

Coordination of the European Future Internet Forum of Member States



D4.9 - Final Roadmap

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1. Introduction

This document is updated in November 2013 with the addition of a section on recommendations, suggested implementation plan and timeline. The deliverable includes outputs from the ceFIMS workshop discussion which formed part of the Fourth INFINITY Concertation Board meeting held at the FI event in Dublin on 8th May, 2013. The theme of the Board meeting was the ‘Adoption of and Opportunities for European ICT Infrastructures’. The ceFIMS workshop session focused on two key themes that are crucial to the relationship between Member States and the FI-PPP i.e. how Member State investment can support the FI-PPP and how Member States can facilitate and support SMEs to engage with and utilise the FI-PPP infrastructures. Many of the inputs received from the workshop touched on these themes. However as the discussions evolved at the workshop, additional inputs on related issues were also offered. These inputs are now contained in this version of the roadmap.

1.1. Introduction to the ceFIMS Roadmapping process

The ceFIMS roadmapping process is a central part of the ceFIMS Project. The roadmapping exercise aims to identify the key elements of a framework to maximise synergies and support stronger collaboration among Member States, and between EU and Member States, in their initiatives and investments in Future Internet research.

The ceFIMS roadmap presents an analysis of the current landscape in European Future Internet research, and sets out a vision of a future involving enhanced cooperation among key Future Internet stakeholders, including those from the FIF, FI PPP and related projects, European Technology Platforms (ETPs), and Research councils. The current state-of-the-art in Future Internet research, the various stakeholders, existing collaboration instruments, the relevant activity levels of Member States and the policy context acting as a backdrop for all of this, are described. The vision of the future describes the modalities of a range of co-operation mechanisms, the barriers and challenges that must be overcome, and potential thematic content and approaches that Member States and the EC may have in common.

The ceFIMS roadmapping process has been an iterative one, involving the publication of a number of documents during the lifetime of the project. These documents have been informed by discussions at the FIF as well as a number of workshops organised by the project which were attended by key stakeholders. It is worthwhile at this point, to briefly set out the steps involved in getting to this point. As a first step an initial interim roadmap (D4.4a) was completed in November 2011. This document represented the first efforts towards preparing the groundwork for this process. These included gathering data on Future Internet projects and initiatives from around Europe and carrying out an initial analysis to identify potential synergies. To inform the content of the first version of the roadmap, ceFIMS held two thematic workshops (FI-PPP and ETP) and one EU-level workshop (with research councils) to discuss collaboration and synergies in the field of the Future Internet. The outcomes of these workshops fed into this first draft of the roadmap.

As the ceFIMS project progressed, the work of data collection and analysis continued. The project continued to engage with a wide range of stakeholders in the European FI community through workshops (thematic and European-level) and through its involvement in the FIF. The project also initiated contacts with other relevant Coordination Actions, most notably the FI-PPP Coordination Action, INFINITY.

Following a wide-ranging consultation and the analysis of a diverse set of inputs, the road-mapping document was updated in October 2012 with the publication of version D4.4b. This version took account of the discussions during the Future Internet Forum meeting in Poznan in 2011 and subsequent comments and revisions. Version D4.4b also moved to specific recommendations which reflected changes in the proposed future direction for planning research and development of the Future Internet in Europe. Version D4.4b in particular, discussed the proposed role for a single point of contact in each Member State (MS) to bring together ideas from all of the stakeholders in the Member State and to lead the coordination, communication and activities (both within the Member State and between Member States). These recommendations and the associated analysis were further deepened as a result of a ceFIMS workshop held in Aalborg and the subsequent FIF discussions at Aalborg and Warsaw (September 2012). In particular, arising from these discussions further detail was added to the sections of the document dealing with possible collaboration mechanisms and thematic areas for research collaborations. The current roadmap document (D4.4c) represents the culmination of these discussions and all inputs received to-date.

It is important to note that in order to improve the accessibility of this document, some sections have been summarised. For additional information and analysis on these sections, the reader should refer to earlier versions of the roadmap as well as other related deliverables (data-gathering reports, workshop reports etc.). It is also important to recognise that this is an evolving discussion.

The ceFIMS road-mapping process is intended to help Member States to identify clearly-defined and agreed-upon, objectives and priorities that will help decrease fragmentation and support investment synergies. Through the engagement of the European Commission, governments, policy-makers, funding agencies and research performers, ceFIMS has pulled together the key stakeholders into this process. Through its data gathering activities, ceFIMS has shone a light on the wide range of FI initiatives being undertaken at Member State and regional levels throughout the EU. Member States can now easily access information and form a picture of what is happening in other Member States. This easy access to information has significantly improved the chances of collaboration and as the project concludes, we are already seeing examples of clusters (emerging communities of interest) of Member States discussing possible collaborations.

The roadmapping process begun by ceFIMS should be seen as a journey. This roadmap document is not the final destination. As Member State contacts increase and discussions progress, new directions and new opportunities emerge. Therefore this document must be recognised as a snap shot of the discussions at this point in time, rather than the definitive end point and conclusion of the discussions. As the policy context evolves and government priorities and resources change, so too the roadmap will change. The most important elements in all of this will be the continued engagement of, and on-going dialogue

between, the key stakeholders. This engagement, started in the ceFIMS roadmapping process, will need to continue. It hoped that this document along with the other outputs from the project will provide a solid basis for this continued engagement and the evolution of enhanced collaboration among Member States in Future Internet research.

2. Current Situation

This chapter outlines the current situation in Future Internet research and the starting point for future collaboration activities. It describes:

- Existing transnational and pan-European funding and collaboration instruments:
- Current Research at Member State level:
- International Experience:
- Policy context:
- Barriers and Challenges:

2.1. Funding & Collaboration Instruments

There are currently several possibilities for the stakeholders to collaborate on Future Internet research. **Figure 1** below, gives an overview of the various Future Internet initiatives under the umbrella of the European Union. These are described and some issues for Member State collaboration through these mechanisms are highlighted. It is worth noting from the outset that many of these instruments overlap and interlink. Therefore their description is not linear but requires the reader to take a more holistic view in the reading of this section of the document.

