Unleashing the Potential of the European Knowledge Economy

Value Proposition for Enterprise Interoperability

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Foreword

ICT is the innovation engine that will continue to drive growth and value for the next ten years. Already today more than 90% innovations in the automotive sector, in logistics, and in medical technologies are based on ICT. We are living through a transition from single to integrated systems and linearity to complexity brought about by the convergence of players, technologies strategies, business models across a complex world.

Today, over 1 billion people use the Internet - 250 million in the European Union alone. The immense growth of the Internet and the increasing use of information and communication technologies (ICT) in business and industry have made the Internet a critical infrastructure for all organisations. What we now call the Web 2.0 – a Web focused around user generated content and social networking using strangely named techniques such as wikis, mashups, APIs, widgets and tagging – has led to new uses of the Internet and new business opportunities.

What a difference from ten years ago. In 1997 landline telephony was still dominant, the state-monopolies were undergoing painful transitions, mobile phones were still novelties and the Internet was only just opening up to dot com services.

Business has changed as well. Economies of scale can now reach world wide, allowing firms to tap into the narrowest parts of the long tail of demand. Creating value means continuous innovation and mass customisation: we are all unique and we want goods and services to match our individuality.

In the fast moving, global and internetworked context we want total interoperability; this is not just a matter of software and applications, but freedom from use of technologies to try to lock out competition. A new approach is needed to make interoperability for networked organisations across multiple industries something that is simple, affordable, accessible and reliable – interoperability must be universal (infrastructural offerings that are open and utility-based), conditional (business model specific offerings that are customised and protect the proprietary assets of business), and testable, measurable and verifiable. Enterprise Interoperability means combining technology and business approaches to catalyze and sustain radical innovations, added value for enterprises and customer value.

Enterprise Interoperability research is needed to support this dream of an open and borderless economy. Progress has been strong. Research activities, some funded by the European Commission, have created technologies, frameworks and specifications for interoperability. But, technical progress is not enough. The competitiveness of EU enterprises, growth and jobs calls for effective transfer of new ideas into applications in the real economy.

A clear vision of ICT interoperability for enterprises will not only catalyse innovation but help to demonstrate its value for enterprises. A solid business case for interoperability would be enormously helpful, especially for SMEs in the decision to take up ICT. It will help new forms of business collaboration to emerge and show how these could create innovative business models and value added services.

That is why; I welcome the report on Value Proposition for Enterprise Interoperability as a step towards this vision. I hope, the report can play provide entrepreneurs and businessmen with the necessary insights to foster the widespread implementation of interoperable solutions. I place great expectations on this document as a vehicle to stimulate progress in Europe.

Viviane Reding,
Member of the European Commission in charge of Information Society and Media

Executive Summary

The online economy and society is anticipated to undergo another wave of transformation and growth over the next decade and beyond. New economic activities will arise with new classes of networked applications and services, new forms of enterprise collaboration, new business models and new value propositions. It is generally accepted that ICT is an enabler for innovation. What is however less clear, and probably controversial, is the changing nature of innovation and the mechanisms for catalysing innovation. This report presents findings that support a direct correlation between value innovation, open business models and Enterprise Interoperability (EI). It affirms that interoperability, as a means for European enterprises to work together, is essential for fulfilling the vision of a competitive and dynamic knowledge-based economy.

Realising this vision shifts the focus of interoperability from interoperation at the technical level to the strategic value of interoperability for the enterprises, the individuals and the economy. The field of EI therefore will need to continue to evolve ***and*** investigate new, radical possibilities and options in order to anticipate and help define enterprise systems required for new business as well as new technology paradigms, including paradigms for the Future Internet. As noted in the Enterprise Interoperability Research Roadmap (European Commission, 2006), the delivery of IT functions as services and interoperability as a utility-like capability are essential enablers for enterprises of the future. The present report builds out from the Vision and Grand Challenges described in the Roadmap, and provides an extensive Value Proposition for Enterprise Interoperability. Importantly, the report establishes that the field of EI brings a unique business-driven perspective to the research and development of ICT. It bridges the gulf between the business view and the technology view of interoperability in order for enterprises systems to deliver innovative and sustainable value.

In recent years, the business context for EI has undergone a remarkable transformation. The opportunities for value creation based on EI have dramatically increased, and will continue to do so in the near future. But the orientation of EI has to change, in order for enterprises to exploit these opportunities.

So far, most investments in EI have been driven by a focus on an increase in efficiency and top-down change of business processes in relatively static value chains. Typical deployment of EI has been based on the idea of an enterprise-wide "big bang" transition to a new "best way of working", pre-conceived largely by a corporate elite of engineers and analysts. The resulting system and the related procedures were supposed to enforce this way of working and make sure that the enterprise would reap the benefits (of efficiency) for some time to come, by discouraging subsequent unofficial forms of smaller-scale and/or bottom-up change. This approach was very much enterprise centric and typically weak in accommodating subsequent change. It is however no longer adequate, because enterprises increasingly need to rely on bottom-up initiative, emergence and flexibility, in order to remain competitive. Due to fierce global competition, enterprises can no longer survive with a focus on efficiency and producing more of the same (for a lower price). Instead, enterprises need to concentrate on value innovation and producing more of not the same (with higher margins). To this end enterprises operate increasingly in dynamic value networks[1].

Therefore EI should be geared towards leveraging creativity, collaboration and change in more dynamic networks to release its full potential as an instrument for value creation. A new objective for EI should be: *To stimulate value creation based on innovation and co-creation in a context of networked enterprises that is very much defined bottom-up, by creative, committed workers.*

This type of support could in due course evolve into an essential part of "innovation ecosystems". These innovation ecosystems are dynamic combinations of:

1. Value networks of a multitude of buyers, suppliers and producers of related products or services plus the socio-economic environment, including the institutional and regulatory framework.
2. A pervasive ICT infrastructure with a particular architecture and framework, which is collectively defined and built through a multi-stakeholder participative process, and which exhibits some characteristics of the natural ecosystems.

[1] *"A value network is any web of relationships that generates tangible and intangible value through complex dynamic exchanges between two or more individuals, groups, or organizations"* (Allee 2002).

Innovation ecosystems enable new forms of business and computable representations of both the micro-economic and the macro-economic aspects. This new configuration of economic activity dramatically increases the need for interoperability.

This report proposes a detailed Enterprise Interoperability Value Proposition (EIVP) framework. Within the context of this report, we consider that EIVP is a set of ICT resources, capabilities and competences, bundled into commercial products, services and R&D offerings, which are of value to individuals, private and public stakeholders, and which contribute to social and economic growth. We have developed a three-level and multi-dimension framework to describe the value proposition of EI. The three levels are Economy-Society Level, Enterprise-Community Level, and Individual Level. The proposed model advocates that an EI Value Proposition must be focused on enterprises and communities of enterprises (Enterprise-Community Level), where it has the largest and most immediate impact. The impact at this level has indirect and "spill-over" effects. These effects include impact on the human capital of companies, i.e. on workers' competences, including technical, relational, knowledge and behavioural aspects (Individual Level). In addition, the effects include impact on the economy and society (Economy-Society Level).

As a result of the changing business context, the EI value proposition has evolved considerably over the last twenty five years. It has evolved from an efficiency focus, based on communication as the primary interaction type, to differentiation, based on more sophisticated interactions types including coordination, cooperation and even some forms of collaboration. Today, with the new social and technological forms emerging on the Internet, collectively designated as "Web 2.0", there is a stronger focus on the collaboration and channel interaction types. In terms of the requirements for EI, there is a shift from an emphasis on efficiency gains and basic differentiation, to a focus on radical technology and business models strategies. The EI Value Proposition in this new business era is: "*Value innovation derived from new forms of open collaboration and channels targeting new, global and highly customised niches, and grounded in interoperable complex ecosystems, connecting end-users, producers, suppliers, software vendors, telcos, public bodies and citizens; empowering employees; and sustaining stronger economic growth."*

On the basis of the EIVP framework, the report makes a distinction between six types of Business Models: *Type 1 Undifferentiated; Type 2 Somewhat differentiated; Type 3 Segmented; Type 4 Externally aware; Type 5 Integrated with the innovation process; and Type 6 Fully open and adaptive.* The need for Enterprise Interoperability is progressively greater in support of the business models from Type 1 to Type 6. The need increases as the company engages more intensively and openly with its business partners and customers. *EI as an enabler is directly linked to the openness of the business model, the intensity of the company's innovation process and the degree of engagement of the company with its business partners and customers.* All of these contribute towards increasing the value level that a company may achieve. Importantly, the increase in the value level for the company benefits also its business partners and customers, creating a win-win situation.

Our economic analysis of business models concludes that investment in EI technologies and infrastructures should focus on:

- Positive feedback: the overall value of the offering as well as the value for the individual participant depends on the number of other participants in the same "network" associated with the offering
- Symmetry of value: all parties involved - including business partners and end-users (who may or may not be paying customers) - gain new value through the relationship
- Innovation: creating or adding value rather than re-distributing value.

The report identifies four main drivers for new business models which will have a significant, long-term impact in the field of EI:

- Web 2.0 developments provide a new impetus to strategies of value innovation by demonstrating the primacy of innovation, and innovation as a basic *logic* of a business through collaboration.
- ICT market trends towards commoditisation and utility progressively erode the sustainability of traditional business models, decreasing their differentiation and their ability to deliver efficiency gain; these trends push companies towards new types of business models, particularly those that target value innovation.

- A new generation of Key Enabling Technologies not only poses new challenges for technical research for EI; specifically, they require moving away from traditional preoccupation with integration of legacy systems to a more systematic, dynamic and "light-weight" approach to interoperability.
- Globalisation requires a radical re-thinking and re-structuring of the innovation process and the technical solutions for global markets as well as local niches within global markets.

In order to enable value innovation at the business level, enterprise systems of the future must be open to dramatic change, rather than lock in the status quo. The open, adaptive and innovation intensive characteristics of business models are the defining characteristics of these systems. Different types of EI offerings are needed to make this happen. In particular, interoperability as a utility-like capability is essential for enabling business innovation and value creation. EI offerings at the infrastructural level are crucial for the innovation potential of technologies, models and tools, which are themselves valuable in terms of the overall impact that they achieve in relation to the business models specific to individual enterprises. Such a utility infrastructure for EI would facilitate two major outcomes: participatory input based on co-creation and innovative output based on the unique nature of individual enterprises.

For Enterprise Interoperability, therefore, a distinction needs to be between *universal* interoperability for utility-based EI offerings, which relate to business norms and routines, and *conditional* interoperability for value-added EI offerings, which address uniqueness and reflect the proprietary aspects of business assets and operation.

At a more detailed level, four types of EI offering can be derived from the four Grand Challenges of the Enterprise Interoperability Research Roadmap:

- Interoperability Service Utility (ISU): a new infrastructure for EI, which is essential for universal interoperability
- Web Technologies for EI: a new generation of technologies in support of applying Web 2.0 to the enterprise space ("Enterprise 2.0"), for both universal and conditional interoperability
- Knowledge-Oriented Collaboration (KOC): methods and tools to support knowledge sharing within a Virtual Organisation to the mutual benefit of partners of the Virtual Organisation, for both universal and conditional interoperability
- Science Base: new scientific foundations for EI by making use of other scientific disciplines – EI offerings that are rested on and subject to the rigour of science, for both universal and conditional interoperability.

Importantly, the provisioning of EI offerings has a wider perspective of public concern and interest in respect of the changing nature of EI and the long-term research needs of EI. It is distinct from the provisioning of EI solutions, which is a commercial concern of the market and involves commercial activity. Specifically, the solution space of EI is a proprietary matter of the market actors concerned.

The report shows that both the mechanism for and the nature of innovation are changing. In parallel, key enabling technologies will continue to define, refine and re-define what is technically feasible to accomplish in an enterprise system, independent of the business value that they may confer on enterprises. The strategic issues of interoperability for enterprises are no longer about basic interconnectivity at the level of technology, or basic information exchange between two entities. Instead, interoperability is closely coupled with the changing nature of business needs, at the level of the enterprise and the community of enterprises (e.g. an established industry, or value networks and ecosystems which transcend traditional industrial boundaries), the individual, and the economy.

Future Internet technologies will re-shape interoperability as a capability, leading to the need to reappraise interoperability between enterprises. Disruptive innovation at the enterprise level needs to be matched by disruptive innovation for enterprise systems of the future. As indicated above, a new generation of infrastructures, methods and tools will be needed to support the characteristics of the future enterprise systems. Such systems are very much part of the Future Internet paradigm. Specifically, developments of Future Internet should reinforce the infrastructural offerings of EI and thereby make interoperability more - rather than less – simple, affordable, accessible and reliable. There is a critical need to develop a utility view of EI offerings that builds on the Internet's tradition of openness and interoperability, in order to unlock the value of business innovation.

The value innovation potential of EI offerings gives rise to the need for a new generation of analytical techniques – a New Value Analysis – in order for organisations to be able to accurately identify and predict the (potential) value associated with investments in EI. At present, a significant number of techniques are used to assess the value of investments in ICT, EI included[2]. However, they mainly use quantitative data and have great difficulty to assess intangible assets[3] which increasingly constitute the bulk of the value, especially in the Knowledge Economy. Such techniques and associated indicators are biased towards promoting competition in efficiency, and do not encourage exploration of value creation or innovation. Importantly, they take no account of the fact that investments in EI are often infrastructural, and will increasingly be so in a (business-driven) networked context.

The challenge for analysing and assessing value in EI needs to shift from a deterministic to a probabilistic approach to investment in EI. As argued throughout the report, the key to value is increasingly about innovation, entailing "doing more of NOT the same"; doing things that are different, with different business partners, to offer solutions that are different but highly valuable. This leads to new key parameters for the analysis, creation and capture of value: complexity, uncertainty, importance of intangibles and new notions of control.

The new offerings and new business models will give rise to radically new opportunities for generating value with EI. Accordingly, a new generation of value analysis techniques and tools, "Information Economics 2.0", is also needed in order to fully reap that potential and turn the potential into concrete success. This means being truly in control of the value creation and not construing investment in EI as a "leap of faith". These new techniques and tools will need to address value beyond the level of a single enterprise, at the level of the enterprise network, the individual, and society. They will need to take into account both intangible benefits and probable network effects as much as immediate returns in cash.

From the findings in the report, the following recommendations are derived:

Recommendations targeting Researchers

- Recommendation 1: Redesign of EI research direction aiming for value innovation
- Recommendation 2: Focus EI research on Collaboration and Channel Interaction Types
- Recommendation 3: Advancing a Systemic View of ICT for Enterprises
- Recommendation 4: Differentiating between Universal Interoperability and Conditional Interoperability to support Future Enterprise Systems
- Recommendation 5: Augmenting EI Technical Research with Business and Policy Research beyond the Enterprise

Recommendations targeting Policy Makers

- Recommendation 6: EI Approaches going far beyond issues at the Enterprise Level
- Recommendation 7: A New Methodology to assess the Value of EI
- Recommendation 8: Support for a Probabilistic Approach to Investment in EI in line with the Blue Ocean Strategy
- Recommendation 9: Establishing EI as a Key Concept for the Knowledge Economy

These recommendations, which are substantiated in Chapter 7, constitute an integrated and coherent set of measures which the authors of the report believe would help advance the value innovation potential of Enterprise Interoperability. The different aspects of the full value proposition for Enterprise Interoperability are detailed in the following chapters.

[2] E.g. ROI (Return on Investment), CLVA (Client Lifetime Value Analysis), EVA (Economics Value Added), TCO (Total Cost of Ownership).

[3] Unlike financial and physical ones, intangible assets are hard for competitors to imitate, which makes them a powerful source of sustainable competitive advantage. If managers could find a way to estimate the value of their intangible assets, they could measure and manage their company's competitive position much more easily and accurately (Kaplan et al, 2004).

1. Introduction

1.1. Background

The lack of a business case for Enterprise Interoperability (EI) is one of the six dimensions of the EI problem space identified in the Enterprise Interoperability Research Roadmap. The Roadmap, being a collective effort of all interested stakeholders for all interested stakeholders in the field of EI, was released by the European Commission in July 2006 and published in book form in the following autumn (European Commission, 2006). As noted in the Roadmap, *"The business case for interoperability is often not apparent to potential adopters of Enterprise Interoperability solutions, particularly for SMEs. Various technologies and tools resulting from research lack follow-up beyond (further) research. Large question marks remain as regards the 'value' and 'impact' of the myriad of initiatives undertaken within the research lab, promoted by technology providers, or organised around groupings of companies... Organisations lack examples of successful cases, best practices, and guidelines about where most value is created through Enterprise Interoperability. The complexity of Enterprise Interoperability operations from a legal and logistical perspective has been overwhelming, particularly in an international context. For enterprise decision makers, with competing priorities, scarce resources and limited time, venturing into solutions for Enterprise Interoperability has not been a realistic option".*

Also as noted in the Roadmap, the lack of a business case for EI is closely linked to the other dimensions of the EI problem space, namely: managing changing by improving the process of innovation, adapting to globalisation particularly in relation to the competitiveness of SMEs, reducing large integration/interoperability costs, optimising business decision-making, and facilitating Open Innovation.

Addressing the above considerations is critical for meeting the four Grand Challenges[4] presented in the Roadmap. In addition, within the context of the FP7 ICT Work Programme 2007-2008 (European Commission, 2006), the business models for new networked applications and services are important features for their interoperation and for the reinforcement of Europe's technology and industrial strengths, as foreseen for the expected impact of Objective 1.3 ICT in support of the networked enterprise.

Following consultation with the EI community, particularly those active in the Enterprise Interoperability Cluster[5], the European Commission launched an Informal Study Group (ISG) on Value Proposition for Enterprise Interoperability in May 2007. This group comprises about 50 active and voluntary members, coming from different constituencies of EI stakeholders. Four editors were appointed by the European Commission to facilitate the preparation of the ISG report, under the coordination of the Commission.

The present report contains original concepts and contents not published elsewhere. It has been prepared on the basis of:

- Written contributions received from the ISG members
- The relevant deliverables and additional materials input by FP6/IST projects belonging to or associated with the Enterprise Interoperability Cluster
- Comments received from public consultation on successive versions of the report that have been published by the European Commission
- Presentations and discussions at open consultation meetings organised by the European Commission
- Additional documents prepared by the editors.

Further details on the history of this report's development are provided in Section 1.6.

[4] The four Grand Challenges are: Interoperability Service Utility, Web Technologies for Enterprise Interoperability, Knowledge-Oriented Collaboration, and a Science Base for Enterprise Interoperability.
[5] http://cordis.europa.eu/fp7/ict/enet/enterprise-inter_en.html

1.2. Purpose

The purpose of the present report is threefold:

- ***To develop a value proposition for Enterprise Interoperability, in support of meeting the Grand Challenges in the Enterprise Interoperability Research Roadmap***. In particular, as the Roadmap is expected to evolve through the joint efforts of the stakeholders, the report is intended to provide a source of guidance and inspiration to the development of future version(s) of the Roadmap.
- ***To fine tune the EI value proposition in relation to the different categories of stakeholders***. In particular, because enterprises must be the primary beneficiaries of EI solutions, the first focus is on the *users* of EI and the second focus is on the *providers* of solutions.
- ***To serve as an input to the refinement and update of Objective 1.3*** in the next version of the FP7 ICT Work Programme, 2009-2010.

The overall context of this report is long-term, goal-oriented, problem-solving and publicly-financed research in the field of Enterprise Interoperability in accordance with the time horizon of FP7 (7 year plus). It is ***not*** the purpose of this report, which is a publication of the European Commission, to provide (1) advice on value proposition for interoperability endeavours of specific organisations; (2) blueprints of business models for the purpose of achieving commercial success by individual enterprises; (3) guidance on the research and development of specific solutions that help enterprises to interoperate; and/or (4) value analysis of individual EI solutions or offerings. Specifically, it is not the purpose of this report to address implementation or technology adoption issues under the umbrella of "e-business", or the day-to-day operation and market concerns of e-business activities.

1.3. Scope

The scope of the present report relates to the full spectrum of issues in the field of **Enterprise Interoperability as defined in the Enterprise Interoperability Research Roadmap**. In the Roadmap, Enterprise Interoperability (with capitals), is defined as *a field of activity with the aim to improve the manner in which enterprises, by means of Information and Communications Technologies (ICT), interoperate with other enterprises, organisations, or with other business units of the same enterprise, in order to conduct their business. This enables enterprises to, for instance, build partnerships, deliver new products and services, and/or become more cost efficient.*

Note that the above is in contrast with the narrower definition of "enterprise interoperability" (without capitals), which – analogous to the IEEE definition of interoperability[6] – concerns the (technical) ability of an enterprise to interact with other organisations, to exchange information and to use the information that has been exchanged.

The present report is fully aligned with the Enterprise Interoperability Research Roadmap, which is the baseline for the direction of the report and the key concepts developed in the report. The report embraces the Vision Statement articulated in the Roadmap, and is compliant with the focus on enterprises' **process of innovation**. It is also consistent with the positioning of EI as a key feature of the **business fabric** of innovation ecosystems, and the view that technology solutions supporting EI must operate within a legal and regulatory framework underpinned by **policy**. Specifically, EI solutions must (1) be readily available and at a cost affordable by all enterprises, (2) produce tangible business and economic value and impact on all users, and (3) act as an essential enabler for enterprises to innovate and to grow.

Importantly, within this report, we make **a distinction between the provision of EI solutions,** which is a *commercial concern and activity*, **and the provision of EI offerings**, which has a wider perspective of *public concern and interest in respect of the changing nature of EI and the long-term research needs of EI*. The changing nature of companies and business-level innovation will have a major impact on the future needs of interoperability for enterprises. **The field of EI therefore will need to continue to evolve and investigate new, radical possibilities and options** in order to

[6] "The ability of two or more systems or components to exchange information and to use the information that has been exchanged." Institute of Electrical and Electronics Engineers. *IEEE Standard Computer Dictionary: A Compilation of IEEE Standard Computer Glossaries*. New York, NY: 1990.

anticipate and help define enterprise systems required for new business as well as new technology paradigms, including paradigms for the Future Internet[7]. As put forward in the Enterprise Interoperability Research Roadmap, the delivery of IT functions as services and interoperability as a utility-like capability are crucial enablers in that respect. The next-generation enterprise systems will be radically different from those of today. **The field of EI brings a unique business-driven perspective to the research and development of ICT.** Importantly, EI bridges the gulf between the business view and the technology view of interoperability in order for enterprise systems to deliver innovative and sustainable value. In developing a new value proposition for Enterprise Interoperability, this report is a contribution in that direction.

