

services for europe

Strategic research agenda
and implementation action
plan for services



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**services for
europe**



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PUBLISHER

VTT Technical Research Centre of Finland

P.O. Box 1000 (Vuorimiehentie 5, Espoo)

FI-02044 VTT, Finland

Tel. +358 20 722 111, fax +358 20 722 4374

CONTRIBUTING ORGANISATIONS

VTT, TNO, Fraunhofer ISI, Fraunhofer IAO, Tecnalia, SINTEF, and SP

EDITOR: Jari Kettunen

VTT RESEARCH TEAM: Jari Kettunen, Pentti Vähä, Ilari Kaarela,
Minna Halonen, Iiro Salkari, Maarit Heikkinen and Matti Kokkala

TECHNICAL EDITING: Marika Leppilähti

GRAPHIC DESIGN: Sari Halme and Kaisa Kuisma, VTT

COMICS: Jutta Suksi and Hannele Törrö

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Summary and foreword

This publication presents a strategic research agenda and implementation action plan for services (referred to as the 'Services SRA'). The publication 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 publication is to provide input to the preparation of EU research programmes and calls for proposals, particularly the forthcoming 8th Framework Programme (Horizon 2020 – the Framework Programme for Research and Innovation). An additional aim is to provide guidance for national and regional funding agencies.

The research and development themes identified have been divided into four broad categories and several subcategories. The themes are general in nature, and most of them are relevant to a number of industries and areas of application. The recommendations for the organisation and funding of research (implementation) have been written specifically 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 be designated as a priority area with a dedicated budget in the forthcoming Horizon 2020. It is argued that the total amount of funding that is allocated for 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 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 beyond the scope of the work. However, a need to limit the scope of the work in some way soon became evident. This led to the decision to focus on general 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. Their views were therefore accentuated at the expense of other sources of information.

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 Technical Research Centre of 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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List of abbreviations

AERTOs	Associated European Research and Technology Organisations
B2B	Business-to-business
B2C	Business-to-consumer
BRIC	Brazil, Russia, India, and China
EARTO	European Association of Research and Technology Organisations
EC	European Commission
ECTP	European Construction Technology Platform
eMobility	Mobile and Wireless Communications Technology Platform
EPISIS	European Policies and Instruments to Support Innovation in Services
ERA-NET	European Research Area Net
ERTRAC	European Road Transport Research Advisory Council
EU	European Union
FP	Framework Programme (funded by the EC)
Fraunhofer IAO	Fraunhofer Institute for Industrial Engineering
Fraunhofer ISI	Fraunhofer Institute for Systems and Innovation Research
GDP	Gross domestic product
ICT	Information and communications technology
MANUFUTURE	Future Manufacturing Technologies Technology Platform
NEM	Networked and Electronic Media Technology Platform
NESSI	Networked European Software and Services Initiative
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
R&D	Research and development
RTD	Research and technology development
RTOs	Research and technology organisations
SINTEF	The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology
SME	Small and medium-sized enterprises
SP	SP Technical Research Institute of Sweden
SRA	Strategic research agenda
Tecnalía	Fundación Tecnalía Research & Innovation
Tekes	The Finnish Funding Agency for Technology and Innovation
TNO	Netherlands Organisation for Applied Scientific Research
VTT	VTT Technical Research Centre of Finland

1 Introduction

Services constitute an increasing element in the EU's economic activity, accounting for around 70% of total employment as well as of the gross added value generated by the EU27 (Pro Inno Europe 2010). For the most part, the share of services in 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 concerns not only industry but society as a whole. However, these developments do not automatically sustain or guarantee sound economic development.

Europe is currently facing a decline in its manufacturing industries relative to other industries. This stems not only from the triumph of the service economy but also from the emergence of Asia, especially China, as the world's main 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 rapidly, which means that the welfare of an increasing number of European citizens will have to be supported by a rapidly shrinking workforce. Considerable reforms in the labour markets are needed for boosting participation among older employees and for reducing 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 of the past and the massive remedial actions necessitated by the recent financial crisis. Such challenges impose increasing demands on Europe's private sector.

Services do have real potential to contribute. The consulting firm Deloitte 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 striving to facilitate product sales, to expand the scope and lifetime of their customer accounts, to lengthen product life cycles, to create new growth possibilities in 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, researchers will need to demonstrate how such methods can be applied in practice with respect to, for example, 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 prioritise some particular topics more than others? Service research is an emerging theme. New conferences and journals are constantly established, and the sheer volume of related research is rapidly increasing. In consequence, also the range of topics being researched under the headings 'service research' and 'service science' has expanded to cover all major

aspects of business, technology, and workplace development. The 10 overarching research priorities listed by Ostrom et al. (2010) provide a good example: the list includes such themes as creating and maintaining a service culture, enhancing service design, optimising service networks and value chains, effectively branding and selling services, and leveraging technology to advance services. The results summarise 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 significant public funding in Europe is far from trivial.

On the other hand, important research themes are also likely to cover the features of the wider socio-economic environment in which service innovation is expected to take place. Given the diverse nature of the EU27, it is no wonder that European policymakers and representatives of EU-level and national funding agencies have stressed such matters as the importance of effective networking and co-ordination, development of regional competence centres, support for small businesses, public-private partnerships, and 'platforms thinking' to foster the creation and exchange of knowledge and knowledge-intensive products and services – to mention just 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. The low-level goals pursued as part of individual actions tended to be especially 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

those of an earlier study carried out by the European Commission in 1998, which concluded that compact projects and clarity of objectives contribute to the success of projects (EC 1998). In short: money can make a difference, but organising too matters.

The development of services is at 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 content of EU-funded research. A recent study carried out by Tekes (the Finnish Funding Agency for Technology and Innovation), revealed that only two per cent of the FP7 project summaries explicitly referred to service innovation. Furthermore, service innovation was not the main topic of any project (Tekes 2011).

We wish to argue that, because of its dependence on services, Europe needs to make sure that the amount of money allocated to services research and development reflects the importance of this field to European economies and citizens. Europe simply 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 sub-optimal in comparison to, for example, that of the US (Roxburgh et al. 2010). Europe's output per hour trails far behind that of the US. The main reason for Europe's disappointing productivity performance was that it failed to squeeze productivity gains out of 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 link service, technology, and workplace development in an effective and inspiring manner. Finally, Europe shall avoid creating excessively complex or abstract programmes and calls for proposals, which blur the line 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 issue

recommendations for the organisation and funding of services-related research in Europe. The key results of the project have been compiled 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). A further aim is to guide national and regional funding organisations.

1.2 SCOPE AND EMPHASIS

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

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

- are general in nature and therefore potentially relevant for many areas of application,
- are related to major socio-economic challenges and/or objectives of Europe,
- have to do with major technology trends, especially in the field of information and communications technology (ICT), and
- were emphasised by the representatives of the participating research and technology organisations, or RTOs.

1.3 METHODS

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

- Tecnalia (Spain),
- TNO (The Netherlands),
- Fraunhofer IAO (Germany),
- Fraunhofer ISI (Germany),
- SINTEF (Norway), and
- SP (Sweden).

VTT and its partners provided the main input to the process. Input was generated by means of on-site interviews and workshops (the participants are listed in Appendix 1). Supporting methods included review of relevant research and policy papers, identification and review of selected technology platforms (see 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 respective countries.

Workshops to support data acquisition and analysis:

- VTT, Finland: 3 Nov. 2010
- Tecnalia, Spain: 22–23 Nov. 2010
- TNO, Netherlands: 29–30 Nov. 2010
- Fraunhofer IAO, Germany: 8 Dec. 2010
- Fraunhofer ISI, Germany: 9 Dec. 2010
- SINTEF, Norway: 20 Jan. 2011
- VTT, Finland: 26–27 Jan. 2011 (management group meeting and general workshop)
- VTT, Finland: 6 and 9 May 2011 (industry workshops)
- 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 the OECD (2005) underscores the importance of services in the further economic growth of developed countries. The report lists a number of elements hampering the development of service economy, including closeness due to anti-competitive legislation and hidden protectionism, barriers to foreign direct investment, high labour taxation, and rigid labour markets. According to the OECD (*ibid.*), it is important to provide a fiscal environment that 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 & 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 toward the desired direction (*ibid.*). Furthermore, Koch et al. state that innovation policies should support a systemic view of innovation, with a 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 expertise of diverse types 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 to some extent FP6, based on a meta analysis of impact reports covering 1999 to 2004. Second, the Green Paper published by the European Commission in February 2011 (COM(2011) 48) summarises the key findings from the evaluation of FP7 but also of the Competitiveness and Innovation Framework Programme (CIP), the

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 socio-economic 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 are socio-economic goals at higher levels, but the 'intervention logic' that should connect the two is not explicit. This means that the expected contribution of FPs toward the socio-economic goals has been based mainly on common beliefs rather than evidenced influence mechanisms.

This burden of proof has gradually 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 have to do with the methodological difficulties of doing so and, in many cases, the timing of the evaluation: even successful interventions require a lot of time to take effect in the broader socio-economic environment. 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 in, for example, the ERA, Lisbon, and Barcelona agendas. While FPs may be necessary, they are unlikely to be sufficient on their own. It is also important to pay attention to 'portfolio impacts'.

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.

One important as well as interesting question is how different stakeholders, such as research institutes and companies, perceive themselves as having benefited from 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 is.

The FP5 Finnish University Impact study found, however, that respondents representing more application-oriented fields were more satisfied with EU programmes than were respondents from more basic-research-oriented fields. This suggests that either the 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 for proposals get tailored to the specific needs and expectations of RTOs.

On the other hand, Arnold (*ibid.*) found that SMEs' 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 do. Involving SMEs and large firms in RTD programmes entails 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 gain 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 are less able to deliver the more concrete, commercially-oriented outputs and benefits desired by some parts of industry, especially SMEs.

2.2.3 Success factors identified and 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, and long-term. The latter involved a high proportion of large companies.

Two earlier evaluations suggested 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 correlated negatively with 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 when compared with smaller ones.

RTD programmes such as the FPs are often criticised for inadequate dissemination of results, and some such criticisms appear in the FP evaluations. Arnold (ibid.) points out that in part this criticism arises from a misunderstanding, based on the popular ‘linear model’ idea that research produces results, which should necessarily lead to development and commercial exploitation. This model implies that results should be disseminated widely, so that they have a high probability of reaching those who can use them. However, the experience of RTD programmes over the past 20 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”, according to Arnold (ibid., 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 initiate public debate on the key issues to be taken into account for future EU research and innovation funding programmes.

The Green Paper summarises the key findings from the evaluation of the key EU instruments

to support research and innovation in Europe, including the 7th Framework Programme but also the Competitiveness and Innovation Framework Programme, the work of the European Institute of Innovation and Technology, and use of the Structural Funds. The results reported are mainly positive. However, a number of shortcomings and deficiencies were identified also. The EC 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 burden, reducing time to grant and time to payment, and achieving 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 stimulate industry and SME involvement further.
- 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 policymakers.

In addition, we want to highlight two additional challenges, or at least big question marks. The first is related to the **competition logic** that applies to EU-funded research programmes and calls for proposals. In the industry workshops, it was posited that the 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 the road for 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 be what guides funding decisions. This should also

encourage representatives of the research community to 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 it 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 show great variety. One of them is that a project is no longer merely a way of organising work. Instead, it has become RTOs' core offering, and fund-raising constitutes an ever-increasing proportion of their activities. While a 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 (ibid.) states that almost no work has been done to estimate the aggregate cost of FP calls to proposers but refers to an FP4 Impact Germany report according to which such costs equate 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 in any activity that does not directly contribute to their own (project) business, such as dissemination of the results of the work outside the project framework.

2.3 A COMMON STRATEGIC FRAMEWORK FOR RESEARCH AND INNOVATION

The Budget Review identified a way forward in this respect through the development of the 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 is aimed at making EU funding more attractive and easy to access for participants. This work also strives for administrative simplification. Flexibility and speed of delivery are also essential for attraction of 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 EC are health; demographics and well being; 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 of these areas, the development of both private and public services is a prerequisite for harnessing the potential of new technologies.

The High-Level Expert Group on Key Enabling Technologies has recently expressed its concern about 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 nano-electronics, advanced materials, photonics, industrial biotechnology, and advanced manufacturing systems. In addition to particular fields of technology, the European Commission is paying increasing attention to the functioning of the European business ecosystem. Innovation in SMEs, improved access to risk financing, support for crossing the valley of death, intellectual property rights issues that govern EU research and innovation funding, and the use of public procurement to stimulate innovation have been given special emphasis (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 influence 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 the foreseeable future holds. Since the time spans in research and development are long, the recommendations given today shall also address realities of the future that may not yet be visible or may not play a major role in today's economic landscape.

The trends identified can be divided into the following categories:

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

Most of the trends in the first two categories have been condensed and further processed from the work of Ahola and Palkamo (2009). The trends in

categories 3 and 4 have been identified and formulated by the project team in association with AERTO's partner organisations.

We have attempted to illustrate these trends by means of four fictional stories. The stories rely on some of today's most visible trends, especially in ICT, but take them a little further into unknown territory.

3.1 MEGATRENDS IN THE GLOBAL ECONOMY AND PRODUCTION

The major trends in the first category are related to the growth of the world economy, deepening division of labour and fragmentation of value chains, rising prices of energy and raw materials, ownership of infrastructure, insecurity in job markets, changing allocation of R&D investments, and pressing environmental problems. The trends and their perceived relevance for services are presented in Table 1.

Table 1. Megatrends in the global economy and production.

Trend	Relevance for services
<p>G1. The world economy continues to grow. This growth is generated mainly by China, the other BRIC countries, and the rest of Asia, but the pace of growth will gradually decrease.</p>	<p>The ability to export services and/or serve customers globally will become 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>
<p>G2. The newest phase of globalisation will deepen global division of labour. Value chains will grow increasingly fragmented. Economic profitability will dictate the geography of specialist expertise. Economies of scale will be significant in the global network.</p>	<p>Increased demand will be seen for various types of co-ordination and support services and supporting ICT.</p>
<p>G3. Rising energy prices pave the way for alternative energy technologies. Alternative technologies, which have been under development for a long time but thus far not been profitable, will gain momentum. The demand for energy-saving products and services exceeds the supply. This may lead to a bubble similar to the IT bubble of 1995–2000.</p>	<p>ICT will enable industry sectors to be connected intelligently (with 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.</p>
<p>G4. Infrastructure is creeping out of national ownership in many countries. Internationalisation of the ownership of strategically important companies has improved companies' efficiency but also brought uncertainty about how important sectors of society will function in times of crisis.</p>	<p>Contingency planning to assure societal robustness in case of a major crisis or system failure will call for co-operation with public and private actors.</p>
<p>G5. Insecurity in the job market, temporary assignments, and risk-sharing with the employer will be seen.</p>	<p>Those who can market their capabilities as services will benefit. Better possibilities will arise for SMEs to sneak into the market.</p>
<p>G6. Developed countries' share in the world's R&D investments is decreasing. Developing countries invest more in R&D, and an increasing proportion of the R&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 there.</p>	<p>This poses a development challenge for Western R&D personnel and institutes. They need to develop their competitiveness in the eyes of current and potential 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&D management will become a sought-after skill.</p>
<p>G7. Some production will return to the developed countries. Some EU member countries, the USA, and Japan can stay competitive in selected sectors of industry by continuously investing in technological developments and 'smart' production systems. This has already been seen in ICT services, and the trend will accelerate in manufacturing once product prices better reflect the costs associated with the environmental impact of production.</p>	<p>The 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.</p>
<p>G8. Environmental problems will limit the growth in developing countries. Economic growth based both on inexpensive labour and neglecting environmental charges will reach its 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 highlights the necessity of 'smart' production systems.</p>	<p>The 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 into their value creation and capture gain advantage.</p>

3.2 MEGATRENDS IN PRIVATE CONSUMPTION

The major trends in the second category are related to population growth, 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 electronic devices and the increasing demand for these, the public sector's diminishing

role as a service provider, the increasing value of leisure time, and the polarisation of markets. The trends and their perceived relevance for services are presented in Table 2.