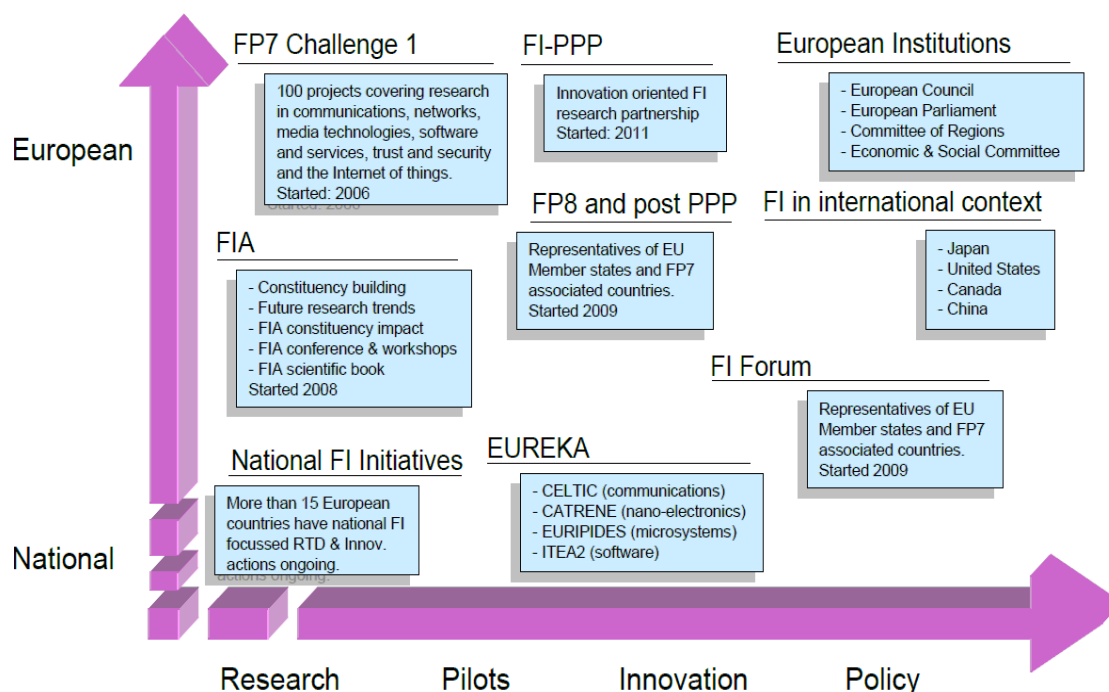


Figure 1 – Landscape of Future Internet Activities in Europe

2.1.1. **FP7 / Horizon 2020**

FP7 (and its successor, Horizon 2020) supports a range of research actions involving the active collaboration of research teams from all sectors, including industry, SMEs, universities and other higher education institutions, research institutes and centres, international European interest organisations, civil society organisations, and any other legal entities. These actions are implemented through the funding schemes: Collaborative Projects, Networks of Excellence, Research for the Benefit of Specific Groups (in particular SMEs), Coordination and Support Actions, Integrating Activities/Preparatory Phase (Combination of collaborative projects and coordination and Support Actions) and International Research Staff Exchange Scheme (IRSES).

Cooperation on the Future Internet mostly comes under FP7's ICT Challenge 1: Pervasive and Trusted Network and Service Infrastructures. The high-level thematic areas covered in this challenge are well established and will most likely inform the content of any Future Internet cooperation. Challenge 1:

“...covers key technological developments in networking, digital media and service infrastructures. It features a Public-Private Partnership on Future Internet tools and platforms for novel Internet application development and deployment. The focus is on:

- **Future Networks** that support the convergence and interoperability of heterogeneous mobile, wired and wireless broadband network technologies, including notably novel Internet architectures; network management and operation frameworks, wireless and broadband systems and ultra-high capacity all-optical networks.

- **Cloud computing**, Internet of Services and advanced software engineering that emphasise technologies specific to the networked, distributed dimension of software and the access to services and data.

- **Architecture** and technological foundations for Internet-connected sensors, actuators and other smart devices and objects, enabling person/object and object/object communications.

- **Trustworthy ICT** including security in networked service and computing environments; trust, privacy and claims management infrastructures; and data policy, governance and socio-economic aspects of trustworthy ICT.

- **Networked media and search systems**, including digital media delivery platforms, end-to-end immersive and interactive media technologies, and multimedia search technologies.

- **New Paradigms & Experimental facilities** (known as FIRE) for experimentally-driven research on the Future Internet; the facilities will provide larger scale and diversity to test and validate the developments at closer to reality conditions.”¹

These broad technical themes will be an important input into the content of any collaboration among Member States and most likely will closely correlate to the thematic content of new collaborations. These are likely to be reinforced through Horizon2020 with its c. €70 billion research and innovation funding.

¹ While FP7 finishes in 2013, it is assumed that Horizon 2020 will address similar themes.

Horizon 2020 will address challenges outlined in the Europe2020 Strategy by funding excellent science, technology and innovation. These challenges include: responding to the economic crisis to invest in future jobs and growth; addressing peoples' concerns about their livelihoods, safety and environment; strengthening the EU's global position in research, innovation and technology.