1.4. Methodology and Structure

The methodology adopted for this report is based on the outcome of the Enterprise Interoperability Cluster meeting convened by the European Commission in Brussels on 23 May 2007. Specifically, a distinction is drawn between:

- Value Proposition for EI
- Business Models for EI
- Offerings of EI
- Value Analysis of EI.

The development of this report is built around the structuring of the above topics, including addressing the intricate relationships between them. These topics are reflected in respectively Chapters 3, 4, 5 and 6. The perspective is that of the EI field as a whole, with a particular focus on the long-term research needs of EI as described in Sections 1.2 and 1.3. Examples, case materials and empirical data are given to illustrate and augment the analysis.

In order to set the scene for the analysis, discussion of the above topics is preceded by an overview of the changing business context for EI, provided in Chapter 2.

Recommendations and Concluding Remarks are provided in respectively Chapters 7 and 8.

1.5. Target Audience

This report targets all stakeholders of Enterprise Interoperability. Discussions within the Enterprise Interoperability Cluster have yielded the following categorisation of EI stakeholders:

- *Users* – potentially all organisations and final end-users as individuals, customers or citizens
- *Providers* – vendors, integrators, application developers, service providers, and other "independent" providers
- *Intermediaries* – trade associations, industry consortia, multipliers, market consultants, and "commentators"
- *Public authorities* – policy makers
- *Standards organisations* – potentially including all of the above
- *Research community* – academia, research organisations, and potentially including all of the above.

The above categorisation is applied throughout this report, with a particular focus on the needs of users and providers in accordance with the purpose of this report as described in Section 1.2.

1.6. History of this Document

The present report originates from discussions of the Enterprise Interoperability Cluster in autumn 2006 and spring 2007. These discussions showed that there was a clear need for a common,

[7] The characteristics and properties of future business and technology paradigms, including those pertaining to the "Future Internet", will need to be defined. It is recognised that there are many "buzz words" used in the field - such as Web 2.0 and Enterprise 2.0 - for which there are many definitions on offer in numerous publications. Where such terms are used in this report, they are characterised and described, within the context of the issues at hand.

shared view of the value proposition of EI among all interested stakeholders, based on open discussions and consultations.

The EI Cluster meeting of 23 May 2007, convened by the European Commission, was dedicated to discussing the business models for EI. The launch of an Informal Study Group (ISG) on Value Proposition for Enterprise Interoperability to further explore the relevant issues was a major outcome of the meeting. The ISG comprises about 50 active and voluntary members, coming from different constituencies of EI stakeholders. Four editors were appointed by the European Commission to facilitate the preparation of the ISG report, under the coordination of the Commission. In parallel, the Commission launched an open call for voluntary input.

The preparation of this report began in June 2007. An initial outline of the report and preparation schedule were prepared by the editors and published by the European Commission in June 2007.

Intensive work over the summer of 2007 led to Version 1 of the ISG report of 24 September 2007[8], published by the European Commission for public comment and consultation with all interested stakeholders. Version 1 was prepared by the editors on the basis of the written contributions received from the ISG members[9], the relevant deliverables and materials input by FP6/IST projects belonging to or associated with the EI Cluster, presentations[10] and discussions[11] at the Cluster meeting held on 23 May 2007, and documents prepared by the editors. Version 1 focuses on the changing business context for EI, an initial EI value proposition framework and primary EI business models.

The European Commission held an open consultation workshop to discuss the contents of Version 1 of the ISG Report and the main issues raised in the report during the eChallenges e-2007 conference on 26 October 2007. The report of this workshop is available[12].

Version 2 of the ISG report of 19 November 2007[13] was prepared by the editors on the basis of further written contributions received from the ISG members and additional interested parties[14], comments and contributions made at the October eChallenges open consultation workshop[15], and additional documents prepared by the editors. Version 2 focuses on EI offerings and EI value analysis, as well as revision of existing contents notably enhancement of the EI value proposition framework. It was published by the European Commission for public comment and consultation.

Version 3 of the ISG report of 3 December 2007[16] was prepared by the editors. It contains draft recommendations, as well as enhancement of the value analysis of EI and additional updates. It was published by the European Commission for public comment and consultation.

A further EI Cluster meeting was convened by the European Commission on 12 December 2007[17], for the purpose of final open consultation of the Work Programme of ICT Programme 2009-2010 (Objective 1.3). Version 3 of the ISG Report and the Enterprise Interoperability Research Roadmap (proposed revisions) were the two principal input documents for consultation.

The meeting output and further written contributions that arrived in December 2007 were extensively discussed and analysed by the editors. Following intensive activity, the ISG Report was finalised in January 2008, in accordance with the original schedule. The present final version of the Report (V4.0)[18] is published together with the Annexes as a separate document[19] by the European Commission. The Report will also be published in book form by the Commission in the coming months.

[8] ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/enet/isg-report-1-1_en.pdf
[9] ftp://ftp.cordis.europa.eu/pub/ist/docs/ict-ent-net/ei-cluster-pres-part1_en.zip, ftp://ftp.cordis.europa.eu/pub/ist/docs/ict-ent-net/ei-cluster-pres-part2_en.zip, and ftp://ftp.cordis.europa.eu/pub/ist/docs/ict-ent-net/ei-cluster-pres-part3_en.zip
[10] http://cordis.europa.eu/ist/ict-ent-net/isg-contributions.htm
[11] http://cordis.europa.eu/ist/ict-ent-net/min-230507.htm
[12] ftp://ftp.cordis.europa.eu/pub/ist/docs/ict-ent-net/echallenges-min1_en.pdf and ftp://ftp.cordis.europa.eu/pub/ist/docs/ict-ent-net/echallenges-min2_en.pdf
[13] ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/enet/isg-report-2-0_en.pdf
[14] http://cordis.europa.eu/ist/ict-ent-net/isg.htm
[15] http://cordis.europa.eu/ist/ict-ent-net/ws20071026.htm
[16] ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/enet/isg-report-3-0_en.pdf
[17] http://cordis.europa.eu/ist/ict-ent-net/ws20071212.htm
[18] ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/enet/isg-report-4-0_en.pdf
[19] ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/enet/isg-report-4-0-annexes_en.pdf

2. The Changing Business Context for Enterprise Interoperability

2.1. Introductory Remarks

It will be argued in this chapter that the opportunities for value creation based on Enterprise Interoperability have increased and will further do so in the near future, and that the orientation of EI should change to exploit these opportunities. So far, most investments in EI have been driven by a focus on an increase in efficiency and top-down change of business processes. EI should instead be geared towards leveraging creativity, collaboration and change in more dynamic networks to release its full potential as an instrument for value creation.

2.2. Increasing Obsolescence of the Traditional Perspective of EI

So far, the deployment of EI has been based strongly on a combination of the following two objectives:

- *Objective 1*: Supporting a "big bang" transition to a more efficient, enterprise-wide "best way" of working. This seeks to make sure that the enterprise remains competitive under changing market conditions. This new best way of working is defined by a relatively small group of dedicated expert analysts (industrial engineers, business engineers, information analysts etc.) and implemented and maintained top-down.

- *Objective 2:* Once the major change related to Objective 1 is completed and the new way of working has become business as usual, exploiting the predicted gains in efficiency as much and as long as possible in order to secure a proper return on the investment made during the initial big bang change process.

Note that while the investment in EI is done to support an initial change in the operations in the enterprise that can be quite radical (Objective 1), it is typically not implemented with the idea of much subsequent change in mind (Objective 2). Instead, it is assumed that after the initial "big bang", life in the enterprise will remain relatively stable for some time.

Also note that according to this approach, most people in the enterprise (i.e. those not part of the group that is dedicated to the design and automation of the work processes) have limited influence on the deployment of EI. Of course, many will be its end-users; but what they need to do as such is determined by others.

Increasingly this approach leaves the knowledge in enterprises largely unexploited. Under the current conditions of fierce competition for knowledge, this under-utilisation of experience and expertise is not a sustainable strategy (Ancona et al., 2003). Consequently, especially in an environment that aims to be the most dynamic knowledge society in the world in accordance with the Lisbon Agenda, EI needs to be driven by a different set of assumptions. We will first briefly look into the historical background of the two objectives mentioned above, before further exploring potential alternatives.

2.2.1 EI to increase efficiency in enterprises

The spectacular rise in wealth in the Western World during the 20th century owes largely to the broad adoption of the "machine bureaucracy" approach to organising work, with the following key assumptions:

- *Assumption 1*: A stable demand exists for durable products with a low price; this makes large scale repetitive manufacturing lucrative.

- *Assumption 2:* The resulting scale and complexity of the work in the large facilities requires that dedicated experts (industrial engineers etc.) specify what needs to be done and not the workers themselves, because the system as a whole is too complex for them to comprehend.

- *Assumption 3:* Common workers – formerly rather independent, if not always very efficient due to their low level of education – will accept the "Faustian bargain": they will submit to strict rules defined by these experts in return for higher productivity, more profit and the resulting higher pay.

This approach is geared towards efficiency (Kanigel, 2000). It is however weak in dealing with innovation and change, and does not accommodate creativity very well and even discourages it (Zuboff & Maxmin, 2003). During the first half of the 20th century, the advantages of this approach clearly outweighed the disadvantages (Landes, 2002). But when the general level of education of employees increased and firms needed to address more sophisticated demands of individualising consumers, the limitations regarding creativity and innovation became more and more clear, from the 1950s onwards. Still, **ICT continued to be deployed as an instrument to leverage efficiency in enterprises almost without exception until the late 1980s.** According to this perspective, ICT is not seen as an enabler but as a *constitutive technology* in the sense that it becomes part of the things to which it is applied (European Commission, ISTAG Report, 2006). After the late 1980s, the quest for efficiency remained an important motivation for investment in ICT, even though the eventual return on investment usually remained modest or difficult to be assessed.

2.2.2 EI to support occasional, drastic change

Only towards the end of the 1980s, did it become more widely recognised that merely using ICT to automate formerly manual, paper-based work was not enough for firms to remain competitive. Instead a more drastic reassessment and change of business processes was required, and one that would really exploit the opportunities of ICT. During the 1990s this awareness led to a flood of projects, aimed at radical change. Once again, however, most results of these projects remained modest and many initiatives ended in severe disappointment (Jones, 1994).

Note that while the two objectives mentioned in the beginning of Section 2.2 differ much concerning the targeted level of (radical) change of work methods, they are also very much the same in two important respects. First, both assume that the enterprise is run top-down. Thus, the only relevant level of discussion about "value" and innovation and change according to this perspective is at the "official" firm level. Secondly, both objectives assume that change only occurs once in a while and is not a continuous phenomenon. This is closely related to the assumption of top-down control. Regarding change, individuals in the enterprise are essentially supposed to wait for instructions that will follow from a comprehensive change master plan. This again suggests that change only needs to be taken into account at the firm level, as the firm is assumed to change in its entirety from one stable state to another.

As we will see in the next section, the assumptions of top-down control and top-down occasional change are increasingly removed from the reality inside enterprises. In fact, even the notion of the enterprise itself as a rather static and "closed" entity managed from the top-down needs to be re-assessed.

2.3. From Creating Value in Chains to Creating Value in Networks

To better appreciate the limitations of the approach discussed in the preceding section, it is important to note that it regards enterprises essentially as formal and quite static structures around value chains (Porter, 1985). The value chain model can be used to analyse the processes in product delivery from inbound logistics to marketing and sales, as illustrated in Figure 2.1. The assumption is that product definitions and customer needs of the enterprise are stable and well understood. The implication is that efficiency (driving down costs) is the key to success (Ellis and Porter, 2005).

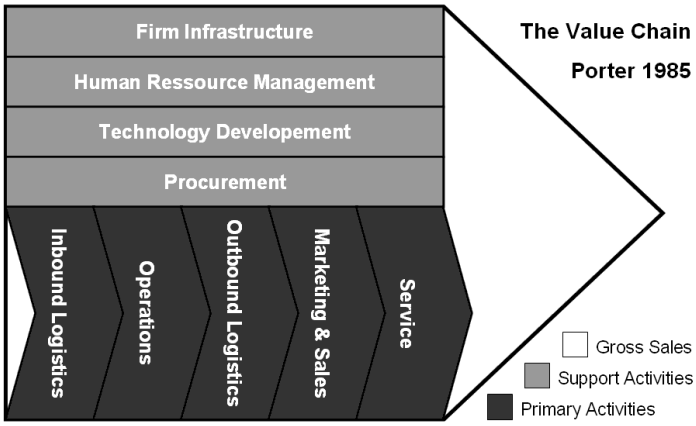


Figure 2.1 Porter's Value Chain (1985)

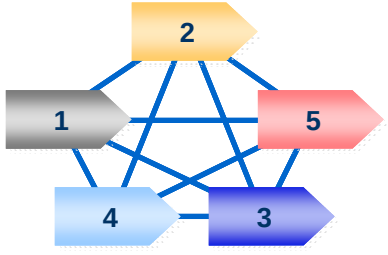
However, in a volatile, competitive environment, strategic behaviour is no longer a matter of positioning a fixed set of activities along a physical value chain; the focus is instead on development of the value creating system itself. In addition, ***in a traditional supply chain, as described by the value chain model, the flow of value, usually through a tangible product, is from supplier to customer (in return for money). In contrast, in a modern interpretation of value chains or value networks, the value flow is vice versa, from customer to supplier, and is to a large extent intangible and knowledge based*** (Hagel & Armstrong, 1997; Von Hippel, 2005).

Consequently, the **"linear, mechanistic view of business that is based on the industrial age production line is limited"** (Allee, 2002) and many sources indicate that the value chain model is not adequate for understanding the complexities of value in the knowledge economy. It is therefore more appropriate to consider deployment of EI in the context of value networks, instead of value chains. A value network is defined as *"any web of relationships that generates tangible and intangible value through complex dynamic exchanges between two or more individuals, groups, or organizations"* (Allee 2002).

In Allee's work, a methodology is proposed which allows modelling organisations and business relationships as living networks of tangible and intangible value exchanges. The approach proposed by Allee implies several important changes in focus, compared to Porter's approach:

- A change of focus from hierarchy to network
- A change of focus from process to people
- A change of focus from structure to relationship.

Figure 2.2 presents some further differences between the value creation approach of the value chain and the value network.

Porter Value Chain	**Value Network**
	
As-is: • Cost based competition • Business process driven by lowest cost	To-be: • Performance and quality based competition

• User needs neglected • Does not promote innovations • Sub-optimisation	• Business process driven by customer perceived value • User needs control the process • Encourages innovations • Total optimisation • Transparency and partnering

Figure 2.2 From Value Chain to Value Networks (Tekes, 2006)

While the value network consists of several independent entities, it must operate with the efficiency of a self-contained enterprise in order to be competitive. This requires managing the network on a process rather than on an organisational basis. This in turn places great importance on the core enterprise, which is no longer just one actor in a chain but also the central point of execution and responsible for the whole value network. The core enterprise provides the operational platform and infrastructure by which the other business partners can collaborate to deliver goods and services (Ellis and Porter, 2005).

Moreover, because the independent entities need to operate as if they were (temporarily) an integrated enterprise, it is key in the value network approach to recognise and leverage the intangible assets, such as joint knowledge, a sense of belonging to the network, and collective intelligence. This is illustrated by the dotted arrows in Figure 2.3 below.

Figure 2.3 Modelling the Value Exchanges (Allee, 2002)

Based on the sense of belonging to the value network and “proximity”, the independent entities in the network will produce joint planning knowledge and joint process knowledge. They will share technical know-how, develop designs and plans together and over time create joint action and policies that can be considered strategic. Recently this development has been most widely discussed in the context of Open Innovation which radically changes the way innovation is carried out (see Chapter 4). Such collaboration cannot be enforced from the top-down, because its foundations are in the network. Instead, it needs to be based on joint trust in the network and a common mission that will gradually develop when its stakeholders (or “members”) come to better understand each other, have shared experience and a shared commitment to success.

The above theoretical approaches are empirically confirmed by the Innobarometer study (2006) which delivers the following figures: *"On average, every fourth company (employing at least 20 persons) in the European Union (24%) work in a cluster-like environment characterised by close cooperation with other local businesses and strong ties to local business infrastructure."* This analytical report also reveals "*that both within the manufacturing and service sectors, high-tech industries are the most likely to show signs of a cluster-like environment. Compared to production, however, the service sector is generally more prone to cluster-like operation.*" Interestingly, this cluster attitude is not related to high tech or low tech activities since the proportion is similar in both

market's segments. Accordingly, the main motivations to join a cluster lie in the following features[20]: hiring of skilled people (64%), exchanging information on market (62%), stimulating the entrepreneurship spirit (61%), developing partnerships on specific business projects (59%), exchanging best practices (57%), exchanging information on technology (55%), facilitating access to finance (47%), facilitating sharing of infrastructures (e.g. buildings, research labs, training facilities) (46%), access to research infrastructures (labs, universities, etc) (43%), developing partnerships to compete in the European market (42%), shortening time to enter market (41%), facilitating access to land (32%). Moreover, it is estimated that by 2009, 60% of new collaboration-related IT projects will seamlessly incorporate supplier, partner and customer personnel – up from less than 10% in 2004 (Gartner report 2005). All these features induce different forms of coordination among the different stakeholders and need to be taken into account in developing an EI value proposition framework (Chapter 3).

Clearly, EI has a vital role to play in facilitating these clusters and networks of value developments. It can help make sure that after initial contact the people involved in the value network can quickly work together, even though they are part of different enterprises, and over time deepen their relationship and retain a common history. EI can also help make sure that the entities involved can really act as a **value network** and facilitate enterprises to flexibly initiate collaborative actions that are geared towards innovation value and new opportunities in the market place.

2.4. Towards a New Perspective for EI

The preceding discussion leads to the following conclusions about EI:

- It is not only a technology to increase efficiency, but a strategic resource to facilitate continuous change and value creation
- It should enable value creation based on very active use of all knowledge in enterprises
- It should connect large companies and SMEs in terms of knowledge and information access, exchange and creation.

Combined, these conclusions point towards a new, third objective for EI, in complement to the two objectives introduced in Section 2.2:

- *Objective 3: EI should stimulate value creation based on innovation and co-creation in a context of networked enterprises that is very much defined bottom-up, by creative, committed workers.*

According to this perspective, EI helps “reflective practitioners” (Schon, 1995) to manage their work, their responsibilities, the key knowledge they possess, and their relations to the work and knowledge of others (inside and outside their own enterprise). Unlike the traditional approach, this support is not driven top-down and purely enterprise centric, but allows a much more individual and subjective approach that leverages personal creativity and initiative. While traditionally individuals were supposed to adjust to “the system”, now the situation is reversed: the system is much more about supporting the individuals.

In this case, the main value of EI for individual enterprises originates in its support to creative destruction (Schumpeter, 1942) and creative construction – EI is a lever for an “open”, “emergent” enterprise. Such an enterprise never really arrives at a solid state. It is always being changed by those associated with it, depending on the market opportunities that occur at a dynamic pace. As a result, the enterprise is no longer regarded as “the machine” that incorporates human labour as little parts with a very strictly defined role and that forces customers to buy what it produces. Instead the enterprise is first and foremost the manifestation of individual talents and initiatives. It facilitates creative solutions that efficiently meet individualised market demands. Enterprises, therefore, are much more an intermediary in a wider context than a dominant actor of total control[21]. The enterprise becomes more organic and flexible. It also becomes more porous: what exactly is inside and outside the enterprise would be far less clear-cut.

[20] Figures indicate percentage of respondents.
[21] Henry Ford, probably the most famous champion of the machine bureaucracy, had this intermediary role of enterprises in mind when he said: “Enterprises do not pay the wages (of the employees). Customers pay the wages and enterprises only handle the money”.

Across enterprises, the main value of EI then lies in facilitating the value network, as described above. Eventually this type of support could evolve into a major part of “innovation ecosystems”. According to a recent publication on this subject (Nachira, F., Dini, P., Nicolai, A. Le Louarn, M., Lèon, L.R., 2007), there are three types of ecosystems: digital ecosystems, business ecosystems and innovation ecosystems. The digital ecosystem is a pervasive ICT infrastructure with a particular architecture and framework, which is collectively defined and built through a multi-stakeholder participative process, and which exhibits some characteristics of the natural ecosystems. The business ecosystem is the value network of a multitude of buyers, suppliers and makers of related products or services plus the socio-economic environment, including the institutional and regulatory framework. The innovation ecosystems, as a dynamic combination of these two dimensions, enable new forms of business and computable representations of both the micro-economic and the macro-economic aspects. Such ecosystems for business have been first coined by Moore (1996) emphasising the interdependence of all actors in the business environment, who "co-evolve their capabilities and roles". As a result, "The industry is less and less identifiable as a discrete sector but is becoming part of a **borderless ecosystem**. In this ecosystem firms are increasingly defined by their role within the converged value *network* - as system developer, content provider, equipment manufacturer, aggregator, access/network operator, etc - rather than by traditional market segments." (European Commission, ISTAG 2006). This new configuration of economic activity dramatically increases the need for EI in new business contexts.

3. Enterprise Interoperability Value Proposition Framework

3.1. To whom is Enterprise Interoperability of Value?

3.1.1 What is an EI Value Proposition?

A Value Proposition can be defined as an overall view of a company's bundle of products and services that together are of value to one or several target customer segment(s) (Osterwalder, 2004). Thus, a Value Proposition (VP) results from a set of elementary offerings (product, services, and their features) that have value to customers. These offerings are a major building block of any organisation's business model.

While decision makers in both private and public organisations recognise the importance of ICT to their organisations (technology as an enabler of innovation), they also acknowledge that it is hard to clearly define its value. In a new business context, a new perspective for Enterprise Interoperability is needed (see Chapter 2). It is therefore important to address the question: "***What is the value proposition of Enterprise Interoperability?***"

As a starting point, and considering EI in a generic context rather than purely at the company level, we can consider that an *Enterprise Interoperability Value Proposition (EIVP) is a set of ICT resources, capabilities and competences, bundled into commercial products, services and R&D offerings, which are of value to individuals, private and public stakeholders, and which contribute to social and economic growth*.

This means that EI must be of value beyond individual companies as traditionally conceived and embrace the wider context of enterprises and of work in a changing business environment, as discussed in Chapter 2. The purpose of this chapter is to demonstrate to managers, public servants, policy makers, and the public in general, ***What value EI brings*** to these stakeholders, and ***How EI can further raise its value*** to them.

3.1.2 Creating Value through EI

Value creation through EI has several dimensions that must be considered, the importance of each of these may vary for the different groups of stakeholders. Enterprise Interoperability must essentially contribute to creating direct value for users of EI solutions, being organisations, customers, or individuals.