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

Table 2. Megatrends in private consumption.

Trend	Relevance for services
P1. The population will grow.	Total demand for products and services continues to grow, but development is uneven. In emerging economies, demand is growing rapidly, while growth in the developed countries is slow or stagnant. Major global firms increasingly target the emerging middle classes of developing countries.
P2. Consumption as a lifestyle is expanding everywhere. Almost all human existence and activities can be analysed and interpreted in terms of consumption. Global information networks and people's mobility promote the dispersion of commodities and influences.	This boosts retail, transport, e-commerce, and personal banking and finance (e.g., consumer credit) services.
P3. Production and consumption are increasingly separate geographically. National and local characteristics are difficult to take into consideration in such a production model. At the same time, both corporate and individual customers want products and services that can be tailored to their needs. Private consumption is strongly differentiated and fragmented.	This trade-off between effectiveness and efficiency supports a range of economic activities, including market research, product design (to support configurability), aggregation of global and localised content (ICT-based products), localised marketing, etc. Generating profit from serving the long tail of the customer base calls for efficient sales, payment, and logistics systems.
P4. Consumers want a new kind of communality. Human beings are still social animals who desire to be part of a group. Global virtual communities based on shared interests and maintained over the Internet are replacing local communities based on geography.	Social media function (or at least 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 of freedom of expression, security, privacy, ownership of content, etc. will emerge.
P5. Other consumers' views are used as a reference. The Internet has a great impact on consumerism. Its forms and methods are changing. The individual consumer is becoming a significant informant to other consumers. Global dissemination of information and tendencies is accelerating.	Peer review is gradually emerging as a de facto method of evaluation in a number of product and service categories: hotels, restaurants, Internet brokers, nursing homes, books, etc. Service providers need to take published reviews seriously. Falsified reviews to boost one's own service or to defame competitors' are becoming commonplace.

Trend	Relevance for services
<p>P6. Immaterial consumption increases overall consumption. In particular, the consumption of immaterial products and services (digital content, tourism, etc.) boosts demand for new devices, infrastructure, and energy.</p>	<p>The distinction between goods (or material products) and services (or immaterial products), including technology (IPRs), is becoming fuzzier and artificial. Sales of material products, such as mobile phones, are increasingly dependent on the supply of services that can make use of the product.</p>
<p>P7. The economic life cycle of devices is continuing to shorten, and the number of devices per household continues to increase. Devices' functional lifetimes shorten as a result of, for example, planned obsolescence, poorer quality, and/or the development of other devices and services, causing interoperability problems. Consumption as a lifestyle adds to this trend.</p>	<p>The ramifications of this complex process are diverse. Services along the entire value chain, including mining, manufacturing, software development, logistics, retail, marketing, consumer credit, and waste management and recycling, will benefit, and the impact on GDP and employment will be positive. In terms of sustainability, the question is how we can generate economic growth without increasing the consumption of raw materials or energy.</p>
<p>P8. The public sector's share in service provision is decreasing. The private sector, the third sector, and households will cover some of the services provided by the public sector. In particular, paring back of public health care services will lead to self-care and volunteer work.</p>	<p>Exploitation of automation and remote consultation for provision of services will increase. The supply of private-sector offerings and various public-private partnership arrangements will increase, as will demand for these.</p>
<p>P9. Leisure time will become an increasingly valuable asset.</p>	<p>More money is being spent on leisure activities. Expenditure for leisure has increased even though the amount of effective leisure time has remained stable. Households will buy housework and cleaning services. This has a positive impact on GDP.</p>
<p>P10. Increasing differences in the standard of living are exerting an effect in combination with the increasing economic insecurity of the middle class (stagnant or decreasing purchasing power).</p>	<p>Product and service markets will polarise further into 1) tailored, flexible premium services available for a premium price and 2) standardised, automated bulk services that cater for the cost-conscious – i.e., the majority of people. This divide is most evident in industries where personal service and professionalism have traditionally made the difference between a 'good' and a 'bad' service, such as health care, legal services, banking, hospitality, and construction.</p>

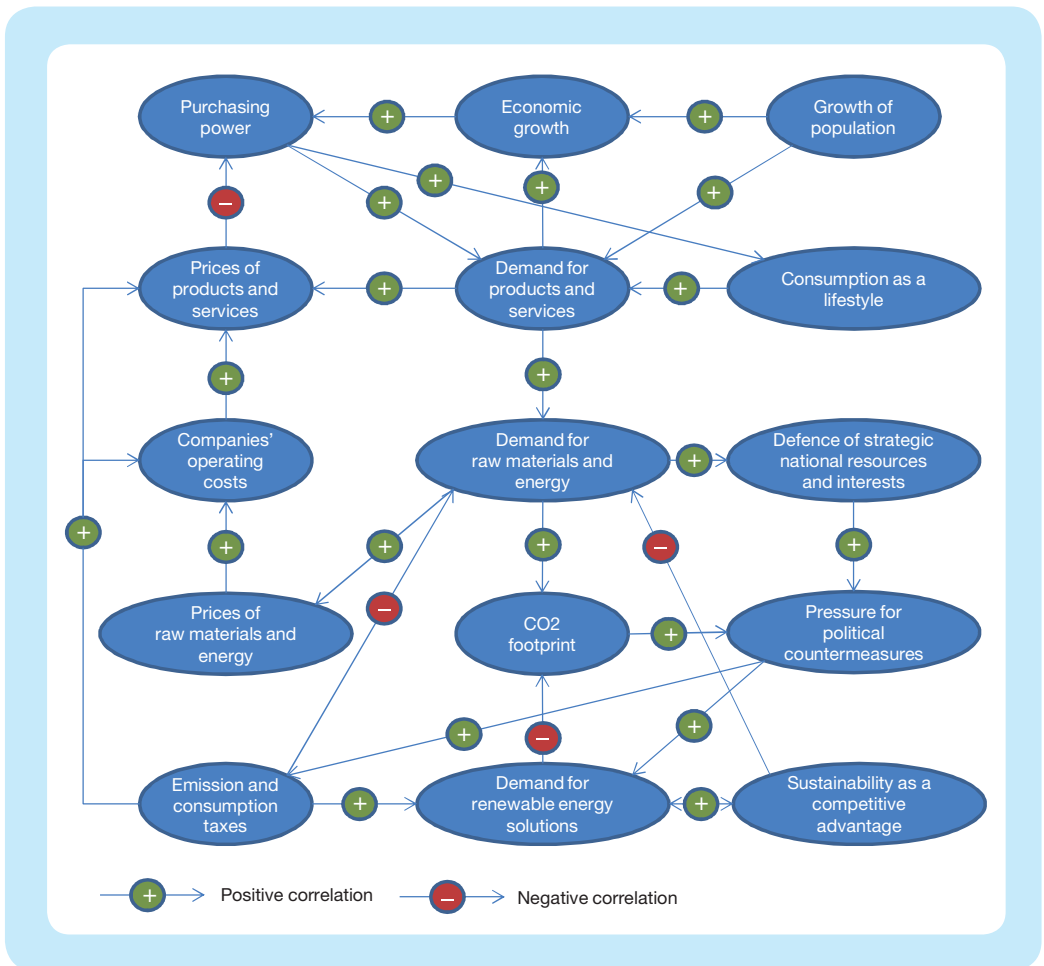


FIGURE 1. Selected megatrends in the global economy and private consumption.

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 trends identified were divided into six subcategories: data-intensiveness,

decentralised system architectures, fusion of ‘real’ and ‘virtual’, disappearing (or hidden) human interface, Web-based organisation of work and life, and increasing need to manage social robustness. The trends and their perceived relevance for services are presented in Tables 3–8.

Selected megatrends in ICT and ICT-enabled services and their interconnections have also been illustrated in Figure 2. Please note that the model is only indicative and that many important factors and influence mechanisms have been omitted.

Table 3. Data intensiveness.

Characteristics	Characteristics
Service providers can automatically collect and analyse a lot of customer/process data.	In the B2B sector, this enables, for example, services based on preventive diagnostics, proactive maintenance, and operational guidance. In both the B2B and the B2C sector, accumulating information may be used to support adaptation, customisation, personalisation, and individualisation of services. It also helps with development of new offerings. With data becoming a valuable asset, data-ownership, privacy, and security issues emerge (especially in cases 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.
Large amounts of unfiltered data are available free of charge.	As there are fewer data monopolies, it is getting harder to charge for information. However, filtering data takes time, and the reliability can be questionable. This opens new business opportunities for related services, such as data-mining and analysis, validation, compression, archival, and publication (concrete examples include business intelligence and market research).

Table 4. Decentralised system architectures.

Characteristics	Relevance for services
Various cloud-computing frameworks, systems made up of other systems, services built on other services, and the semantic web are commonplace. 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.	Increasing complexity adds to the challenge of ensuring interoperability of various systems, devices, and application and raises concerns over the quality of service, especially in 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 assist in solution-building.

Table 5. Fusion of 'real' and 'virtual'.

Characteristics	Relevance for services
<p>We are proceeding toward the Internet of things: sensors and processors are being installed in many products, paving the way for ubiquitous computing.</p>	<p>Enhanced capabilities of virtualisation and augmented reality enable a range of business and entertainment applications. New technologies are increasingly applied to combine live, recorded, and computer generated materials (e.g., in broadcast media, such as television), as well as commercial and non-commercial content (a practice that has traditionally been typical of film and print media) and to create immersive digital environments (artificial, interactive, computer-generated worlds) for purposes such as professional training, product demonstrations, and entertainment.</p>
<p>Exponential development of computing power can be seen.</p>	<p>The gap between the feel and touch of the real and the virtual is gradually vanishing in some areas of application.</p>

Table 6. The human interface going into hiding.

Characteristics	Relevance for services
<p>Striving for productivity means more automation and less personal service.</p>	<p>Almost everything possible is becoming automated. This can be characterised as a transition from 'service' to 'self-service', from shopping to online shopping, etc. Amid transition, customer service agents will help customers to 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.</p>
<p>Systems are getting more advanced and complex, and system development and maintenance will require increasing investments from service providers.</p>	<p>The development of easy-to-use and robust systems will remain a major challenge. In the trade-off between opportunity costs (such as lost revenue or damage to brand image, from non functioning service) and development costs, IT service providers are likely to benefit.</p>

Table 7. Web-based organisation of work and life.

Characteristics	Relevance for services
<p>Access to all relevant information, products, private and public services, and 'players' is generally possible over the Internet.</p>	<p>Private and business networks are increasingly formed and maintained on the Internet too. Businesses harness user/consumer communities to generate content (open innovation and crowd sourcing). The line between business and private is growing increasingly blurred.</p>
<p>Mobility is increasing. Mobile (wireless) use of Internet services in combination with high bandwidth, robust connections, automated networking, and a range of terminal devices suitable for mobile Internet use is becoming the norm.</p>	<p>This will have a profound impact, which can already be seen, on the organisation of work and consumption of Internet services. The need for permanent office space is decreasing, while work in flexible virtual offices, on the customer's premises, at home, and on trains and aeroplanes increases. This also creates new challenges for IT support.</p>

Table 8. Increasing need to manage social robustness.

Characteristics	Relevance for services
<p>Dependence on ICT increases the risk of system failures that may paralyse essential societal functions.</p>	<p>Regulation for social robustness, security, and privacy may become a necessity. This boosts or necessitates the creation of new services that are designed to be more robust or aid in coping with increasing uncertainty and possible blackout situations.</p>



FIGURE 2. Selected megatrends in ICT and ICT-enabled services.

3.4 GENERAL SERVICE-RELATED TRENDS

General service-related trends encompass a shift from 'operand resources' (value in property) to 'operant resources' (value in use), meaning that services, rather than goods, will be the basis of economic and social exchange. The trends identified in this section are related to the characteristics of services business in general, reflecting the 'fundamentals' or 'logics' that are perceived as guiding 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 is gaining ground

Customers demand value in use, while service providers struggle to develop pricing models based on the value delivered. The underlying driver is the quest for a greater yield. The key challenges relate to sharing and pricing of risks, and to measuring of value in financial terms.

In particular, B2B offerings are becoming more complex. The vendor is often expected to take more responsibility for the functioning of the product or service sold, especially in cases of expensive investment goods and IT system deliveries. In general, (physical) goods are more often perceived as elements of the offering, rather than service being perceived as a supplement to the physical product (this is characterised by the use of such terms as technology / software / infrastructure as a service).

The root cause is dynamic value chains: at least bigger companies typically have many suppliers, the supply chains extend beyond national borders, there are many head-and-tail types of companies (with manufacturing and logistics outsourced), and there is a lot of intra-company trade, too. The gradual migration from vertical integration toward functional specialisation has created new business opportunities for service integrators and other 'complexity managers'.

Example: A power plant sold to the customer (e.g., a utility company) under 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

the electricity generated. The supplier would feel the strain caused by any delays or outages directly in its own purse, since the customer would pay not 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, with the charges in line with the service level agreement.

3.4.2 Sustainability becomes a necessity

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 modes of operation gradually become expensive or illegal (at least in most developed countries).

Sustainability is not yet a core driver for service innovation (the exception being sustainability-supporting services). Moreover, economic cycles and standards of living influence market demands and regulatory approaches. Many developing countries have different market dynamics: sustainability is a luxury, and few are willing to pay for it.

Example: The striving for reduction of CO₂ emissions has spawned a range of R&D projects aimed at commercial applications, including the neutralisation of carbon dioxide by means of feldspar (WO/2010/000937). The underlying idea of this innovation is to introduce a much more affordable alternative to the relatively expensive carbon storage technologies and to turn coal-fired power plants into environment-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 multiplied. Also, the convergence of the electricity grid, metering, and home automation will open new markets for energy service companies. They can optimise the purchasing and consumption of electricity for their customers.