Horizon2020 will bring together all EU-level research and innovation funding into a single programme. It will cover current FP7 research, the innovation activities from the Competitiveness and Innovation Framework Programme (CIP), and EU funding to the European Institute of Innovation and Technology. It will also provide a major simplification - a single set of rules, less paperwork, and faster funding. The aim is to attract the best researchers and innovators regardless of where they are located. The three ICT-related priorities of Horizon2020 are:

1. **Excellent Science:** FET Open: fostering novel ideas; FET Proactive; FET Flagships; E-Infrastructures
2. **Industrial Leadership:** Components & systems; Next generation computing; Future Internet; Content technologies & information management; Advanced interfaces & robots; Key enabling technologies
3. **Societal Challenges:** Health, demographic change & wellbeing; Secure, clean & efficient energy; Smart, green & integrated transport; Food security; Climate action; ICT for increased resource efficiency; Inclusive, innovative and secure societies

Horizon2020 will mean broader access to the Framework Programme for SMEs (dedicated projects), the regions (tailored support), international partners ("mainstreaming"), and for all forms of innovation. Public-public partnerships will also be supported in Horizon2020, with particular attention being paid to joint programming initiatives between Member States. As such, it will ensure that EU R&D Funding will continue to remain at the centre of Member State R&D.

2.1.2. FIRE

In order to promote and advance the experiments on FI infrastructures, the European Commission launched the FIRE - Future Internet Research and Experimentation - initiative under the FP7 ICT research programme - Challenge 1: "Pervasive and Trustworthy Networks and Service Infrastructures", Objective 1.6 - Future Internet Experimental facility and experimentally-driven research.

FIRE has two interrelated dimensions:

1. FIRE Facility aiming to provide the researcher with a tool and sustainable resource to investigate, test and compare visionary approaches towards the Future Internet. The FIRE Facility is open to all European research activities, public or private.
2. FIRE Research, where visionary concepts for the Future Internet are explored using an experimentally-driven multidisciplinary approach, considering also social, economic, environmental or energy-related concerns, and taking a holistic view of the Internet as a complex system.

During the years 2008-2010 two waves of FIRE projects established the first prototypes of the FIRE Facility and used it for the visionary research on Future Internet. The ICT Workprogramme in 2011-2012 extended the FIRE activities further. The main issue going forward for the FIRE initiative is likely to be the sustainable operation of the testbeds.

FIRE is building upon the complementarities and strong cooperation amongst all projects addressing Objective 1.7 and is positioned as a cross-cutting initiative able to provide support to all other objectives of Challenge 1. FIRE is therefore emerging as a strategic European initiative ideally positioned to promote peer discussion with similar initiatives worldwide, such as GENI (USA).

FP7 and the preceding Framework programmes together with FIRE have provided a highly valuable mechanism for international collaboration among teams of researchers from different Member States. As such, they have played an important role in Member State collaboration and will remain a key support mechanism for transnational collaboration.

2.1.3. Testbeds and Living Labs. Smart Cities

The developed countries are doing significant research and development work on Future Internet technologies and services. To undertake experiments with new network components and technologies it is necessary to test them in experimental systems. All over the world, as well as in Europe, a large number of pilot systems and testbeds have been set up in recent years, like OneLab, PanLab, FEDERICA, WISEBED, etc. These testbeds are playing an important role in the development of the technology of the Future Internet, examining new protocols and undertaking research on the interaction of the existing and emerging technologies. The challenge for Member States is to fully exploit these testbed facilities and to support end-users to utilise these infrastructures. It will be increasingly important for Member States to cooperate in experimental FI research and to stimulate the use of testbeds across Member State boundaries while at the same time, encouraging researchers (especially SMEs) in their countries, to utilise these testbeds.

The **Living Labs** community is rapidly extending not only in Europe, but worldwide. There are currently more than 200 Living Labs globally. Living Labs are a real-life test and experimentation environment where users and producers co-create innovations. The dynamic expansion of Living Labs in the field of ICT is very useful for European industry because the involvement of users in the development of new products and applications accelerates the research to market process, yielding comparative advantages for European companies over their competitors. Similarly, higher education institutions can benefit greatly from Living Labs as students and researchers access high-tech innovative testbeds.

Living Labs have been characterised by the European Commission as Public-Private-People Partnerships (PPP) for user-driven open innovation. The European Network of Living Labs (ENoLL) is a successful

initiative which has a strong interaction with the Future Internet Research and Experimentation (FIRE) initiative of the EU. There is a growing need to strengthen the use of these testbeds by Member States and to optimise the benefits that they can deliver to European researchers and industry. Both EU and Member State Living Lab initiative have the potential to greatly advance FI research, particularly in the small Member States of the Community, where testbed resources can be limited or not fully able to meet demand.

The concept of “**Smart Cities**” is trying to address the key challenges being faced by many big cities through the open innovation model. In this regard, Smart Cities are an implementation of the Living Lab idea. The concept of the smart city as the next stage in the process of urbanisation has been quite fashionable in the policy arena in recent years, with the aim of drawing a distinction from the terms digital city or intelligent city. Its main focus is still on the role of ICT infrastructure, but much research has also been carried out on the role of human capital/education, social and relational capital and environmental interest as important drivers of urban growth. The EU in particular, has devoted constant efforts to devising a strategy for achieving urban growth in a smart sense for its metropolitan city-regions. Other international institutions and think-tanks also believe in a wired, ICT-driven form of development. In Europe there are several success stories such as Santander (Spain) and Oulu (Finland). Smart cities are in a key position to test new internet-based services and also to bring these to wider society. One of the main pillars of Horizon 2020 is aimed at concerns shared by all Europeans such as climate change, developing sustainable transport and mobility, making renewable energy more affordable, ensuring food safety and security, or coping with the challenge of an ageing population. Future Internet based Smart City solutions can help us to address these challenges.

Member States can benefit greatly by linking into existing Living Labs and by learning from their experiences, especially the experiences of leading Smart Cities. In addition to increasing their awareness and utilising pan-European and Living Lab investments by other Member States, it may well also prove fruitful to launch new national, regional or local government-based Living Labs and Smart City initiatives.