Value can be created either through the *Use* that users have of products/services; reduction of users' *Risk*; or by making life easier by reducing users' *Efforts*, across the whole value proposition life cycle (Osterwalder, 2004).

Value through *use* is created when products/services correspond to users' needs. Thus, value is created when interoperability provides companies with processes, products, services that are really needed by them to efficiently and effectively conduct their business.

Interoperability can also deliver value by reducing the *risk* that companies must encounter in business. One example is that interoperability can significantly reduce the risk of information systems investment by reducing or eliminating hardware, software and communications compatibility issues. Another example is when companies use interoperability for inventory visibility aiming at reducing the "bullwhip effect" (for managing forecast-driven supply chains).

Reducing customer' *efforts* means creating value through interoperability to lower the effort and associated costs for search, acquisition, operation, maintenance, training and post-sales services.

Providers of EI solutions, being established companies, organisations or innovative entrepreneurial start-ups, are also important stakeholders for whom there is an important issue of value creation. The Enterprise Interoperability Research Roadmap (European Commission, 2006) defines the problem space of EI, provides a new vision for EI, and proposes major research challenges ("Grand Challenges") for solving problems and realising the Roadmap's vision in a climate of profound change in the business environment.

Value creation in an EI context means also that companies should bear in mind a fourfold simultaneous tendency: *Co-creation of Value*; *Exploiting the Long Tail*; *Thickness of Products/Services*; and *Use of Collective Wisdom / Knowledge*[22].

Co-creation of Value means engaging users and customers in companies' innovation processes. Authors like Von Hippel (2005), Prahalad et al (2004), Anderson (2006) and Tapscott et al (2007) have addressed this rapid movement of innovation development that has emerged in both digital/software development and production of goods in manufacturing industries. Thus Prahalad and Ramaswamy have defined a new frame of reference for value creation where the consumer is central to the co-creation experience.

Exploiting the Long Tail implies considering not only the high demand segment of customers/consumers, but also the capability to address the large number of customers/consumers that have usually very specific requirements, and that may need highly customised or even unique products/services. By taking advantage of the Web's low cost delivery capabilities and functionality such as information filters and aggregators, companies are able to profitably mine the "long tail" – the previously elusive and hard-to-reach huge volume of low-volume market opportunities, even at the level of individual persons (Anderson, 2006).

Thickness of products/services is about how companies commercialise products and services that are becoming more complex and rich. There is on-going competitive pressure that leads firms to enrich their product/service offerings. In a society where, for example, embedded sensors are becoming pervasive and ubiquitous, interoperability is a key enabler for the provision of these new services that are bundled with goods, equipment and traditional services.

Use of Collective Wisdom/Knowledge is a rapidly evolving tendency that makes companies tap into the collective knowledge of people (either at the individual level or at the institutional level) on the decision-making processes and also on the development of the product itself (Sunstein, 2006, Surowiecki, 2005). An example is the emergence of *prediction markets* that help public and private organisations with their decision making process, where a price mechanism is used to collect the fragmented knowledge/wisdom of the very many people existing in a market.

Yet, it is not only at the "institutional" enterprise level that value is created. EI is also becoming of higher value to workers within companies. Previous studies have illustrated the importance of developing a society based on knowledge workers, which will partially be grounded in the ICT competences of individuals (Denis et al, 2005). The new business context demonstrates the importance of not only the ICT competences of consumers and workers, but also the rising importance of individual participation in rich networked ecosystems, filled with workers, researchers, academic, and consumers. Thus, EI is also creating value to individuals as workers by allowing a second movement towards employees' empowerment (after the downsizing and re-engineering movement in mid-1990s).

Finally, some authors acknowledge that disruptive technology is key to "quantum" leaps in terms of economic growth (Verspagen, 2001). Recent studies have demonstrated how ICT contributed to increasing the labour productivity in the US and EU and therefore also to the economic growth since the mid-1990s (Denis et al, 2005). These studies have also demonstrated that a main reason for the difference in economic growth between EU and US in the 1990s was due to the direct, indirect and "spill-over" effects of ICT. Thus, with EI increasing its importance in the ICT market (see the next Chapter 4), it is possible to infer that EI may have an increasing contribution to the ICT impact on economic growth. EI is likely to create value to the economy and society at large.

3.2. A Multi-Level and Multi-Dimension EI Value Proposition Framework

A multi-level and multi-dimension framework is needed to describe the value proposition of EI, in order to capture the richness and complexity of the subject area. The three levels are Economy-Society Level, Enterprise-Community Level, and Individual Level. Within each level, there are different dimensions for describing the EIVP at that level. The EI Value Proposition Framework is depicted in Figure 3.1.

[22] Expanded notes on the fourfold simultaneous tendency are provided in Annex II, Note 3.1.

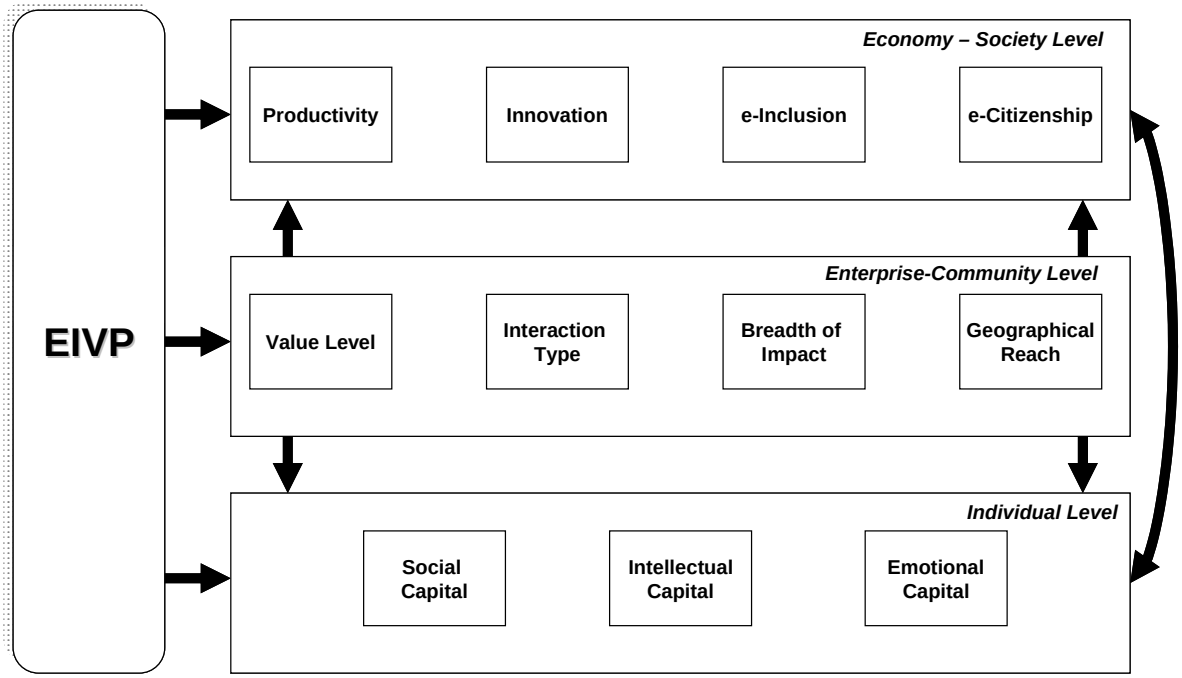


Figure 3.1 EIVP Framework

This framework assumes that EI Value Proposition must be focused on enterprises and communities of enterprises (Enterprise-Community Level), where it has the greatest and direct impact. The framework also assumes that impact at this level has indirect and "spill-over" effects. These effects include impact on the human capital of companies, i.e. on workers' competences, including technical, relational, knowledge and behavioural aspects (Individual Level). In addition, the effects include impact on the economy and society (Economy-Society Level).

While all three levels are of interest, we concentrate on the Enterprise-Community Level, as it is of the most immediate relevance within the scope of the present report. The interlinking Individual Level and Economy-Society Level require other types of analysis and research methods, which are beyond the scope of this report. These two levels therefore are only briefly described in the rest of this chapter.

3.2.1 EIVP at the Enterprise-Community Level

The dimensions identified are: Value Level; Interaction Type; Breadth of Impact; and Geographical Reach.

Value Level addresses the impact that EI can have on the companies' strategy and strategic positioning through the utility that interoperability will bring to citizens, consumers, enterprises, and governmental bodies. *Interaction Type* captures how the value derived from interoperability may be created and why there is the need for EI for improving companies' strategy. *Breadth of Impact* describes the scope of interoperability, ranging from an intra-organisation initiative to broader situations that are industry wide or even cross-industry. *Geographical Reach* is about whether EI is confined to a localised geographical area or whether it has an impact on a wider range, e.g. at the European or even global level. These dimensions are illustrated in Figure 3.2.

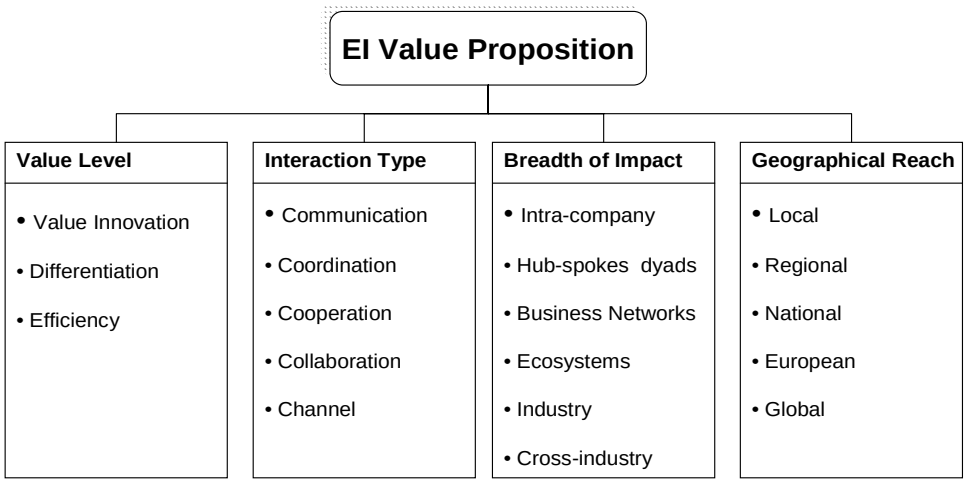


Figure 3.2 EIVP for Enterprise-Community Level

Value Level

Value level measures the utility that interoperability has for enterprises in its strategic positioning and strategy, and as a consequence, how EI deployment is perceived and valued by consumers, citizens, public bodies and other companies (adapting from Osterwalder, 2004). To measure this dimension it is useful to reference a qualitative description by Kim and Mauborgne (2005): the concept of ***"blue ocean strategy"*** and "***red ocean strategy"***.

These authors divide companies competing on blue ocean strategies and companies competing on red ocean strategies. Companies competing on blue ocean strategies simultaneously pursue differentiation and low cost. Their aim is not to out-perform the competition in the existing industry, but to create new market space or a "blue ocean", thereby making the competition irrelevant. They achieve this through *value innovation*, i.e. introducing radical innovations in the products, services, processes, etc., that are genuinely valued by customers.

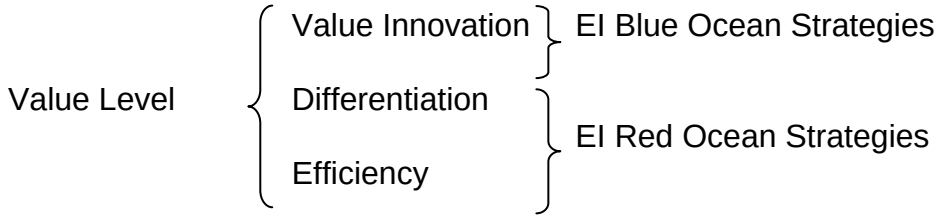
The blue ocean strategies differ from red ocean strategies, where most companies compete, through seeking lower cost, achieved by higher efficiency; or through differentiation, achieved by introducing marginal innovations that are targeted at specific market segments with premium price.

Studies demonstrate that blue ocean strategies have a clear impact on companies' revenues and profits, higher than that of red ocean strategies (Kim and Mauborgne, 2002 and Kim and Mauborgne, 2005).

Higher EIVP is likely to be achieved when companies are looking to interoperability as a means for developing blue ocean strategies, by creating value innovation for customers. In other words, this is more likely to be achieved where companies consider EI as an enabler for the four tendencies described in Section 3.1.2.

It should however be noted that interoperability can still be used as an enabler to sustain competitive strategies based on lower cost in order to obtain efficiency gain, or to sustain competitive strategies based on differentiation in order to obtain incremental value-added in products, services and processes.

Thus,



Bringing innovation, differentiation and efficiency to customers through EI, as discussed below, may occur in different ways. Importantly, interoperability can relate to that between companies, between companies and consumers/citizens, and between companies and public bodies. Accordingly, while the prime beneficiaries of EI are the customers (enterprises or consumers), citizens in general and public bodies are also beneficiaries. Policy consideration is and must be an intrinsic aspect of EI.

Interaction Type

Value creation will vary considerably according to how companies exploit EI's five interaction types (adapted from Pollar 2005). This is designated as the EI 5C Model, as depicted in Figure 3.3.

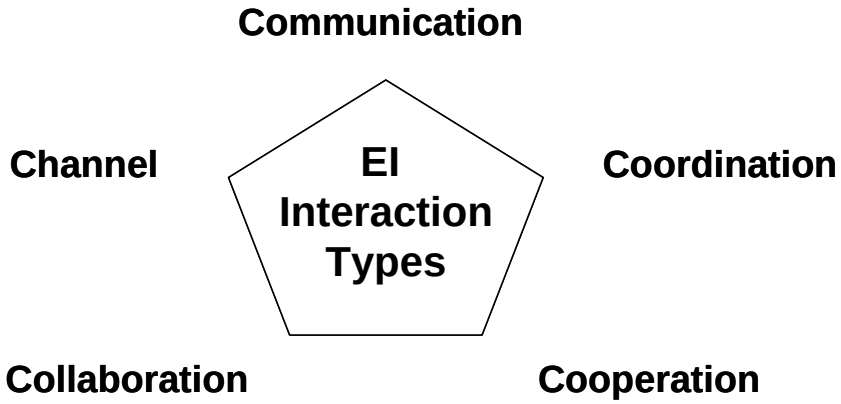


Figure 3.3 EI 5C Model

These interoperability interaction types are mainly related to interactions between enterprises, but can also apply to interactions between enterprises and consumers/citizens, and between enterprises and public organisations.

Communication – the main purpose of interoperability is to exchange information. The informational interaction type has evolved. Currently, beyond simple Web pages with descriptions, some companies make available databases with sophisticated data about products, services and the exchange (e.g. through business intelligence tools), including 3D CAD components to be embedded into 3D CAD applications.

Coordination – the goal is to align activities for mutual benefit, avoiding gaps and overlaps, and thus achieve efficiently results. An example of this interaction type is the electronic exchange of commercial data related to the transaction life-cycle electronic commerce, from the request for quotation, order, etc. to invoicing. Most of the interoperability/integration developed between companies and electronic marketplaces has coordination purposes.

Cooperation – in this interaction type interoperability is used for obtaining mutual benefits by sharing or partitioning work. This will not only allow greater efficiency but also the possibility to obtain some differentiation through time and cost savings. Supply chain visibility, where

manufacturers and distributors allow each other's visibility of stocks and sales and production plans in order to optimise value chain stocks, is an example of the use of interoperability for cooperation.

Collaboration – through this interaction type there is an engagement to achieve results that the participants would be unable to accomplish alone - interoperability is a backbone for the collaboration. This implies joint goals, joint responsibilities, and working together for the creation of innovative solutions. Collaborative tools have appeared in the market, with very complex and complete functions like on-line CAD red-lining and mark-up, forums, logs registration, workflow, etc., allowing true on-line product design and development. This interoperability interaction type can enable the creation of new value propositions, grounded on value innovation, and not just on efficiency and differentiation. This can be achieved by involving leading users, consumers and business partners in the company's innovation process of new products/services and processes. This analysis will be further developed below.

Channel – in industries like software development, music/video, and other specialised and mainstream content (including newspapers), the product/service is becoming digital. The consequence is that the preferred distribution channel is not physical anymore, but the Internet itself. Even in industries where the product is essentially physical, the service component is increasing delivered on-line. The Internet is also a crucial means for allowing companies to deliver more products to a wider number of people, i.e. "selling less of more products" (Anderson, 2006; cf. the Long Tail of Section 3.1.2). Hence, the Web allows democratisation of the production means – implying producing a wider range of products; democratisation of the distribution means – implying greater access to niche markets; and connection of demand and offer – implying a bigger focus on the niches. EI can be used to support the channel, thus achieving not only efficiency and differentiation but also essentially value innovation.

However, the relevance of the EI channel interaction type is not equal for all enterprises – it depends on whether companies produce goods, equipment, equipment bundled with services, services or pure digital services. This is depicted in Figure 3.4.

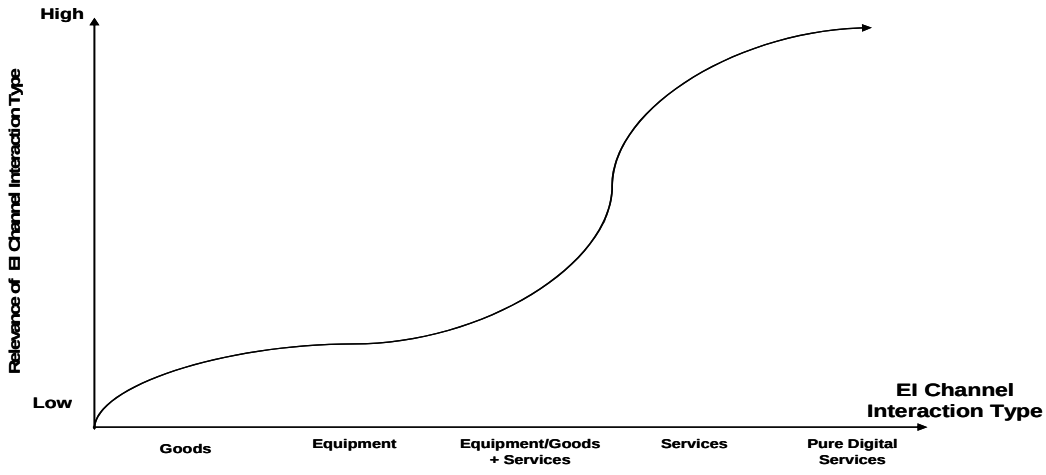


Figure 3.4 Relevance of EI Channel Interaction Type

EI interaction types can occur simultaneously within any business relationship, and the degree of sophistication can also vary, with a consequence for the value level of the EIVP. This is depicted in Figure 3.5.

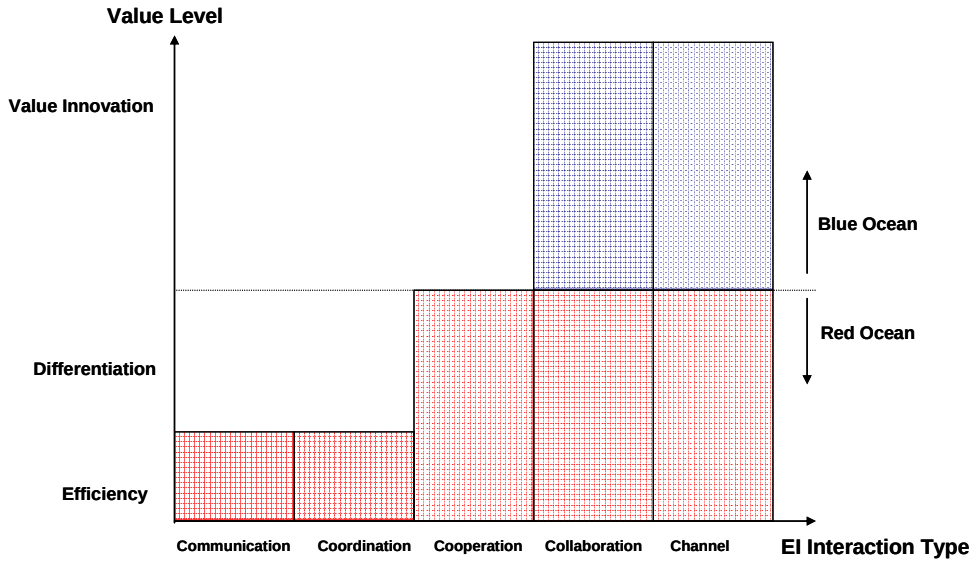


Figure 3.5 Value Level and EI Interaction Types

The extension of the more technically focused notion of interoperability to cover the organisational and operational aspects of setting up and running IT-supported relationships (ATHENA Business Interoperability Framework, 2006) means that different EI interaction types have distinct implications for information systems, business processes, employees and culture and management of external relationships. This is depicted in Figure 3.6.

	Communication	Coordination	Cooperation	Collaboration	Channel
Management of External Relationships				●	●
Employees and Culture			◗	●	●
Business Processes		◗	●	●	●
Information Systems	●	●	●	●	●

Figure 3.6 EI Interaction Type Implications for Multi-faceted Interoperability

It can be concluded that in order for EI to achieve higher value levels, it needs to depart from traditional red ocean strategies (efficiency and differentiation), and aim at blue ocean strategies, i.e. value innovation. To accomplish this, collaboration and channel interaction types need to be developed and reinforced. Moreover, this requires changes not only in the information systems and business processes, but also major changes in respect of employees and culture, and of management of business relationships. In other words, ***Enterprise Interoperability high-end value propositions will require new business models***, as described in Chapter 4.

Breadth of Impact

The Breadth of Impact dimension addresses the impact that the EI has in terms of scope. EI could be deployed for achieving a company's internal information integration, for example, by making the

different company branches, having disparate applications, become interoperable. However, as the scope of interoperability becomes wider, EI can be deployed to target specific dyadic business relationships, a hub-spokes structure, or business networks. Ultimately, EI may also have an industry-wide impact or even an impact across industries.

Extensive studies have reported on how interoperability, through its communication, coordination, cooperation, collaboration and channel interaction types have been evolving from intra-organisational to business networks, and beyond to industry and across industry (e.g. Camarinha-Matos and Afsarmanesh, 2005). Recently, several authors have stressed that the digital infrastructure has led to the emergence of another type of Internet-based business networks – ecosystems (Nachira et al, 2007). These new networks are characterised by creating relationships with business partners and customers across industry boundaries and user market segmentations. Within the new business context as described in Chapter 2, the distinction between provider and customer is blurring, as customers co-create with producers highly novel products and services. In addition, although the ecosystems have mainly emerged in the digital sector, there is sufficient evidence of the development of these new networks in the more traditional industries (Von Hippel, 2005; Chesbrough, 2007; Tapscott et al, 2007; Nachira et al, 2007)[23].