3.4.3 Flexibility and efficiency in service development and provisioning

ICT can be used to increase the flexibility, scalability and efficiency of service development and provisioning by various means. Widely applied technologies include modelling, simulation, automation, and modularisation. The optimisation of the value of the service (with respect to its cost/benefit ratio to the customer and profitability to the service provider) is expected to gain more ground in the future.

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

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

Example: Many Internet service providers offer virtual server and Web hotel services that are easy to purchase, configure, and maintain over the Internet via 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 schedules, and so forth. Web hotels typically offer domain registration, and the package typically features several mailboxes. A customer who needs more resources or less than this can typically upgrade or downgrade the package online (e.g., by determining the new feature combination using radio buttons and then pressing the 'Purchase' or 'Confirm changes' button). The same flexible subscription management logic is applied in many other businesses, too, such as dating, professional networking, market data, and news sites.

3.4.4 Marketing imperative

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 virtualisation, testability, or 'gamification'. Service providers also fiercely look for 'lock-ins', making it difficult or expensive for a customer to change service provider.

The situation described above has resulted in opportunistic utilisation of buzzwords and 'marketing norms' (e.g., 'green'), irrespective of real substance.

Example: Telecoms operators are fiercely fighting for market share. Differentiation is difficult because the core product, mobile connectivity, is immaterial and bulk. Typically there are no great differences in bandwidth, price, or other terms of contract. All major operators also provide a range of Internet services, including television channels, films, and online games; they lease and sell computers; and they provide additional disk space on their servers, to mention just a few examples. But how do they compete? They invest heavily in advertisements. In Finland, for instance, you may see two-minute televised adverts at prime time. No effort has been spared in work to capture the viewers' attention: viewers can see Miami Vice types shovelling banknotes into the fireplace, nutty professor look-alike types coaching llamas in agility training, and men in black suits diving into a swamp somewhere in Finland and popping up somewhere in Nepal – all to catch the attention of, and to create a good feeling for, active people. For customer retention, discounts offered for packages and long-term subscriptions play an important role.

3.5 Trends and people – what all this means in the longer term

EVER SINCE PETER WAS A LITTLE BOY HE HAS DREAMED OF LIVING AND WORKING ABROAD. ONE DAY PETER DECIDES TO TAKE ACTION AND LEAVES IT UP TO AN AUTOMATIC NET SERVICE TO FIND HIM A SUITABLE JOB.

GLOBAL
RECRUITMENT
LTD

PETER'S
SECRET
DREAM

upload
CV

CLICK

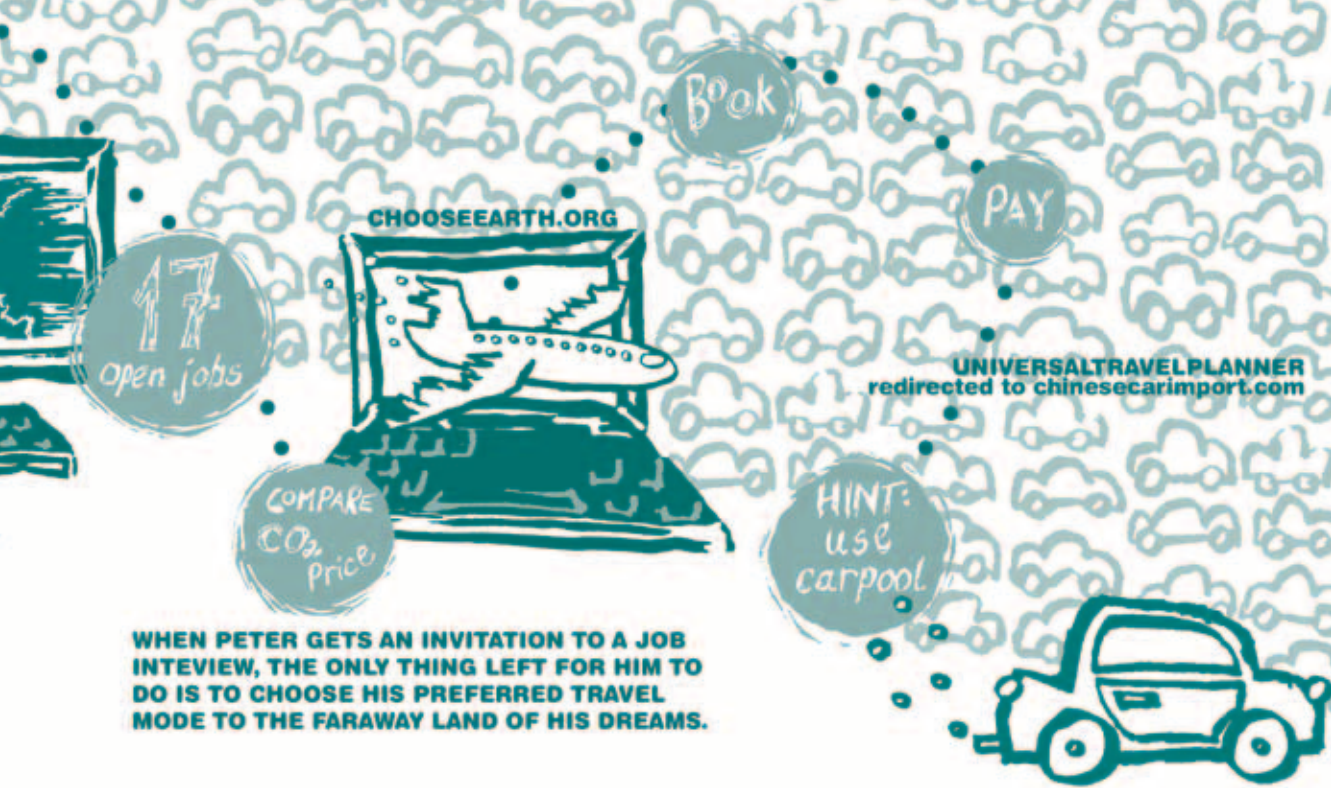


Year
2015

**Peter – an
ordinary
knowledge
worker**

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

One day, he receives a notice of several vacancies that meet his criteria. One that really draws his attention is far away in the North. He contacts the company and gets an invitation for an interview.



WHEN PETER GETS AN INVITATION TO A JOB INTERVIEW, THE ONLY THING LEFT FOR HIM TO DO IS TO CHOOSE HIS PREFERRED TRAVEL MODE TO THE FARAWAY LAND OF HIS DREAMS.

Peter starts looking for an affordable and sustainable mode of travel. Since 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 over the Internet.

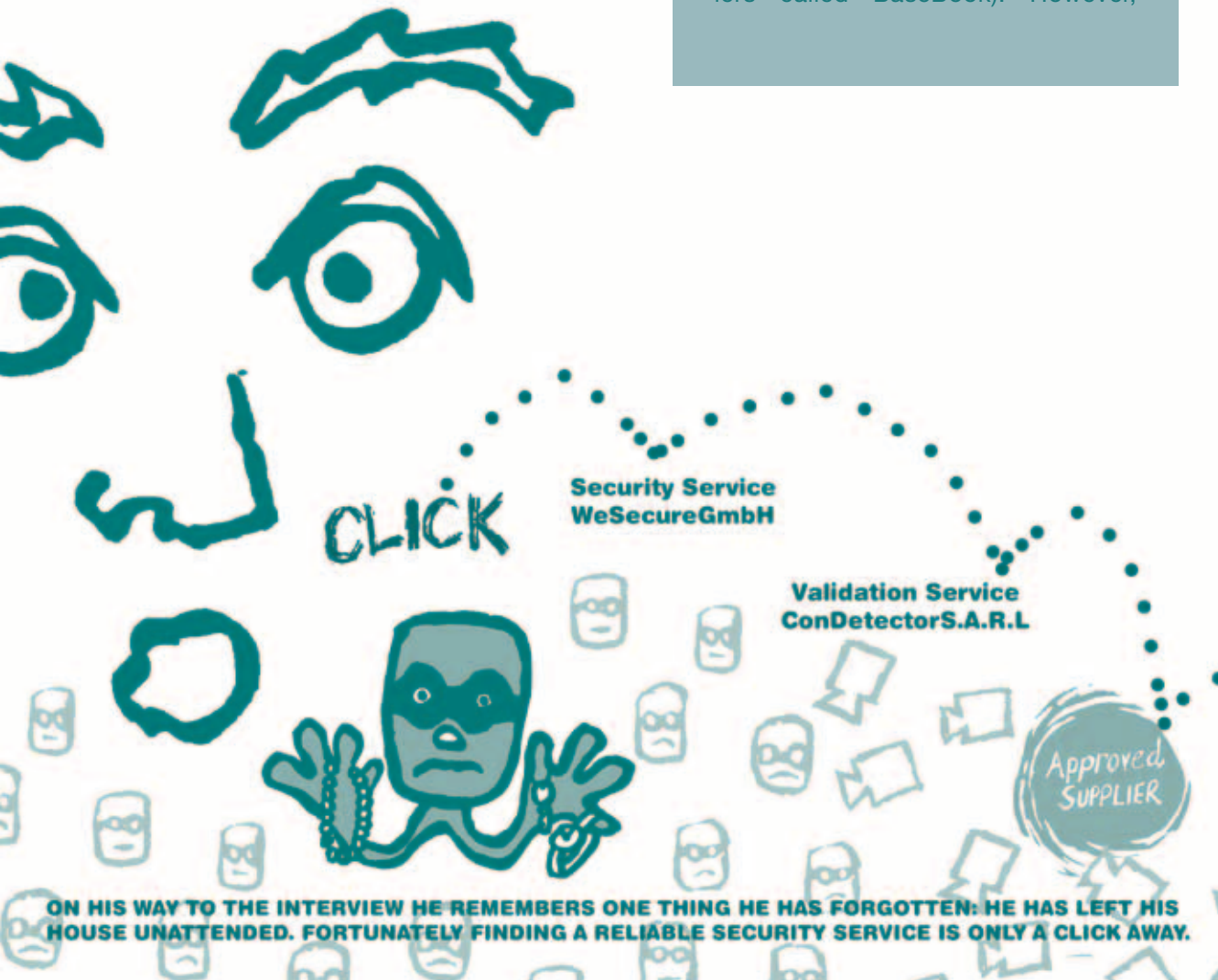
Instead of taking a taxi to the airport, he books a ride with a local carpool – as he was advised to do by UniversalTravel-Planner, a service provided by a company owned by the leading importers of Chinese cars. En route to the North, he suddenly recognises that he has left his house unattended. Since 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 are highly 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 its background and credentials through a dedicated service, ConDetector, and, after receiving the all-clear, makes an agreement and sends the electronic key code to the security company – still using his mobile phone. The security company now has access to his home and can install the control and monitoring systems necessary to enable automated surveillance of the house.

The service provider also provides Peter with remote access to the security systems installed. Now Peter can, for example, monitor his home from his personal laptop and view live footage from the security cameras. He also decided to pay a small extra fee to get rid of the annoying adverts 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 of his friends share his happiness through a social networking site (a well-known service among expats, foreign students, and other international travellers called BaseBook). However,

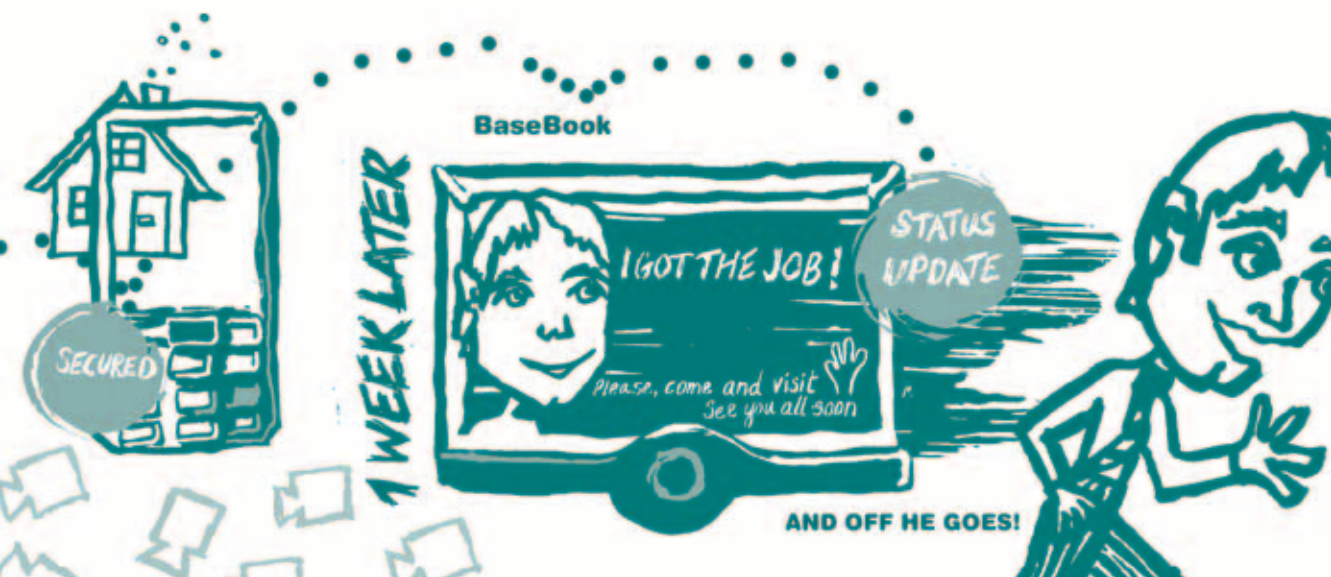


ON HIS WAY TO THE INTERVIEW HE REMEMBERS ONE THING HE HAS FORGOTTEN: HE HAS LEFT HIS HOUSE UNATTENDED. FORTUNATELY FINDING A RELIABLE SECURITY SERVICE IS ONLY A CLICK AWAY.

happiness soon gives way as Peter realises that there are many things he urgently needs to deal with, such as opening a bank account, arranging long-term accommodation, understanding tax regulations, and clarifying his right to use publicly-funded medical services. His new employer, who had never before hired a foreigner, could not really help him much. All Peter learns from his new employer is that the administrative department will deduct the income tax directly from his salary.

To Peter's surprise, an information desk at a local supermarket proves the most useful source of information for him. The

local authorities had set up the service a few years earlier 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 muses joyfully while walking back to his not-so-luxurious but affordable downtown hotel.



PETER'S HAPPINESS SOON GIVES AWAY ONCE HE REALIZES THAT THERE ARE MANY THINGS HE NEEDS TO DEAL WITH BEFORE HE WILL BE ABLE TO MOVE. TO PETER'S SURPRISE A HELP DESK AT A LOCAL SUPERMARKET SET UP BY LOCAL AUTHORITIES AND LAW STUDENTS PROVED TO BE THE MOST USEFUL SOURCE OF INFORMATION.

