

**Future Internet Enterprise Systems (FInES)**

**Position Paper on Orientations for FP8**  
***A European Innovation Partnership***  
**for Catalysing the Competitiveness of**  
**European Enterprises**

Final version

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## Introductory Note

This document originates from the [Future Internet Enterprise Systems](http://cordis.europa.eu/fp7/ict/enet/ei_en.html) (FInES) Cluster ([http://cordis.europa.eu/fp7/ict/enet/ei\\_en.html](http://cordis.europa.eu/fp7/ict/enet/ei_en.html)) established under the auspices of the European Commission DG Information Society & Media. It is compiled by the editors based on various official input documents to FP8 as available, FInES Cluster publications, Future Internet Assembly (FIA) Enterprise documents, and additional background documents and references.

### Purpose of the Position Paper

Input to the preparation of the EC paper on the orientations for FP8.

### Principal target audience

Policy makers

### Scope

The focus is the [FInES](#) domain and issues related to this domain, taking into account policy and business-economic perspectives in addition to that of research. The full scope of the document however takes into account the broad spectrum of ICT and ICT-related issues in support of setting the orientations for FP8.

### Relevant Documentation

#### *Official input documents*

- FP7 Mid Term Evaluation Report (forthcoming)
- ISTAG Report (forthcoming)
- FIA Roadmap (forthcoming)
- Digital Agenda, COM(2010) 245, 19.05.2010  
[http://ec.europa.eu/information\\_society/digital-agenda/documents/digital-agenda-communication-en.pdf](http://ec.europa.eu/information_society/digital-agenda/documents/digital-agenda-communication-en.pdf)
- Europe 2020 Flagship Initiative - Innovation Union, COM(2010) 546 final, 6.10.2010  
[http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication\\_en.pdf](http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication_en.pdf)

#### *FInES Cluster documents*

- Enterprise Interoperability Research Roadmap, Version 4.0, 2006  
[http://cordis.europa.eu/fp7/ict/enet/ei-research-roadmap\\_en.html](http://cordis.europa.eu/fp7/ict/enet/ei-research-roadmap_en.html)
- Enterprise Interoperability Research Roadmap, Version 5.0, 2008  
[ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/enet/ei-research-roadmap-v5-final\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/enet/ei-research-roadmap-v5-final_en.pdf)
- Value Proposition for Enterprise Interoperability Report, 2008  
[http://cordis.europa.eu/fp7/ict/enet/ei-isg\\_en.html](http://cordis.europa.eu/fp7/ict/enet/ei-isg_en.html)
- FInES Cluster Position Paper, 2009  
[http://cordis.europa.eu/fp7/ict/enet/fines-positionpaper\\_en.html](http://cordis.europa.eu/fp7/ict/enet/fines-positionpaper_en.html)
- FInES Research Roadmap, 2010  
<http://cordis.europa.eu/fp7/ict/enet/documents/fines-researchroadmap-final-report.pdf>
- FInES Cluster Book, 2010 (consolidating many of the above)  
<http://cordis.europa.eu/fp7/ict/enet/documents/clusterbook-ict2010.pdf>

#### *FIA Enterprise documents*

- FIA Stockholm Enterprise Session Report, 23 November 2009  
[http://services.future-internet.eu/images/0/0b/Enterprises\\_report.pdf](http://services.future-internet.eu/images/0/0b/Enterprises_report.pdf)
- FIA Valencia Enterprise Session Report, 15 April 2010  
[http://services.future-internet.eu/images/2/23/FIA\\_Valencia\\_Enterprises\\_report\\_v2.pdf](http://services.future-internet.eu/images/2/23/FIA_Valencia_Enterprises_report_v2.pdf)
- FIA Ghent Scenarios for Future Internet Business Session Report, 17 December 2010 (forthcoming)

#### *Background documents and references*

- The Economics of Information for citizens, communities and commerce, by M. Boniface, M-S. Li, T. Trinh and J. Cave (background paper for FIA Valencia socio-economic session)  
[http://www.future-internet.eu/fileadmin/documents/valencia\\_documents/agenda/20100415FIA-Valencia-economics-of-information-agenda-final1\\_0.pdf](http://www.future-internet.eu/fileadmin/documents/valencia_documents/agenda/20100415FIA-Valencia-economics-of-information-agenda-final1_0.pdf)

- Factories of the Future PPP - Strategic Multi-annual Roadmap, Prepared by Ad-hoc Industrial Advisory Group of the FoF PPP, 20 January 2010  
[http://www.earto.eu/fileadmin/content/07\\_News\\_public/FoF\\_PPP\\_Roadmap\\_Final\\_Version.pdf](http://www.earto.eu/fileadmin/content/07_News_public/FoF_PPP_Roadmap_Final_Version.pdf)
- ISTAG Report on Orientations for Work Programme 2011-2013, Nov 2009  
[ftp://ftp.cordis.europa.eu/pub/ist/docs/istag/wp-rep-nov09\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/ist/docs/istag/wp-rep-nov09_en.pdf)

### **Consultation**

Drafts of this position paper were made publicly available for consultation with, in particular, members of the FInES Cluster in between November 2010 and January 2011, as well as with all interested parties through dedicated dissemination such as the presentation at the FIA Ghent “Scenarios for Future Internet Business” session on 17 December 2010.