The value level will vary from simple efficiency gains to differentiation as the breadth of impact of EI moves from intra-company to hub-spokes and to business networks. In contrast, value innovation is likely to emerge in relation to a wider scope, towards ecosystems, industry wide and even cross-industry wide impact. This is depicted in Figure 3.7.

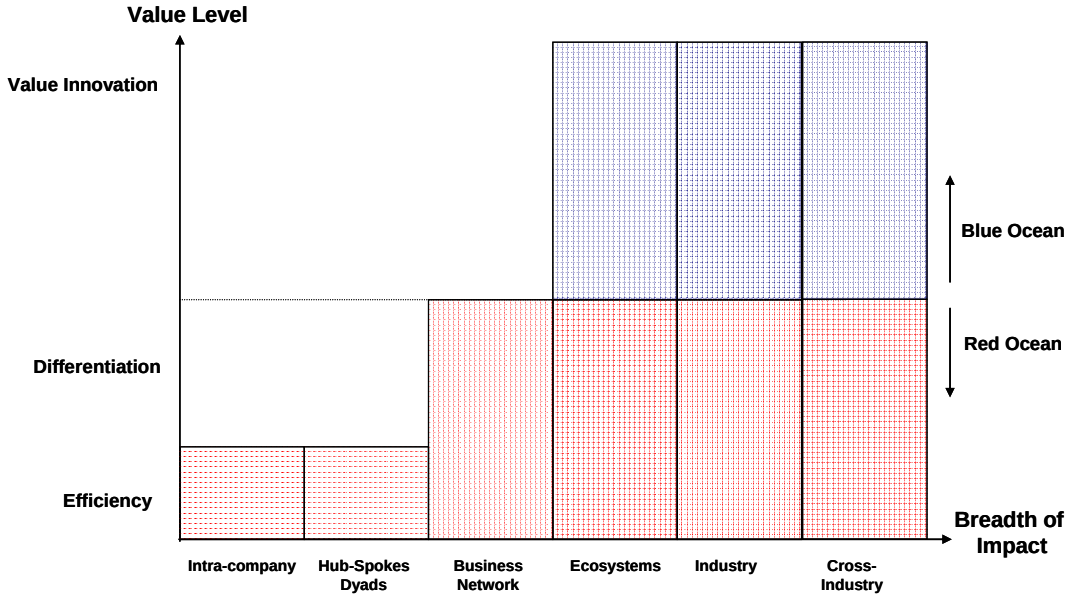


Figure 3.7 Value Level and Breadth of Impact

Geographical Reach

The Geographical Reach dimension addresses the impact of EI on geographical boundaries. EI initiatives may occur at the local level, i.e. the EI development has business impact within a very limited geographical locality, or it can have impact at a regional level, national level, European level or even global level.

As businesses move to a new business context as described in Chapter 2, it is expected that EI initiatives will target wider geographical coverage. However, it remains true that there are and will continue to be many EI initiatives with less ambitious geographical coverage, as much of business is still conducted locally and regionally.

[23] Expanded notes on ecosystems are provided in Annex II, Note 3.2.

The value level of EI significantly changes along the Geographical Reach dimension. It is expected that EI developments on a much localised base are likely to contribute marginally to value, whereas as interoperability is deployed on a wider geographical scale, the value level may substantially increase. However, interoperability on a wide-scale (European or global level) alone is not sufficient for achieving value innovation, though it can help because of the wider reach. The wide scale interoperability context that accompanies wider reach may mitigate a firm's exposure to risks.

The Geographical Reach dimension is depicted in Figure 3.8.

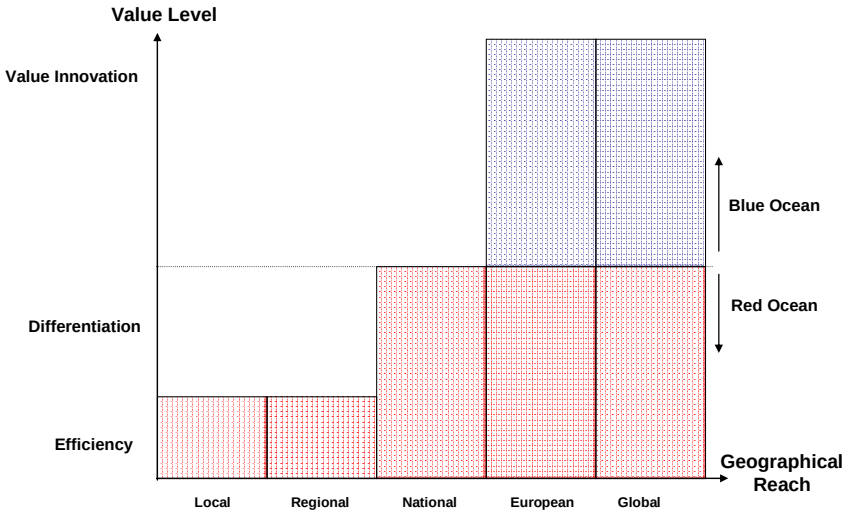


Figure 3.8 Value Level and Geographical Reach

3.2.2 EIVP at the Individual Level

The emergence of the new business context is accelerating continuous changes in the nature of the relationship between individuals (employees or knowledge workers) and the organisations that employ them. All of these changes have led to a gradual transition from an era in which employees' responsibilities were those of loyalty, attendance, satisfactory performance and compliance to authority, to a new era in which people are exhorted to be entrepreneurs, innovators, enactors of change and excellent performers (Schalk and Rousseau, 2001).

Human capital can be defined as the employees' productive resources that create value for themselves and for the organisation of which they are part (Gratton and Ghoshal, 2003; Viedma and Enache, 2007). EI can have indirect impact on employees' three kinds of resources described below, which collectively constitute their individual human capital.

Intellectual capital (IC) refers to fundamental individual attributes, such as cognitive complexity and the capacity to learn, together with the tacit and explicit knowledge, skills and expertise that an individual builds over time. EI is currently a major enabler of the IC of firms, not only through traditional ICT systems like searching algorithms, web-based distributed business intelligence, but also through advances in semantic technologies, the Semantic Web and new knowledge-based systems.

Social capital (SC) is the result of past interactions having developed trust, which enable collective actions. It refers to the networks of relationships that provide access to the resources that members of a network possess or have access to. Web-based social and online communities (e.g. "communities of practice", "epistemic communities") have been a major building block of the new

business context, as previously described. Some commentators believe this is the area where EI is having the biggest impact at the Individual Level.

Emotional capital (EC) refers to self-confidence based on the self-esteem, courage and resilience that individuals need in order to convert their knowledge and relationships into effective actions. Although there is still a diffused understanding of the phenomenon, there seems to be a general movement towards "empowered workers", with employees being more self-confident and more proactive.

These different elements of human capital are highly interrelated. EI will thus be of major value to individuals since it reinforces and accelerates the virtuous circle of human capital. Social capital, in the form of extensive, fluid and reciprocal relationships with people based on ICT-enabled networks, helps individuals to develop intellectual capital by accessing the knowledge and skills those people possess, either at an implicit level or supported by extensive and accessible knowledge management systems and databases. Emotional capital brings the integrity and self-awareness to build open and trusting relationships which underpin the creation of social capital. The learning propensity of intellectual capital can be a driver for self-development, resulting in self-awareness of emotional capital. Within this reinforcing feedback loop, the self-knowledge built though open and meaningful relationships further enhances self-awareness and self-esteem (Gratton and Ghoshal, 2003). This creates the environment for open innovation and collaboration.

3.2.3 EIVP at the Economy-Society Level

Several studies by NIST address the economic impact of interoperability in various economic sectors. The NIST work on the economic impact of STEP (a standard for interoperability in product data) stresses that interoperability problems in manufacturing industries affect society's economic welfare in two ways: by increasing the cost of designing and producing final products and by delaying the introduction of new improved final products. An increase in the cost of designing and producing a new automobile or aircraft may lead to an increase in the equilibrium price of their respective markets (Gallagher et al, 2002).

One of the NIST studies estimates that lack of interoperability led to a cost of US$ 15.8 billion to the US governmental infrastructure capital investments, i.e. on all governmental building and construction infrastructures, meaning an excess of that amount in public money and therefore tax payers' contributions (Gallagher et al, 2004). The study focuses on three types of interoperability costs: avoidance costs to prevent technical interoperability problems before they occur; mitigating costs to address interoperability problems after they have occurred; and delay costs that arise from interoperability problems that delay the introduction of a new product.

Other studies published by NIST (Brunnermeier et al, 1999 and White et al, 2004) provide the following estimates of cost for the US economy, arising from lack of interoperability:

- US$1 billion/year: engineering data in automotive
- US$5 billion/year: all supply chain data in automotive industry
- US$3.9 billion/year: all supply chain data in electronics industry.

A recent study on ICT contribution to economic growth of European Commission DG Enterprise (Denis et al, 2005) illustrates that productivity is correlated with ICT deployment, though its impact is not uniform. Firstly, ICT clearly contributes to economic productivity directly by the increased revenue generated by ICT providers and vendors; this being ICT's main contribution to economic growth. In this respect, US ICT companies have had a significant advantage over European ICT companies. Secondly, the study shows that the positive correlation between ICT and productivity through indirect and "spill-over effects" is greater in sectors like retailing, financial and most services, while the evidence of positive impact on other economic sectors (including manufacturing) is not so clear. In all the studied cases, US economic sectors have been able to obtain more benefits than European ones. Thirdly, although the share of EI solutions in the whole ICT market is still relatively low, its importance is growing very fast.

The same study also highlights that ICT has an important role in the "innovation infrastructure" of an economy, and that also contributes to productivity growth. A similar message is provided in the latest edition of the European Competitiveness Report, which also states that almost all industries with the highest rate of value added growth are related to the new ICT (European Commission,

2007). Thus, it is likely that the impact of EI on innovation processes will also have a positive impact on the economy.

Finally, by supporting the emergence of geographically dispersed and democratised ecosystems, EI is expected to have an important contribution to e-inclusion and e-citizenship.

3.3. EI Value Proposition Evolution

The EI value proposition has considerably evolved over the last twenty five years. Early deployment of "interoperability", notably Electronic Data Interchange (EDI), was very much based on the communication type of interaction, regional/national based initiatives, and internal and dyadic or hub-spokes type of networks. The value of interoperability was essentially about efficiency. With the emergence of Web technologies, which have developed alongside the previous EDI initiatives, interoperability enabled the expansion of interaction type, supporting e-commerce and e-business. Thus, besides the communication interaction type, Web technologies enabled also coordination, cooperation and even some simple forms of collaboration. These forms of interoperability went beyond the traditional stable hub-spokes structures, sustaining business networks and reached beyond the regional/national boundaries, to become European-wide and even global. Interoperability became not only a driver for efficiency, but also a driver for differentiation.

Today, with new forms of interactions started to emerge on the Internet, collectively designated as "Web 2.0" (see further in Section 4.4.1), there are major changes to the EI interaction types deployed, with a stronger focus on collaboration and channel. This means significant potential for increasing the value level, shifting from the red ocean strategies of efficiency gain and differentiation, to the blue ocean strategies of value innovation[24].

Hence, the **EI Value Proposition in the New Business Era** is:

"Value innovation derived from new forms of open collaboration and channels targeting new, global and highly customised niches, and grounded in interoperable complex ecosystems, connecting end-users, producers, suppliers, software vendors, telcos, public bodies and citizens; empowering employees; and sustaining stronger economic growth."

[24] Expanded notes on the different periods of interoperability from the lenses of technology evolution are provided in Annex II, Note 3.3.

4. Enterprise Interoperability Business Models

4.1. Business Model and Value Proposition: Context and Definitions

The term "business model", while certainly not a modern invention, has enjoyed a renaissance during the "e-Business Era" in connection with the rise and fall of the dot.coms. Since then, the term has passed into the common parlance of ICT discussions, as well as making regular appearances in business and management literature. As a popular term, business model has come to be associated with many concepts, such as value, revenue, logic, logistic, strategy, competitive advantage, organisation structure, organisation transformation, market structure, and market transformation. The most parsimonious definition of business model is probably this one: a business model spells out how the company makes money (Rappa, 2002). A recent survey of usage of the term concludes that "logic" and "value" are the core words in the literature on business models (Keen and Qureshi, 2006).

In the preceding chapter, we have attempted to answer the questions what value does EI bring to the stakeholders and how can EI further raise value to them. We have described the value proposition of EI in terms of an EI Value Proposition (EIVP) Framework. We have concluded that in order for EI to achieve higher value levels, it should target blue ocean strategies, i.e. value innovation, in departure from traditional red ocean strategies (efficiency and differentiation). Accordingly, for the purpose of this study, we define a business model as follows:

"A business model is a hypothesis, i.e. a model, of how to generate value in a marketplace." (adapted from Keen and Qureshi, 2006)

A business model generates value by defining a series of activities that ultimately deliver a product or service to customers. Value generation includes generating both new value (value innovation) and incremental value (value added). Value innovation is typically associated with a new marketplace; whereas value added is typically associated with an existing marketplace. A business model captures value by maintaining resources, assets, capabilities or positions within that series of activities. The implementation of that series of activities is described in a business strategy.

Importantly, consistent with our approach to the EIVP, value is broadly interpreted beyond the boundary of particular companies; it extends to other stakeholders in accordance with the breadth of impact as described in the previous chapter. The impact of particular business models is not an isolated event for individual companies in the context of networked enterprises. It is not the purpose of the present study to provide blueprints for business model design and development in order to achieve commercial success in specific cases.

In this chapter, we will describe a set of concepts, based on the EIVP, for addressing business models in the field of EI. Specifically, we will provide the characteristics for business models which generate high value levels, and seek to explain why that is the case. We will address both supply and demand sides of the EI markets, and with reference to the 5C functions of the EIVP Framework, focussing particularly on the relationships between the provider and the customer.

4.2. Types of Business Models

Following our categorisation of value levels in the previous chapter, business models are classified as follows:

- Business models targeting efficiency
- Business models targeting differentiation
- Business models targeting value innovation.

Adapting from the work of Chesbrough (2007), we can distinguish between six main types of business models.

Type 1 – Undifferentiated, comprising companies whose business models are commodity-based, competing purely on price and availability.
Type 1 targets a modest degree of efficiency in an existing market, with the company being primarily inward looking.
Innovation process: none.
Example: corner shops

Type 2 - Somewhat differentiated, comprising companies whose products and services have some degree of uniqueness, which however can be easily imitated and therefore overtaken.
Type 2 targets both efficiency and some degree of differentiation in an existing market.
Innovation process: ad hoc.
Example: "one-hit wonder" which characterises much of the IT industry

Type 3 - Segmented, comprising companies that compete in different market segments simultaneously, offering differentiated products and services based on the characteristics of the individual market segments, and therefore can also spread risks, but nevertheless remain vulnerable to major technical shifts in the marketplace.
Type 3 targets both efficiency and segmented differentiation in an existing market.
Innovation process: planned.
Example: mature, vertically integrated industrial companies

Type 4 - Externally aware*, c*omprising companies that have started to open themselves to external ideas and technologies in the development and execution of the business and have some relationships with outsiders for access to the planning of their internal innovation activities.
Type 4 targets both efficiency and a high degree of differentiation in an existing market.
Innovation process: externally supported.
Example: IT companies that open their APIs to external developer communities

Type 5 - Integrated with the innovation process*,* comprising companies whose business model plays a key integrative role within the company. Suppliers and customers enjoy formal institutional access to the company's innovation process and reciprocate in kind. Companies therefore begin to experiment more directly with the business model itself.
Type 5 targets efficiency and differentiation in an existing market, but also pays attention to value innovation in new markets.
Innovation process: integrated with the business model.
Example: IT companies that move from products to include services as well, companies that offer its own capability as a turnkey solution

Type 6 - Fully open and adaptive, comprising companies who are fully open to innovation, highly sensitive and adaptive to change, and have a strategic commitment to experiment with business models as a continuous, "normal" part of the business. For these companies, suppliers and customers are business partners, with whom the companies share risks as well as benefits. The business models of these partners are incorporated into the company's business model(s) and vice versa. A key integration enabler is the company's ability to make its technologies a platform of innovation for the value network, or even the entire market.
Type 6 targets not only efficiency and differentiation in an existing market, but is also highly focused on value innovation in new markets.
Innovation process: continuous experimentation with new business models.
Example: "Household names" in Web 2.0, such as Amazon, Yahoo, eBay and Google

The need for Enterprise Interoperability is progressively greater in support of the business models from Type 1 to Type 6. The need increases as the company engages more intensively and openly with its business partners and customers. In other words, ***EI as an enabler is directly linked to the openness of the business model, the intensity of the company's innovation process and the degree of engagement of the company with its business partners and customers.*** All of these contribute towards increasing the value level that a company may achieve. Importantly, the increase in the value level for the company benefits also its business partners and customers, creating a win-win situation.

The above analysis is depicted in Figure 4.1.

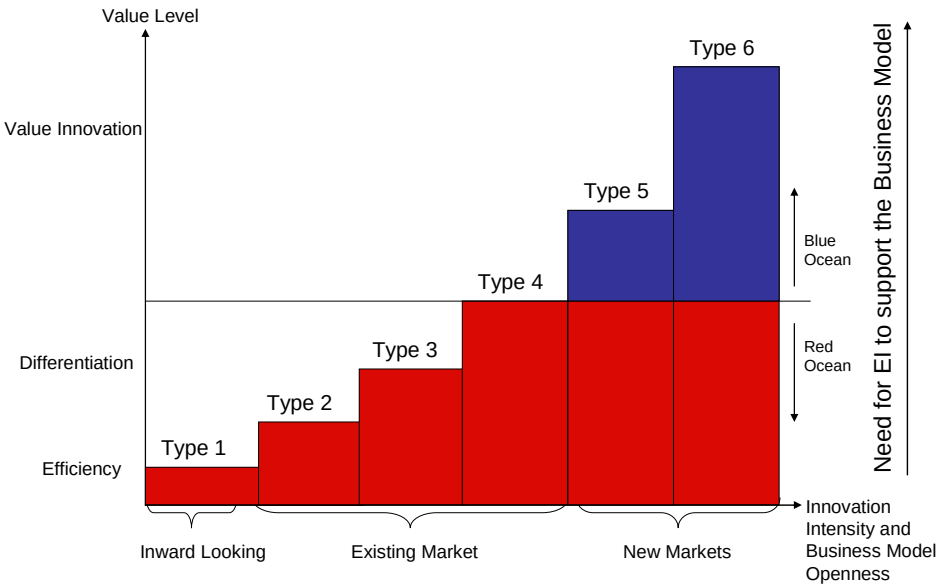


Figure 4.1 Business Models, Value Level, Innovation and Need for EI (adapted from Chesbrough, 2007)

A collection of business scenarios for EI drawn from FP6 projects in the field are presented in Annex III, Section 1.

4.3. Business Model Design Principles and Theoretical Foundations

A survey of applying value theories to business model design yields the following theoretical foundations: Value Chain analysis (Porter 1985), Resource-based theory (Peteraf, 1993), Network economics (Shapiro and Varian, 1998), Transactional Cost economics (Williamson, 1985), Utility theory (Rappa, 2004), and Schumpeterian analysis (Schumpeter, 1934, 1942). Value Chain analysis focuses on "superior, long-term return on investment" within a (fixed) industry structure. Resource-Based theory focuses on "complementarities" (the firm's bundling of capabilities and resources and of products and services). Network economics addresses both lock-in and positive feedback. Transactional Cost economics, which underpins many B2B initiatives, focuses on efficiency. Utility theory concentrates on service delivery in relation to a combination of requirements linked to necessity. Novelty or innovation is the overriding theme of Schumpeter's theory. Schumpeter not only postulates the recurring cycles of innovation as creative destruction, he also introduces the concept of Schumpeterian Rents – extra profits arising directly from innovations that are not reached by business as usual. Creation of new markets and reorganisation of industries are the prime sources of Schumpeterian Rents. These theories are summarised in Figure 4.2.

Business Model Design	ROI	Lock-in ------- Positive Feedback	Complemen-tarities	Efficiency	Necessity	Innovation
Economic Theories	Value Chain Analysis	Network Economics	Resource-Based View	Transaction Cost Economics	Utility Theory	Schumpete-rian Analysis

Figure 4.2 Economic Theories in support of Business Model Design

The economic foundation for business models is important, because it directly correlates to the driver for investment in the business model, which in turn also determines the financial basis for investing in EI. A mapping between these theories to the business model types identified in Section 4.2 yields the following:

- Type 1: commodity model based on price and availability. This relates to Necessity.
- Types 2, 3 and 4: product and service uniqueness. This relates variously to ROI, Lock-in, and Efficiency.
- Types 5 and 6: business model experimentation and new markets. This relates to Positive Feedback, Complementarities and Innovation.

This analysis is depicted in Figure 4.3:

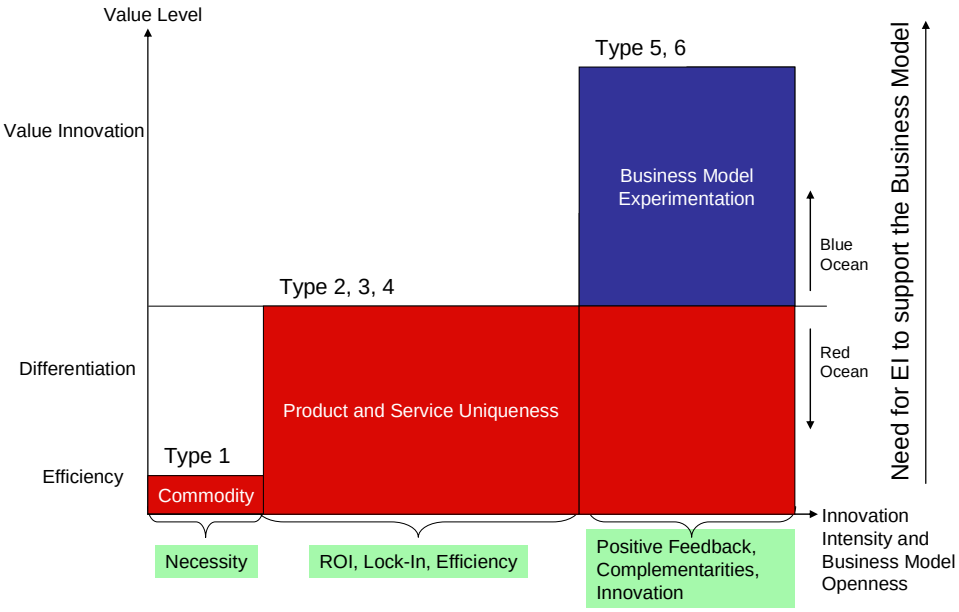


Figure 4.3 Economic Bases for Business Model Types

On the above analysis, investment in EI technologies and infrastructures should focus on:

- Positive feedback: the overall value of the offering as well as the value for the individual participant depends on the number of other participants in the same "network" associated with the offering
- Symmetry of value: all parties involved - including business partners and end-users (who may or may not be paying customers) - gain new value through the relationship
- Innovation: creating or adding value rather than re-distributing value[25].