Medical services?
SEARCH
Accommodation?
SEARCH
Bank account?
SEARCH
Taxes?



CAN I HELP YOU?

YES, PLEASE

The Bank
Get the best interest rates from us!

TaxAuthority
Just provide us your information and we will make sure that you pay full amount of taxes!

OwnHouse Oy
Buy your residence instead of leasing it!

HE

Peter is not enjoying the benefits of an expat, since he had concluded an ordinary local employment contract. However, his salary is relatively good, and he has just received an inheritance from his aunt, so he decides to look for a nice house in a nice area. The only question is whether to rent or buy (there are no restrictions here on foreign ownership of residential property). Consultation with a local estate agent swiftly convinces him of the benefits of purchasing property: he would avoid paying excessive rent and should be able to sell the house easily whenever he wants – for a much higher price.

The agent helps Peter find a conveniently located house, allowing him to use



NOTHING BEATS PERSONAL CONTACTS!



public transportation when commuting between his home and the office. The agent also provides details of the energy rating and emissions of the building, affecting the level of the Sustainability Promotion Tax that was passed by Parliament a few years earlier to promote energy-efficiency and the use of renewable energy in the country. The house is equipped with electric heating, but the agent provides much information on alternative energy systems, such as heat pumps, wood, and solar and geothermal energy, that could also be used for heating and lighting.

Everything goes well. After a few hectic weeks, Peter can congratulate himself for his new job, which has proved rewarding,

and his new home, which was indeed nice and in a good location. Only one thing was missing: an Internet connection. Local operator FastFone had promised delivery within six weeks' time, but it would still take more than 10 weeks before Peter gets connected to FastFone's 1 Gbit/s optical cable network.

Year
2020

An advanced grandmother



ELECTRICITY
← USE
→ GENERATE

YEAR 2020

FAMILY PLANT
LIVES 500 KM APART
FROM EACH OTHER.
THEY HAVE VIRTUAL
MEETING NOW. (MAXIMUM
NUMBER OF FLIGHTS USED
THIS YEAR!)

RATIONING
CARD



An 'advanced grandmother' goes on a biking tour with members of her family who live 500 km away. This happens in a virtual environment created around an exercise bike in the grandmother's living room. The year is 2020, but in the virtual environment the year is 2050. This was a special request of the grandmother's two grandchildren, who take part in the biking tour with their parents.

The virtual environment contains familiar elements from the grandmother'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 a 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 credit-card company PASSPORT International – for product development and marketing purposes. In the future, they will know everything we have done, be able to predict what we are likely to do, and also be able to profit from that information in various ways. From said data plus artificial intelligence, the program can easily generate plausible future scenarios for its users.

The pedalling grandmother also generates the electricity for the system. Further 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 grandmother to stop for a ShowStopper meal. The meals are made and served by robots, but the outlet feels familiar otherwise. The interior decoration includes the backseat of an 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 use it without payment to promote



their products. In a premium version of the biking program, no added advertisements would be shown, barring those introduced by the hackers.

The situations generated by the program feel quite real, and not all of them are very pleasant for the grandmother. In particular, recklessly driven and noisy rocket cars make her heart beat rapidly, as she is nervous. Porn ads 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 socio-economic strata just won't walk or bicycle around, and our grandmother had forgotten to tick the 'no beggars' box when starting the program).





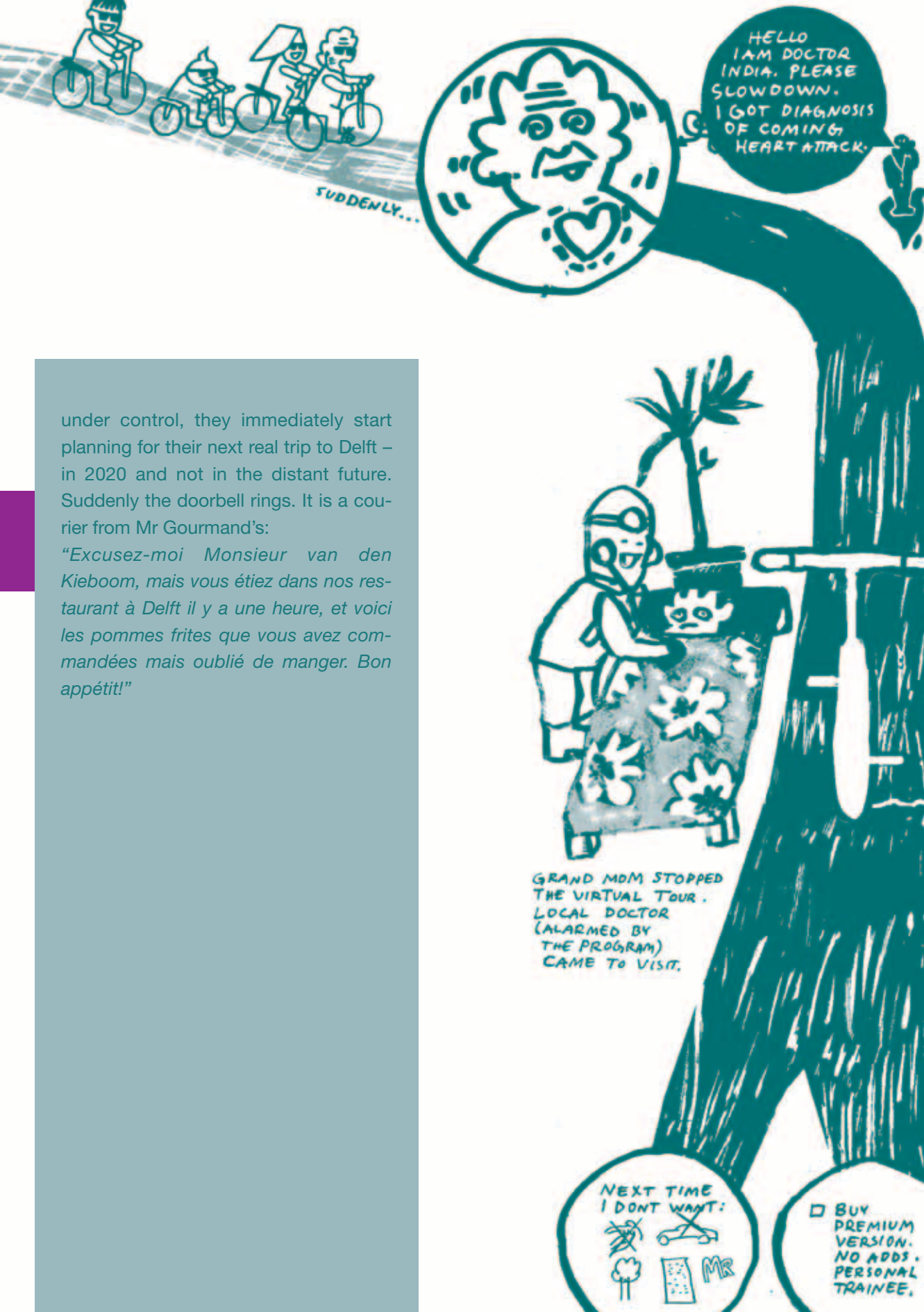
TOUR CONTINUED. BELGARS AROUSED SORROW AND SPEEDY CARS SCARED GRANDMOM.

It is the biking system that first detects that not everything is OK. Before the grandmother notices the problem herself, the system concludes that she is about to have 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 she has visited in the last 10 years. The records and the physiological measurement data recorded by the exercise bike are sent to a remote medical diagnosis centre, the local (nearest) health station is informed about a potential case of emergency, and a live connection is created to a doctor on duty.

The doctor contacts the grandmother in the virtual world, tells her the news, and requests her to slow down while the diagnosis is being prepared. The grandmother, however, is not sure whether this is happening in reality or is generated by the program. In the end, 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 grandmother. From the diagnosis completed by medical computers in India and his own inspections in the grandmother's bedroom, where she is now taking a well-deserved break after the tour, the doctor concludes that there is no immediate danger. Regardless, she is referred to a cardiologist for further checks. The tests will take place at a private hospital. There are no other options: the Dutch public health care system had proved uncompetitive and was consequently dismantled a few years earlier, in connection with other cost-cutting measures. The grandmother will have to pay for this from her own pocket, as she has forgotten to upgrade her health insurance to cover treatments provided by level-A+ medical professionals, such as cardiologists. A portion of the amount billed by the hospital will find its way to the service provider, SuperReal, as a commission for customer tracking. 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 feel relieved after having heard that the situation is



SUDDENLY...

HELLO I AM DOCTOR INDIA. PLEASE SLOWDOWN. I GOT DIAGNOSIS OF COMING HEART ATTACK.

under control, they immediately start planning for their next real trip to Delft – in 2020 and not in the distant future. Suddenly the doorbell rings. It is a courier from Mr Gourmand's:

“Excusez-moi Monsieur van den Kieboom, mais vous étiez dans nos restaurant à Delft il y a une heure, et voici les pommes frites que vous avez commandées mais oublié de manger. Bon appétit!”

GRAND MDM STOPPED THE VIRTUAL TOUR. LOCAL DOCTOR (ALARMED BY THE PROGRAM) CAME TO VISIT.

NEXT TIME I DONT WANT:

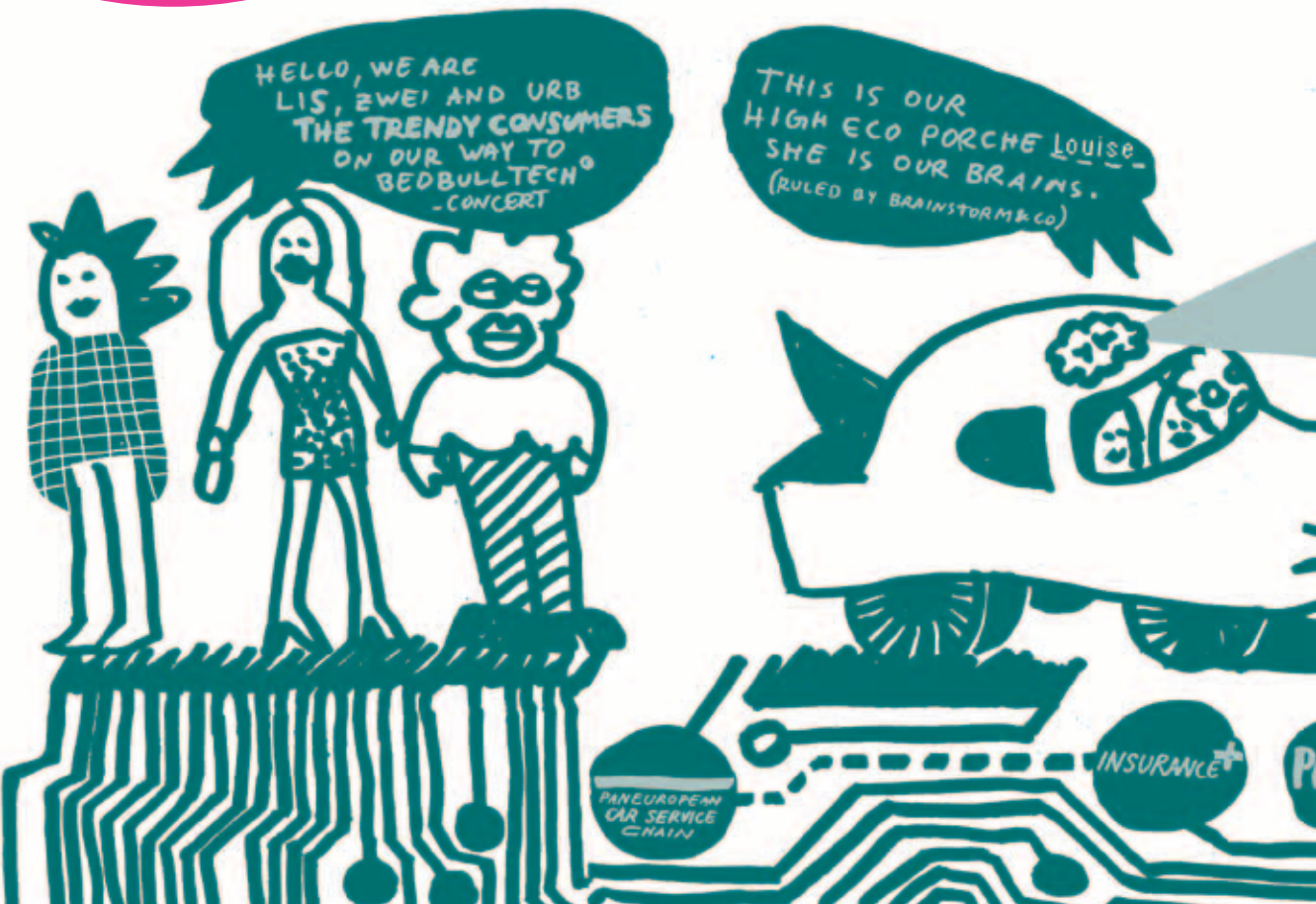
BUY PREMIUM VERSION. NO ADDS. PERSONAL TRAINEE.