2.1.4. Future Internet Public Private Partnership (FI-PPP)

The **Future Internet Public Private Partnership (FI-PPP)** aims to advance Europe's competitiveness in Future Internet technologies and systems, and to support the emergence of Future Internet-enhanced applications of public and social relevance. It addresses the need to make public service infrastructures and business processes significantly smarter through tighter integration with Internet networking and computing capabilities. The FI-PPP has clear and relevant goals, such as increasing the effectiveness of business processes and of the operation of infrastructures supporting applications. The FI-PPP programme is in its second phase (see Figure 2 below) and will evolve into the 3rd phase until 2015.

The FI-PPP follows an industry-driven, holistic approach encompassing R&D on network and communication infrastructures, devices, software, service and media technologies. The FI-PPP provides an efficient, service-oriented model for cooperation between academia and industry. But the tight priorities of the Call and the industry structure of the countries narrows the possibility to have every

country involved. To increase the participation of MS in the EU-wide FI-PPP process it is necessary to raise awareness among national policy- and decision-makers regarding this research and innovation infrastructure throughout EU Member States.

Member States will also need to increasingly take cognisance of the FI-PPP in prioritising its own R&D programmes. In particular, it would be useful to create similar national or regional R&D programmes related to FI-PPP to boost national players onto this European field. This point is picked up again later in this roadmap, but for now it is sufficient to say that FI-PPP can provide valuable new opportunities for Member State engagement but to optimise this involvement, a number of awareness-raising and dialogue-initiation actions will need to be undertaken

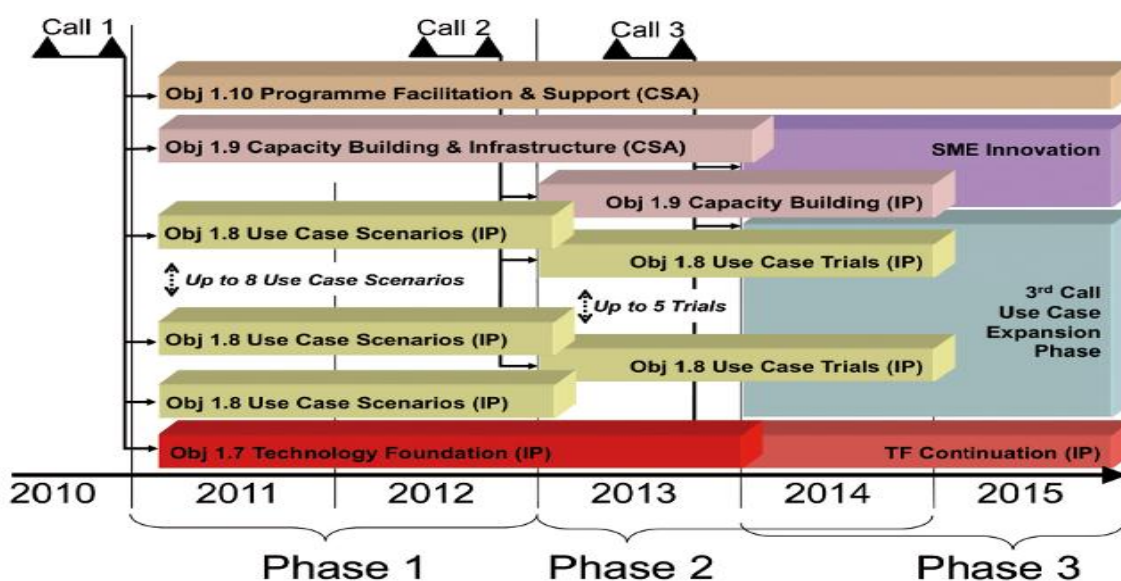


Figure 2– Timeline for the FI-PPP

2.1.5. Joint Programming

Joint Programming is a relatively new process combining a strategic framework, a bottom-up approach and high-level commitment from Member States. It builds on the experience gained from existing schemes that coordinate national programmes. Suitable Joint Programming areas are identified by a High Level Group on Joint Programming (“GPC”- from the French “Groupe de Programmation Conjointe”) comprising nominees from Member States and the EC, following a thorough consultation of stakeholders. Based on the result of the GPC, the Council, upon a proposal by the Commission, recommends a limited number of areas in which to implement priority Joint Programming.

From there on, participation of Member States in each initiative is based on voluntary commitments that can lead to partnerships. Each initiative comprises variable groups of countries and is based on national priorities and interests. The overall aim of Joint Programming is to pool national research efforts in order to make better use of Europe's precious public R&D resources and to tackle common European challenges (such as climate change, food and energy security) more effectively. These are subjects that are beyond

the capacity of any individual country to resolve, and which can benefit from a co-ordinated approach to research.

Currently, there is no purely Future Internet-related Joint Programming activity. “City of the Future”² is probably the most relevant, followed by the “More Years, Better Lives - The Potential and Challenges of Demographic Change”³.

As Member State collaboration grows, the expansion of the idea of Joint Programming to new and emerging areas, is likely. This will require more Member State involvement and lead to increased use of this mechanism in aligning and coordinating Member State research in the Future Internet.

2.1.6. *Joint Technology Initiatives*

In its current Framework Programme for research, technological development and demonstration activities, the European Union supports a number of Joint Technology Initiatives⁴ (JTIs). In the ICT field, the ARTEMIS and ENIAC JTIs were established in 2007 as Joint Undertakings (JUs). These two bodies constitute public-private partnerships between industry, a number of EU Member & Associated States, and the European Union. Their aim is to implement, by means of a budget from both the EU and participating Member States, a research agenda defined by the European research communities (industry and academic/research organisations) in their respective fields. The JTIs thereby seek to strengthen Europe’s future growth, competitiveness and sustainable development. Their ambition and scope, the scale of the financial and technical resources that need to be mobilised, and the need to achieve effective coordination and synergy of resources and funding called for action at European level.