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***Annex: Consolidation of comments from consultations (Separate Document)***

# 1. Context

*Not all is well for European enterprises today despite some recognized advances in the business domain. European ICT research should be re-directed to better serve the interests of European enterprise, anticipating and shaping the new environment, thus supporting changing business realities and responding to essential societal needs.*

Progress in the take-up of ICT applications by enterprises in recent years has been slow, with no significant change observed since 2008. The "digital divide" between large enterprises and SMEs remains large [1]. Europe still fails to translate scientific advances into marketable innovations [2].

**Europe urgently needs to develop its own distinctive approach to innovation** which guides its strengths and capitalises on its values [3], and fosters a new innovation culture. Innovation should contribute to societal goals and, in the context of this paper, business values. We all should tackle the fundamental problem: not only how to bring about the optimal conditions to encourage new ideas to be created, but also how to realise, diffuse and implement them. Technologies should be deployed to serve entrepreneurship. Building Europe's innovation capacity must go hand in hand with strengthening Europe's innovation deployment capability right across the value chain.

**The enterprise is a place where innovation and sustainability can co-exist**, where both new values are created and proven old values need to be preserved. The financial market is not providing adequate support to enterprises. At the macro level, the flow of value in an economy is not aligned with the activities that generate productivity and growth, reducing the value creation potential of enterprises. The sustainability of the service economy should not be assumed. The risk of the digital (and increasingly "virtual") economy turning into another financial and economic bubble should be recognised. With marginal costs racing towards zero in the economic inputs of intangibles (Note 1), and the fundamentals of traditional economics being challenged, there is a need to re-evaluate how policy making could best support the interests and activities of enterprises. Because Europe's economy - and innovation - thrives mainly through its SMEs, any new approach must bolster the SME landscape first.

**Virtual Enterprises are no longer mirrors of their counterparts in the physical world.** With increasing dematerialisation blurring the physical with the virtual, enterprises are not only becoming digital, they are acquiring multiple roles, cyber presences and distinctive virtual identities. Already, virtual enterprises are information based and knowledge intensive, operating in multi-dimensional "ecosystems" (e.g., web, mobile, 3D, "cloud") and networks (e.g., [Internet of Things](#), content nets, real-time nets), which, however, are not yet integrated. These enterprises replicate themselves along different value chains, mobilise their resources in a myriad of novel ways, dip in and out of markets; they even create new market spaces and market logic. Such developments bring new means of working and, potentially, a new meaning to work.

**Several aspects have emerged in society which are likely to trigger profound changes**, such as: (a) sustainability in its broadest sense touching the foundation of human activities, (b) the interpretation and understanding of "stakeholdership" including relations between enterprises, their employees and customers, and (c) the basis for decision-making in light of an explosion in the quantity and quality of data (e.g., sensing info, geo, local). These aspects have been sharpened by the latest global crisis, which calls upon policy makers to steer the direction of change effectively and responsibly.

Given the current context, **a new way of doing business is essential.** More changes are afoot, calling for a new notion of enterprise. This involves a re-assessment of the role, mission and responsibility of an enterprise in a digital society; new notions of business behaviour, forms, and values; and new perspectives of what "business" means in a changing world order.

## 2. Re-defining the Enterprise

**“By 2025, the Internet will become a universal business environment on which new values can be created by competing as well as collaborating enterprises through innovation in a level playing field.”**

*FInES Position Paper, 1 September 2009*

In the next decade, the dynamics of the world economy will be transformed by a near-certain re-distribution of economic power among countries and re-alignment of geo-politics between regions. With an increasingly uncertain future, European societies will have to change profoundly as they are forced to adjust to a new global scenario. In parallel, European enterprises will need to become even more agile in the prevailing setting, more anticipatory of what may arise, more adaptable to absorb volatile systemic shocks, and more opportunistic in embracing a new landscape of competition. That landscape will involve new actors, revised rules, and a more diverse set of cultures and (rising) aspirations that will trigger cross-domain collaboration. It will also need to be sustainable economically and socially, as well as environmentally. A new definition of an enterprise will have to account for a game change and reflect the following key developments:

**The disappearing boundaries of the Enterprise.** With globalisation bringing further developments and economic crises being increasingly viewed as recurring phenomena, enterprises can no longer be static. Enterprises will no longer operate within fixed boundaries. Their scope will not only traverse geographic borders, but also span both physical and virtual worlds. Novel business environments will become more diverse as well as pervasive (e.g., individuals’ improvisation turning into business initiatives, the [“Facebook type” of enterprise](#), [“social” enterprises](#), [“crowdsourcing” enterprises](#), niche markets). Virtual teams, extended value chains, dynamic value networks and a kaleidoscope of ecosystems will change the contours of the business world. Consequently, the nature of collaboration will be shaped by new features, requiring, amongst other things, a re-definition of collaboration schemes (such as “co-opetition” and [public private partnership](#)).