Year
2030

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 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 at the destination, ability to carry goods, carbon footprint, and/

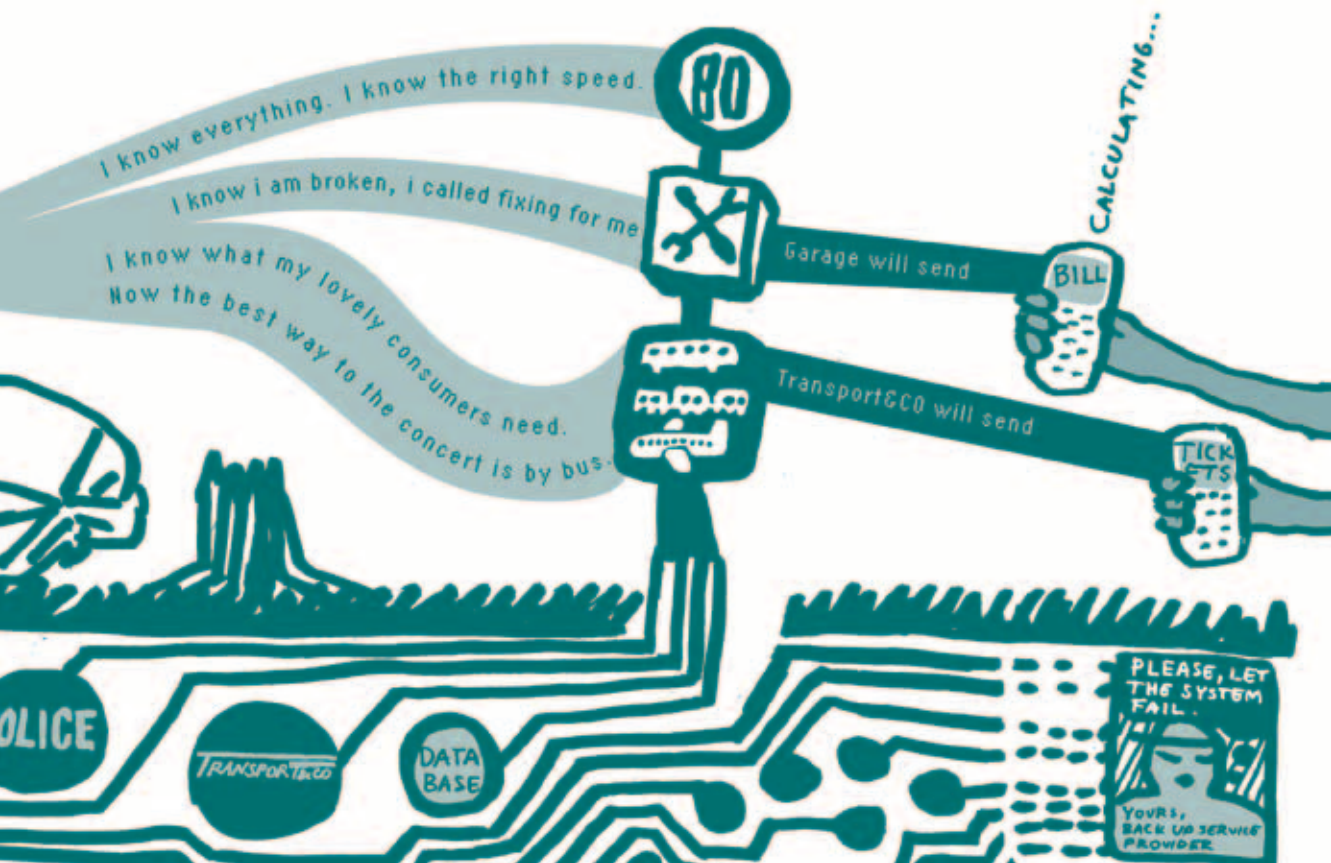


or sheer comfort. Whichever option is chosen, the car makes the necessary arrangements – calls a taxi, books or changes tickets and reservations, and so forth. So, the breakdown does not ruin the atmosphere in the car.

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 because of an engine failure. Their system has generated an alarm, indicating that a car has stopped

on a dual carriageway where parking is strictly prohibited.

There has been a lot of talk about the road authorities' ability to monitor traffic automatically. Many people are irritated because it also enables automated speed surveillance and route tracking. The police do occasionally purchase such data – the information 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 deliberately.



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

Also the insurance company was automatically contacted. The company 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 the car's towing and repairs and the continuation of the trip by other means.

Jürgen and his friends will be late for 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 through 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.

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

Despite the engine failure and other delays, Jürgen and his friends manage to arrive at the concert on time. The band represent the main genre of the day, which is BedBullTechnoPop, characterised by technology, fancy effects, and energy. As all trendy and successful Europeans do, Jürgen prefers BedBull-TechnoPop – the sole exception is Finland, where BedBullRoughGuitar is the dominant music genre.



The music industry in general has undergone a major transformation. Nobody pays for music anymore. The bands and artists are completely dependent on advertising revenue and online sales of merchandise. Merchandise is easy for bands and artists to produce, market, and distribute, and for consumers to purchase: everything is conveniently managed by BedBullSociety services. There are already more than 2.3 billion BedBullSociety account holders who have 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, terms it. No wonder BedBull Group plc is currently the world's most valuable company by market capitalisation.

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 of this was automatically diagnosed in a matter of seconds. It was also confirmed that no damage had resulted from the postponed maintenance. In a way, Jürgen was lucky. He has to pay for the towing and check and for the train tickets as well, and he will receive no compensation from the insurance company. On the other hand, he has avoided a much more expensive repair that he would have had to pay for from his own pocket had the engine failed as a result of his negligence. He

also has learned an important lesson: not to assume that everything gets fixed automatically!

When the car is serviced and ready for use, it is delivered to the hotel where Jürgen is staying with his friends. The car has found its way to the right hotel, although the travellers had moved to another hotel because of water damage at the hotel where the car had first booked them – thanks to the BedBull-Society PalLocator service.





PETER - A COUPLE OF YEARS LATER

PETER, A GOOD REPRESENTATIVE OF THE AGING EUROPE, IS STILL WORKING ALTHOUGH HE HAS ALREADY TURNED 65 - AND WHY NOT? HE IS HEALTHY AND IN GOOD CONDITION, AND HE LIKES HIS JOB.

THIS IS THE CITY WHERE I MET YOUR GRANDMA... SHE WAS WORKING

PETER IS JUST TELLING HIS GRANDSON, LUIGI, ABOUT THE ADVENTURES HE HAS HAD WHILE WORKING AROUND EUROPE, WHEN SUDDENLY HIS EMPLOYER EUROMAN TRIES TO REACH HIM.

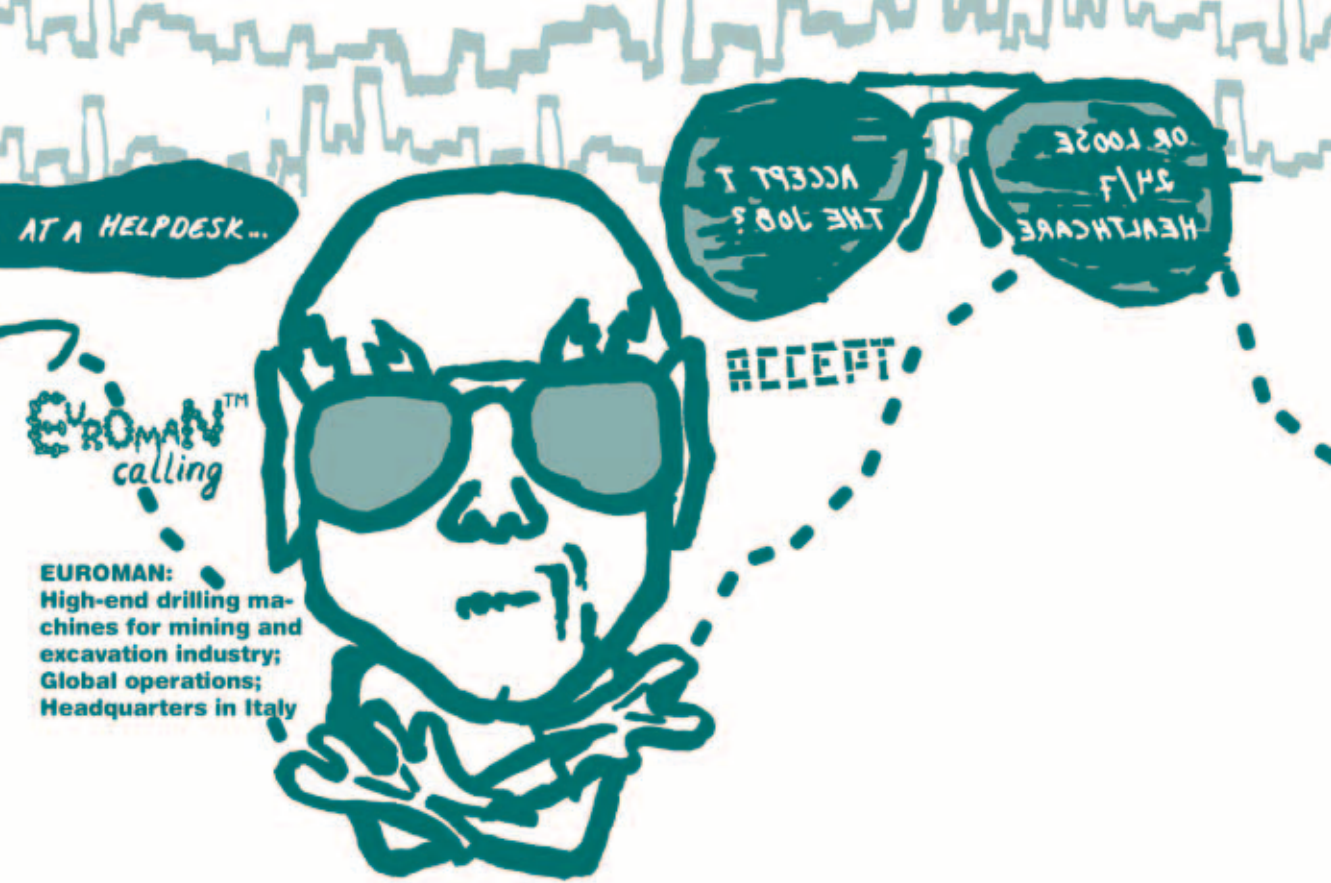


**Year
2045**

**Peter – a
seasoned
knowledge
worker**

Peter has had a long career. As an older professional, Peter is a good representative of the ageing Europe. He is still working although he has already turned 65 – and why not? He is healthy and in good shape, and he likes his job. Peter 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 it also provides a range of services from repairs to operation support.

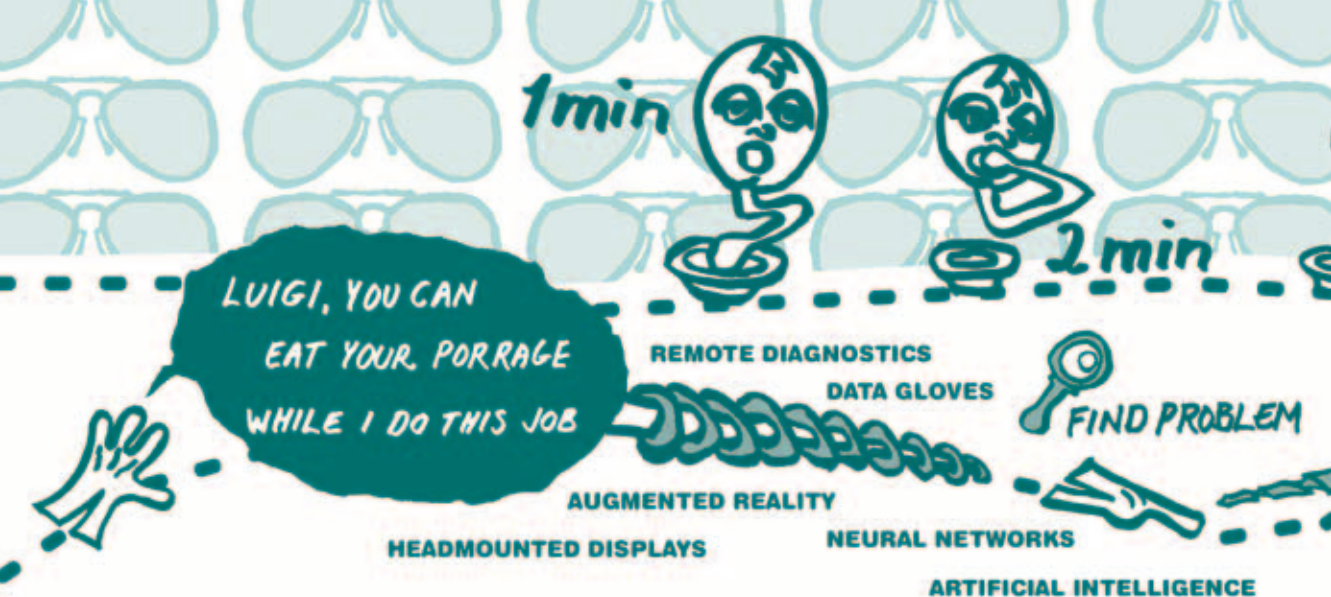
EuroMan has made a strategic decision not to outsource production outside Europe. They firmly believe in the competitive advantage of 'Old Europe' in the field of high-end



EUROMAN:
High-end drilling machines for mining and excavation industry;
Global operations;
Headquarters in Italy

manufacturing and industrial services. In consequence, they operate more than a dozen R&D centres and manufacturing plants in Italy and in five other EU member countries.

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

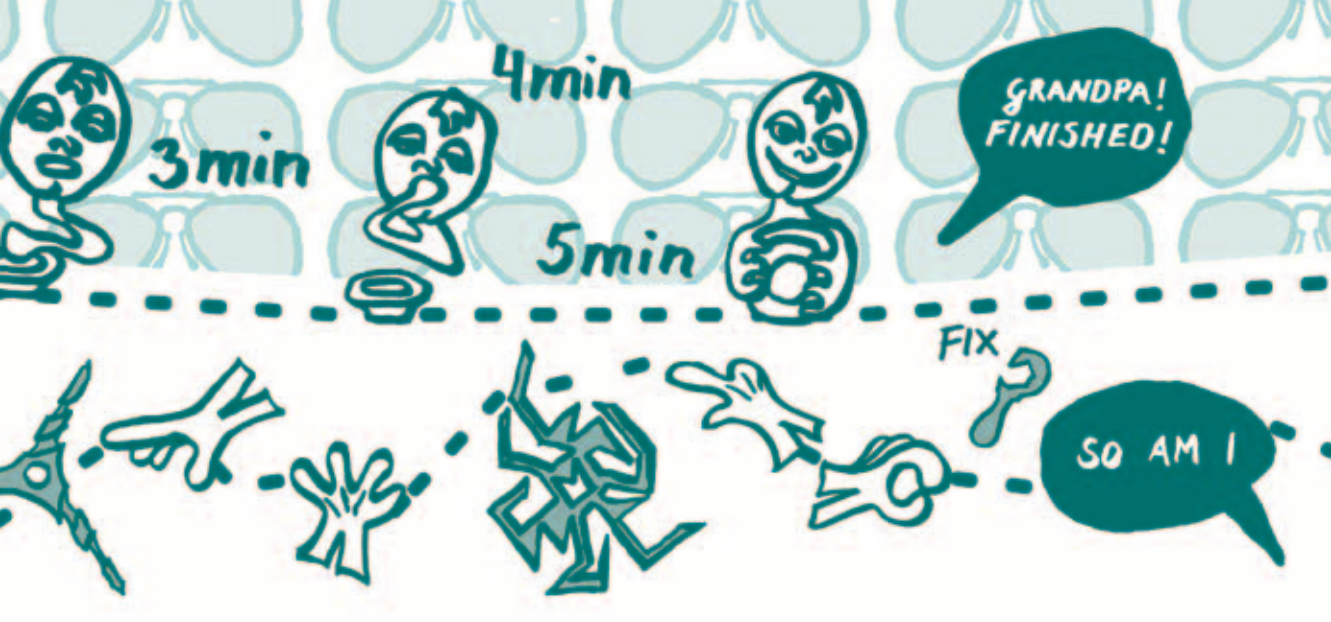


Peter likes his job for two main reasons. First, his employer is highly customer-focused, trying to understand and solve the customer's business problems instead of just selling and installing the machines manufactured. This is something about which he is really, really glad, since he believes that customer satisfaction and a commitment to high quality form the backbone of a successful enterprise. Moreover, most of the customer representatives are his personal friends.