All the above attributes also correlate with (increasing) openness of the business model. Thus, investment in EI directly contributes to the openness of the business model. Put it in another way, the openness of the business model is directly linked to the depth of investment support.

[25] A broader perspective has been introduced in a contribution to this report by Jan Goossenaerts of Eindhoven University of Technology. The contribution discusses the institutional framework for investment and growth in the knowledge economy, and draws a distinction between public and private sector contributions to investment in different models of the economy (Goossenaerts, 2007). Further research in this direction may lead to new insight into the economic foundation for EI and investment analysis of EI as an "essential utility" for enabling value creation and innovation (see further under Section 4.4.2).

4.4. What has Changed – Drivers for New Business Models

Our research to date has yielded a number of drivers for new business models which will have a significant, long-term impact in the field of EI:

- Web 2.0 developments
- ICT market trends towards commoditisation and utility
- A new generation of Key Enabling Technologies (KET)
- Globalisation.

In this section, we will argue that Web 2.0 provides a new impetus to blue ocean strategies, and also that the trends towards commoditisation and utility relegate many traditional business models further into the red ocean zone (see Section 3.2.1 for a description of blue ocean and red ocean strategies). KET not only poses new challenges for technical research for EI; specifically, they require moving away from traditional preoccupation with integration of legacy systems to a more systematic, dynamic and "light-weight" approach to interoperability. Globalisation requires a radical re-thinking and re-structuring of the innovation process and the technical solutions for global markets as well as local niches within global markets. Finally, we will examine these drivers in relation to their impact on innovation enabled by EI.

4.4.1 Web 2.0 Developments

In Chapter 3, we have presented a new value proposition of EI in a New Business Context, which is itself described in Chapter 2. One of the most prominent developments that helps shape that context is what has come to be known as "Web 2.0". Building on the analysis of the preceding chapters, we examine the business characteristics of Web 2.0.

Whilst Web 2.0 encompasses a seemingly unlimited range of services, these services do have a number of common features:

- They use the Internet as a low cost delivery platform
- They involve the direct participation and tap into the creativity of a huge community of end users
- They "emerge" rather than being "pre-defined"
- The companies behind these services do not typically sell software or related services despite being heavy users of both
- These companies move quickly from the "innovation" phase to mass market adoption, often through "viral" marketing techniques[26]
- The provisioning model is intricately linked to "Software as a Service"[27].

These service features lead to the following business characteristics of Web 2.0 companies:

- ***Novelty*** – Web 2.0 companies are doing something new: they create new demand; the most successful among them *make* markets.
- ***Customer centric*** – Web 2.0 companies not only put customers at the centre, many go to the extent of blurring the distinction between provider and customer, as epitomised by customers being the producer as well as the consumer of content (a.k.a. "prosumers").
- ***Network effect*** – the usefulness and ultimately the value of the offering rises exponentially in relation to the number of customers, as per "Metcalfe's Law".
- ***Defined by ecosystem*** – Web 2.0 companies do not fit into traditional industry categories or market segments (a consequence of the above characteristics); instead, they create an ecosystem of relationships with business partners and customers across traditional industry

[26] Viral marketing refers to "marketing techniques that use pre-existing social networks to produce increases in brand awareness, through self-replicating viral processes, analogous to the spread of pathological and computer viruses. It can be word-of-mouth delivered or enhanced by the network effects of the Internet".(www.wikipedia.org)

[27] Technically, the services have several common attributes, linked to the "connectedness" of the Internet as a service delivery platform and software as a service:

- Decentralisation of services, with services growing from the "edges" rather than from the "core"
- The services are usually open for customisation and composition with other services through "public" APIs
- The services are based on lightweight programming models (simple data formats and protocols, agile methods, programming languages based on conventions not configurations, etc.)
- Use of peer-to-peer architectures and techniques.

boundaries and user market segmentations. The most successful Web 2.0 companies spawn vast concentric cycles of start-ups who make their own business by leveraging various new services and capabilities offered by the "hub" company[28].

- ***Involves a wide array of revenue streams*** – Web 2.0 companies, though born out of technology and pioneer technologies, do not however sell technologies. Instead, they derive revenue from three main sources: 1) Advertising, e.g. Google AdSense; 2) Subscription, typically for services with a large "foot print", such as 37Signals; 3) Transaction commission, which itself encompasses an enormous variety of intermediary transaction-related services, e.g. service aggregation, content syndication/ filtering, identity management etc. Note however that the business activities and scenarios associated with these revenue streams vary considerably. They also engage users in a variety of manners.

Web 2.0 provides a new impetus to blue ocean strategies by challenging traditional business assumptions. Web 2.0 companies show that:

- Better and more efficient technical integration at the level of the firm does not necessarily lead to better or more efficient networked organisations.
- The conventional interpretation that companies are defined by their production function, and must organise to optimise their costs and operations so that they can gain a differentiation in the marketplace and attract consumers, is inadequate.
- The conventional paradigm for understanding business processes as the production of goods and the linear supply chain, where the value points are relatively static, is becoming obsolete.
- In a given market place, value is re-distributed among a fixed amount of value. But in re-structured and new market places (such as Web 2.0), *new* values are created.
- The existing accounting of cost in IT implementation (e.g. CAPEX v. OPEX) and of the cost distribution across a given value network is inadequate.
- The business assumptions behind the Web 2.0 companies are radically different from those relating to companies operating with known business processes, stable information flow, and established patterns of business and customer relationships. The traditional business assumptions typically apply only to companies operating *within* an existing industry. In contrast, Web 2.0 companies do not take existing industry as a given.
- **There is no necessary causal link between value proposition and revenue models.** Instead, the value proposition of the Web 2.0 companies is closely tied to their business characteristics (see above).

The business models of Web 2.0 companies comply with Types 5 and 6 as described in Section 4.2. These companies target innovation by new value creation rather than re-distributing value; they provide symmetry of value for the parties involved; they also engender positive feedback. Web 2.0 company constitutes an ecosystem in the sense that the overall value of Web 2.0 companies is not so much derived from the supply and demand approaches of traditional theories of value, but from the "ecosystem" of these companies, comprising all the stakeholders, their relationships, and the technical, business-economic and policy infrastructures and frameworks. The *competitive advantage stems from the ecosystem in which the specific offerings of these companies are seamlessly embedded*. An entire ecosystem bolstered by network effect raises the bar of entry for competitors in the *same* market. The stickiness of the ecosystem is the new lock-in of new business models.

In summary, Web 2.0 developments create a new impetus to blue ocean strategies by demonstrating the primacy of innovation, and innovation as a basic *logic* of a business through collaboration. Moreover, the innovation models of Web 2.0 are premised upon the fourfold simultaneous tendency identified in Section 3.1.2: Co-creation of Value; Exploiting the Long Tail; Thickness of services; and Use of Collective Wisdom/Knowledge. Web 2.0 has already triggered a major re-think across the ICT industry. As a case in point, Figure 4.4 is an analysis of the transitioning from "Product Development 1.0" to "Product Development 2.0".

[28] Example Web 2.0 companies and the basis of their ecosystems: Amazon (built on recommendation system); eBay (built on reputation system); Google (built on relevancy ranking); Yahoo (built on the "walled garden" but without walls); PayPal (built on the "missing piece of e-commerce"); LinkedIn (built on "professional networking"); Skype, YouTube, MySpace, Gawker, Craigslist, Flickr, del.icio.us, Wikipedia (built on personal conviction/hobby); Facebook (built on "social graphs"); and Second Life (built on "alternative reality").

	Product Development 1.0	Product Development 2.0
Primary Customer Interaction Channel:	*Telephone, Mail, Face-to-Face, One Way Media (Print, TV, Radio, etc.), e-mail*	*World Wide Web, e-mail, IM*
Source of Innovation:	*Organizations*	*Customers*
Innovation Cycle:	*Months, Years*	*Minutes, Hours, Days, Weeks*
Content Creators:	*Internal Producers*	*External Producers*
Feedback Mechanisms:	*Market research, satisfaction surveys, complaints, focus groups*	*Analytics, online requests, user contributed changes*
Customer Engagement Style:	*Controlled, well-defined process*	*Spontaneous and chaotic*
Product Development Process:	*Upfront design*	*Less upfront, much more emergent*
Product Architecture:	*Closed, not designed for easy extension or reuse by others; walled garden*	*Open, very easy to extend, refine, change and add on to, ecosystem friendly, designed (and legal) for widespread remixing and mashups*
Product Development Culture:	*Hierarchical, centralized, Not Invented Here, somewhat collaborative, expert-driven*	*Egalitarian, decentralized, remix instead of reinvent, highly collaborative, Wisdom of Crowds*
Product Testing:	*Internal, dedicated test groups, hand-picked select customers*	*Users as testers*
Customer Support:	*Customer Service*	*User Community*
Product Promotion:	*One-Way Marketing and Advertising*	*Viral propagation, explicit leveraging of network effects, word of mouth, user generated and other two-way advertising*
Business Model:	*Product Sales, Customer Service and Support Fees, Service Access Charges, Servicing High Demand Products*	*Advertising, Subscriptions, Product Sales, Servicing All Product Niches (The Long Tail), Unintended Uses*
Customer Relationship:	*External Buyer (Consumer)*	*Partner and -- increasingly remunerated -- Supplier (Consumers as Producers)*
Product Ownership:	*Institution, particularly executive management and shareholders*	*Entire User Community*
Partnering Process:	*Formal, explicit, infrequent, mediated*	*Ad hoc, thousands of partners online, disintermediated*
Product Development and Integration Tools:	*Heavyweight, formal, complex, expensive, time-consuming, enterprise-oriented*	*Lightweight, informal, simple, free, fast, consumer-oriented*
Competitive Advantage:	*Superior products, legal barriers to entry (IP protections), brand name advantage, price, popularity, distribution channel agreements*	*#1 or #2 market leader, leveraging crowdsourcing effectively, mass customization, control over hard-to-create data, end-user sense of ownership, popularity, cost-effective customer self-service, audience size, best-of-breed architectures of participation*

Figure 4.4 The Move to Product Development 2.0 (Hinchcliffe 2007)

The above figure illustrates the diversity of the issues involved. Moreover, some experts are already discussing the characteristics of "Web 3.0" and "Web 3.0 in Enterprise Integration"[29].

The use of Web 2.0 within organisations is only at its initial stage. The available case studies show that there is significant opportunity to exploit Web 2.0 technologies, particularly the more advanced variety of such technologies, for enterprise collaboration. Several case studies and additional details of Web 2.0 are presented in Annex II, Note 4.1[30]

4.4.2 ICT Market Trends towards Commoditisation and Utility

As noted by the European Commission in its annual Information Society Report (European Commission, 2007), ICT products have become increasingly commoditised and future growth can be expected mainly in new, niche and replacement products as well as in software and IT services. Already the idea of "utility computing" has begun to influence the development of computer technology in several areas. These include: Grid technology (Foster, Kesselman, Nick and Tueckel, 2002), Service-Oriented Knowledge Utility (Next Generation Grids Expert Group, 2006) and, within the field of EI, the proposal for an Interoperability Service Utility (ISU) in the Enterprise Interoperability Research Roadmap (European Commission, 2006). A new perspective of IT is emerging, specifically:

- *Basic IT functions, which are essential for economic activity, have become a critical infrastructure for society, and therefore are not a purely commercial concern*
- *As the cost of producing and delivering IT continues to fall, basic IT functions are becoming commodities, and should be provisioned as such.*

As noted in the above Roadmap, interoperability as a utility-like capability is essential for enabling business innovation and value creation. Specifically, within the concept of the ISU, interoperability is interpreted as technical, commoditised functionality delivered as services. The question is: what is the impact on the business models for EI?

The software industry is changing rapidly and radically. There are a lot of developments surrounding the notions of service on demand, software as a service, application-based services, and user-centric and user-generated services. As evidenced by the Web 2.0 developments described in the previous subsection, all of these potentially open up vast business opportunities for the creation and provision of innovative, low-cost, value-added, software services (e.g. Paypal and Google Checkout for making electronic payment; Facebook, LinkedIn, Rize, and Friendster for social networking; Google Adwords for advertising; eBay and Amazon for marketing and selling; Thwate and VeriSign for digital signatures; and Microsoft Windows CardSpace and Liberty Alliance for identity services).

Importantly, many of the services that are associated with Web 2.0 today are in a prime position to transition to business-to-business services, and specifically as utility services. In parallel, more high value added capabilities will be provided through the provision of services, delivered on-line and in real-time. These value added services will be more fine-tuned to the needs of the end-user of the services and add direct value to the business operation of the customer. Critically, these services can be created at low cost and therefore provided at low cost, and need not be locked into the "ecosystem" of particular platform providers. Moreover, these services will need to compete on their own merits within the market. The corollary is that they would encourage the emergence of innovative business models. They would particularly encourage the emergence of new service providers in accordance with the fourfold simultaneous tendency identified in Section 3.1.2 – i.e. service providers who focus on "co-creation of value", utilise standard basic tools pooled from "collective wisdom and knowledge", leverage "thickness of products/services", and target markets which are traditionally less well-served by exploiting the SME "Long Tail".

Accordingly, the trends towards commoditisation and utility will enlarge the scope of Type 1 business models, i.e. relegating increasing numbers of hitherto "value added" business models into Type 1. As a result, companies on the supply side of the ICT industry need to step up the innovation process and provide higher value offerings that deliver specific business benefits to the customers and end-users.

[29] See the presentation slides of Mathew West of Shell International submitted for the European Commission DG INFSO EI Cluster Workshop held during eChallenges on 26 October 2007 – reference given in Footnote 15. The slides include a pictorial description of the trajectory from "Web 1.0" to "Web 4.0", sourced from Radar Networks, based on the progression of "Semantics of Information Connections" and "Semantics of Social Connections".

[30] These case studies are provided by courtesy of Igor Santos, Fundación European Software Institute.

This would become crucial for the competitiveness of these companies in open markets. In other words, ICT commoditisation and utility pushes business models towards value innovation, i.e. business models of Types 5 and 6 in our foregoing analysis.

The distinction between utility service based business models and value added service based business models can be described in terms of trade-offs between their economic properties (exclusivity and rivalry), as well as trade-offs between cost and functionality. This is depicted in Figure 4.5.

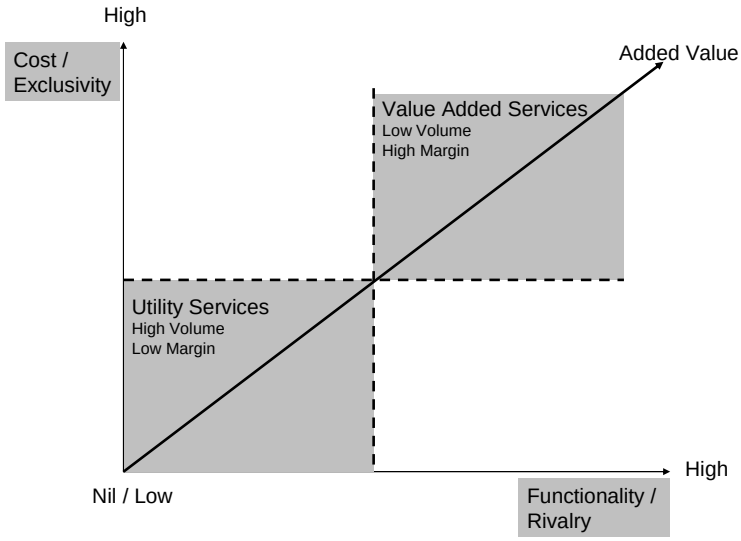


Figure 4.5 Comparison between Utility Service based Business Models and Value Added Service based Business Models based on Trade-offs (Li, 2007)

The innovation creation of value added service is critically dependent upon the widespread availability of utility services, i.e. *value add to utility*. To date, there has little research into the utility service business models in ICT, though the situation is expected to change as the business-economic aspects of the ISU are further explored. A notable exception is the study of utility characteristics for computing services (Rappa, 2004), in which 6 common characteristics are identified: Necessity, Reliability, Usability, Utilisation, Scalability and Exclusivity. Consistent with the view expressed above, Rappa argues that the nature of utility model needs to be understood within the context of business models in general, i.e. not treating it as an isolated market phenomenon. Specifically, supplier-customer relationship is identified as the primary differentiator for different types of business models in Web-based enterprises. This reinforces the emerging view that companies are nowadays less defined by the production function, but by their ability to cultivate (new) relationships with customers. Companies therefore must think carefully how to balance value to the customer with value to themselves. Business models are a vehicle for addressing this balance (Keen and Qureshi, 2006).

4.4.3 A New Generation of Key Enabling Technologies

The present study is grounded in the changing context for businesses. As indicated above, interoperability is closely coupled with the changing nature of business needs. New technologies and tools give rise to entirely new models of collaboration and competition which call into question the traditional notion of systems, assets and value creation. They re-define the relationships between the provider and the user. They also potentially enable a more transparent, open and level playing field in existing and new markets, particularly important for SMEs and entrepreneurial start-up companies.

ICT solutions for enterprises must address the new context of interoperable enterprises, as individual entities staffed by people and as units within evolving ecosystems. Specifically, enterprises, as end-users of ICT solutions which purport to interoperate, must be the beneficiary of these solutions. As noted in the Enterprise Interoperability Research Roadmap, the EI research field so far covers a number of main topics, each with its own state-of-the-art. These include: enterprise business relations,

frameworks, sector specific specifications, service oriented computing and service oriented architectures (Web services, Grid services and P2P services), commercial middleware solutions, semantic web services, domain ontology, modelling and notation languages, enterprise modelling, and trust and contract management. European supported projects under the previous research programme FP6 have tended to focus on one or more of these areas, with varying emphasises on individual elements. The challenge remains to converge between these different technological areas, to develop and build long-term generic solutions rather than piecemeal quick fixes, and to take due account of neighbouring developments which are not traditionally within the confines of the "enterprise solution space". Given that some of the key enabling technologies of the past are increasingly subject to commoditisation (see Section 4.4.2), the need to leverage next generation key enabling technologies to solve enterprise problems in evolving and new business contexts is critical - not just for the ICT industry, but for the economy in general.

Web 2.0 developments are highlighted in this report. The massive "spill over" of Web 2.0 developments from the consumer into the business space has been confirmed by a multitude of recent (2007) reports in the business world, such as BusinessWeek, Forrester and McKinsey among others. For example, Software as a Service is already a well horned and profitable business model for several high profile, young companies delivering on-demand, pay-as-you-go applications; social networking technology and "social" features are expected to be increasingly common among business software; the concept of "ERP mashup" has been mooted; RSS information syndication heralds a new channel of information exchange between business systems; and the technology offerings of the likes of Google and Amazon attract high interest, experimentation and uptake among both ICT and non-ICT SMEs. In general, technology development is increasingly less top-down and locked-down; sandbox development with user involvement is challenging the static orderly pipeline approach of software development; and the glass-box approach of open, modular, light-weight software building blocks is eroding the black-box proprietary platforms requiring complex, hard-wired interfaces. In short, the growing and seemingly chaotic profusion of "simple" Web 2.0 technologies are emerging as the next building blocks for new technology systems, applications and models. In parallel, service oriented architectures shift the focus from complex and expensive system integration to dynamic service creation, execution, discovery, composition and orchestration, potentially rendering some traditional IT issues irrelevant. Software as a Service is already changing the product offerings and even business models of major providers in the field[31]. The stage therefore is set for a new generation of business models leveraging a new generation of key technology technologies.

4.4.4 Globalisation

The term "globalisation" is by no means new, and is so broadly used that it has come to mean slightly different things at different points in time to different people[32]. In general, its use is linked to the spread and connectedness of production, communication and technologies across the world. However, despite the vintage of globalisation, many believe the current situation is of a fundamentally different order to what has gone before. Thomas Friedman (2005) uses the metaphor of a flattening world to capture the powerful forces unleashed by globalisation. In the Enterprise Interoperability Research Roadmap, globalisation is linked to the enterprise challenge of managing changing and innovation in an increasingly competitive world. The Roadmap also observes that this challenge is the greater for SMEs, "which do not have the large R&D budgets available to the large corporations and have more limited capability to interoperate with other enterprises (if at all)".

Recent studies at the OECD (Pilat, 2007) suggest that the current phase of globalisation is characterised by four new trends that impact on businesses:

[31] For example, SAP announced in September 2007 a new line of Web-delivered software that will radically change the company's business model (CEO Kagermann: "It's a new era for SAP") and may shake up Internet software provisioning. Called Business ByDesign, the software is initially a one-size-fits-all, subscription-based package aimed at mid-sized companies. It integrates management of several application areas including financials, human resources, supply chain and CRM. According to the company, Business ByDesign will cost $149 per month per user and $54 per month per five users for a pared-down version. The new software is said to have been developed involving one-fifth of the company's 12,300 developers, and is a crucial plank in SAP's strategy to more than double its customer base to 100,000 by 2010. By way of comparison, Salesforce.com currently has 35,000 customers (predominantly SMEs), with prices starting from $60 per user per month.

[32] The themes that appear with regularity in the literature on globalisation include: de-localisation and supra-territoriality; the speed and power of technological innovation and the associated growth of risk; the rise of multinational corporations; and whether and the extent to which the moves towards the creation of (global) "free markets" lead to instability and division. A sample of the discussion on these themes is at http://www.infed.org/biblio/globalization.htm.

- The spread of global value chains: production is increasingly fragmented across countries leading to more specialisation
- Inter-firm trade by multinational enterprises accounts for a large part of global trade flows
- Trade in services is growing rapidly, enabled by information and communications technologies
- The integration of large emerging economies, notably China and India, in increasingly more innovative areas of economic activity.