**Everybody is an Enterprise.** The role of SMEs and especially micro enterprises and start-ups is expected to become more important, while the entrepreneurial movement will be more bottom-up driven by a wide range of actors. Future enterprises will be community-oriented in their innovation, organisation, production and business partnership – “the network is the enterprise”. As networks proliferate, entrepreneurship will soon touch upon every aspect of the lives of individuals. Society will have to support diverse expressions of entrepreneurship, up to the level of individuals being (at the centre of) the enterprise – from “everyone can be an enterprise” to “everyone is an enterprise”, facilitated by the compound provisioning of networked business services and knowledge. The nature of businesses will change, involving responsibilities and ubiquity different from those of today.

**The [WhatYouSenseIsWhatYouGet](#) (WYSIWYG) Enterprise.** With massive quantities of real-time information becoming pushed rather than pulled on a global scale (e.g., tweets, sensing information, GPS data), future enterprises will be (a) context aware, (b) dynamically configurable, and (c) multi-identity oriented virtual entities that manifest themselves in many different ways and re-invent themselves over and over again. Real-time applications (characterised by social media providing real-time global awareness) and [Internet of Things](#) (characterised by sensor based information published to the enterprise) are just two examples of technologies and practices which may bring tremendous opportunities while at the same time posing new challenges to the traditional enterprise. The “power” and control in the development of future enterprise systems will progressively move from IT specialists to business experts. The former will be skilled in designing and managing enterprises with advanced interactive, immersive tools, where the [“Web-top”](#) will be as rich as and indeed surpassing today's desktop. The latter will be [digital natives](#), who will have entirely different expectations and skill sets from the business professionals of today. Enterprise software applications (components) available online will be “immersed” in the enterprise system’s entities and built into their (multiple) identities.

**A [Knowledge Commons](#) for Enterprises.** Knowledge as an intangible good will become ever more important for wealth generation in the future economy. An increasing amount of knowledge will need to be put to use, and more commonly and broadly acquired, shared and combined to unlock the value of knowledge and to create new value out of knowledge. In other words, there is a need for open and accessible [“Knowledge Commons”](#) facilitated by the Internet for all enterprises to freely, responsibly and legitimately exploit. The proprietary knowledge built on top of the [“Knowledge Commons”](#) importantly includes

“intellectual capital”, which should be added to the assets of businesses. However, whereas the added value of intellectual capital is undisputed, precisely what to measure and how to measure it is yet to be determined. At present, it also remains unclear whether the [knowledge commons](#) will “naturally” emerge from linking the many data sources already existing on the Internet, or whether specific measures are needed to facilitate better re-use and exploitation of knowledge for enterprises on a global scale.

**The advent of the intelligent Virtual Kingdom.** The world around us will dramatically expand into the virtual dimension, empowering imagination and deeply transforming the notion of value. The future will be populated by constellations of intelligent, reactive, animated, seamlessly connected physical and virtual objects and entities, offering a wealth of services, information and knowledge, proactively reaching the right destination, at the right moment, in the right way. In short, the enterprise environment will be radically different from that of today, challenging existing assumptions about the why, what and how of businesses.

### 3. ICT Research for supporting Enterprises in the Digital Economy

“Europe needs to get its story line back.” P. Himanen

To achieve this, Europe needs to modify its approach to ICT research, leveraging trends such as:

**The changing nature of (complex) systems.** Complexity and speed will be an essential attribute of business, requiring a new generation of intelligent systems. Similarly, “teradata applications” will need proactive, intelligent filtering able to extract “sense” from the information flood, giving also to information the capability to proactively reach the correct addressees, semantically, geographically or otherwise. A key point will be represented by the continuous process of “ICT embedding”, implying the progressive “hiding” of ICT (e.g., within smart objects, augmented reality), while repositioning more (human) intelligence to the value producing activities and business innovation, in a scenario where civil society and enterprises will be mutually permeated.

**Blending software and enterprise engineering.** Future enterprise software cannot be produced by using the software engineering methods of today. There is a need to reduce the software development time and costs and, at the same time, the Business/IT gap, but also the anthropological gap in approaching the users’ needs. “Self-engineering” will also take place, with Smart Business Entities (e.g., FInERs, Note 2) able to “self-assemble” with proactive, autonomic capabilities, reducing the human effort required. [Complex Dynamic Systems theory](#) will become increasingly relevant, with progressive relinquishment of the human control in expanding areas of the system that will take care of themselves (self-repairing, evolving, emergent, etc.).

**[Enterprise System 3.0.](#)** The evolution of Web 2.0 and, in particular, the “user-generated content” approach, will impact enterprise systems. Such systems will increasingly be characterised by *user-generated business applications* (“ES 3.0”). Business experts will take over, and develop software applications with enterprise engineering (rather than software engineering) methods and tools, but also end users will be able to contribute, when supported by suitable instruments (e.g., high-level modelling and organizational languages.) ES mashup will be largely adopted, supported by suitable platforms and tools, starting from reusable components (from smart objects to services and apps) largely available over the Internet. This evolution will be made possible by (a) the tight mirroring of enterprise and software application architectures, (b) the availability of a [WYSIWYG](#) approach, based on (c) the dynamic proactive collaboration of intelligent hardware and software components (Note 3) at run time.