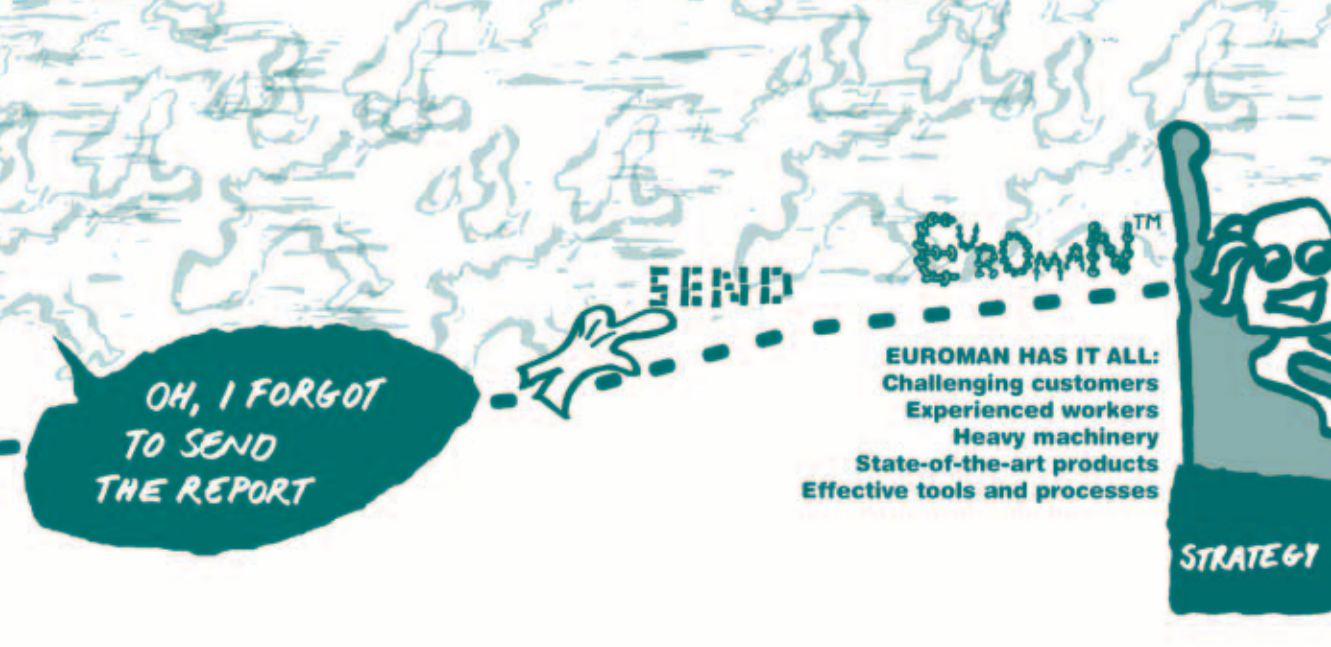
The second reason he likes his employer is that they can make good use of ICT-based applications. Only in the most demanding cases has it been necessary for him to inspect the machine personally. For the most part,

he can do the service work remotely by controlling maintenance robots from his home or office. They use, for example, remote diagnostics, artificial intelligence based on neural networks, augmented reality, lightweight head-mounted displays, and data gloves. Although Peter loves to travel in exotic locations, he has realised that the robots can be very handy for an ageing craftsman: he can avoid places that are detrimental to the health, inconvenient, or difficult to access. He can also resort to the virtual community he is involved in and chat with other elderly craftsmen whenever he might need assistance.

EuroMan are very pleased to have experienced elderly workers on the payroll. By taking care of demanding customers



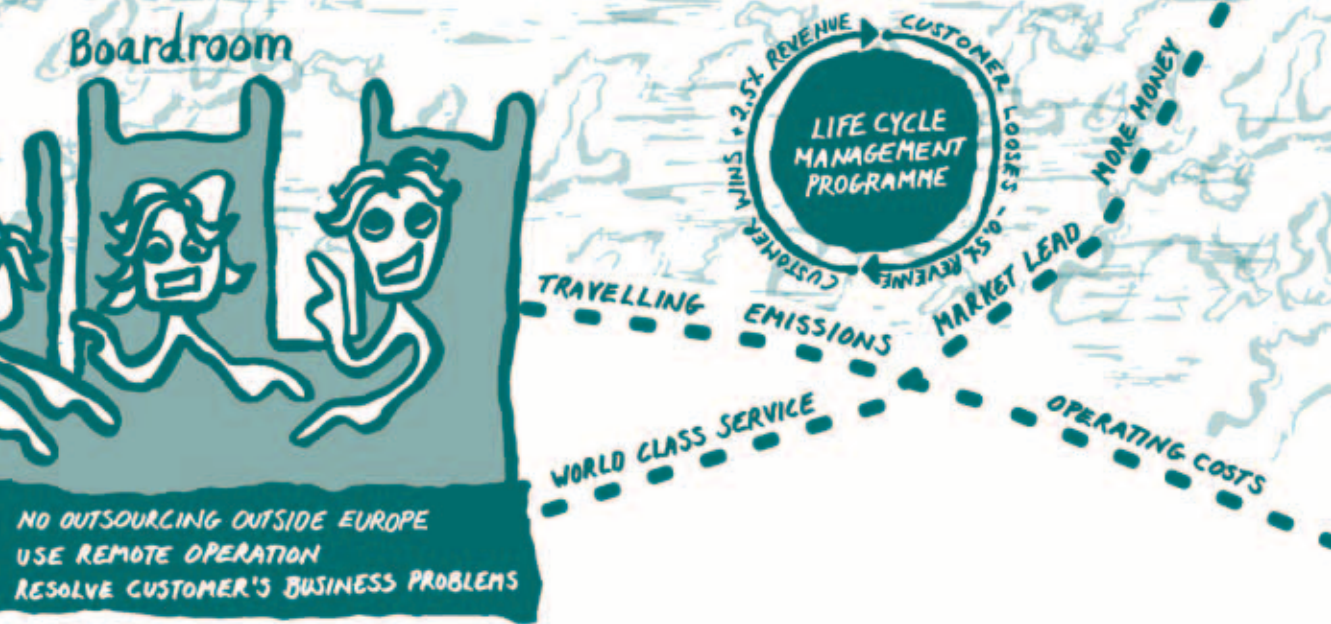
– as well as demanding machines – over the long term, they have helped EuroMan make more money. Knowledgeable workers, state-of-the-art products, effective tools and processes, and a profound understanding of their customers’ business environment have enabled world-class service business that has made the company a market leader in its field – and not only the market leader but also sustainable.



Sustainability is a core part of EuroMan's business model. First, remotely controllable robots help reduce travelling, and therefore also emissions. At the same time, they reduce EuroMan's operating costs. Secondly, the advanced life-cycle management programme, which warranty terms state must be applied to all EuroMan products, has been designed to minimise long-term environmental impact. The programme does not maximise the machines' capacity factor or the customer's return on investment. Some EuroMan customers have not been particularly happy with this, but most have admitted, however, that it sounded good as

marketing. EuroMan has been clever enough to provide the 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 whenever the customer wins a major contract in 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 the customer does not get the contract, EuroMan must pay a penalty equal to 0.5% of the value of



the winning offer. So far EuroMan has performed well, but they reckon that some of their customers have submitted poorly prepared offers solely for the purpose of pocketing the penalty fee. Peter and company lawyers are working hard to develop better model contracts, to thwart such behaviour.

4 Important research and development themes in services

This chapter specifies 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 general in nature; no particular lines of business have been emphasised at the expense of others.

The underlying motivation for the research may be of an applied nature, academic, or both. We wish to argue that this is determined not by the theme itself but by 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.

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

4.1 MARKETS AND BUSINESS LOGIC

4.1.1 Market creation and growth

Price competition is typical of mature, saturated markets. Everyone offers pretty much the same thing, the offerings become commodities, and the one with the least expensive offering wins the game. The prevailing market logic is often cost-driven. In such a situation, only those companies with the most cost-efficient global value chains may survive. This is especially challenging for SMEs: developing 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 of these new value chains and networks that they cross 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 emerge 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

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. Developing products and services into integrated solutions; arranging solid division of responsibilities and liabilities in the network; developing business models to support the sharing of risks, costs, and revenue among the market participants; and addressing practices and tools of co-operation.
- Removal of structural barriers to new market creation. Identifying and dismantling unnecessary regulatory barriers to free trade in services; facilitating SMEs' access to financing; and facilitating 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.
- Management of uncertainty and risks in market creation in the service business context.

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 operating in the field of electronics and mobile phones. Suddenly, Nokia emerged as the world's biggest supplier of cameras (although the related technology and equipment were mostly sourced from 'traditional' camera and lens manufacturers). On the other hand, Apple and Google set new rules for the mobile phone and services industry and surpassed Nokia in the smartphone market. Apple introduced its App Store 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 provision of access to a large customer base through different routes – namely, the search engine, the Android operating system, and Google Earth. Taking a proactive role in building of new markets,

value networks, and introduction of services increases the opportunity to have a central role in the renewed markets.

Creation of new markets can take place either incrementally or in a radical manner. For industrial goods, life-cycle services have provided a means of incremental market creation. The value chain has changed over time as various stakeholders gradually developed new capabilities, services, and also expectations as to 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 evident. This is because the end product does not need life-cycle services. Here, the change may be more radical in nature.

Mounting public debt, coupled with slow GDP growth in the EU27 (2009: -4.2%, 2010: 1.8%, 2011: 1.7% (f), according to Eurostat), provides an additional incentive for supporting the

development of services through dedicated public research grants. Services can contribute to growth of the economy but only if an increasing number of European companies will be able to develop competitive offerings and to open new markets effectively.

4.1.2 Value-in-use and value capture

Even today, some professional purchasers of industrial goods and equipment indicate that they do not want to pay for 'air' and are annoyed at their suppliers' eagerness to generate additional revenue by offering (chargeable) services to complement the (physical) core product. However, they still expect effective support to be 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 items, especially 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 branches of industry. For some reason, it is often psychologically easier to pay for a service when it has been factored into the price of the physical product, as if services were provided free of charge. Service offerings that are about assuring availability and/or performance instead of operations involving observable, measurable, and cost-incurring labour might be especially difficult to sell to old-school buyers for whom 'cost-plus' pricing is the only plausible reference model. "Why should I pay the supplier for

Key research and development themes

- Understanding value-in-use. Identifying, specifying, and measuring individual components of perceived customer value in services. Understanding the links between such constituent elements and traditional measures of operational and economic performance (in case they do not overlap) and 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 have to do with such matters as 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 its business. There are open questions about 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 several non-controllable factors have an impact on the performance metrics used, and managing profitability.
- Brand, experience, and IPR management in services. Addressing 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.

not having his men on site and maintaining the machine?” circulates in the minds of many such ‘old hands’.

There are also other contributing factors. One of them is the division of labour and responsibilities in large industrial companies. Maintenance managers typically work within a predetermined cost budget, while professional purchasers typically pursue the lowest item costs. They 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 generation 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 because of technical problems. This is where industrial services may easily prove their business value. The tricky element, 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, on its own 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 into value-in-use. This is the key proposition of current business research into service-dominant logic (e.g., Vargo & Lusch 2004). Good results call for successful definition of objectives and mutual responsibilities, and for the integration of the service provider’s and 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 for sharing the risks and proceeds of co-created value between the customer and the service provider.

4.1.3 Verification and validation

Service providers’ reach extends close to the customer, and they are often integrated into customer processes. As a result, they collect large quantities 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 with it the specific challenge of the trustworthiness of the partners in 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? For example, where else and for what purpose may the confidential information be used? 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 might 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. 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 alone, however. Just as classification societies certify vessels in operation, also some services are being assessed and classified by independent organisations – e.g., IT services

Key research and development themes

- Concepts and technologies to support the verification and validation of services. Important areas include, for example, terms of contract, vendor background, functionality, robustness, and data privacy and security. Special attention should be paid to online services (both mobile and fixed-Internet-based), services offered to retail customers, and services in specific 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. Developing guidelines for peer review in order 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 the validator's sphere of responsibilities should be, and the role of the public sector.
- Verification and validation for internal use. Collaborative piloting, testing, and ramp-up of new services for managing uncertainty related to service quality and delivery.

(CMMI levels), government and corporate 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 fields of application, including hotels, cinemas, and online brokers. But there are still difficult questions to be answered. For example, who may validate schools, health stations, and hospitals, and by which methodology?

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 more rapidly in the USA than in Europe. According to an article in *The Economist*, McKinsey have concluded that two thirds of the difference can be attributed to lower productivity of local services in Europe, such as retail and wholesale services (Smart work 2010). Heavy regulation and protection against international competition were named as the main culprits. Other contributing factors

identified in the article include 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 the 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 grow intertwined. This complicates the development and day-to-day management of services. Additionally, the greater supplier–customer relationship dependency in services impedes 'productisation' 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 resolve if customer expectations are non-standard and the firm's competitive

Key research and development themes

- Development of workable indicators for service efficiency and productivity that are both practical and theoretically sound. 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 optimisation models, managing the trade-off between effectiveness and efficiency, and measuring the value and return on investment from service.
- Development of effective approaches for practical development of service processes and systems. Specific questions involve process integration, customer involvement, and management oversight.

advantage is based on its ability to provide tailored solutions. These unique characteristics of service business justify further research in this area.

4.2.2 Utilisation of new technologies

The application of information and communication technologies 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 tens or hundreds of millions of euros to purchase, implement, and maintain), a well-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 a degree that they become inseparable. A good example is Internet banking: The service could not exist without a well-developed ICT infrastructure and has become a must for any banking group that wants to expand its customer base. It contributes to cost-effectiveness too.

While service development is increasingly ICT-driven, ICT itself – especially computing architectures – is undergoing a major change. The current trend is away from monolithic, centralised enterprise systems built around a central database and toward 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.

According to the official NIST definition, “cloud computing is 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) together translate into significant challenges, most notably in the areas of technical and semantic interoperability and quality of service. Add in 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 telecoms operators, and the proportions of the challenge ahead will emerge.

It will take some time before service providers will sign service level agreements accepting high availability requirements and clauses imposing strict penalties for substandard performance in hosting of mission-critical applications in a cloud computing environment. At the same time,

the number of end customers 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 telecommunication services.

4.2.3 Data management

ICT gradually reshapes service provisioning wherever 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, whether deliberately or unconsciously, generating vast quantities of data. Said data, stored in various systems, may be used for the benefit of the user or in pursuit of some other goal(s).

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 mobile phone or perform an Internet search, you also end up submitting data

Key research and development themes

- Technologies for enhanced interoperability and quality of service. Developing 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 presents 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 – for example, ‘who sells what to whom’ and who does the ‘packaging’ for the end customer. Supporting market participants’ efforts to come up with practicable contract models as well as cost-, risk-, and revenue-sharing schemes.

