation on project level. In addition to joint (such as EU-funded) projects effective co-operation can be based on informal exchanges between project teams sharing a common interest but separate funding. Complementary competence areas add to the value of co-operation, but also overlapping competences are needed, for they enable effective exchange of ideas and information.

Given the diverse objectives of national and regional research and development activities, it is relatively difficult to issue generic, yet precise recommendations for organization and funding of research. Different programmes and funding instruments are needed. Locally-funded R&D
activities should, however, try to respond to one of the European paradoxes – good science but poor translation into products and services. In particular, greater support for practically-oriented concept development, market validation and commercialization projects should be expected from both public sponsors of R&D and research institutes that provide applied R&D services. Possible hurdles (if any) in EU directives and national legislation that might restrict the use of public money for supporting pre-commercial business development activities shall be identified and removed.

Regarding the development of national and regional funding for services our recommendations are the following. It must be noted that the idea is not to propose limitations to the current selection of funding instruments or criteria.

1. **Small business promotion.** In accordance with the Small Business Act for Europe, a policy adopted in June 2008 by the European Commission, the EU and its member states should promote entrepreneurship and in particular diminish administrative burdens and facilitate access to finance and access to markets (SBA 2008). Various funding instruments are needed to support the use of local business incubators, setting up of mentor networks, arrangements to facilitate entrepreneur-investor interactions (such as investor summits), and co-operation with export promotion organisations and chambers of commerce to help start-ups and SMEs market their offerings internationally. This is especially important in services due to scalability challenges (few VCs are interested) and various barriers to international trade.

2. **New service development and commercialisation.** Related calls should target industry/commerce-driven initiatives that focus on the further development, piloting and commercialisation of service concepts and supporting technologies developed in other publicly-funded R&D projects or elsewhere. The project consortia should include service providers, technology vendors, present or prospective customers and necessary mediating organisations, such as RTOs and/or business development consultants. Both large and small companies should be encouraged to participate. Concrete pilots, preferably with international partners, and hands-on business planning and development activities would constitute the ‘core’ of the project work. A new ‘service concept’ or ‘reference model’ would not qualify as a project target. Instead, an eligible objective could be incorporation of a new company to provide a new kind of service, or development and launch of a
technologically, commercially or otherwise very demanding as well as generally useful service to be provided by established market players. Sound eligibility criteria to justify public funding of commercial development are important.

5.3 The role of research and technology organisations (RTOs)

The term ‘research and technology organisation’ (RTO) refers to a research institute that carries out applied research and development work in close association with its clients, typically industrial enterprises and also government agencies. RTOs typically operate in a number of technology or application areas, though some RTOs are more specialised than others. RTOs may be public or private. Public RTOs are to a varying degree financed from government budgets. All private and also many public RTOs are dependent external project finance, however. In consequence, RTOs actively compete for industry assignments and grants provided by public sponsors of R&D, such as national funding agencies and the European Commission. RTOs have consequently become active participants in European and international research consortia and trusted R&D partners for their clients.

There are two principal differences between RTOs and universities. First, RTOs do not provide education and do not grant academic degrees, though some university units may operate like RTOs (e.g. provide contract research). Second, RTOs are mainly judged on the basis of their ability to develop useful technologies, applications and solutions for industry and the society as a whole in short to mid-term future, while universities – at least traditionally – have been ranked on grounds of their scientific and educational achievements.

Service research and business is a vast area. There is certainly enough ‘manoeuvring space’ for all players who want to get involved, e.g. for companies, industry associations, ministries and governmental and regional development organisations, the Commission and national funding agencies, RTOs, and universities. RTOs, however, are particularly well-equipped to assume a key role in the research and development of services for various reasons:

1. **Multidisciplinary approach with a solution focus.** There is a need to look for synergies and holistic approaches over heterogeneous service sectors. Major RTOs are typically able to provide and combine a broad spectrum of competences, to model and analyse complex system-level phenomena, and to come up with practical solutions. In comparison to most
universities RTOs also possess superior technology commercialisation and business development capabilities.

2. **Extensive reach.** RTOs are well networked across the borders with each other, towards industry, and within the public administration. By joining forces RTOs can develop programmes with global significance, support internationally-operating companies, tap the broad and varying competence base of European regions, and help develop and implement national and European research, innovation and industrial policies.