**New architectures for enterprise systems.** New technologies, paradigms such as Cloud Computing and Web of Data, and the emergence of “Open Platforms” supporting vast ecosystems, will continue to stretch (and stress) the capabilities of the Internet infrastructure. However, there is a risk that technologies will not converge if their usage partitions the Internet. Conversely, real convergence could lead to an [Augmented Internet](#), facilitating and enriching [ES 3.0](#). Future Internet architectural design can potentially ensure full access to the [Augmented Internet](#), and will set the baseline for new architectures for FI technology enabled enterprise systems (“FInES Arch”). These architectures must account for next-generation software applications, which will change in their nature, architecture, components and development processes, thereby opening up a new, disruptive ground for their conception, design and implementation.

**Innovation-driven enterprise systems.** Future enterprise systems will be designed for business innovation rather than for routine resource management and planning (e.g., ERP, CRM, SCM, to name but a few) that will undergo progressive commoditisation. [ES 3.0](#) will support full innovation lifecycles leading to *business*

innovation. Particularly relevant will be the role of “intelligent social networks” and crowd-sourcing knowledge media to promote new forms of innovation (e.g., collaborative, deep, and [open innovation](#)) and structurally different enterprise governance models. To support continuous innovation, software architectures will be highly distributed and flexible, with an agile organisation, pushing componentisation and reuse to an extreme, and leveraging new knowledge-based infrastructures.

**Enterprise cooperation and interoperability.** The new approach to [ES 3.0](#), capable of tackling the rich diversity and articulation of business and society in a seamless fashion, will pose new challenging problems in terms of cooperation of a variety of players with diverse cultures, backgrounds, experiences, and objectives. ICT will be asked to provide innovative solutions to support agile and purpose-oriented forms of enterprise aggregations, with cross-fertilization of competences, leveraging on diversity while minimising the hindrance it may bring. Here the disruptive notion of an [Interoperability Service Utility](#) (ISU) capable of providing automatic interoperability services embedded in the [Augmented Internet](#), should be systematically pursued, while the mutual understanding will be supported by multi-cultural and multilingual ontologies.

**Scientific approach.** As new services, systems, objects and clouds emerge, there will always be new challenges for systematic approaches to complexity, while providing simple usage paradigms. A scientific foundation is essential here, in order to obtain robust, reproducible methods and tools to deal with new challenges in a systematic way. More fundamentally, a science base is required for the development of the next-generation Internet-based Enterprise Systems able to cope with a new set of complex issues and requirements, while at the same time ensuring reliability, flexibility, scalability and other qualities that have made the Internet such an indispensable tool for businesses and society. This scientific approach should be inclusive of cross-domain stakeholder interests.

## 4. Recommendations

**In FP7 we built the means to understand, in FP8 we need to build the means to change.**

The preceding analysis strongly indicates that **the role of publicly funded ICT research to support enterprises needs to change and become more ambitious.** Research priorities should be strategic options carrying defined expected impacts. The priorities must be derived from a solid policy vision based on a long-term view. That vision should be centred on the users of ICT, these users including both enterprises and of course all humans involved. It determines the balance between disruptive research and incremental research. The former aims at high risk, ground-breaking outcomes and tends to favour innovation and new actors; while the latter requires the demonstration of anticipated benefits and tends to favour incremental improvements to the status quo and incumbents. Impact of research on the market should mean a technology offer leading to more and better choice for (enterprise) users, without influencing the actual market outcome. Knowledge transfer should be prioritised over technology transfer (Note 4), e.g. through Living Labs. In this section, six fields of action are proposed. They are grouped in "circles" because this configuration offers a flexible and holistic perspective to the challenge, without the usual drawback of a meticulous categorisation.

**The Policy circle (Everyone can be an enterprise. Society can be an enterprise. And vice-versa, in a multi-polar society).** EU priorities need to facilitate the "horizon of possibilities" for business in a systemic way. They should (a) provide user-centric, customised access to all kinds of knowledge, (b) resolve how to (re-) define IP holders and protect their rights while optimising exploitation potential, increasing knowledge sharing and re-use, fostering innovation, and avoiding lock-ins and lock-outs, (c) reinforce public-citizens-governments-private partnerships to regenerate the European business fabric, (d) prioritise the issues posed by new paradigms such as governance, complexity problems, interoperability, and their impacts on the innovation culture, privacy, intellectual property rights, trust and security as well as individuals' well being, (e) support the dynamics of innovation in different contexts, and with different value creation, in line with societal priorities: **Innovation with a purpose**, (f) promote better use of standards for enterprises with a reasoned and robust scientific foundation as well as enhancing interoperability through coordination (Note 5). As such, it can become a building block towards achieving the "Innovation Union" in counteracting fragmentation and supporting the free movement of knowledge.

**The Socio-Economic circle.** A new scientific approach to finance and economic science is urgently required and must be activated at the international level by the Commission. Economic theories need to be re-vamped in order to ascertain and define the value of intangible assets (intellectual capital, value of information,

reputation, etc.) at macro- and micro-levels, as well as other soft factors (i.e. well being, adaptability, dynamicity, etc.). At the macro-economic level, there is a need to re-define key notions of business and economic theories such as value, growth and competitiveness, taking account of profound changes at all levels of society in recent decades, the emerging world order, new visions and alternative future scenarios. Ultimately, the impact of the immaterial economy on businesses and society will have to be systematically and comprehensively analysed, leading to better insights and potentially better policy making and governance.