Key research and development themes

- Data- and media-mining. Further developing methodologies and services for intelligent search and for synthesis and interpretation of information from large databases involving different data types (e.g., text, voice, and pictures) and recording formats (e.g., .html, .mp3, and .jpg files). Developing user-friendly interfaces for such systems – for example, to support the use of natural languages.
- Use pattern recognition. Developing theories and methodologies for analysing patterns of use of different systems and services, to help determine what the user is trying to achieve, to what extent the user managed to reach the desired end, and how to develop the system.
- Data privacy, security, and ownership. Developing 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. Addressing 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 commercial use.

to your service provider on your whereabouts and interests – without having much say in the use of the data. 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 so-called long tail marketing – see, for example, Anderson 2006).

In an industrial context, ICT-based process control systems generate enormous quantities of data on the use and performance of systems and equipment, enabling, for example, remote diagnostics, condition-based maintenance, and optimisation of operations. The 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 (letting the service provider judge whether the equipment has been used in accordance with use instructions). In many lines of business, resources management is completely built on the premise that data will always be up to date: airlines, retail chains, and car manufacturers could not function without reliable enterprise systems and databases, not to mention stock and derivatives exchanges. In this respect, experimenting with new technologies, such as 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.

4.3 SOCIO-ECONOMIC ENVIRONMENT AND REGULATION

4.3.1 Sustainability in practice

Sustainable development extends into at least three domains: the 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 not only causes erosion and increases the likelihood

of devastating floods but may also endanger the traditional means of livelihood of people who are dependent on the forest ecosystem.

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

1. 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.
2. In sustainable economic development, the focus is on the development of the economic infrastructure and on an efficient management of natural and social resources.
3. 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.

The views of Martens are easy to endorse. The real challenge, however, is to make sustainable development economically more attractive for nation-states, companies, and individuals. If the economic incentives are missing, development will be slow and dependent on broad international agreements that 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 could be paramount. First, sustainability-enhancing planning, consulting, and implementation services should be widely available, especially to industries with a significant carbon footprint, reliance on natural resources, and large-scale operations in developing countries. Securing and developing the know-how necessary for such services deserves ample public funding. It is also important that the business planning aspects not be overlooked. Helping firms develop and market sustainable yet profitable offerings and modes of operation will contribute to sustainability more efficiently than any policy paper ever can.

Second, as industries develop, the relative importance of immaterial assets and services tends to increase. This is manifested in the increasing share of services in the GDP of most developed as well as developing countries. This, in turn, may loosen – if not break – the connection between 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 Section 3.2, the relationship

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; actively reviewing and developing related policies; and fostering EU-level and international co-ordination of related activities.
- Metrics for sustainability. While much work has been done in the field of ecological sustainability, there is a need to develop and lobby for clear and commonly acceptable metrics. Developing 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 forming conclusions as to the implications for business and technological development.

does not have to be linear. A clear sign of this opportunity is the gradually diminishing need for physical delivery mechanisms (such as newspapers or CDs) for digital content and the broadening range of use of various terminal devices, such as smartphones and tablet computers. If, however, future business models will be firmly based on the development and sales of new devices instead of content, applications, and services – which is a plausible scenario in view of, for example, the range of kinds of devices that have been introduced to the market over the last few years – then this opportunity may well be lost.

4.3.2 The EU's 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 a presence in the EU-internal market. This applies especially to services. About 70% of the EU's GDP is generated by services, but only 20% of those services cross borders (Smart work 2010). The barriers take many forms, such as quotas, high licence fees, or tenders tailored such that they 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 (ibid. 2010). The topic is important, since the combination of competitive pressures from outside the EU and dire public finances in many EU member countries leaves little room for economically unsound structures or policies. RTOs could play an especially meaningful role here, because they typically possess a good understanding of the public as well as the private sector and are experienced 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 on, for example, grounds of strategic national interests or public safety. Sectors with heavy government involvement, limited international participation, and/or few or no small- or 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.

4.3.3 Securing vital ICT infrastructure and social robustness

More attention should be given to management of social robustness in case of a major failure in one or more important support systems of society, such as the electricity grid, communication networks, and financial institutions. This does not concern authorities only, since an increasing part of these systems and related services is privately owned and managed. Effective prevention and mitigation strategies can be based on a number of technologies and organisation models, but the risks and emergency scenarios should be identified, understood, and acted upon well in advance. In view of the pervasive nature of ICT as a backbone for a modern society, ICT-related societal risks in particular should be highlighted on future research agendas.

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

4.4 CONCEPTUAL AND METHODOLOGICAL ISSUES

Service science (or service research) is a relatively young field of study. Service researchers have both academic and practical objectives, and they apply a range of theories and methodologies. Many of these were originally 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 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). Theoretically oriented researchers have been especially keen to develop service science as an independent discipline.

New approaches are required in the collaboration 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, consistency of argumentation, and respect for the complexities of the real world that time after time successfully defy our attempts at categorisation.

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 stage of development of service research is taken into account – as well as annoying. In the same way that the term ‘innovation’ is (wrongly) used to describe everything possible from a vague product or business idea to a ground-breaking, successfully commercialised therapy, ‘service’ may refer to anything between a machine-to-machine communication protocol to legal counselling, and from 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.

Key research and development themes

- The functioning of the EU's internal market for services. Critically reviewing national and EU-level regulation of international trade in services, identifying both formal and informal barriers to free trade (including state monopolies, rules of public procurement, and difficulties faced by foreign companies), identifying areas wherein restrictions may be justified on such grounds as public or national safety (including methods for implementing such restrictions) and where they are 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 the services arena. 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 for growth, tax revenues, public expenditure, competitiveness, employment, purchasing power, etc.
- Facilitation of SMEs' 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.

Key research and development themes

- Risk assessment. Identifying the major ICT-related societal risks and their possible root causes, development mechanisms, and consequences. Reviewing existing risk scenarios.
- Contingency planning. Reviewing and developing the existing risk management plans for government and municipal agencies and key industries, such as power generation, telecom-munications, media, transportation, health care, and financial services. Conducting drills to strengthen co-operation and operation-readiness. Reviewing related laws and ordinances.

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 cases of physical 'core' products merely supplement the core. Others regard service as the fundamental basis of exchange, which implies that 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 drawn along the material-immaterial axis or on grounds of the nature of the value creation process, or whether the whole 'product' concept will prove outdated and deserves to be forgotten. The latter seems unlikely, because both terms have consolidated their position in general parlance. While service development is clearly gaining ground among traditional manufacturing and product companies, services are being 'produced' and referred to as products in many other lines of business, especially in consulting and financial services.

4.4.2 The value of a service and its components

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 characteristics of both products and services.

A bank may serve its customers 24 hours a day over the Internet without putting clerks on night shifts. The customer too may be represented by a computer program, if the bank's services can be accessed via an application programming interface (API). Complex transactions may take place without any direct human involvement. This leads to interesting theoretical considerations. For example, are automated (ICT-based) services produced while being consumed, or can they be interpreted as having been produced in advance as physical products are 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 upon use?

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 if we are to understand and develop them, 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 even be irrelevant. 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 industrial boundaries as well.

The concept of value in itself is very challenging too. We have already referred to potential (or embedded) value and to value-in-use (see Subsection 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, for example, 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 conveniently fit into either of these two categories.

The real value of a service contract can largely be derived from 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 be based not on its present yield but on the option of expanding to a new sector or scaling up production rapidly in response to changing demand conditions. It is good to have, for example, a screwdriver, effective painkillers, and some food at home because ready availability when needed is valuable in its own right. And who wouldn't like to own a nice sports car and have it parked in front of the 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 of these modalities of value are, of course, closely interrelated. A field of research called *real options theory* can provide relevant concepts and insights here.

4.4.3 Strengthening the theoretical foundations of service science

The following themes deserve 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 characteristics of both products and services and therefore cannot – in the dominant research parlance – be comfortably classified as 'products' or 'pure services'.

- Service science should, above all, strive for conceptual clarity. That would assist in accumulation of knowledge and in its application 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), in which labour and services were perceived as valuable only if they directly contribute to manufacturing of goods¹, cannot be completely disregarded. The legacy is here to stay. The trick is to harness the best yield from that legacy for the benefit of services research: what applies to the efficient development and production of physical goods may selectively apply to the efficient development and provisioning of services as well.
- The pervasive nature of the use of information and communication technologies in services may necessitate review and redefinition of what characterises a 'service' in service science. This is because the built-in (often implicit) assumption of direct human involvement as a key feature of the value creation process does not hold anymore. The emergence of such concepts as 'software as a service' (SaaS) and 'infrastructure as a service' (IaaS) is an example.
- Understanding the different modalities of 'value' and the mechanisms through which value is being or can be created. An ambitious objective would be the development of a general conceptual framework to support the analysis of perceived value and value creation in different product-service systems, ranging from 'pure products' (do they even 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 or developed. Such features are likely to include, for example, the use of labour, application of ICT, the customer sector (industrial vs. consumer) and customer industry, product/service type (tailored vs. bulk), and the need to manage material flows.

Because of the multidisciplinary nature of the field, the range of theories, concepts, and research methodologies applied is likely to remain broad for the foreseeable future. We are not in a position to pick 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).

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.)

5 Implementation

5.1 EU-FUNDED RESEARCH AND DEVELOPMENT

5.1.1 General findings and recommendations

The results of evaluation of EU Framework Programmes (e.g., COM(2011) 48; Arnold 2005; Luukkonen 2002) suggest that successful EU-funded projects are typically either 1) moderately ambitious, close to market, and product-oriented; or 2) technically complex, of high risk, long-term, and work 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 is industry. It has been stated that research organisations representing more application-oriented fields are more satisfied with EU-funded projects than are those representing more basic research-oriented fields. This suggests that either the RTOs operating in the field of applied R&D are best equipped to take advantage of the FPs or, alternatively, the research programmes and calls for proposals get tailored to the specific needs and expectations of RTOs.

It has been found that SME participation is generally less successful than participation of big companies and produces smaller impacts. There is a logical explanation for this finding. Bigger companies simply have more resources for processing the intermediate results produced by EU projects (mostly new knowledge and contacts) and, therefore, to leverage their investment in the project work. For an 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 specified in advance and the proposals are rigidly evaluated against the predefined criteria, the possibilities for application and for allocation of funding for new topical issues diminish. There is a real danger that, as a result of increasing economic pressures and dependence on external project financing, many representatives of the research community will decide to 'play it safe' to secure the much needed funding, at the expense of creative thinking.

The general recommendations for developing EU-funded research and development are as follows:

- 1. Pursue real effectiveness.** Streamlined project consortia with clear, focused, and common objectives should be favoured. The objectives may 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. 'Market realism' should find its way to project proposals, too. For example, technology commercialisation is a highly uncertain business and is influenced by many factors over which the project consortium exercises no control.
- 2. Maintain flexibility.** We should develop readiness to respond to emerging policy needs (COM(2011) 48) and to support new innovative research and development initiatives. Also, we should acknowledge that different types of projects and of funding instruments are needed for reaching 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 (ibid.). Variety in instruments is needed, but creation of additional complex structures (institutes, communities, platforms, etc.) should cease. The perceived complexity can be reduced, and the usability of the existing instruments can be enhanced through development of guidance.

- 4. Facilitate SME participation in EU research programmes.** The FP7 interim evaluation highlighted the need for further stimulating industry and SME involvement (ibid.). 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 Organisation of research and development in services

At present, there is no service-specific programme or action within FP7 (FP7 2006). In consequence, EU-funded research into industrial, knowledge-intensive, and consumer services, when conducted, is typically embedded in technology-driven projects that receive funding from the co-operation programme, especially the ICT action. When the relative importance of services and service innovation for European economic development is taken into account, one can safely state 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 two per cent of FP7 project summaries explicitly referred to service innovation and that service innovation was not the main topic of 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 traditional EU project types such as 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 technology developers well but does not provide a fruitful starting point for the research and development of services or value networks. Practical service development is essentially context-dependent, and the line of business and the area of application typically determine what technologies are relevant and what are not rather than vice versa.

Service development is characterised by close co-operation with current or target customers. Especially for industrial services, which are typically co-specified and co-produced, the division of responsibilities and liabilities shall be clearly defined and the management and operative processes need to be aligned well. In comparison to technological development, customer involvement is much more important; it is, in effect, mandatory in the case of a practical development project. On the other hand, the integration of potential customers into the project raises a multitude of question related to confidentiality, level of commitment, terms of contract, and the alignment of business interests in general. This may necessitate the development of new participation criteria, types of projects, 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 close co-operation between companies and research units, carrying out research and development work that has been jointly defined and, if possible, also jointly applied. In general, experimentation and iterative work methods 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 support 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 of 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 phase of rapid and dynamic development. In Europe, however, services research is still fragmented, lacks international orientation, and is generally poorly integrated into industry and commerce in comparison to technology-focused R&D (Ganz 2008). There is a resulting danger that European services research will remain in the margins as a peculiar academic exercise. It is, therefore, essential that special attention be given to fostering fruitful, mutually beneficial interactions between different sectors of industry, public administration, and the research community.

The recommendations related to the development of EU-funded research programmes for services are as follows:

- 1. Designate 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 into services should be funded mainly 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, such as 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 on this agenda.
- 3. Several types of projects are needed for industry/market-driven R&D and for research-institute-driven R&D in services.** Industrial R&D projects would be shorter (lasting 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 (of 2–4 years' duration) and research-oriented, focusing on the development and validation of general knowledge and methodologies for services to support industrial R&D in the longer term. Publishing in applicable domains (scientific and industry-oriented alike) should be expected. Industry participation should be strongly encouraged.

- 4. Develop readiness for consulting on cross-border commercialisation activities and provide hybrid funding to support them.** The development and commercial implementation of international service concepts is very demanding and therefore deserves special attention and support. The European Commission, the European Investment Bank (EIB), and the European Investment Fund (EIF) and national funding agencies should co-operate to develop better guidance in combining 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 more national funding agencies and extend to several Member States should have privileged access to complementary EU funding and also legal-advice services.

5.2 NATIONAL AND REGIONAL FUNDING

Naturally, national and regional funding agencies, as well as research institutes and universities with access to direct government funding, shall play an important role in the funding of services research. First, they should be capable of addressing specific local interests and needs in an effective manner. Second, they may secure the essential basic funding for research when suitable EU calls are not available. In the ideal case, local funding may leverage EU funding and vice versa. Also, the EC should expect a strong national and/or regional contribution with regard to issues that are of national and/or regional significance.

Such local 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 steering the business environment in a more favourable direction, for example, 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, as is often the case.