3. **Developed research infrastructure.** In many application areas a systematic development of services requires a unique research infrastructure, which allows a realistic involvement of both producers and users of services. Some RTOs have established dedicated service laboratories to serve local industry clusters. These local efforts provide natural nodes for a European wide R&D infrastructure.
6 References


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Appendix 1. Workshop participants

Tecnalia, Spain: 22-23 Nov 2010
Tecnalia: Unai Antero, Miguel Loichate, Miguel Dorronsoro, Iñaki Angulo, Sonia Bilbao, Maite Álvarez, Jesús Maria Santamaria, Marta González, Begoña Sanchez, Hanna Kuittinen, Estíbaliz Delgado, and Stefan Schuster. VTT: Jari Kettunen and Ilari Kaarela

TNO, Netherlands: 29-30 Nov 2010
TNO: Erik Fledderus, Erik Huizer, Jantine van der Weerdt, Wout Hofman, Mark van Staalduinen and Jack Verhoosel. VTT: Pentti Vähä, Jari Kettunen and Minna Halonen

Fraunhofer IAO, Germany: 8 Dec 2010
Fraunhofer: Walter Ganz and Thomas Burger. VTT: Iiro Salkari, Maarit Heikkinen and Minna Halonen

Fraunhofer ISI, Germany: 9 Dec 2010
Fraunhofer: Gunter Lay, Sabine Biege, Christian Lerch and Steffen Kinkel. VTT: Iiro Salkari, Maarit Heikkinen and Minna Halonen

Sintef, Norway: 20 Jan 2011
Sintef: Arnor Solberg, Amela Karahasanovic, Arne Jørgen Berre, Bjørn Skjellaug, Ernst Kristiansen, Jan Håvard Skjetne, Shanshan Jiang and Øystein Haugen. VTT: Pentti Vähä and Ilari Kaarela

VTT, Finland: 26-27 Jan 2011
Matti Kokkala (VTT), Jari Kettunen (VTT), Iñaki Angulo Redondo (Tecnalia), Jessica Algehed (SP), Sabine Biege (Fraunhofer ISI), Thomas Meiren (Fraunhofer IAO), Jantine van der Weerdt (TNO), Erik Fledderus (TNO), Ernst H. Kristiansen (SINTEF), Arnor Solberg (SINTEF), Martti Soininen (Tekes), Pentti Vähä (VTT), Iiro Salkari (VTT), Minna Halonen (VTT), Ilari Kaarela (VTT), Jutta Suksi (VTT), Hannele Törrö (freelancer)

Industry Interest Groups, Finland: 6 and 9 May 2011
Jari Kettunen (VTT), Ilari Kaarela (VTT), Jaakko Talvitie (TIVIT Ltd), Juha Saarnio (The Federation of Finnish Technology Industries), Ilkka Niemelä (The Federation of Finnish Technology Industries), Heikki Ojanperä (The Association of Finnish Technical Traders), Markku Uitto (The Association of Finnish Technical Traders), Christine Hagström-Näsi (Forestcluster Ltd), Saara Hassinen (SalWe Ltd), Anu Turpeinen (Valio Ltd), Pertti Lukkari (Fastems Ltd), Jari Kokkonen (SabriScan Ltd)

TNO, Netherlands: 17-18 May 2011
Appendix 2. Selected technology platforms

**European Construction Technology Platform - ECTP**

ECTP aims to raise the construction sector to a higher, world beating level of performance and competitiveness. This is to be achieved by analysing the major challenges that the sector faces in terms of society, sustainability and technological development. Research and innovation strategies will be developed to meet these challenges engaging and mobilising the wide range of leading skills, expertise and talent available within the industry over the coming decades, in order to meet the needs of the society. The strategic research priorities include meeting client/user requirements, becoming sustainable, and transformation of the construction sector into a knowledge-intensive industry. New materials, innovative technologies and services are deemed necessary to reach the objectives. Construction is a huge industrial sector involving more than 2.5 million enterprises in Europe.

Services SRA relevance: An important line of business where service development can e.g. enhance customer satisfaction, promote energy-efficiency, and help identify new sources of revenue.