**The Enterprise circle.** ICT should support the optimisation of any kind of resources for enterprises, including human resources. Constant anticipation of enterprise performances, of the context, of the technology and of the markets is required to support continuous (preferably “open”) innovation. Successful enterprises in many domains will be those capable of quickly adopting the new paradigm of intelligent [virtuality](#) in their business and organisational strategy. Mobility, adaptability and awareness will be at the forefront of enterprise innovation that eventually will lead to an increased level of cohesion, not only socially but also territorially, thus contributing to a major European policy goal.

**The Manufacturing Industry circle.** The EU manufacturing sector, evolving from a Product-oriented towards a Service-oriented sector, is of particular relevance for the EU economy and self-sufficiency, sometimes dramatically highlighted by the rise (and, some would argue, fragility) of the services sector. To reduce the complexity and standards-dependency of manufacturing systems, partnerships are possible, and even necessary in order to move away from incremental research and spark-off deep innovation. Besides investment in and inclusion of Internet technology to accompany the evolution of the manufacturing sector, the prospects of the sector will also depend on complementary organisational changes, including, in particular, management practices and decentralisation, innovation, and skills development. The European ICT sector should embrace a genuine partnership with the European manufacturing sector.

**The Systems circle.** There is a need for [WYSIWYG](#) systems at design time intimately linked to a dynamic proactive collaboration of intelligent hardware and software components at run time. These “smart” components will provide global awareness to systems, eventually empowering the business people that use them. Potentially they could be personal assistants, intelligent agents, intelligent social networks and crowd-sourcing knowledge media in the area of [Open Innovation](#), allowing continuous improvement of enterprise systems. Additionally, interoperability between these systems is required (notably through standardisation). Multiple dimensions and multiple stakeholders are an integral part of this perspective: the sensing net, the web based net, the mobile net, the virtual net as well as multiple actors (users, applications, agents, objects, animals, data, etc.), as they create exponential possibilities for innovative businesses. A consistent architecture is needed to re-use components and resources across multiple environments (networks, contexts and instantiations). The DNA of the next-generation Internet will require incorporating the multi-dimensional network purpose and objective in its design principles – helping it become truly user-centric.

**The ICT circle (The network is the enterprise).** Internet technologies developed should give to enterprise users, especially business personnel, the power to directly develop their own systems. User-generated enterprise software applications (ESA) constitute a high-potential application domain for future ICT. There is a need for technologies to “hide” technology, reduce the Digital Divide and infuse more (human) intelligence to the value-producing activities. Ultimately, Europe should master the mechanisms which underpin the way in which ICT is contributing to the value creation, resource optimisation, and supply/demand balance, and more generally to wealth generation in the digital economy. The impact of smart machines operating without human intervention should also be carefully studied and better understood.

*Europe needs a wide-ranging approach to take account of the above, and ultimately a new scientific base to strengthen its business fabric through the “arrow” of Research and Technology Development.*

### **The Research Arrow: reaching the target**

[Future Internet Enterprise Systems](#) (FInES) is one domain of the overall FI research field, supporting enterprise competitiveness through Internet technologies. Research in FInES primarily targets [business value innovation in open paradigms](#), to be structurally [embedded in future enterprise systems](#). The final outcome should be a [new and sustainable infrastructure for enterprises](#) at the European level, including SMEs and the manufacturing industry, a new generation of technologies in support of applying the Internet developments to the enterprise space (“[Enterprise 3.0](#)” and beyond), [methods and tools to support knowledge sharing](#) within business ecosystems (Clouds, Clusters, etc.) and [new scientific foundations](#) to produce [FInES](#)

offerings that are rested on and subject to the rigour of science. The outcome requires fusing technology with business and policy research.

Achieving this outcome is the major challenge that calls for a substantial research and development and innovation (R+D+I) effort at the European level, involving different disciplines. The outcome will not be reached through fragmented research in ICT. This postulate is in line with almost all key actions recommended by the Digital Agenda [5], one of Europe's seven flagship initiatives for the coming decade. In particular the realisation of the Digital Single Market cannot be imagined without strong and efficient interoperability among Europe's enterprises.

**The overall conclusion is that there is a necessity for a European Innovation Partnership (EIP) fully dedicated to supporting the competitiveness of European Enterprises through research, i.e. an innovative, multi-disciplinary approach using a mix of research, development and policy tools, and leveraging the synergy of multiple and inter-related initiatives.**

## 5. Leveraging FP8 Instruments

In line with the approach of this document, the [FInES](#) cluster believes that research should be initiated to attain a societal/policy goal (Note 6), or supported to meet the targets of a specific technology roadmap. In both dimensions, industry should play a leading role, as a provider of solutions in the former, or as a contributor to the technology roadmap in the latter. In both cases, industrial involvement should be carefully assessed to maximise programme competitiveness, excellence, effectiveness and good governance. Furthermore, two dimensions should be horizontal to the whole of FP8 and to the proposed EIP in particular: **innovation and science** (Note 7). This final section presents how the currently proposed instruments could be leveraged to implement the above recommendations.