Research institutes, in particular (i.e., the RTOs – see below), have several roles. For nation states, they are instruments that support the specification and implementation of national technology, industrial, innovation, and/or research policies. Industry and commerce, on the other hand, expect support that addresses their specific needs – often with a subsidised price. RTOs are also autonomous actors with their own research strategies and priorities. Increasing dependence on project financing implies that research organisations are going to 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 through 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, wherein striving for reasonable self-sufficiency ultimately results in overproduction and sub-optimal allocation of resources (under normal market conditions). However, this does not exclude co-operation on the project level. In addition to joint (e.g., EU-funded) projects, effective co-operation can be based on informal exchanges between project teams that share a common interest while having separate funding. Complementary fields of competence add to the value of co-operation, but overlapping competencies are needed too, since 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 general yet

precise recommendations for the organisation 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 commercialisation 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.

Where the development of national and regional funding for services is concerned, 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, reduce administrative burdens and facilitate access to financing and 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 for services, on account of 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, existing or prospective customers, and the

necessary mediating organisations (such as RTOs and/or business development consultants). Both large and small companies should be encouraged to participate. Concrete piloting, 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 might be incorporation of a new company to provide a new kind of service, or the 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

The term 'research and technology organisation' 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 fields and application areas, though some RTOs are more specialised than others. RTOs may be public or private. Public RTOs are to a varying extent financed from government budgets. All private RTOs and also many public ones depend on external project financing, 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 main differences between RTOs and universities. First, RTOs do not provide education and do not grant academic degrees, though some university units may operate in the manner of RTOs (e.g., providing contract research). Second, RTOs are judged mainly on the basis of their ability to develop useful technologies, applications, and solutions for industry and the society as a whole in the short to medium

term, while universities – at least traditionally – have been ranked in terms of their scientific and educational achievements.

Service research and business is a vast area. There is certainly enough 'room to manoeuvre' for all players who want to get involved – for example, for companies, industry associations, ministries and both governmental and regional development organisations, the European 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 focus on solutions.** There is a need to seek synergies and holistic approaches over heterogeneous service sectors. Major RTOs are typically able to provide and combine a broad spectrum of competencies, 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 with each other, in their relations with industry, and within 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 to develop and implement national and European research, innovation, and industrial policies.
- 3. Well-developed research infrastructure.** In many areas of application, systematic development of services requires a unique research infrastructure, one that allows 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 Europe-wide R&D infrastructure.

6 Summary of key recommendations

We have argued that, while services play an increasingly important role in the economy of Europe and in the daily life of its citizens, services can and shall contribute more. There are pressing challenges and development needs that deserve further attention. In particular, Europe needs to make sure that the key issues are acknowledged and addressed in an effective manner, and that the amount of money allocated to services research and development reflects the importance of this field to European economies and citizens.

6.1 RESEARCH AND DEVELOPMENT THEMES

The themes identified for research and development were classified into four main categories: markets and business logic, operations and enabling technologies, socio-economic environment and regulation, and conceptual and methodological issues. The summaries below highlight some of the most important topics but are by no means comprehensive. Detailed descriptions of the research and development needs identified have been given in Chapter 4.

Markets and business logic. One of the distinctive characteristics of service business is the central role of the customer in the value creation process. It is therefore essential to continue research into effective value co-creation mechanisms, including distribution of work and responsibilities and sharing of costs, risks, and added value, and to develop a better understanding of the factors that determine the competitiveness and the perceived use value of a service under different circumstances. We should also enhance our understanding of the

factors and mechanisms that facilitate market creation and growth and the renewal of value networks in Europe. At the same time, it should be easier for the customer to assess the credibility of the service provider and to verify the content and applicability of the service before entering into a binding contract. More research is needed on technical solutions, service provision models, and regulatory frameworks to support verification and validation.

Operations and enabling technologies.

The competitiveness of most service businesses depends on improvements in efficiency and productivity. Companies would benefit from better performance metrics that combine operative and financial performance data and from better understanding how firm-level development actions and the functioning of the whole value network jointly determine (the attainable level of) efficiency and productivity. ICT based process modelling and optimisation and also advanced data-mining and analysis methods deserve more research and development. While ICT is a key enabler, it is a source of new management and technical challenges too. Emerging distributed computing architectures (such as cloud computing and Web services) and related interoperability, quality of service, and liability issues call for more research. Various data privacy, security, and ownership issues have also emerged as a result of the constant accumulation of user-generated content and transactional data in the systems of private service providers and public administration. These issues will require careful consideration and constructive solution models in the coming years.

Socio-economic environment and regulation. The features and regulation of the wider socio-economic environment in which service

innovation is expected to take place have a profound impact on companies' ability to succeed and generate wealth. As demands for sustainability are increasing, it is important to help companies in a broad range of industries develop sustainable operation models and sustainability-promoting offerings that are also economically viable. Clear and commonly acceptable metrics, supporting legislation, and tax incentives can play a major role. Another important issue is the functioning of the EU-internal market for services. There are both formal and informal barriers to trade that shall be identified and subjected to critical analysis; at the same time, SMEs would benefit from concrete guidance in cross-border trade in services. Finally, the need to prepare for managing the vital ICT infrastructure and social robustness well in case of a major systems outage is greater than ever. The pervasive nature of ICT as a backbone of modern society and today's economy calls for dedicated research and for allocation of development investments to contingency planning and identification of risks.

Conceptual and methodological issues.

Services research is an emerging field of study. Researchers have both academic and practically oriented objectives and apply diverging theories and methodologies. A greater striving for conceptual clarity would help accumulate knowledge, enhance the practical relevance of services research, and also support the development of the field toward an independent discipline or a branch of science. There are several open questions, with respect to, for example, the treatment of the concepts of 'product' and 'service', that deserve further attention. This is because making a distinction between the two in the real world is far from trivial, and often impractical, especially in cases of ICT-based services that exhibit product characteristics but are immaterial in nature. Other theoretically interesting questions have to do with, inter alia, human labour as an attribute of service (e.g., the degree to which direct human involvement in service provisioning determines the nature of the value creation process and/or the range of feasible business logics), different modalities of value, and the mechanisms through which value (in principle) can be created.

6.2 ORGANISATION AND FUNDING OF RESEARCH

Our recommendations for the organisation and funding of research (implementation) are given separately for EU-funded research and for nationally and regionally funded research. The recommendations for EU-funded research are divided into a general section and a services specific section. Detailed recommendations, with related arguments, are presented in Chapter 5.

EU-funded research: General recommendations. The EU Framework Programmes have been assessed as producing good results in general, but the quality and applicability of the results depend on a number of influencing factors, including ambition level, development focus, and the size and composition of the project consortium. The overall development goal shall be enhanced effectiveness, which can be pursued through favouring of relatively lean project consortia with clear, focused, and common objectives. Flexibility should be a key feature of all future programmes, for otherwise it would be difficult to address new emerging policy issues or to support new innovative research and development initiatives. It is also essential to reduce administrative complexity. Different funding instruments are needed, but complexity created by overlapping organisational structures and programmes for channelling public funding is counterproductive. Finally, to facilitate fruitful SME participation in EU-funded research, the European Commission should consider developing more market-oriented programmes and calls for proposals with limited project size and length, reduced administrative burden, and greater financial support for small companies.

EU-funded research: Services. Europe lags behind the USA in the commercial exploitation of new knowledge and technologies and in the productivity of services. At the same time, EU funded research has been very technology-driven. To unleash the full potential of its traditional service sectors and to develop the competitiveness of its manufacturing base, Europe needs to invest more in services research and development. Our first recommendation is that services be designated as a priority area with a dedicated budget in the

forthcoming Horizon 2020. Secondly, programme structures and funding criteria should reflect the interdisciplinary nature of services. Services are seldom technology- or even industry-specific where the underlying business logic is concerned. Thirdly, we conclude that several types of projects are needed for industry/market-driven R&D and for research-institute-driven R&D in services. In view of the interactive nature of service development and provisioning, it is essential that service providers themselves, private as well as public, assume a central role in market validation/development types of projects. Fourth, the European Commission should develop readiness to be involved in consulting and give financial support to regional cross border commercialisation and service development undertakings with initial funding from other sources.

National and regional funding. National and regional sponsors of R&D form the backbone

of research funding all over the world. Together with local universities and research institutes, they can address specific local interests and development needs in an effective manner – for example, enhancing the competitiveness of nationally important sectors and contributing to the development of the business environment. Local funding may also leverage EU funding, and vice versa. It is recommended that EU member countries begin to place special emphasis on promotion of small businesses and on new service development and commercialisation. Bigger industrial corporations, by contrast, are better equipped to participate in large-scale EU projects and to benefit from their results; consequently, they are not that dependent on local public support.

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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, Estibaliz Delgado, and Stefan Schuster. VTT: Jari Kettunen and Ilari Kaarela.

TNO, Netherlands: 29–30 Nov. 2010

TNO: Erik Fledderus, Erik Huizer, Jantine van der Weerd, 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 Weerd (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), and Hannele Törrö (freelancer).

Industry Interest Groups, Finland: 6 and 9 May 2011

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

TNO, Netherlands: 17–18 May 2011

TNO: Jantine van der Weerd, Erik Fledderus, and Wout Hofman. VTT: Matti Kokkala, Pentti Vähä, and Jari Kettunen. Fraunhofer ISI: Sabine Biege. Tecnalia: Hanna Kuittinen.

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 transforming the construction sector into a knowledge-intensive industry. New materials, innovative technologies, and services are deemed necessary for reaching 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, for example, enhance customer satisfaction, promote energy-efficiency, and help identify new sources of revenue.

ECTP SRA 2005. Strategic research agenda for the European construction sector: Achieving a sustainable and competitive construction sector by 2030. European Construction Technology Platform (ECTP). 23 December. Available at http://www.ectp.org/documentation/ECTP-SRA-2005_12_23.pdf.

European Road Transport Research Advisory Council – ERTRAC

ERTRAC aims to develop a shared vision and to ensure timely, co-ordinated, and efficient implementation of research in Europe, with the objective of tackling the societal challenges of road transport and enhancing Europe's competitiveness. The strategic research agenda recognises the societal demand for decarbonisation, and the importance of the reliability and safety of the road transport system for its users. ERTRAC takes a systems approach to address innovation in the use of the road transport system. Increasing levels of congestion will place mounting pressures on mobility services, particularly in 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 co operation among the various actors in the chain. In particular, there will be a need to optimise the movement of goods and people to reflect the actual demand for mobility services (including public transport) in a better way. Again, ICT and better knowledge of transport demand will play a major role in these developments.

Services SRA relevance: An important part of societal infrastructure wherein service development can contribute, for example, to safety, lower emissions, and economic efficiency.

ERTRAC SRA 2010. Towards a 50% more efficient road transport system by 2030. European Road Transport Research Advisory Council, October. Available at http://www.ertrac.org/pictures/downloadmanager/1/1/ERTRAC_SRA_2010.pdf.

Future Manufacturing Technologies – MANUFUTURE

The mission of MANUFUTURE is to propose, develop, and implement a strategy based on research and innovation, capable of speeding up the industrial shift toward high-added-value products, processes, and services; securing high-skill employment; and winning a large 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: Transformation of the manufacturing industry from an operating mode based on the manufacturing and sales of physical products to provision of tailored customer solutions based on complex product–service systems. The expectation that services will offer greater customer satisfaction, characterised by better performance, availability, and life-cycle economics, to generate new revenue and to reduce the environmental impact associated with conventional buy–use–dispose products.

ManuFuture Platform 2006. Strategic research agenda: Assuring the future of manufacturing in Europe. Manufacture High Level Group and Support Group, June. Available at http://www.manufuture.org/manufacturing/wp_content/uploads/Manufuture_SRA_web_version.pdf.

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

Communications networks enable interaction between users of various types of equipment and 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 serves Europe's citizens and the European economy in the best possible way. The platform declares two key messages: ICT is essential for continued economic growth and job creation in Europe, and research on new networks and services has to start now if it is to be ready to support the mass-market use of new applications. Health and inclusion, transport, the environment, and the future Internet were selected as the most important application areas for the platform's strategic research agenda. The SRA addresses detailed research priorities to pave the way for developing user-centric and context-aware services addressing these applications areas in the future.

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

e-Mobility SRA 2010. eMobility mobile and wireless communications technology platform: Strategic applications research agenda (SARA), Staying Ahead, July. Available at http://www.networks.etp.eu/fileadmin/user_upload/Publications/SARA/Emobility_SARA_100731.pdf.

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 place in the value chain. The NEM Initiative foresees a service oriented society in which ambient and context-sensitive services are created and provided, personalised, and tailored to people's individual and social needs, and in which they 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 as a good example of an industry wherein digitalisation 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 not only affect media themselves but also transform many other industries that make use of electronic data acquisition and processing technologies and distribution channels.

NEM SRA 2009. Current version of strategic research agenda 'Networked and Electronic Media', European Technology Platform, September. Available at

<http://www.nem-initiative.org/fileadmin/documents/VisionSRA/NEM-SRA-070a.pdf>.

Networked European Software and Services Initiative – NESSI

NESSI is active in the field of information and communication technologies and aims to make an impact on the 'Internet of Services' through contributions to standards, open source, and commercial projects. The platform supports application domains from health and public services to the future Internet and 'smart cities'. The latest NESSI strategic research agenda addresses two main research challenges to be tackled on the way toward the Internet of Services: interaction with, and management of, services. The former is related to technical aspects of services, such as permanence ('always-available' attribute), seamlessness (availability via all modes of communication), level of transparency (hiding of the technology's details), 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 that is open, dynamic, without centralised governance, and unpredictable in its behaviour. This includes all aspects of lifecycle management: operations management, service design, service development and deployment, and service delivery assurance.

Services SRA relevance: ICT is transforming services in many ways – it helps increase the efficiency of services and enables completely new services – while, at the same time, it brings a completely new set of challenges (for example, in relation to interoperability, quality of service, and data privacy and security). Most of the research needs identified in the workshops organised as part of this study had to do with ICT in some way.

NESSI SRA 2009. NESSI strategic research agenda: NESSI research priorities for FP7. A NESSI Roadmap series document, May. Available at

http://www.nessi-europe.com/files/ResearchPapers/NESSI_SRA_VOL_3.pdf.

services for europe

Strategic research agenda and implementation action plan for services

This publication identifies, and provides the rationale for, the most important research and development themes in services and supplies recommendations for the organisation and funding of services-related research in Europe. The major socio-economic and technological trends that currently influence the development of services have been identified also.

The research and development themes identified have been divided into four broad categories: markets and business logic, operations and enabling technologies, socio-economic environment and regulation, and conceptual and methodological issues. The recommendations concerning organisation and funding of research have been prepared specifically for EU-funded research.

The key recommendation is that services be designated as a priority area with a dedicated budget in the forthcoming Horizon 2020 – the EU Framework Programme for Research and Innovation – on account of services' huge importance and potential for European economies and societies as a whole.

The work was conducted in association with AERTOs ERA-NET Coordination Action. The participating organisations included TNO (Netherlands), Fraunhofer ISI and IAO (Germany), Tecnalia (Spain), SINTEF (Norway), SP (Sweden), and VTT Technical Research Centre of Finland. The project received financial support from Tekes – the Finnish Funding Agency for Technology and Innovation.

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