Importantly, globalisation provides **new opportunities, as well as challenges, for innovation**. These include leveraging ICT for more rapid innovation in particularly services, the broadening of markets and the need for greater specialisation, and the rising resources being dedicated globally to R&D. It has led some commentators to suggest that globalisation and innovation should be addressed as inter-related topics of a new research agenda. Moreover, IT innovation and public policy shifts towards reducing barriers to market should be part of this research agenda (Hagel and Brown, 2006).

Globalisation therefore is tightly coupled with the other three key drivers for new business models described in the preceding sub-sections. Web 2.0 developments are a manifestation of the interaction between technological innovations combined with world-wide reach, new forms of network and networking. The ICT market trends towards commoditisation and utility are a consequence of competition in wider and more open markets which strengthen the pressure to innovate, and which force ICT companies to move up the value chain. The power and impact of key enabling technologies are a direct result of rising global investments in R&D; with these technologies further fuelling the momentum and power of change on a global scale.

As a consequence of globalisation, the world today is one of multiple connections (Mulgan 1998). Value networks and ecosystems which transcend firms, industries and geographic boundaries are classic examples of this - they are organised around networks of R&D, production, management and distribution. Those that are successful must be able to respond quickly to change, both in the market and in production. Innovative and dynamic business models are essential. Globalisation therefore has created a business environment in which a static, “overarching” business model is irrelevant.

As R&D and innovation become more dispersed, enterprises will begin to face a new set of challenges. Global innovation presents opportunities for enterprises to widen their net of knowledge inputs and access to new skills, technologies and customers. But managing and integrating these activities requires new organisational structures, processes and capabilities. In other words, a new approach to business model needs to be underpined by a new approach to enterprise systems, as well as a new approach to assessing the value of investment in those systems (see respectively Chapters 5 and 6).

4.4.5 Impact on Innovation

In conclusion, the above drivers show that the process of innovation will increasingly be linked to enterprises ability to collaborate and to interoperate, in continuously evolving value networks and new ecosystems. Systems should be designed to encourage participation (the “open innovation” model of Web 2.0 is in contrast with the “closed innovation” model of the more traditional companies). The architecture of participation must be an intrinsic part of business interoperation, at the level of the enterprise and community of enterprises, the individual and society.

Delivering software as a service is here to stay. The output of innovation, particularly software, is increasingly not so much an artefact, but a process of engagement with users and partners.

Until recently, innovation was a function of tapping into internal intellectual resources and nurturing the business while protecting it from outside exposure or interference. Companies have fiercely guarded their patents, trade secrets, and other intellectual property to leverage the most value from their own innovative efforts. Open innovation, by contrast, calls for companies to make much greater use of external ideas and technologies while sharing their unused ideas with others. This requires each company to open up its business model to let more external ideas and technology flow in and more internal knowledge flow out, as Web 2.0 has clearly shown.

There is a clear business case for Enterprise Interoperability, by relating this business case to value innovation and openness in business models.

5. Enterprise Interoperability Offerings

5.1. Enterprise Interoperability Value Proposition, Business Models and Offerings

ICT promises evolutions, revolutions and even transformations in how companies do business. As noted in the Enterprise Interoperability Research Roadmap (European Commission, 2006), today an enterprise's competitiveness is to a large extent determined by its ability to seamlessly interoperate with others. However, the Roadmap also cautions against the sustainability of ICT-enabled first mover advantage: any such advantage gained by an enterprise can be rapidly eliminated by competitive improvements elsewhere. Instead, the only advantage that an enterprise will enjoy will be its process of innovation. Moreover, the core innovation of enterprises is closely linked to an enterprise's ability to collaborate, ability to adapt, and ability to interoperate. In this respect, the Roadmap positions future enterprises as nodes in innovation ecosystems, where interoperability spans all enterprises throughout and across entire innovation ecosystems.

In Chapter 3, we have described an Enterprise Interoperability Value Proposition (EIVP) Framework with a specific focus on value innovation – the introduction of radical innovation that makes the competition irrelevant. We have contrasted this with the pursuit of cost reduction (marginal innovation through efficiency) and differentiation (marginal innovation through specific market segment targeting), both of which can rapidly be bargained away – and therefore "de-valued" through competitive pressures. The analysis based on the four dimensions of the EIVP framework yields specific guidance on the focus of EI offerings, which is depicted in Figure 5.1.

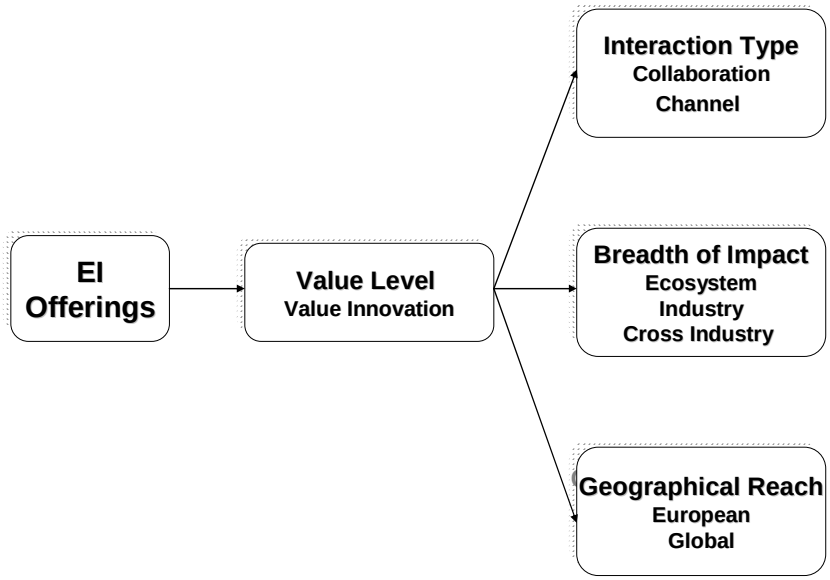


Figure 5.1 Focus of EI Offerings from EIVP Analysis
-- EI Offerings to support Value Innovation

In Chapter 4, we have applied the EIVP framework to the analysis of business models and the underlying economic foundations. This yields the proposition that the need for EI is progressively greater for those business models that are "open", that enable the innovation processes, and that encourage engagement of the company with its business partners and customers. We have linked the need for and intensity of EI with both creation of new markets and experimentation with business models. This creates a win-win situation for not just the enterprise concerned, but also its business partners and customers. Specifically, EI offerings should focus on supporting Type 5 and Type 6 business models. This is depicted in Figure 5.2.

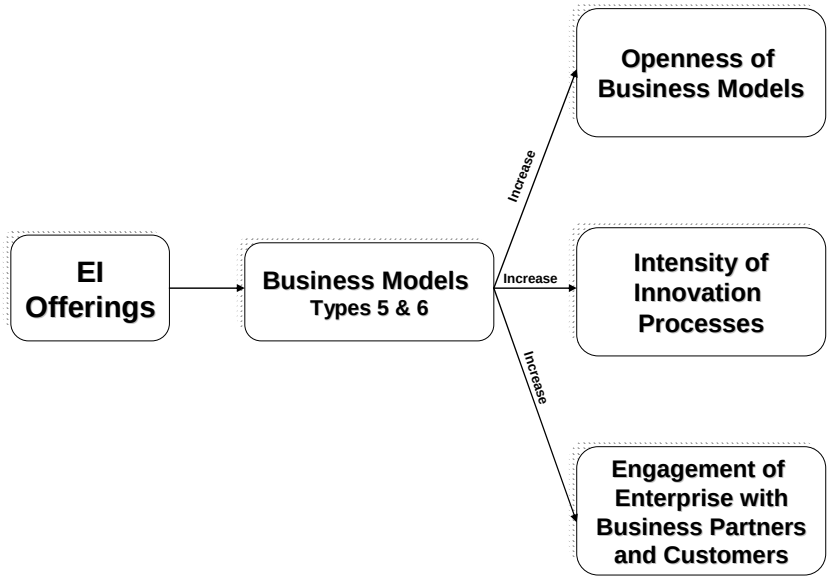


Figure 5.2 Focus of EI Offerings from EI Business Model Analysis -- EI Offerings to support Types 5 & 6 Business Models

In the present chapter, we provide an overview of EI offerings within the focus as presented above. The analysis is **complementary to the Enterprise Interoperability Research Roadmap**. EI offerings are positioned in relation to the *Problem Space* as defined in the Roadmap, and are categorised in accordance with the four *Grand Challenges* described in the Roadmap. The offerings are then further described with reference to achieving the *Vision* of the Roadmap. Consolidating the findings of the previous chapters on value innovation, it is proposed that **disruptive innovation at the enterprise level needs to be matched by disruptive innovation for enterprise systems of the future**.

In accordance with the direction of the previous chapters, we are less concerned with specific solutions that help enterprises to interoperate – EI solutions here are highly context dependent; arguably their value-add to the customer depends on the customisation of those solutions. The solution space of EI is a commercial concern of the market and proprietary matter of the market actors concerned. Instead, we focus on **offerings that contribute to the EI field as a whole**, and that are driven by the business needs of evolving enterprises, within the scope of the present report which concerns the long-term research needs of EI, particularly publicly financed research[33].

It is not the purpose of the present chapter, or within the scope of the present report, to identify specific technical and other *Research Challenges* in the field of EI. This important exercise is part of a separate activity of updating the Enterprise Interoperability Research Roadmap, which is on-going at the time of preparing the present report.

5.2. EI Problem Space and Solution Space in accordance with the EI Research Roadmap

Under FP6, EI research has focused on interoperability of enterprise software and applications, including intelligent infrastructure in dynamic networks, new generation of semantic tools, architectures and frameworks as well as open networks of interactive, autonomous and intelligent software components (European Commission, 2007). The key results of several FP6 projects in the field are summarised in Annex III, Section 2.

[33] As noted in the Scope of this report (Section 1.3), we make a distinction between the provision of EI solutions, which is a commercial concern and activity, and the provision of EI offerings, which has a wider perspective of public concern and interest in respect of the changing nature of EI and the long-term research needs of EI.

The Enterprise Interoperability Research Roadmap has linked EI solution provisioning with EI problem solving. The Roadmap identifies six dimensions for the EI problem space. The present study not only reinforces this approach, but further advances the relationships between the problem dimensions which EI offerings must address. In particular, offerings that have a sound business case and provide a clear value proposition (addressing Roadmap problem dimension 5) are those that also enable the process of innovation, facilitate Open Innovation, and take into account the geographical reach of globalisation (addressing respectively Roadmap problem dimensions 1, 6 and 2). Moreover, those offerings also relate to decision-making (addressing Roadmap problem dimension 3) by increasing the engagement between the enterprise with both business partners and customers. So far, the reduction of IT cost (addressing Roadmap problem dimension 2) has not been explicitly raised in the present report; instead this report has made a careful distinction between value and financial cost/revenue. However, as will be seen below, the cost issue is closely linked to offerings that flow from tackling the Grand Challenges proposed in the Roadmap.

From the four Grand Challenges of the Roadmap, four types of EI offering can be derived:

- Interoperability Service Utility (ISU): a new **infrastructure** for EI
- Web Technologies for EI: a new generation of **technologies** in support of applying Web 2.0 to the enterprise space ("Enterprise 2.0")
- Knowledge-Oriented Collaboration (KOC): **methods and tools** to support knowledge sharing within a Virtual Organisation to the mutual benefit of partners of the Virtual Organisation
- Science Base: new **scientific foundations** for EI by making use of other scientific disciplines – EI offerings that are rested on and subject to the rigour of science.

By linking the EI offering with the EIVP and EI business models, we can further characterise EI Offerings, as shown in Figure 5.3.

Grand Challenges	Offerings	Analysis from EIVP & associated Business Models	
ISU	Infrastructure	Drivers for New Business Models ▪ Web 2.0 developments ▪ ICT market trends towards commoditisation and utility ▪ A new generation of Key Enabling Technologies (KET) ▪ Globalisation	**Moving from closed proprietary platforms to a service-oriented, global infrastructure that provides interoperability as a utility like capability**
Web Technologies	Technologies		**Enterprise 2.0: user co-creation of content, services and technologies**
KOC	Tools & Methods		**Enabling collaboration and service–oriented channels**
Science Base	Scientific Foundations		**Multidisciplinary scientific foundations to support and close the gap between the Technical, Business and Community aspects of EI**

Figure 5.3 EI Offerings in support of the Grand Challenges of EI Research Roadmap

Throughout this report, we have emphasised the importance of value innovation for enterprises, and the theme of change for enterprises that wish to succeed – or maybe even survive – into the future. We have also indicated that both the mechanism for and the nature of innovation are changing. Accordingly, there is a critical need for innovation of IT systems that enable, support and catalyse the innovation of enterprises in times of profound and accelerating change. Disruptive innovation at the enterprise level needs to be matched by disruptive innovation for enterprise systems of the future. Importantly, infrastructures, technologies, methods and tools are valuable in terms of the *overall business impact* that they have on the enterprise. Specifically, enterprise does not implement an EI offering in isolation of other EI offerings already adopted or planned – the technical merit or advancement of individual infrastructures, technologies, methods and tools does not on its own, or by

itself, provide business advancement or impact. Value is delivered at the level of the system, not components or elements of such a system[34]. The four Grand Challenges of the EI Research Roadmap underlines this **systemic view of ICT for enterprises**, which is intrinsically different from the technology-driven approach of other areas of ICT research. The question therefore becomes: what innovation is needed for EI offerings to support future enterprise systems?

5.3. EI Offerings to support Future Enterprise Systems

5.3.1 Characteristics of Future Enterprise Systems

The requirements for enterprise systems flow from the business model that a system is intended to enable and support. Successful future systems therefore will increasingly be aligned with the needs of Type 5 and Type 6 of EI business models as described in Chapter 4. We further propose that this alignment should be a *full* alignment in the sense that they reflect directly the main characteristics of these business models, namely:

> ***Enterprise systems which are fully open, adaptive and integrated with innovation processes.***

Interoperability of enterprises therefore will need to focus on System Openness, System Adaptability and System Integration within a new perspective of the enterprise. The following provides a description of these three characteristics.

Characteristics	Description
System Openness *An enhanced definition is needed.* *Specifically, "openness" for enterprise systems is wider than basic interconnectivity at level of technology, or basic integration of application solutions from multiple sources.*	The following attributes map directly onto the six dimensions of the problem space defined in the EI Research Roadmap: • Openness to change • Openness to competitiveness in a globalised economy • Openness to integration (with other IT solutions) • Openness to information access and optimisation (addressing the "information big bang") • Openness to business cases and business models • Openness to ideas, specifically openness in ideas sourcing and sharing
System Adaptability	*Moving from centralised production to peer production*: • Productive power is on the edge of the network • Shift of control from enterprises as "institutions" to enterprises as "communities of individuals" • Design to change rather than design to stay *Moving from planned use to "emergent" use, producing output which is:* • More voluminous • More diverse • More unpredictable • More open-ended *Moving from a push paradigm to a pull paradigm:* • Replacing demand forecast with the capability of providing flexible resourcing • Connecting people with the resources that are most relevant to them whenever and wherever they need the resources

[34] Moreover, a system is not just "a sum of the parts", as evidenced by the complexity of integration in past EI research (Li, Deshmukh and Jones, 2006). The value of an enterprise system is enterprise specific – an enterprise system as a collection of IT technologies and assets is valuable in terms of the business value it delivers. It certainly is not an amalgamation of the "value" of individual subsystems or components. Not only does the latter make little business sense, it is also impossible to measure. For further discussion, see Chapter 6.

	Moving Web 2.0 concepts and technologies into the workspace, new system properties that lead to "richer" outcomes, and encourage "emergent structures and behaviours" (see further under 5.3.2): • Ability to deal with freeform as well as structured information • Simplicity over complexity • Service oriented delivery channels • Ease of change • Ability to handle both intended and unintended use • "Social" – focus on diffusion rather than centralisation, practice rather than design, "light weight" rather than "heavy weight", de facto rather de jure, users as co-creators rather than passive consumers, user control rather than central control
System Integration	• Moving away from a monolithic platform view of integration to an infrastructural view of interoperability • Moving away from technology "silos" • Moving away from integration of specific solutions and tools to light-weight modular building blocks ("widgets") • Re-thinking the boundary between applications and services – business processes are artefacts and therefore not immutable • Software as part of an ecosystem larger than itself • New approaches to integration with legacy systems

5.3.2 "Enterprise 2.0"

As noted in Section 4.4.3, there is clear evidence of a massive "spill over" of Web 2.0 type of development from the consumer into the business environment. As part of this trend, the term "Enterprise 2.0" was coined in 2006, and has been most prominently associated with the definition proposed by Andrew McAfee: "*Enterprise 2.0 is the use of emergent social software platforms within companies, or between companies and their partners or customers*" (McAfee, 2006a). According to McAfee, in comparison with previous attempts to use the Web for business work, proponents of Enterprise 2.0 do not seek to impose on users any pre-conceived notions about how work should proceed and how output should be categorised or structured. Instead, they are building tools that let these aspects of knowledge work emerge[35]. Importantly, in the opinion of Enterprise 2.0 proponents, this is based on a new view of **software platforms that support the changing nature of enterprises** and that focus on the **practices and outputs of knowledge workers**.

A summary of the change from Enterprise 1.0 to 2.0 is provided in Figure 5.4. Of note are the changing *characteristics* of the enterprise, which reflect the changing context of business as described in Chapter 2.

There is much on-going discussion about the similarities and differences between Enterprise 2.0 and the equally topical Service Oriented Architectures (SOA) – a discussion that is beginning to eclipse the discussion of "Web 2.0 vs. SOA". One crucial area of debate is about whether, and if so the extent to which and the importance of which, there is "human in the loop". Another is the structure of the systems involved, notably planned (imposed) up-front or emergent over time. A third area of debate is the modality of IT development and production, notably centralised or peer-to-peer. A fourth area of contention is the extent to which Enterprise 2.0 and Web 2.0 are technology neutral.

[35] McAfee continues: This is a profound shift. Most current platforms, such as knowledge management systems, information portals, intranets, and workflow applications, are highly structured from the start, and users have little opportunity to influence this structure. Wiki inventor Ward Cunningham highlights an important shortcoming of this approach: "For questions like 'What's going on in the project?' we could design a database. But whatever fields we put in the database would turn out to be what's not important about what's going on in the project. What's important about the project is the stuff you don't anticipate." (McAfee, 2006b).

Enterprise 1.0	Enterprise 2.0
Hierarchy	Flat Organization
Friction	Ease of Organization Flow
Bureaucracy	Agility
Inflexibility	Flexibility
IT-driven technology/ Lack of user control	User-driven technology
Top down	Bottom up
Centralized	Distributed
Teams are in one building/ one time zone	Teams are global
Silos and boundaries	Fuzzy boundaries, open borders
Need to know	Transparency
Information systems are structured and dictated	Information systems are emergent
Taxonomies	Folksonomies[36]
Overly complex	Simple
Closed/ proprietary standards	Open
Scheduled	On Demand
Long time-to-market cycles	Short time-to-market cycles

Figure 5.4 Comparison of Enterprise 1.0 with Enterprise 2.0 (Source: Unknown, 2007: What is Enterprise 2.0?)

It is not within the scope of this chapter, or this report, to resolve this debate; clearly both Enterprise 2.0 and SOA are undergoing continuing development in both theory and practice[37]. However, the resolution of the debate would have implications for the kind of EI solutions that will become available on the market, and the positioning of those solutions. They would therefore also impact on the practical means of achieving of EI, at least in the short to medium term. For example, solutions that focus on a pragmatic extraction of what actually works best in online product design (Enterprise 2.0) would be different in nature to those that are the outcome of a rigorous *a priori* engineering exercise (SOA). Interoperability in the former would prioritise on run time issues, whereas in the latter would prioritise on design time issues. The core of interoperability would also shift, depending on whether data, information or knowledge is considered as the centre of enterprise applications (Enterprise 2.0); or whether services are considered as the centre of composition and application development (SOA).

5.3.3 Utility and Value Added EI Offerings

The Vision Statement of the Enterprise Interoperability Research Roadmap describes interoperability as a "utility-like capability that enterprises can invoke on the fly in support of their business activities", with specific IT functions being delivered as services that are "cheap, fast, reliable, and without major integration efforts". The overall aim is to make IT "a transparent and invisible part of the business operation". An infrastructure is required to make this happen, which is labelled the **Interoperability Service Utility (ISU)**, constituting the first Grand Challenge of the Roadmap.

From the perspective of the present report, one of the most important innovations that the ISU brings to EI systems is a Utility approach to interoperability in order to enable, facilitate and catalyse the development of technologies, methods and tools that are fine-tuned to the specificity of the user (end customer). In section 4.4.2, we have made a distinction between utility service based business models and value added service based business models. In order to optimise the disruptive innovation of the latter, the former is a pre-requisite. From the point of view of EI offerings, an infrastructure of EI utility services must be in place, in order to support next-generation EI value added services that meet the characteristics of future Enterprise Systems. Using the idiom of Enterprise 2.0, a utility infrastructure for EI is needed to facilitate two major outcomes: **participatory input based on co-creation** and **innovative output based on the unique nature of individual enterprises**.

[36] www.wikipedia.org: Folksonomy (also known as collaborative tagging, social classification, social indexing, social tagging, and other names) is the practice and method of collaboratively creating and managing tags to annotate and categorize content.
[37] Or "philosophy". To quote McAfee: "So both SOA and Enterprise 2.0 are really philosophies; the former about letting computers interact with each other without humans, the latter about letting humans interact with each other via computers" (McAfee, 2006(a)).

The characteristics and properties of the ISU services (utility as well as value added) are a major topic of discussion and research within the European EI community[38]. Different models are being proposed, particular in relation to the definition and categorisation of the services, as well as the provisioning and governance of the services. An example of the ISU service model, among several being put forward and additional ones that are emerging, is given in Figure 5.5.