### A European Innovation Partnership for European Enterprises

The overall concept of the EIP is described in the Innovation Union Communication (Note 8). The proposed EIP is directly motivated by the vision of supporting public research to address societal challenges: for attaining European Enterprise competitiveness, notably but not only, through [FInES](#). Concretely this means a strategy-driven platform of interlinking activities based on business value innovation and derived from new forms of open collaboration and channels. The platform should target new, global and highly customised markets as well as market niches, inclusive of interoperable complex ecosystems, connecting and empowering enterprise end users, producers, suppliers, software vendors, telcos, public bodies and citizens. The proposed EIP supports the manufacturing sector, addresses specific SME needs for technology, reinforces interoperability and collaboration mechanisms for enterprises, while embracing the most innovative and disruptive technology produced by ICT.

This EIP could be composed of different kinds of “instruments”, including (but certainly not limited to) various [RTD](#) schemes which are briefly outlined as follows:

#### 1) Collaborative research (technology-led, top down agenda)

Partnerships such as clusters of projects must be seen as accelerators towards the new, smart enterprise and as a stepping stone to boost (and maintain) sustainable competitiveness of the EU industry at the global level. Additionally, there is a need to develop partnership projects with clear scientific roadmaps to pool effort in order to achieve a breakthrough. These roadmap based projects should be inclusive of multi-stakeholder interests and address conditions of technology enablement rather than prescriptive technology options (Note 9). The [Sensing enterprise](#), for example, could be a candidate research topic for the [FInES](#) domain.

**a) Clusters (fully open)** First, a more effective and inclusive cross-stakeholder communication effort ought to be the absolute priority in the next years. FP8 needs to introduce new mechanisms that allow funding of the already existing [FInES](#) Cluster and clusters in other areas (in the context of financing, areas of knowledge, competence centres etc.) (Note 10).

**b) Partnership projects (partnerships)** Then, based on the research challenges that are presented in the [FInES](#) Cluster Research Roadmap [4] and relevant neighbouring initiatives such as the ETPs and software and services [RTD](#), a roadmap based analysis must be carried out by performing a top down objective driven process from the conceptualisation of research challenges to the more specific articulation of these challenges in the technological sector. In conclusion, roadmap based collaborative

projects would be an activity involving users/providers pursuing a joint and systemically defined technological goal. These types of projects should support cross-disciplinary, cross-industry approaches with a long term vision (Note 11).

## **2) Light & open projects (bottom-up agenda)**

In parallel, the current technology situation should be constantly investigated from the base. This requires the identification and exploration of new and emerging technological trends which will affect enterprise systems in the future. In order to analyse emerging technologies and to evaluate their potential effects on the research in [FInES](#), small [FET](#)-like (Note 12), disruptive and high risk projects are required to explore options not constrained by conventional roadmaps, in a fast and freewheeling way.

## **3) International Coordinated Actions**

The goal must be to strengthen Europe through its cooperation internationally, involving cross-sector, cross-regional players. The [Future Internet Enterprise Systems](#) cannot be a European only concept in "splendid isolation" of comparable developments elsewhere. The opening up of FP8 to third country participants can be strategically justified by the creation of international consortia that can act strategically at the global level (e.g., already for the [Internet of Things](#)) and share common values (e.g., the [Open Innovation](#) concept, standardisation issues, etc.). [FInES](#) therefore endorses the international approach which will allow European enterprises to act and benchmark themselves at the global level to remain competitive.

**Final remark:** a proposal about potential improvements to the current evaluation process is presented in Note 13.

## References

- [1] Europe's Digital Competitiveness Report 2010, [http://ec.europa.eu/information\\_society/digital-agenda/documents/edcr.pdf](http://ec.europa.eu/information_society/digital-agenda/documents/edcr.pdf). According to the report, in 2009, some 34 % of EU enterprises used ICT to exchange information with business partners and 15% used ICT for supply chain management. Such applications were mainly used by large enterprises, by a factor of 3 and upwards compared to SMEs.
- [2] Commissioner Neelie Kroes' speech delivered at the European Business Leaders Convention, Brussels, 4 May 2010, <http://europa.eu/rapid/pressReleasesAction.do?reference=SPEECH/10/203>. A problem termed "European paradox" in a European Commission Green Paper as early as 1995.
- [3] Innovation Union Communication: Europe 2020 Flagship Initiative: the Innovation Union, COM(2010) 546 final, [http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication\\_en.pdf](http://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication_en.pdf).
- [4] Future Internet Enterprise Systems (FInES) Research Roadmap, 2010, a publication of the FInES Cluster, [http://cordis.europa.eu/fp7/ict/enet/ei-research-roadmap\\_en.html](http://cordis.europa.eu/fp7/ict/enet/ei-research-roadmap_en.html).
- [5] Digital Agenda Communication: A Digital Agenda for Europe, COM (2010) 245 final, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52010DC0245%2801%29:EN:NOT>.