2.1.7. *Future & Emerging Technology Flagship Initiatives*

Transnational collaboration underpins the *FET Flagship Initiatives*⁵. These Flagship initiatives are centred on ICT future emerging technologies (FETs). These FET Flagships will be much larger than the FET Proactives already in place, and will align European research priorities at EU and national levels with very substantial research funding to address grand scientific challenges which will cut across different national science research programmes and European programmes. In 2013, two large FETs will be launched. These large initiatives will run for 10 years and will be examples of what is called “Big Science”. Currently, there are six pilots competing to become one of the two Flagships; the selected two will be announced in early 2013.

² <http://www.era.gv.at/events/13280.html>

³ <http://www.jp-demographic.eu/documents/synthesis-paper>

⁴ www.artemis-ju.eu/publication/download/publication/1

⁵ http://cordis.europa.eu/fp7/ict/programme/fet/flagship/home_en.html

FuturICT⁶ is one of these six pilots and it is very much related to Future Internet research. FuturICT will bring together the disciplines of social sciences, complexity, economics and computer science. Based on big data and multidisciplinary research, scientists, industries, governments and citizens can observe and influence planetary movements when it comes to financial, social and biological developments. In many ways this pilot can be linked to the Future Internet theme. The internet will be an important source of information as well as the medium where the developments can be overseen. There are a number of potential possible liaisons between the FuturICT and the FIF which are explored in section 3 of this document. It is sufficient here to say that the FETs will be an important element in Member State collaborations into the future.

2.1.8. EUREKA & Celtic-Plus Collaboration

EUREKA is an intergovernmental network which supports market-oriented R&D projects, and provides access to national public and private funding schemes⁷. A number of different types of project exist: there are the *EUREKA projects*, which are labelled by EUREKA; *cluster projects*, which are generated by a EUREKA cluster, and the *umbrella projects*, generated under an umbrella. The *clusters* are industrial initiatives that work in close collaboration with national funding authorities. The *umbrellas* are networks that focus on a particular technology or business sector.

2.1.9. European Institute of Innovation and Technology (EIT)

The European Institute of Innovation & Technology⁸ (EIT) is a body of the European Union based in Budapest, Hungary. The EIT achieves its mission by fully integrating all three sides of the ‘knowledge triangle’, i.e. higher education, research and business, in Knowledge and Innovation Communities (KICs). By bringing together major players from all these dimensions to cooperate in the KICs, the EIT is able to promote innovation in Europe.

Three KICs were launched in 2010:

- **Climate-KIC:** climate change mitigation and adaptation
- **EIT ICT Labs:** information and Communication Technologies
- **KIC InnoEnergy:** sustainable energy.

While the EIT’s headquarters are situated in Budapest, Hungary, the EIT is not concentrated in one campus as a traditional institute, instead operating through the KICs. Each of the KICs operates across a limited number of hubs called ‘co-location centres’ located in Berlin, Eindhoven, Helsinki, Paris, Stockholm and Trento. They support innovation in existing companies and the creation of new business opportunities in ICT through a set of tools.

⁶ <http://www.futurict.eu/>

⁷ <http://www.eurekanetwork.org/>

⁸ <http://eit.europa.eu/about-us/>

EIT ICT Labs⁹ is the EIT's Knowledge and Innovation Community with a focus on future Information and Communication Society. It breeds entrepreneurial ICT top talent by transforming higher education towards promoting innovation and entrepreneurial spirit. The KIC's Co-location Centres and mobility programs help bring people from different countries, disciplines and organisations together. Some of the EIT ICT Labs' business catalysts are: EIT Awards, best-practice benchmarking, Entrepreneurs Club, Entrepreneurship Support System, European SME program, and Innovation Radar.

Section 2.1 has attempted to give an overview of a number of relevant pan-European initiatives that together provide the backdrop and offer opportunities for increased levels of collaboration among Member States. It is now necessary to look at current developments at Member State level with a view to establishing a sense of what Member States are prioritising, how they are organising their FI initiatives and the existing role and level of Member State collaboration.

2.2. Current Developments at Member State Level

A wide range of initiatives relating to the Future Internet are underway at Member State level. These have been listed and described in previous ceFIMS deliverables (D3.2 Report on existing Member State Future Internet activities). Funding agencies and initiatives for each MS are listed in Appendix 1 to this document. It is not intended to describe them here again but rather to present a picture of what research areas are being focused on in these initiatives and how these might be aligned with Member State collaborations, taking account of the pan-European initiatives described in section 2.1 above. Full details of a wide range of Member State initiatives are available on the ceFIMS database: <http://www.cefims.eu/database/>. In addition, an up-to-date summary has been presented in deliverable D3.2e 'Report on existing Member State Future Internet activities' which was updated in November, 2013.

	Applications/ Services	Transport/ Communications	Infrastructure	Security/ Other
Percentage of Total	55%	22%	15%	9%

Figure 3 – Thematic Areas in Member State FI Initiatives

The insight into the thematic focus of Member State activities offered in the table above, is a useful input to the selection of possible topics that may offer highest potential for collaboration among Member States and between Member States and the EU. Based on this information, the ceFIMS project has undertaken a round of detailed contacts with individual FIF members during 2012 with a view to identifying Member States that are active in particular research topics and interested in collaboration. Member States were asked to prioritise those topics in which it had an interest and where collaboration might yield benefits.

⁹ <http://www.eitictlabs.eu/>

Based on this information and in preparation for the ceFIMS workshop in Aalborg, May 2012, (D4.6) a list of topics and Member States who are active in these research areas, was developed.