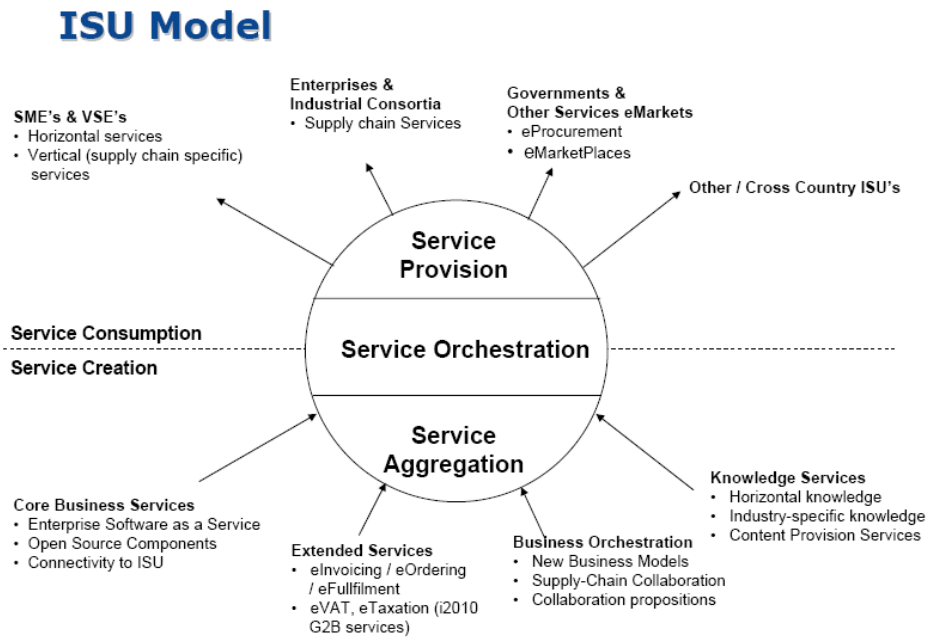


Figure 5.5 An example of ISU Model (Charalabidis, 2007)

For the purposes of this chapter, what is of most interest is not so much the technical details, but the contribution to value innovation that the infrastructure, such as the ISU, can bring to the EI field as a whole[39]. In this respect, it is of immense significance that the ISU is conceived in the Roadmap as a conceptual (i.e. not a functional or technical) "layer" of the Future Internet, atop telecommunications, Internet and the Web. Critically, the ISU is intended to be based on the same principles that secure the openness of the Internet and the Web. It is the ***openness of the ISU that drives the value innovation capability of future enterprise systems,*** and help achieving Type 5 and Type 6 EI business models **within an environment of co-existence of different types of business models**. That openness is the key attribute that enables unanticipated change through unfiltered contributions from broad and varied sources, as envisaged in Enterprise 2.0. This is in contrast to a closed infrastructure, such as a proprietary IT platform, where growth is channelled through the maker of the infrastructure, regardless of the size and even the "openness" of the ecosystem based on the infrastructure.

John Hagel has summarised IT developments in relation to IT architectures that are designed "inside out", i.e. those typical of traditional large enterprises, and those that are designed "outside in", i.e. those that are designed from the outset to support sustained collaboration across large numbers of enterprises, as epitomised by "Enterprise 2.0" (Hagel, 2007). Instead of seeing an infrastructure as transaction-based, which characterises many of today's enterprise systems, the move is towards an infrastructure for "**relational architectures**", enabling enterprise systems to support enduring and deepening relationships of individuals and institutions.

[38] See for example the presentations given at the European Commission DG INFSO EI Cluster working held during eChallenges in October 2007, reference given in Footnote 15.
[39] As pointed out by Andreas Friesen of SAP, a contributor of this report, the business model(s) for the infrastructure, including for the ISU, must however be investigated. Innovation on top of the ISU is dependent upon the sustainability of the ISU. See Section 4.4.2.

The above analysis points to a further distinction between EI offerings: **EI offerings that are open and utility-based, and EI offerings that are customised and value-added**. This further distinction between EI offerings is depicted in Figure 5.6.

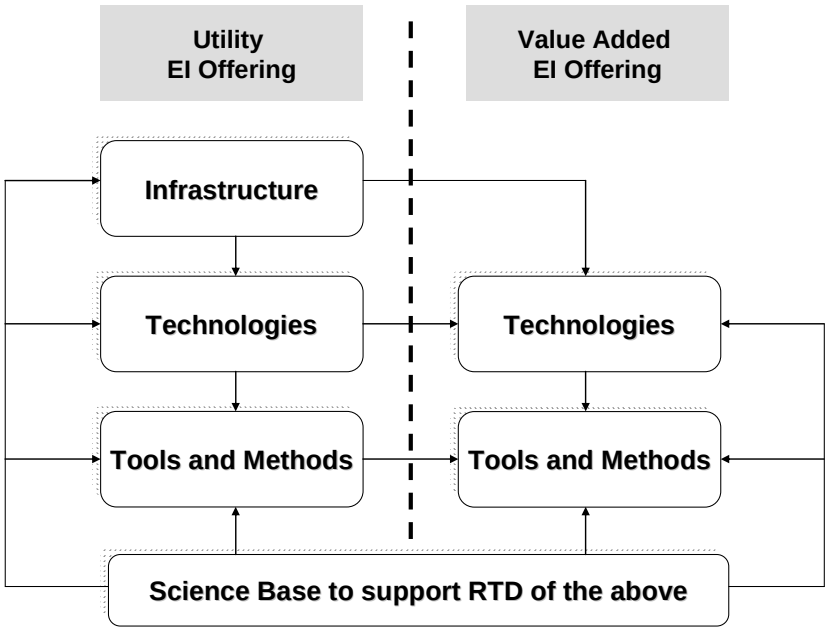


Figure 5.6 Utility and Value Added EI Offerings

Note: A utility offering is "open", as defined within the meaning of this chapter (see Section 5.3.1). A value-added offering may or may not be open.

On this analysis[40], we can distinguish between ***universal* interoperability** for utility-based EI offering and ***conditional* interoperability** for value-added EI offerings. For universal interoperability, interoperability is needed at two levels:

1. ***Between potential providers* of utility service offerings** – to ensure that connectivity across the services that is required by one or more users can be supported.

2. ***Between users and providers of utility service offerings*** – to ensure that value added services can be freely added by any user without fear of the investment being lost due to unforeseen changes in the connection, APIs or service conditions.

For conditional interoperability, the degree and level of interoperability needed would be directly derived from the business model of the individual users of value added services. In other words, specific services may be open under certain circumstances (e.g. for enterprises within an ecosystem) but closed in others (e.g. between competing ecosystems). Value added services need to be tightly coupled with the business innovation processes of enterprises. Value added services address uniqueness, reflect the proprietary aspects of business assets and operation, and therefore are about exceptions, rather than the business norms and routines of utility services.

Importantly, in order to meet the needs of future enterprise systems targeting value innovation (see Section 5.3.1), offerings that are traditionally proprietary, i.e. in the value-added category, might usefully be re-categorised as utility offering. Indeed, the history of technology development in general

[40] Detailed supplementary analyses have been provided by various contributors, in particular Steven Willmott of 3scale S.L., whose contribution identifies different levels of interoperability in relation to the provisioning and use of open and interoperable infrastructural business services. That contribution concludes that interoperability must form a core part of the business models of both providers (who create and maintain core business services) and users (organisations that rely on them).

underlines this development: technology which was highly priced and available to a few became, over time, commoditised and affordable to all. There is already a movement in this direction for some time in the world of IT, such as e-payment in the case of PayPal, identity federation in the case of the Liberty Alliance, location mapping service in the case of Google Maps, and basic data hosting in the case of Amazon's S3. However, while these meet the second level of universal interoperability described above, the first level remains unfulfilled.

Another consequence is that the characteristics of EI offerings at the infrastructure level will drive developments of those at the level above the infrastructure. The kind of EI offerings that could (should?) be available at the infrastructure level is a rich ground of research in terms of technical possibilities, business model configurations (for both providers and customers) and policy enablement.

5.4. Conclusion: Enterprise Systems in the Future Internet

The discussion in this chapter is from the perspective of the evolving needs of enterprises at the system level. The systemic view of ICT for enterprises is a central characteristic of EI, and distinguishes EI from other fields of ICT research which have a predominantly technology-driven approach. The central argument in the chapter is that in order to enable value innovation at the business level, enterprise systems of the future must be open to dramatic change, rather than lock in the status quo. The open, adaptive and innovation intensive characteristics of business models are the defining characteristics of those systems. Different types of EI offerings are needed to make this happen. In particular, EI offerings at the infrastructural level are crucial for the innovation potential of technologies, models and tools, which are themselves valuable in terms of the overall impact that they achieve in relation to the business models specific to individual enterprises.

An important conclusion from the foregoing analysis is that **the strategic issues of interoperability for enterprises are no longer about basic interconnectivity at the level of technology, or basic information exchange between two entities. Instead, interoperability is closely coupled with the changing nature of business needs, at the level of the enterprise and the community of enterprises[41], the individual, and the economy.**

It is not the purpose of this chapter to consider the customary question: what are the killer apps / killer technologies for future enterprise systems? On the other hand, it is vital to point out that key enabling technologies (see Section 4.4.3) will continue to define, refine and re-define what is technically feasible to accomplish in an enterprise system, independent of the business value that they may confer on enterprises. Interoperability of enterprises is based on the capability of the Internet, and Future Internet technologies will shape that interoperability as a capability in future. But what should the Future Internet offer to enterprises? Would the Future Internet deliver those characteristics of future EI systems consistent with our analysis? Importantly, would the Future Internet reinforce the infrastructural offerings of EI and thereby make interoperability more – rather than less – simple, affordable and accessible?

While predictions about the future are by definition speculative, it is highly likely that the Future Internet will give rise to new opportunities of creativity and innovation, enable new forms of participation, further catalyse the formation of networked enterprises and communities that span the world, thereby ushering in a new generation of enterprise systems requiring a reappraisal of interoperability between those systems. It is therefore the more important to develop a utility view of EI offerings that builds on the Internet's tradition of openness and interoperability, in order to unlock the value of business innovation.

[41] Notably an established industry, or value networks and ecosystems which transcend traditional industrial boundaries, as described in the EI Value Proposition framework (Chapter 3).

6. Towards a New Value Analysis of Enterprise Interoperability

6.1. Introduction

The previous chapters describe how EI solutions derived from new business models and new offerings can generate significant extra value, in a rapidly changing business context. However it is unlikely that the potential that is outlined in the previous chapters will be fully exploited, if managers, financiers and other stakeholders lack a suitable analytical framework that can help them to accurately identify and predict the (potential) value associated with investments in EI. Indeed, the current techniques for value analysis provide little support for investments in value innovation through EI. They are still very much based on traditional assumptions of creating value, i.e. through scale benefits and efficiency gains and via investments with predictable results. Such techniques are biased towards competition in the "red ocean" and do not encourage exploration of "the blue ocean". A new generation of analytical techniques – a New Value Analysis – is needed to adequately support that type of investment in EI. This chapter will further explore the requirements of such an analytical framework, bearing in mind the developments and trends described in the preceding chapters. It will first outline the limitations of the current techniques and subsequently describe the main requirements of the New Value Analysis.

6.2. Current Techniques for Value Analysis and Their Limitations

A significant number of techniques are used to assess the value of investments in ICT, EI included. Prominent representatives of this class of techniques are:

- **ROI:** (Return on Investment) represents the expected benefits in light of the costs of acquiring the benefits. It underlines the need for having a precise idea of what the investment and the return (with also the cost of capital) are in order to produce an accurate ROI.
- **Client Lifetime Value Analysis:** represents the value of cash flows received from a particular client over time less (-) the costs of acquiring the client.
- **EVA:** (Economics Value Added) is after-tax operating profit less the cost of capital employed in generating that profit. It is mainly used by large companies for strategic direction, acquisitions, operational improvements, product line discontinuation, working capital focus, cost of capital focus, and incentive compensation.
- **TCO:** (Total Cost of Ownership) originated from Gartner in 1987; when incorporated in any financial benefit analysis (ROI, IRR, EVA, ROIT, etc), TCO provides a cost basis for determining the economic value of that investment. TCO aims at determining the viability of any capital investment.

Especially when considered in the light of the trends discussed in the previous chapters, these existing techniques for value analysis show a number of serious shortcomings: they only relate to financial benefits, especially cash and have great difficulty to assess intangible benefits which increasingly constitute the bulk of the value, especially in the Knowledge Economy.

Moreover, a related problem with regards to investments in EI is that current techniques presume all relevant costs and benefits can be directly related to the investment itself. However, as indicated in Chapter 5, **investments in EI are often infrastructural and will increasingly be so in a (business-driven) networked context**. It is however very difficult to judge the wisdom of investing in an infrastructure, because its eventual value depends on the subsequent investment in applications that will make use of it. Note that in this case the term "infrastructure" has a broad interpretation. It does not only concern a basic technical communication infrastructure, but essentially all "provisions for common use"[42]. Most of the current techniques only take into account benefits and costs at the level of the single firm. Increasingly this is not the only relevant level. At the level of the enterprise, the value network and the ecosystem have become more useful objects of analysis than the single firm in isolation.

[42] This could for instance include joint ontologies or other provisions to secure semantic consistency between business partners.

Furthermore, we can underline that none of the current techniques and associated indicators give due acknowledgement to **value innovation**. All these indicators reflect the *company-centric perspective with an efficiency driven view of value creation* (Prahalad, 2002). This has led to a gap in the perception of value creation between a company and its customers. Together these disadvantages of enterprise level analysis imply that the current generation of techniques is not able to discern **differences in the potential for value innovation** that are associated with investment alternatives. Instead, these techniques presume that value creation occurs through economies of scale and efficiency gains alone (Zuboff et al, 2003; Malone et al, 2003). This problem is associated with the differences between how most companies think and how most customers think, as shown in Figure 6.1.

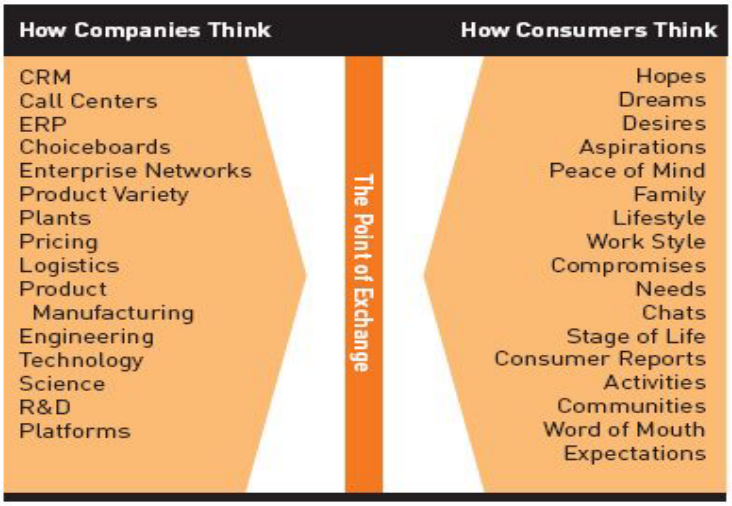


Figure 6.1 Value Creation - How Companies and Customers Think (Prahalad, 2002)

The current techniques for value analysis have additional disadvantages. They fail to address the increased need to assess the effects on value at the individual level. Even when the value of an investment at the level of an enterprise or a network as a whole may seem obvious (at least to the final decision makers), such an investment can still dramatically fail to become a success when the benefits at the individual level are not evident. Because the current techniques for value analysis still assume deployment of solutions from the top down, they do not trigger sufficient checks on whether, at the individual level, the investment at least also looks compelling enough to avoid resistance to change as described in the case study below.

Already in the early 1990s MIT's Wanda Orlikowski presented a spectacular case of how a seemingly obvious investment in knowledge exchange facilities at a globally operating leading consultancy firm (code-named Alpha Company) with over 50,000 employees had gone dramatically wrong (Orlikowski 1993). A new CIO together with Alpha Company's top management had decided to deploy Lotus Notes around the firm, to boost exchange of knowledge among its consultants and across branches. This would improve the quality of the consultancy services and reduce "re-inventing the wheel". While the implementation was relatively straightforward and the benefits seemed obvious in the knowledge-intensive activities of Alpha Company, the firm nonetheless failed to turn the use of Lotus Notes into a success. The junior staff, the majority of the employees, held a significant part of the innovative knowledge but proved most hesitant to share them. Alpha Company cultivated an atmosphere of fierce competition among the staff on their way to the limited number of lucrative senior posts and "sharing" and "helping" did not fit that company's culture. In addition, because the juniors were pushed to make as much billable hours as possible, most of them decided not to spend (non billable) time on Lotus Notes training, thus missing the key collaborative features of the product. Most employees thought it was just a new email system. Finally, senior users were especially afraid that the information they would put in the system would be used out of context and in the wrong way by people they would not know, creating a risk of damage to their reputation and claims from clients. Thus, lack of understanding and joint commitment, together with resistance at the individual level, destroyed the value of the investment that seemed so tangible to the top management. This stresses that the value of technology has to be seen not only as an efficiency and productivity enhancer, but also as a social object and a trigger of structural change.

Better and higher levels of education and training, as well as greater independence of the current and future generations of (knowledge) workers, will increasingly shift the most significant source of value

innovation to the individual level. Ignoring this in value analysis will leave an increasing potential unexploited. Finally, current techniques fail to grasp the value of investment in EI at the level of society as a whole. Impact measurement at that level typically comprises standard measures of productivity and improvement that are assumed to be the same for any kind of technology or even for progress in general. Such measures do not reflect a specific appreciation of the effect of ICT, let alone the even more specific results that EI can produce in national and international economies as a whole.

6.3. The Challenge: From a Deterministic to a Probabilistic Approach to Investment in EI

The current generations of techniques for value analysis to support investments in EI are based on a deterministic approach for value generation. They assume that after some calculation a clear cut winner would appear among the investment alternatives, i.e. the one with the best trade-off of explicit costs and immediate tangible benefits. In a world where the key to generating value lies in "doing more of the same" this may be true. It justifies a deterministic investment approach to EI. But, as argued throughout this report, the key to value is increasingly about innovation, entailing the opposite: "doing more of NOT the same"; doing things that are different, with different business partners, to offer solutions that are different but highly valuable (Evans & Wurster 2000). However, it cannot be predicted in advance with precision or certainty what opportunities will appear and how enterprises should be different (and with whom) to be successful. Thus, investments in offerings as described in the previous chapter are definitely not deterministic. They provide the **potential** to be innovative. They provide the **flexibility** to develop profound relationships with new business partners quickly in order to jointly exploit a narrow window of business opportunity. These investments therefore cannot be based on a "guarantee" of discernable benefits that are associated with any aspect of "business as usual". To the contrary, their *raison d'être* is to undermine business as usual. They reduce certainties and create opportunities and probabilities. Consequently, these investments are characterised by a probabilistic approach.

It is important to see that the value associated with investments in this last category can be dramatically higher that the value associated with traditional investments in ICT (Hagel & Armstrong, 1997). Many examples can be given of companies today that have very substantial value - often associated with intellectual capital - not because they have realised significant profits recently (or at any time), but because these companies are full of "potential" that is to materialise spectacularly in the future.

It is especially the transition from a deterministic to a probabilistic approach that drives the need for a next generation of techniques for value analysis. Figure 6.2 illustrates the perspectives and requirements for the next generation techniques, based on the analyses and findings from the preceding chapters. The new techniques are essential to support investment decisions in value innovation through EI.

Our preliminary research also suggests that complexity, uncertainty, importance of intangibles and new notions of control are among the key parameters for the analysis, creation and capture of value. These four parameters can be variously applied to the main topics addressed in this report (see the colour coded annotation of these parameters in Figure 6.2). For example, transposing the concept of Web 2.0 into the enterprise environment creates a whole series of issues from knowledge creation and sharing, to employee empowerment and new reward systems, to organisational processes of the firm and also the firms' relationships in its value network. There are deep interdependencies between these issues. The complexity needs to be accounted for by the EI offerings that support the transposition. In addition, the EI offerings must support the intangible aspects of knowledge creation and sharing, and their impact on the processes of the firm and its relationship with customers and partners.

The reason for highlighting "creating and capturing value**"** is that new techniques must address the difficulties that organisations face in grasping the concept of the Knowledge Economy with its share of intangibles. Managing the complexity of this economy has become more difficult than in the past when it was more a matter of management by reducing production lines, for instance.

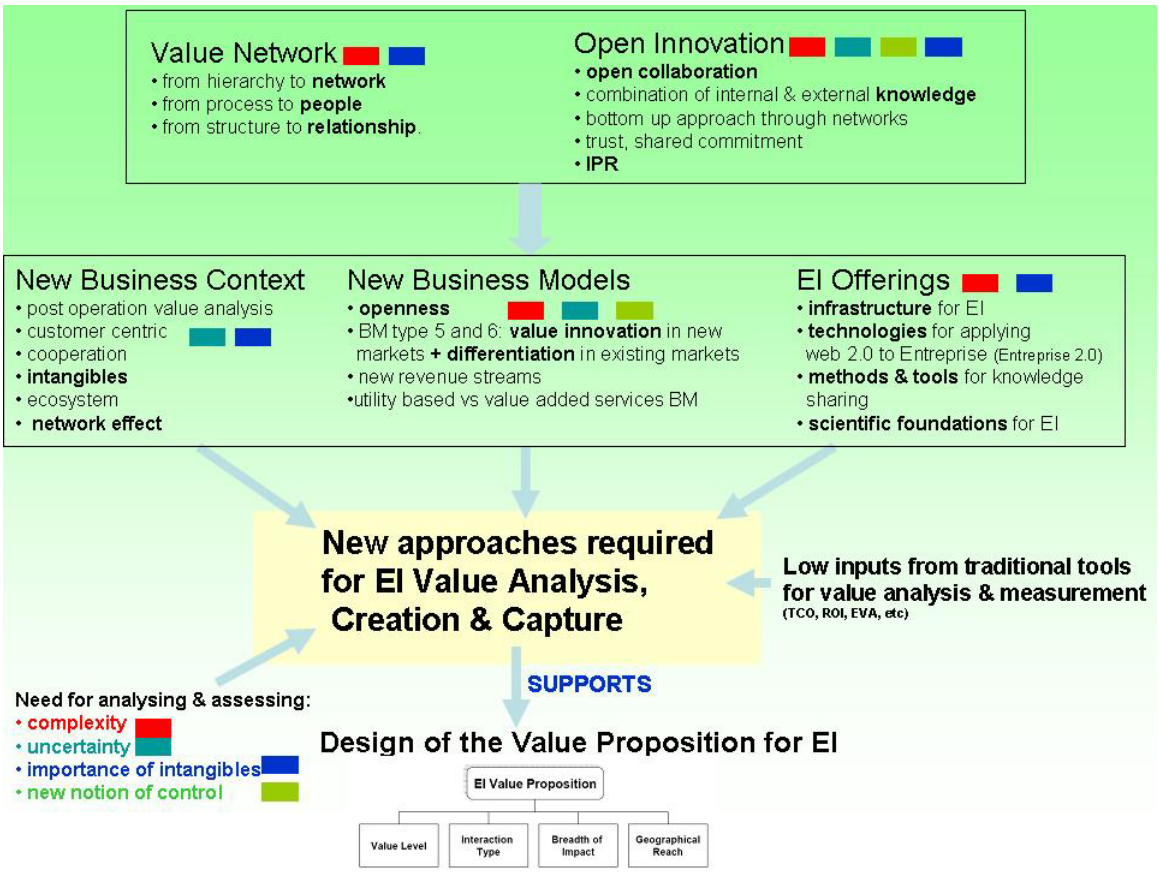


Figure 6.2 Enterprise Interoperability Value Problem Space

As presented in Chapter 2, a value network generates economic value through dynamic exchanges between two or more organisations of any kind. Allee (2000) quotes three main *value currencies* which can be found in a value network:

- ***Goods, Services and Revenue (GSR):*** Exchanges for services or goods, including all transactions involving contracts and invoices, return receipt of orders, request for proposals, confirmations or payment. Knowledge products or services that generate revenue or are expected as part of service (such as reports or package inserts) are part of the flow of goods, services and revenue.