## Notes

- [1] While intangibles have undoubtedly become an important element of the global economy, their quantification and measurement remains an issue in any given theory of economics. There are also different ways to categorise intangibles in the literature, which range from intellectual property to customer goodwill and reputation. Within the [FInES](#) Cluster, the discussion of intangibles has taken place in the context of business models associated with new technologies and trends such as Web 2.0 and Enterprise 2.0 (see the Cluster publication on Value Proposition for Enterprise Interoperability, 2008, [http://cordis.europa.eu/fp7/ict/enet/ei-isg\\_en.html](http://cordis.europa.eu/fp7/ict/enet/ei-isg_en.html)) and in particular the role of knowledge in an enterprise setting (see the Cluster Position Paper, 2009, [http://cordis.europa.eu/fp7/ict/enet/fines-positionpaper\\_en.html](http://cordis.europa.eu/fp7/ict/enet/fines-positionpaper_en.html)). The debate is set to continue.
- [2] Referred to as "FInER" (Future Internet Enterprise Resources) in the FInES Research Roadmap.
- [3] For example: FInER (see above).
- [4] Because widening the knowledge base rather than the more specific technology implementation(s) leads to greater market transparency, opportunity and uptake.
- [5] This may include ex-ante disclosure, lock-in effects and interoperability information, and must be extended to any type of cloud computing (IaaS, PaaS, SaaS, etc.). Another issue is whether over time, interoperability could be achievable even without the presence of standards (e.g., dynamic interoperability, interoperability by design, interoperability by discovery).
- [6] Under the Digital Agenda for European strategy.
- [7] Both innovation and science are necessary at all steps, in all programmes and in all project types. The ICT programme (or its successor) should therefore include these as criteria in the evaluation. Accordingly, how research projects could more pronouncedly as well as systematically incorporate these dimensions into their approach and methodology needs to be carefully explored.
- [8] The motivation for EIP could be summarised as follows: to accelerate research, development and market deployment of innovation to tackle major societal challenges, pool expertise and resources and boost the competitiveness of EU industry.
- [9] The development of the roadmap cannot be solely driven by industry alone, as it appears that most of the time, it proves difficult to gather the key (or future) players of a domain, and the incumbent large companies available for collaboration may not be sufficiently representative of a multi-stakeholder and competitive market. The risk also involves privileging mainstream approaches over diverging, speculative (and potentially more competitive) approaches when defining a technology roadmap for a

specific domain. Creating the conditions for possibility rather than prescriptive technology options should be favoured in the cluster's opinion.

- [10] In order to contribute to setting up joint activities which better network competences in the triangle of knowledge and to meet constantly changing European and global challenges. The Clusters could replace the existing Networks of Excellence and enforce standardisation activities.
- [11] The existing FI and FoF PPPs are examples of Partnership Projects. It has been argued that in so far as the current PPPs focus on short term market approaches, they could be hosted within the CIP. In this respect, old instruments such as CSAs should not only be used as marginal instruments to support dissemination activities in very specific areas but become strategic instruments for market analyses and feed-back, in particular from SMEs, with regard to further technology needs.
- [12] It should be mentioned that for disruptive research, [RTD](#) innovative solutions cannot be reduced to pre-commercial deployment.
- [13] The Evaluation process put in place under FP6 and FP7 proved effective in a large number of aspects but sometimes failed to identify new, innovative proposals in favour or more traditional, mainstream or low risk proposals. Without fully challenging the current conditions of the evaluation, it seems clear that the evaluation criteria and process require an extremely good knowledge of the state of the art, which argues for introducing a large-scale peer review process, involving a wide online community of experts at the preliminary "pre-proposal" stage (restricted to the scope or the technology tackled by the proposal). Criteria for the review obviously need to be specified in advance, and voting allowed for anyone with proven credentials in the domain. This could help avoid perceived or real "corporatism" among the stakeholder community while at the same time facilitate the identification of truly innovative or breakthrough proposals.

## Glossary

Term	Definition
Augmented Internet	The next generation Internet, based on different architectural principles, ensuring, among other capabilities, the interconnection of today's and tomorrow's existing networks (e.g. web, mobile, sensor networks, etc.) using common network and transport protocols (for instance the TCP-IP protocols, or alternative ones).
Complex Dynamic Systems Theory	Large systems characterised by an inherent complexity, such as social, managerial, economic, or ecological systems. Such systems exhibit a non-linear behaviour and unstable equilibrium, but at the same time they exhibit self-organization and homeostatic capabilities*, recovering a new unstable equilibrium each time the previous one is lost. [Source: <a href="http://www.systemdynamics.org">www.systemdynamics.org</a> and Francis HEYLIGHEN, "Complexity and Self-organization" in <i>Encyclopedia of Library and Information Sciences</i> , 2008]  *A system's capability of regulating its internal environment and its tendency to maintain a stable, constant condition. [Source: <a href="http://en.wikipedia.org/wiki/Homeostasis">http://en.wikipedia.org/wiki/Homeostasis</a> ]
Crowdsourcing Enterprise	An enterprise whose business model is based on outsourcing tasks, traditionally performed by an employee or contractor, to an undefined, large group of people or community (a crowd), through an open call. [Source: <a href="http://en.wikipedia.org/wiki/Crowdsourcing">http://en.wikipedia.org/wiki/Crowdsourcing</a> ]
Digital Native	A young person, who was born during or after the general introduction of digital technology, and through interacting with digital technology from an early age, has a greater understanding and smooth usage of its concepts (also called the <i>e-Generation</i> ). [Source: <a href="http://en.wikipedia.org/wiki/Digital_native">http://en.wikipedia.org/wiki/Digital_native</a> ]
Facebook type of enterprises	"On the run" types of enterprises sometimes based on open collaboration schemes, building on shared knowledge prospects.