Topic/theme			
Infrastructure	Services & smart applications	Mobility & IoT	Security
Czech Republic	The Netherlands	Norway	United Kingdom
Ireland	Hungary	Ireland	Czech Republic
Poland	United Kingdom	The Netherlands	Poland
UK	Spain	Hungary	Ireland
Hungary	Norway	United Kingdom	Romania
Belgium	Poland	Poland	Hungary
Austria	Ireland	Greece	Greece
Israel	Romania	Turkey	Turkey
Turkey	Belgium	Switzerland	Israel
Italy	Greece		Cyprus
	Cyprus		Austria
	Switzerland		

Figure 4 – Member State interest in specific research topics / themes

This question of identifying suitable topics for Member State collaboration has also been extensively looked at in a number of ceFIMS deliverables, most notably D3.3. ‘Potential Member States & Member State-EU Research Synergies’ and earlier versions of this roadmap document. Rather than repeating this exercise here, the focus now is to narrow the research topics to those where collaboration is possible in the short to medium term. This approach has proved fruitful with a group of Member States (UK, Finland, Sweden and Netherlands) focusing in particular on the possibilities in the Internet of Things and Open Data domain. At the time of writing this roadmap document, a questionnaire has been circulated to all FIF members asking them to select specific research topics within these domains, in which they would have an interest in transnational collaboration. This ‘low key’ contact has the potential to develop into a sustainable and useful series of collaborations.

In parallel, there has also been some discussions on possible collaboration around specific end-use applications such as for example, at the most recent FIF meeting in Warsaw, two areas were introduced for possible coordination among the MSs: - the Internet of Things for Harbours and ICT for Agriculture. This only serves to reinforce the point that topics for collaboration can come from a myriad of diverse sources and any new collaboration mechanisms will need to respect this ‘ground up’ approach to identifying collaboration topics. The mechanisms for cooperation are explored more fully in chapter 3 of the roadmap.

Before leaving this topic, it is worthwhile looking at the attitude to and experience of, Member States participating in cooperation initiatives. A report from the Joint Research Centre (JRC) in 2010 described in detail the level of Member State participation in ERA-NET and ERA-NET+ schemes, in FP6 and FP7

respectively¹⁰. The report by the JRC also states that similar clusters of countries with different behaviour can be identified in both FP6 and FP7 ERA-NETs:

- Four large countries (France, Germany, Spain and UK) participate extensively;
- A group of smaller countries also have significant participation levels (Austria, Finland, the Netherlands and Belgium). Italy has similar levels of participation, despite its bigger size;
- A diverse group of countries have a medium level of participation, including countries such as Sweden, Poland, and Greece;
- Newer Member States have a lower degree of participation with Romania and Hungary being the most active of this group.
- It is expected that this process would be the same for an ERA-NET+. An ERA-NET differs from an ERA-NET+ in that for the latter, the EC provides additional financial support, based on the potential European added value, to facilitate joint calls for proposals between national and/or regional programmes.

Finally, as an indicator of openness to international cooperation, it is worth considering that the Member States with a high number of proposals in FP7-ICT Calls were: Germany (16.6%), Italy (13.5%), UK (11.9%), France (9.5%), and Spain (9.6%)¹¹.

2.2.1. *International Cooperation*

It is also worth looking at experiences outside of Europe which could help inform the discussions on Member State collaboration. There are a number of initiatives similar to that of the Future Internet Forum in other regions in the world, particularly in North America and Asia. It is important to note these organisations, how they organise and their activities as it may be necessary to liaise with these organisations to coordinate the global effort to define and develop the Future Internet and synchronise European efforts in Research and Development in this area. For the same reasons that it makes sense to coordinate across Europe, a coordination worldwide would also reduce duplication and accelerate progress.¹² For the sake of completeness, the principal international initiatives are listed and briefly described below.

- GENI (The Global Environment for Network Innovations) and NetSE (USA): A unique virtual laboratory for networking experimentation for the Future Internet, providing collaborative and exploratory environments for academia, industry and the public to catalyse ground-breaking discoveries and innovation.

¹⁰ Source: Joint Research Centre Scientific & Technical Reports - EUR24668 - 2010 ("Mapping ERA-NETs across Europe")

¹¹ Source: SPRERS FP7 project, Deliverable D1.2 Actions for better integration of new Member States at FP7-ICT

¹² There is also a connection between FIRE and the Asia Future Internet Forum:

- *FIND Initiative*: FIND (Future Internet Design)¹³(USA): A long-term initiative of the USA's NSF NeTS research programme, looking at the requirements for and design of future networks.
- AKARI (Japan): The AKARI Architecture Design Project¹⁴ aims to implement the basic technology of a new generation network by 2015, developing network architecture and creating a network design based on that architecture. AKARI is designing a new network, using testbeds to evaluate the quality of those designs experimentally.
- AsiaFI (East Asia): The Asia Future Internet Forum (AsiaFI)¹⁵ was founded to coordinate Future Internet R&D among countries in Asia as well as with other continents. China, Japan and Korea all participate. AsiaFI is actively looking at the realisation of synergies and symbioses among its participants.

2.3. Policy Context

The policy context is an important driver influencing Member State collaboration. There has been a major political push in response to the financial crisis and rising joblessness, to focus Europe on stimulating economic growth, creating employment, strengthening Europe's competitive position, creating smarter/more sustainable/greener economic development and tackling grand societal challenges such as healthy ageing, energy security, climate change and environmental protection.

Europe 2020, agreed at the June 2010 European Council is the EU's growth strategy and will set the agenda for the coming decade. The Innovation Union and the Digital Agenda as two of the flagship initiatives of the Europe 2020 strategy, set out the key enabling roles that the use of Information and Communication Technologies and ICT research can play in Europe's recovery.

The key themes emerging from these important policy documents are:

- Innovation has moved centre stage. For the first time the EU is moving towards a more integrated policy approach between research and innovation. In the future, innovation will be reflected in all policy instruments, measures and funding.
- Innovation is being more broadly defined - it includes not only technological innovation but also innovation in business models, design, branding and services.
- Greater focus on more business-oriented research, commercialisation of research and 'getting ideas to market' - ensuring that innovative ideas can be turned into products and services that create growth and jobs.