- ***Knowledge:*** Exchanges of strategic information, planning knowledge, process knowledge, technical know-how, collaborative design, policy development, etc., which flow around and support the core product and service value chain.

- ***Intangible benefits****:* Exchanges of value and benefits that go beyond the actual service and that are not accounted for in traditional financial measures, such as a sense of community, customer loyalty, image enhancement or co-branding opportunities.

The value of GSR for a single company is certainly the easiest element to be assessed; but when it comes to a network, the complexity increases as described above. Knowledge is a critical value especially when the focus is on networks where situations of cooperation/competition among the different stakeholders occur (see Section 6.4 for additional analysis). Strongly linked with strategic information and knowledge sharing is the *trust value* which is an important attribute of the intangible benefits; such benefits cannot be measured using traditional methods.

Literature review shows that:

- It is today's central strategic challenge and tomorrow's competitive necessity to capture the value that an organisation creates; but in the meantime the same forces that enable value creation also make the sources of value - knowledge and information - increasingly available (Torsilieri and Lucier, 2000).
- Many of the companies did not shift their focus from value creation (revenues) to value capture (profits) soon enough, and instead followed the flawed logic that scale, scope, and increasing returns on incremental investments govern their business (Germany et al, 2001).

We will discuss some of the most critical additional requirements for value analysis techniques, at the three levels of enterprise, individual and society incorporated in the EIVP framework (Chapter 3).

6.4. Extra Requirements for Value Analysis at the Enterprise (Network) Level

Value analysis from the perspective of the single firm and the value network both occur at the "meso" enterprise level. From a theoretical point of view, within the value network, firms by definition still have the power to decide on investment independently. However this does not mean that they can still be only concerned about their own immediate benefits and costs. Instead a network perspective implies that the primary concern lies in the benefits and costs of the network as a whole. This requires an appreciation of the multiple cost/benefit combinations for the various actors in the network for each investment proposal. This in practice may be difficult to assess, since each value network presents specific characteristics in terms of openness, structure of the markets addressed, and degree of control and power of stakeholders. The best alternative is not necessarily the one that gives the highest net total benefit for all distributed effects combined. After all, if an alternative is clearly beneficial for all except for one (type of) crucial actor, the sustainability and overall value of the network would be jeopardised if such an alternative were implemented.

Changes in the value analysis framework should facilitate that investment proposals can be compared on their "high level" effects, as follows:

- The extent to which they facilitate the members of a network to jointly pursue opportunities that are otherwise impossible to reach. Because of this, it should be possible to accurately estimate the magnitude of these opportunities.

- The extent to which they discourage vital members of the network to leave because other business opportunities they have (in competing networks) are more attractive. Of course this requires a solid understanding of the contributions of the individual partners in the network to the joint, unique solution of the network as a whole[43].

Additionally, "coopetition" (simultaneous cooperation and competition strategic behaviours of two or more firms) - which has effects on collective intelligence, emergence of communities of practice and adoption of new approaches - also changes the value analysis framework. This is reflected in the work of the FP6/IST ECOLEAD consortium on value systems in a Virtual Organisation Breeding Environment (VBE). Members of a VBE can in essence be partners inside the VBE (industrial district, cluster etc) and at the same time be competitors outside the VBE in different markets or different lines of products/services. The work developed by ECOLEAD (ECOLEAD, 2006) on Value Systems deserves a specific mention since it shows the main elements that generate value in the VBE.

6.5. Extra Requirements for Value Analysis at the Individual Level

Recent history shows an erosion of the enterprise as *the* unique vehicle to organise the connection between supply and demand. No longer is the operational core of organisation within firms mainly

[43] Note that this second argument may cause all partners in the network to invest in a solution which has a net negative effect for them individually in order to keep a crucial partner on board. Also note that at the moment this logic often also has a strong technical association and as such often induces SMEs to invest in proprietary systems used by a dominating OEM, in order to stay being part of the OEM "network". Future improvements in the openness of technology would shift the emphasis from keeping partners on board and creating technical lock-in, to creating business opportunities and competing with other networks based on actual value innovation.

about executing routines that have been preconceived by others. No longer is meticulous repetition in machine bureaucracies the key to generating value. Instead companies that flourish are those that show they can exploit the capital that is associated with a talented workforce. The value of this ability is seldom reflected in market capitalisation of companies even though it has a great impact on revenues and profits. More and more theorists and practitioners are convinced that actually capturing value and generating profits - as opposed to merely creating value and generating revenues - in the 21st century requires smart individualised propositions that intelligently mix richness (i.e. specific solutions for specific needs) and reach (i.e. solutions that, to a large extent, still serve the needs of many). It is also realised that doing this well requires excellence at the level of individual employees.

Yet, making an accurate appreciation of increased ability to compete in the knowledge economy at the individual level through EI remains difficult. As mentioned above, current techniques for value analysis do not extensively cover the effects on intellectual capital, social capital and emotional capital. A new generation of value analysis techniques should be equipped to assess the potential of investment in EI, in especially the following three respects.

The contribution to autonomy of individuals (employees and customers). EI should facilitate **decentralisation**, accelerate the death of distance and support decision making and activity regardless of time and place, in order to foster the managerial and physical independence of individual employees. It should also strengthen the networking potential of individuals and encourage them to make use of weak ties[44] essential for open innovation.

The contribution to individual creativity. EI should support co-creation, i.e. creating solutions for and with customers by joining forces and expertise instead of development in a linear, time-consuming and less effective way. Several value measurement indicators[45] have been developed in the past decade, but they are unable to address the idiosyncratic nature of intellectual capital which covers creativity. Creativity is at the core of knowledge generation process for innovation, but this process and its outcomes are totally unpredictable. Moreover, this process can be seen as company specific which hinders building reference indicators for comparison with other companies[46].

The contribution to serendipity. The Internet was not designed for its current (main) use. Many other ICT inventions were eventually used in valuable ways that were not foreseen at all by their developers, such as the growth of "social systems" around the application of technologies that were originally developed for a different purpose. These technologies always benefit from *network externalities*, where it becomes increasingly interesting for more individuals to adopt it and join the associated social network if more people have already preceded them. Such effects make it difficult to identify the potential for social and emotional values in advance, let alone to predict to what level the potential will develop. It is a consequence of capturing value in an era where many things are becoming "radically different" and the value proves to be in areas where it was not foreseen.

While this element of serendipity - of finding something important that one was not really looking for - is a characteristic of innovation in general, it is especially relevant for investments in EI. Thus, increasingly investment measures in EI should be checked for their level of "open-endedness", for

[44] "Weak ties provide people with access to information and resources beyond those available in their own social circle; but strong ties have greater motivation to be of assistance and are typically more easily available" and "individuals with few weak ties will be deprived of information from distant parts of the social system and will be confined to the provincial news and views of their close friends. This deprivation will not only insulate them from the latest ideas and fashions but may put them in a disadvantaged position in the labour market, where advancement can depend […], on knowing about appropriate job openings at just the right time". (Granovetter, 1983, pp 209)

[45] Calculated Intangible Value, Knowledge Assets Approach, Performance Prism. For more information on Intellectual Capital measurement, see http://www.valuebasedmanagement.net/articles_cima_understanding.pdf and also Annex 4 of ECOLEAD deliverable D21.4 (ECOLEAD, 2006).

[46] Viedma (2002) has developed a new management method on the valuation of Intellectual Capital for organisations acting in networks in the knowledge economy: the *Social Capital Benchmarking System*. This approach is derived from Porter (1990a) who states that in the new economy, "companies and organisations build sustainable competitive advantages not only relying on their internal intellectual capital, but also on the intellectual capital of other companies, organisations and institutions and specifically on those of the cluster." This kind of intellectual capital embedded in the networked organisations and represented by relationships is assimilated to Social Capital. According to Viedma, developing a systematic benchmark on social capital is "an unavoidable practice if profiting from existing social capital becomes a strategy priority of the intelligent enterprise." This benchmark will need to addresses six dimensions: resources and capabilities, demand, suppliers and other related industries, the firm's strategy, culture and structure, competitors and government. Applying the benchmark will lead to two main results: "identifying the world best cluster locations where the intelligent enterprise is able to establish the necessary relationships that each specific business model needs in order to build its network organisation and identifying the specific external social capital factors and criteria which are relevant in a given business model or industry segment."

their potential to reach the blue ocean in ways not yet explored, to encourage new routes to India that eventually lead to America. Technical enablement and support for true intellectual and social freedom and for "emergence" in business processes will increasingly constitute a competitive advantage when the creative class drives the economy. Naturally, almost by definition the net effect of this support cannot be predicted in advance. In that sense it will remain a risk and a leap of faith. But the potential for emergence should nonetheless become a criterion that at least "hums in the back of the minds" of future investors in EI. After all, serendipity does not completely fall from the sky - as the French physicist Louis Pasteur famously said: "Chance favours the prepared mind".

6.6. Extra Requirements for Value Analysis at the Society Level

The EU has a number of specific advantages to offer in a networked world economy that competes in knowledge: these advantages are related to a tradition of accommodating diversity of various kinds. Successes in Europe and by Europeans do not derive from the dogged pursuit and imposing dissemination of "one best way" but instead from the relative tolerance for difference; differences that result from competition between truly different suppliers and from the continuous trigger that different people and different situations need different solutions. In a global business context that develops towards "markets of one", this cultural heritage is an enormous asset.

The opportunities offered by European culture however need to be leveraged by a suitable business infrastructure to fully exploit these advantages, not the least through adequate facilities for EI, to support swift conception and delivery of unique solutions (see the analysis of EI offerings, in particular EI infrastructure, in Chapter 5). This support to business networking and its role as a backbone for innovation ecosystems is a specific feature of EI offerings which is however not yet reflected in metrics to assess investments in EI at the macro/society level. Instead standard metrics are almost exclusively used to assess the impact of EI, e.g. in terms of its effect on labour productivity, that can equally be applied to other technologies or even to assess the level of progress in general. Note that these metrics can only describe the ex post effects of these investments. They cannot be used to judge alternative investments ex ante, e.g. by comparing their contribution to creating a truly open environment where digital ecosystems can flourish. To this end metrics could for instance be developed to describe and predict how many individuals would be connected to a non-proprietary environment after a certain investment, or how many employees in SMEs would be able to benefit from it without much further effort[47].

6.7. Conclusions

"Business competition is a lot more unpredictable when innovation and flexibility, rather than efficiency, are the main drivers of value" *(*Prahalad, 2002*).* However the current techniques to support value analysis of investments in EI are not very effective in dealing with that unpredictability and fuzziness. At present, the dominant methodologies to help identify value from investments in EI are still very much assuming investment in monolithic, proprietary technology that supports single firms in isolation. Thus, given the new opportunities that exist, the traditional techniques for value analysis will increasingly deepen the gap between what would be possible and what is eventually pursued. We lack the appropriate tools and techniques to adequately assess, predict and compare the value that can be created with EI when it is being used to support a strategy of value innovation.

This leads to an important conclusion: the potential created by new offerings and new business models together reflects radically new opportunities to generate value with EI. A new generation of value analysis techniques and tools, "Information Economics 2.0", is also needed to really reap that potential and turn the opportunities into concrete success and to be truly in control of the value creation and not construing investment in EI as a "leap of faith". These new techniques and tools will need to address value beyond the level of a single firm, but also at the level of the enterprise network, the individual, and society. They will need to take into account both intangible benefits and probable network effects as much as immediate returns in cash.

[47] Various proposals for assessing EI value proposition and investment at the macro/society level have been made by contributors to this report. See for example the contribution of Jan Goossenaerts, Eindhoven University of Technology, on the dimensions that need to be taken into account.

7. Recommendations

7.1. Introduction

This report aims to develop a value proposition for Enterprise Interoperability, in support of meeting the Grand Challenges in the Enterprise Interoperability Research Roadmap. The overall context of the report is long-term, goal-oriented and problem-solving research in the field of EI. Specifically, the report is an input to the work programme of FP7. Within this context, the report provides an overview of the changing business context for EI, proposes an Enterprise Interoperability Value Proposition (EIVP) Framework and a new value proposition for EI in the new business era. Furthermore, this report discusses the need for EI in relation to different types of business models, describes the concept of EI offerings and requirements for different types of EI offerings, and identifies the requirements for a new value analysis of EI. From the findings in the preceding chapters, the following recommendations are derived.

7.2. Recommendations Targeting Researchers

The changing nature of companies and business-level innovation will have a major impact on the future needs of interoperability for enterprises. The field of EI therefore will need to continue to evolve and investigate new, radical possibilities and options in order to anticipate and help define enterprise systems required for new business as well as new technology paradigms, including Web 2.0 (and emerging successors), Enterprise 2.0 (and emerging successors) and the Future Internet. For example, the application of Web 2.0 technologies and concepts into the enterprise environment to foster differentiation and facilitate innovation, the possibility of co-creation of content/services/technologies between producers and consumers, the move from closed proprietary platforms to service-oriented global infrastructures and the emergence of an “Internet Economy”, are all expected to have a profound impact on the business logic and the technical means for networked enterprises to collaborate and compete. Novel concepts, approaches, techniques and tools for a new generation of interoperable enterprise systems are required.

Recommendation 1: Redesign of EI research direction aiming for value innovation

The traditional goals of efficiency and incremental differentiation are already sufficiently well served by the current state of the art. EI research should be re-directed from integration of existing technologies and solutions to developing new bundles of technology and business approaches that catalyse and sustain radical business-level innovations, added value for enterprises, and that are highly valued by customers.

Recommendation 2: Focus EI research on Collaboration and Channel Interaction Types

Interoperability enabling enterprise collaboration and new channel(s) is likely to deliver increasing value innovation. Research should move away from well established business practices and embrace the new business context. In particular, de-materialisation of products, the rising importance of services, greater interaction between producers and customers and the need to tap into the collective wisdom will enable radically new forms of business, leading to new requirements for EI.

Recommendation 3: Advancing a Systemic View of ICT for Enterprises

Disruptive innovation at the enterprise level needs to be matched by disruptive innovation for enterprise systems of the future. Importantly, infrastructures, technologies, methods and tools are valuable in terms of the *overall business impact* that they have on the enterprise. EI research needs to

develop a new systemic approach to interoperability that encompasses new characteristics and properties of System Openness, System Adaptability and System Integration; that is viable and sustainable in new business contexts; and that enables experimentation with business models targeting value innovation.

Recommendation 4: Differentiating between Universal Interoperability and Conditional Interoperability to support Future Enterprise Systems

Enterprise systems will increasingly be aligned with those business models that target value innovation, i.e. business models that are open, adaptive and enable innovation processes[48]. Future enterprise systems will require EI offerings that are open and utility-based (for universal interoperability), and EI offerings that are customised and value-added (for conditional interoperability).

EI research should support and help realise:

- The utility view of EI offerings that builds on the Internet's tradition of openness and interoperability. Research is particularly needed for EI offerings at the infrastructure level, and the technologies, methods and tools that help advance universal interoperability. This is essential for encouraging the widest possible innovation, by both solution providers and users, large and small, incumbent as well as new.
- Value added experimentations to support business uniqueness and protect proprietary business assets. Research should demonstrate the innovation potential of value added offerings that leverage the utility infrastructure in specific business contexts.

Recommendation 5: Augmenting EI Technical Research with Business and Policy Research beyond the Enterprise

The new and continuously changing business context must be the starting point of EI research. Research that advances understanding of the non-technological implications of EI (e.g. business processes, employees and culture, social capital) should be an integral part of the EI research agenda. The enterprise should not be the only object of study, or the sole organising entity, of EI research. There is an important need to understand and foster, for example, the contribution of individuals, within and outside the corporate boundary, to value innovation. Similarly, it is of fundamental importance to understand and establish the difference between EI impact and ICT impact in general at the macro level (economy), and the way in which the macro level may hinder or foster EI value innovation.

7.3. Recommendations Targeting Policy Makers

Recommendation 6: EI Approaches going far beyond issues at the Enterprise Level

The analysis developed in this report strongly indicates that public policy has a key role in creating an enabling environment for enterprises to target and achieve value innovation. Policy initiatives must take into account wider and deeper interactions at the level of value networks and ecosystems, cross-industry perspectives, and increasingly fuzzy industrial boundaries. European measures by public authorities are particularly important because they can mobilise research beyond individual corporate interests, create critical mass with global impact, and nurture EI-led value innovation by the mix of radical technological advancement, individual capabilities and competences derived from ICT, and wider economic-societal considerations with a longer term time horizon. Public authorities are also the neutral stakeholder that can facilitate EI as an infrastructure and the provisioning of such an

[48] As noted in Chapter 4, "*EI as an enabler is directly linked to the openness of the business model, the intensity of the company's innovation process and the degree of engagement of the company with its business partners and customers*".

infrastructure for common use. Public decision makers should have a more significant role in making available “non-financial venture capital” for EI.

Recommendation 7: A New Methodology to assess the Value of EI

Because investments in EI are often infrastructural and will increasingly be so in a (business-driven) networked context, there is a need to change the valuation of EI in companies' accounting of assets and liabilities. EI investments are mainly related to infrastructures in the broad sense; in relation to which it should be feasible to assess the investment in financial terms. This would require the development of a new methodology that values EI differently from conventional value analysis techniques, and that defines accurate and verifiable indicators for measuring the contribution of EI to the assets of companies, including intangible assets and goodwill[49].

Recommendation 8: Support for a Probabilistic Approach to Investment in EI in line with the Blue Ocean Strategy

The findings in this report point to the need for exploratory, high risk research in EI, where failure should be an option. This can hardly be done at the level of corporate R&D, and especially unfeasible for SMEs who constitute the vast majority of European enterprises. In line with the Blue Ocean Strategy, publicly financed EI research should particularly foster disruptive innovation, thereby increasing innovation *potential*. It should make a clear differentiation between EI solutions and EI offerings as described in this report, focus on the latter, and without requiring the delivery of specific “marketable solutions” as an outcome of the research. The envisaged exploitation of publicly financed EI research should have a positive impact beyond and above the individual participants of a research project.

Recommendation 9: Establishing EI as a Key Concept for the Knowledge Economy

Empowering employees and customers is receiving increasing attention as a source of innovation. The key asset being "traded" in the Knowledge Economy will be some form of Intellectual Property. The innovation potential of EI offerings will be closely tied to the provisioning for and management of Intellectual Property Rights in a European and indeed global environment: protecting author's creation in collective achievements but also rewarding co-creators on the basis of their real contribution. The necessary non-functional (business, legal and regulatory) frameworks for EI need to be in place in order to protect and ensure value innovation in the Knowledge Economy.

[49] E.g. studies by PriceWaterhouseCoopers in 2005 concluded that intangible assets and goodwill constituted 74 per cent of the average purchase price of acquired companies in 2003.

8. Concluding Remarks

The field of Enterprise Interoperability brings a unique business-driven perspective to the research and development of ICT. Dramatic changes in the business context lead to the need to re-define the value proposition of ICT for enterprises and the requirement for interoperation between enterprises.

In the 20th century *creating value for enterprises was primarily based on doing more of the same.* Increase in benefit was closely linked to increase in revenue, economies of scale, and reduction in transaction cost. Despite the drive towards networked enterprises, individual enterprises remain the vehicle to organise the connection between supply and demand in the calculus of benefit and cost. As a result, value creation largely derived from a combination of repetition, efficiency, scale and marginal differentiation.

Today, *creating value requires innovation and delivering products and services that are in some sense unique*: doing more of not the same with not the same business partners to deliver increasing customisation in increasingly fragmented markets. Value innovation has become the key to business models that are economically and socially sustainable.

In this new business context, value generation is increasingly knowledge-intensive and requires new and adaptable expertise in products, services, and markets. The intensity of the collaboration required to jointly produce something truly innovative requires trust. The management of collaboration and trust is becoming the defining characteristic of value networks and innovation ecosystems. This takes place against a backdrop of change, which will be more than ever emergent, unpredictable, probabilistic, partly "invisible" to the formal hierarchy, and largely bottom up. Change is originating from a work floor that relies on individuals' know-how and capabilities, as much as from customers that are increasingly demanding and fickle. The latter is additionally associated with external sourcing of inputs to innovation.

This alters the way in which Enterprise Interoperability serves business needs. Instead of connecting partners in an extended and deterministic enterprise to support business as usual, EI will need to accommodate continuous, emergent change. EI will need to support new, flexible, temporary partnerships with changing members of the ecosystem, within and across ecosystems which are themselves changing. The openness of enterprises and of enterprise systems requires reappraisal. Specifically, this is not only a matter of being open in the conventional sense of "plug and play", but also of being very "closed" in accordance with dynamically changing and unique business needs, such as allowing (new) business partners to quickly and effectively share strategic and proprietary information in a protected environment. Interoperability for enterprises, therefore, is no longer about basic interconnectivity at the level of technology, or basic information exchange between two entities, in static contexts of "universal" business models. Instead, interoperability is closely coupled with the changing nature of business needs, at the level of the enterprise and the community of enterprises, the individual, and the economy.

This report presents findings that support a direct correlation between value innovation, open business models and Enterprise Interoperability. It affirms that interoperability, as a means for European enterprises to work together, is essential for fulfilling the vision of a competitive and dynamic knowledge-based economy. It examines the different aspects of the value proposition for EI and establishes a clear business case for EI. In doing so, it also brings out the unique characteristics of the field of EI and the value-add of EI offerings to different groups of stakeholders. The analysis in the report supports and confirms the criticality of the Grand Challenges of the Enterprise Interoperability Research Roadmap. It helps charts a course for the evolution of as well as new radical possibilities for enterprise systems for the future, and establishes the rationale of and requirement for an enabling open infrastructure that fosters and catalyses business-level innovation.

The report, as a collective effort of all interested stakeholders for all interested stakeholders, should serve as a useful reference for the issues at stake in unleashing the innovation potential of Europe at a time of momentous change, with the accompanying opportunities as well as risks. Enterprise Interoperability is an integral part of that picture.

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