Term	Definition
Enterprise (System) 3.0	Enterprise System (ES) 3.0 is increasingly characterised by user-generated business applications developed by business experts with enterprise engineering (rather than software engineering) methods and tools. ES mashup will be largely adopted, supported by suitable platforms and tools, starting from reusable components (from smart objects to services and apps) largely available over the Internet.
FET	Future Emerging Technologies
Future Internet Enterprise Systems	A specific research area of the Information and Communication technology domain funded by the European Union through the 7 <sup>th</sup> Framework Programme for Research and Development (also called FInES). It states that the full potential of the Future Internet is accessible to, relevant for, and put to use by European enterprises including SMEs. The Internet thus becomes a universal business system on which new values can be created by competing as well as collaborating enterprises - incumbent as well as new - through innovation in a level playing field, with sustainable positive benefits for the economy, society and the environment. [Source: FInES Cluster Position Paper, 2009]
Internet of Things	The Internet of Things (IoT) is an integrated part of the Future Internet and could be defined as a dynamic global network infrastructure with self configuring capabilities based on standard and interoperable communication protocols where physical and virtual “things” have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network. [Source: <a href="http://www.internet-of-things.eu/">http://www.internet-of-things.eu/</a> ]
ISU (Interoperability Service Utility)	The Interoperability Service Utility (ISU) is a concept created by the <a href="#">FInES</a> community. It denotes the overall system that provides enterprise interoperability as a utility-like capability which can be invoked on-the-fly by enterprises in support of their business activities. That system comprises a common set of services for delivering basic interoperability to enterprises, independent of particular IT solution deployment. [Source: Enterprise Interoperability Research Roadmap, 2006 (Version 4.0) & 2008 (Version 5.0)]
Knowledge commons	The knowledge commons encompass immaterial and collectively owned goods in the information age. [Source: <a href="http://en.wikipedia.org/wiki/Knowledge_commons">http://en.wikipedia.org/wiki/Knowledge_commons</a> ]
Open innovation	Open Innovation is a term promoted by Pr. Henry Chesbrough, University of California, Berkeley. The concept assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology”. The boundaries between a firm and its environment have become more permeable; innovations can easily transfer inward and outward. The central idea behind open innovation is that in a world of widely distributed knowledge, companies cannot afford to rely entirely on their own research, but should instead buy or license processes or inventions (i.e. patents) from other companies. In addition, internal inventions not being used in a firm's business should be taken outside the company. [Source: <a href="http://en.wikipedia.org/wiki/Open_Innovation">http://en.wikipedia.org/wiki/Open_Innovation</a> ]
Public–Private Partnership (PPP)	A government service or private business venture which is funded and operated through a partnership of government and one or more private sector companies. [Source: <a href="http://en.wikipedia.org/wiki/Public_private_partnership">http://en.wikipedia.org/wiki/Public_private_partnership</a> ]
RTD	Research & Technical Development
Sensing Enterprise	The <i>Sensing</i> Enterprise is a concept created by the <a href="#">FInES</a> community in the context of the advent of the <a href="#">Augmented Internet</a> . It refers to an enterprise anticipating future decisions by using multi-dimensional information captured through physical and virtual objects and providing added value information to enhance its global context awareness.
Social Enterprise	In the context of the <a href="#">Future Internet Enterprise Systems</a> Research Roadmap, the concept of <i>Social</i> Enterprise is understood as a type of enterprise bringing the attention to the people, managing services – both from and towards people and their internet representations (e.g., avatars). [Source: FInES Research Roadmap, 2010]

Term	Definition
Virtual Enterprise	<p>Traditionally, a business management concept based on the ability to create temporary co-operations and to realize the value of a short unpredicted business opportunity that the partners cannot (or can, but only to lesser extent) capture on their own [Source: Katzy BR, Schuh G. The Virtual Enterprise. In: Molina A, Sanchez J, Kusiak A, eds. Handbook of Life Cycle Engineering: Concepts, Methods and Tools. Kluwer Academic Publishers; 1998:59-92].</p> <p>In the context of this paper, the concept evolved towards the de-materialization of the enterprise and entails new business behaviours and dimensions through the pervasive usage of Internet technology employed individually or collectively by business organisations. It allows the acquisition and handling of multiple roles, cyber presences and distinctive virtual identities on the networks, supporting new forms of business processes, allowing for new business models.</p>
Virtuality	Virtuality refers to the seeming of anything, as opposed to its reality. [Source: <a href="http://en.wikipedia.org/wiki/Virtuality_%28software_design%29">http://en.wikipedia.org/wiki/Virtuality_%28software_design%29</a> ]
Web-top	A desktop environment embedded in a web browser or similar client application. A web-top integrates web applications, web services, client-server applications, application servers, and applications on the local client into a desktop environment using the desktop metaphor. [Source: <a href="http://en.wikipedia.org/wiki/Web_desktop">http://en.wikipedia.org/wiki/Web_desktop</a> ]
WhatYouSenseIsWhatYouGet (WYSIWYG) Enterprise	A future enterprise which is characterized as a context-aware, dynamically configurable, and multi-identity oriented virtual entity that manifests itself in many different ways and re-invents itself over and over again. This concept relates to the <a href="#">Sensing Enterprise</a> concept described above.

Final note from the editors: the annexe of this document is available in the publishable version of this Paper (in a separated document).