¹³ <http://www.nets-find.net/>

¹⁴ <http://akari-project.nict.go.jp/eng/index2.htm>

¹⁵ <http://www.asiafi.net/>

- Importance of industrial participation (particularly from SMEs) and the development of partnerships between education and research, the public sector and business, including business-academia collaborations through 'knowledge alliances'.
- The Digital Agenda will require a sustained level of commitment at both EU and Member State levels (including at regional level). This means smart regional specialisation strategies, focusing on regional strengths and greater alignment between EU, national and regional levels, creating a Europe-wide free movement of knowledge.

It is evident from the current policy context that these policy drivers will be key determinants of the scale and scope of any Future Internet cooperation. Increased collaboration among Member States and between Member States and the EU, will be supported and indeed required, to maximise resources in pursuit of these themes.

2.4 Barriers & Challenges

Finally before leaving this section, it is important to briefly recap on the barriers and challenges to realising pan-European cooperation models. These issues have been specifically highlighted by FIF members, research council representatives, EU programme managers and invited experts:

2.4.1 *Multiplicity of Research Programmes*

Many Member States have launched national initiatives on the Future Internet (research programmes, technology platforms, interest groups, etc.), demonstrating their activity on a crucial theme for the future of European competitiveness. This multiplicity of different national and regional initiatives is an opportunity to add value to Future Internet pan-European initiatives on the basis of complementarities and synergies. Benefits and efficiency could, thus, be increased if those initiatives cooperated more closely.

Europe's strength lies in its diversity. Care must be taken though to maximise individual national efforts by promoting cooperation at European or bilateral level. Structured coordination is an opportunity to ensure Europe optimises and adds value to its funding and implements complementary and coordinated approaches in targeted areas. Consolidated infrastructure may also result from such coordination.

A lack of dissemination can lead to a number of potential challenges posed to collaborative development, including:

- Poor visibility of EU projects and achievements in Member States and vice versa: such awareness could allow Member States to focus on niche areas which complement larger, EU-wide work (e.g. create applications to work on EU-wide platforms);
- Perception of a lack of coordination between EU research and the USA, Asia;
- Perceived gap between top-down, regulated R&D and grassroots activities;

— Failure to keep track of the state-of-the-art in technology advances.

A formal mechanism to feed research outputs from Member State programmes into the EU framework could help address shortcomings in dissemination. Similarly, a common language or set of definitions could increase data-sharing across Europe.

2.4.2 Bureaucracy & Legislation

To increase research collaboration, a number of bureaucratic and legislative issues must be addressed. Some more obvious issues include cross-border data-sharing agreements and Intellectual Property Rights (IPR). Also, in some instances, regulation time-scales are mismatched with technology developments, meaning that regulators cannot keep pace with (and therefore cannot introduce) new technologies when they appear.

3. Vision of the Future: A Roadmap

This chapter describes a roadmap of next steps that if implemented, can provide a platform for enhanced collaboration between Member States. These next steps have been identified and defined through the project's data-gathering and data analysis activities and from inputs received from Member States and other stakeholders during discussions at the FIF and ceFIMS-organised workshops (thematic and European-level).

It is important to note that the context and environment influencing Member State collaboration is continually evolving and changing. Nevertheless, this chapter sets out the current thinking.

3.1. Proposals for Future Development 1: Institutionalising the role of National FIF Chapters

Since its initiation, the FIF has played an important role as a conduit to the Member States. It is a valuable forum for Member States to share their views on the evolution of the Future Internet and has offered an important networking opportunity for Member States. FIF can play an important institutional role in supporting Member State collaboration with the EU and each-other.

As the FIF evolves, a discussion has emerged on how FIF members can best engage with their national stakeholder community and act as points of contact / ambassadors in their own Member State.

During the Future Internet Forum meeting held in Poznan in October 2011, it was decided to investigate the potential for FIF members to act as Future Internet Ambassadors within their own country. A working group of FIF members was established, charged with the task of developing a position paper on the scope, operation and support infrastructure required to support this role. An initial draft of the position paper was presented to the FIF in Aalborg in 2012.

While feedback to the idea of having a central contact for national and regional stakeholders (including industry, policy-makers, researchers etc.) was positive, it was felt that the most appropriate method to achieve this was through the creation of National FIF Chapters rather than the appointment of a network of individual Ambassadors. The debate converged into a re-definition beyond the role of the Ambassador to evolve into institutionalising and establishing National FIF chapters to cater for a wider responsibility with a central focus and longer-term sustainability.

In the development of a National FIF Chapter in each Member State, a number of issues were considered including: scope and focus of the Chapters, workload involved and THE support required from the EU-FIF and/or EC, the relationship of the Chapter to other complimentary roles that may exist at national level (such as the role of the NCPs and national Future Internet Forums) and the interface between the National Chapter and national funding and governments agencies engaged in Future Internet activities.

It must also be remembered that each Member State organises itself differently and national FIF chapters need to reflect and align with their respective national institution. As examples of how Member States organise differently :- Hungary has established a Future Internet National Technology Platform, with their R&D&I policy coordinated by the Ministry for National Economy and the National Innovation Office: Italy has adopted an application-driven approach which means the Digital Agenda is under the “umbrella” of the Ministry for Public Administration & Innovation: Norway sees the Future Internet as a driver of the Government’s ICT policy to secure “an information society for all”.

The consensus from the Poznan and Aalborg discussions was that these issues would need to be considered within the context of national frameworks, given that there are considerable differences in the way future internet funding is managed at national level and the range of agencies involved. This requirement to tailor the national FIF Chapter to the contexts and structures in each individual Member States is returned to in the discussion statements later in this chapter. However before considering these Member State - specific factors, it is worth highlighting the key points of consensus on the role of National FIF Chapters.