**European Road Transport Research Advisory Council - ERTRAC**

ERTRAC aims to develop a shared vision and to ensure a timely, coordinated and efficient implementation of research in Europe, with the objective to tackle the societal challenges of road transport and to enhance the competitiveness of Europe. The strategic research agenda recognizes the societal demand for decarbonization, and the importance of the reliability and safety of the road transport system for its users. ERTRAC takes the systems approach to address innovation in the use of the road transport system. Increasing levels of congestion will place mounting pressures on the mobility services, particularly in the larger urban areas. This
will give rise to comprehensive, integrated service concepts and business models that complement the existing modes of transportation, and for which the dominant factor will be extensive cooperation between the various actors in the chain. In particular, there will be a need to optimize the movement of goods and people to better reflect the actual demand for mobility services (including public transport). Again, ICT and a better knowledge of transport demand will play a major role in these developments.

Services SRA relevance: An important part of societal infrastructure where service development can contribute e.g. to safety, lower emissions, and economic efficiency.


**Future Manufacturing Technologies - MANUFUTURE**

The mission of the MANUFUTURE is to propose, develop and implement a strategy based on research and innovation, capable of speeding up the rate of industrial transformation to high-added-value products, processes and services, securing high-skills employment and winning a major share of the world’s manufacturing output in the future knowledge-driven economy. Recommended activities focus on competitiveness in manufacturing industries, leadership in manufacturing technologies, eco-efficient products and manufacturing and leadership in products and processes, as well as in cultural, ethical and social values.

Services SRA relevance: The manufacturing industry is undergoing a transformation from an operating mode based on the manufacturing and sales of physical products to the provision of tailored customer solutions based on complex product-service systems. Services are expected to offer greater customer satisfaction, characterized by better performance, availability and life-cycle economics, to generate new revenue, and to reduce the environmental impact associated with the conventional buy-use-dispose products.

Mobile and Wireless Communication – Net!Works (also called e-Mobility)

Communications networks enable interaction between users of various types of equipment, either mobile (e.g. mobile phones) or fixed (e.g. PCs); they are the foundation of the Internet. The mission of Net!Works is to strengthen Europe’s leadership in networking technology and services so that it best serves Europe’s citizens and the European economy. The platform declares two key messages: ICT is essential for the continued economic growth and job creation in Europe, and research on new networks and services has to start now to be ready to support the mass market use of new applications. Health and inclusion, transport, environment, and the future Internet were selected as the most important application areas in the platform’s strategic research agenda. The SRA addresses detailed research priorities to pave the way for developing user-centric and context-aware services on these applications areas in the future.

Services SRA relevance: Communications infrastructure is the key enabler of data and knowledge-intensive services.


Networked and Electronic Media – NEM

The NEM Initiative aims at building sustainable European leadership in content production and networking technologies. The media industry consists of a value web creating, storing, adapting, aggregating, delivering, and consuming ‘content’ – understandable information made available to a user at any stage of the value chain. The NEM Initiative foresees a service oriented society in which ambient and context-sensitive services are created and provided, personalised and customised to people’s individual and social needs, and are available to all citizens. The strategic research agenda addresses a number of research topics, including
media-related applications and business models, content creation, networking and delivery infrastructure, content search and media presentation, and technology drivers and enabling technologies.

Services SRA relevance: Media is a good example of an industry where digitalization is having a profound impact on the functioning of the whole value chain, from production to the nature and distribution of end products. Services built on the application of ICT do not only affect media itself, but also transform many other industries that make use of electronic data acquisition and processing technologies and distribution channels.


Networked European Software and Services Initiative - NESSI

NESSI is active in the field of information and communication technologies and aims to achieve an impact on the Internet of Services through contributions to standards, open source as well as commercial projects. The platform supports application domains from health and public services to Future Internet and smart cities. The latest NESSI strategic research agenda addresses two main research challenges to be tackled on the way towards Internet of Services: interaction with, and management of, services. The former relates to technical aspects of services, such as permanence (always available), seamlessness (available through all modes of communication), level of transparency (hiding the details of the technology), trustworthiness (confidence that the service can be relied upon), and adaptability across a wide range of applications. The latter refers to the management of services in a world which is open, dynamic, without centralised governance, and behaves in an unpredictable manner. This includes all the aspects of lifecycle management: operational management, service design, service development and deployment, and service delivery assurance.

Services SRA relevance: ICT is transforming services in many ways: it helps enhance the efficiency of services and enables completely new services. On the other hand, it brings about a completely new set of challenges e.g. in relation to interoperability, quality of services, and
data privacy and security. Most of the research needs identified in the workshops organized as part of this study had to do with ICT in some way.