3.1.1. Key points of consensus on the role of National FIF Chapters

A number of key points of consensus can be presented arising from the discussions at the FIF workshops (Poznan and Aalborg) the outputs from the CeFIMS Steering Committee meetings and the correspondence received from the individual FIF members.

- A key aspect of increasing levels of coordination and knowledge-sharing among European and National Future Internet stakeholders is the development of an effective network of National FIF Chapters that can reach out to national and regional players.
- National FIF Chapters, by bringing together the national stakeholders responsible for Future Internet policy making, funding and roll-out together with industry and academia, can provide a potent national focus for the realisation of the Future Internet.
- National FIF Chapters could be a useful vehicle to support greater engagement of national industry (particularly SMEs) in European initiatives such as the FI-PPP
- National FIF Chapters can act as a bridge between the Member State stakeholders and European-level research in the Future Internet domain. National Chapters can provide an effective means to communicate the views of National and Regional stakeholders to the European FIF and at

international level, resulting in a greater synergy between Future Internet planning and investment at National and European levels and the sharing of best practices, solutions, applications and services.

- In each National FIF Chapter, the nominated national member to the European FIF will play a key coordination role. In the case where there is more than one nominated national FIF representative, then the members can carry out the role collectively. The role is passed on from retiring FIF members to their replacement.
- There is a need for organisational and national support for FIF members to empower the national representative and the FIF Chapter to act on its plans of activities. FIF members have limited time available to carry out the role and therefore require a support infrastructure. It was also suggested that the role of ceFIMS (or a follow-on project) should be extended to provide a co-ordinated support framework to all participating members.
- The National FIF Chapter should play a role in developing cooperation and the concept of national and regional Information Points. Conversely the National FIF Chapters can also collect information about Future Internet R&D programmes/projects from within the Member State and through their nominated member of the European FIF, convey this information to the FIF. The National FIF Chapter disseminates relevant EU information back to national/regional institutes; thereby, creating a European network of Future Internet information resources
- Some duties envisaged for the National FIF Chapters are already being performed by FIF members, while others are outside the scope of responsibilities of one person. In this regard, FIF participation could be the responsibility of an institution rather than a person.
- Any Future Internet initiative, including the role of the National FIF Chapters should focus on the use of technologies, and subsequently be firmly placed in the context of the 2020 Digital Agenda.

It is worth presenting more detail on some of the points above and in particular, to elaborate on some of the key concepts.

(A) FIF MEMBERS AS A BRIDGE

Different countries organise themselves in different ways. Hence, within any particular Member State, a number of different organisations may be responsible for various aspects of the Future Internet. The visibility of the EC's Framework Programme may also vary from organisation to organisation.

While FIF members would not attempt to take over the tasks of these organisations, they could act as a bridge between them and the EC Framework Programme, ensuring they are fully aware of European-level research in the Future Internet domain. That is, the role of the delegate from the national FIF Chapter

could be to communicate on-going dialogue and funding opportunities at Framework level to the various national (and regional) organisations, in an appropriate, localised format. (At national level usually state or governmental institutions are responsible for ICT research cooperations with the EU and Future Internet policy making. Therefore these institutions send delegates to FIF, and cooperate with FIF Chapters.)

FIF members could also collate a two-way feedback from the different national organisations and bring it to the FIF, and the EC's programme development process as well as informing organisations in their country of EU initiatives and opportunities. As shown in Figure , the remit of the FIF National Chapter involves improving communication nationally between the different organisations, improving communications from the national entities to the European and other International entities and facilitating communication from these international entities to the national organisations. A national FIF support role to facilitate these tasks has also been included - this could be in the form of a PPP, CSA or other.

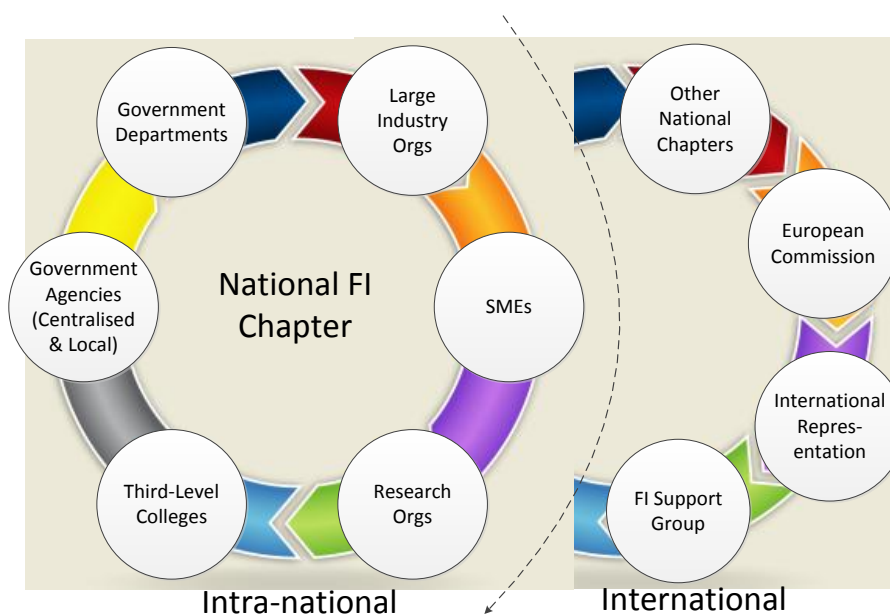


Figure 5 - National and International FI Stakeholder Groups

(B) OVERALL SCOPE OF THE FIF MEMBER IN THE NATIONAL FIF CHAPTER

Having key coordinating roles in the National FIF Chapters, FIF members could potentially carry out the following functions:

- Engage as 'quasi-neutral' communication facilitators between the FIF and their national organisations.

- Promote collaborative efforts between the FIF and their national organisations (e.g. inputting into the defining of a thematic portfolio for engagement - Digital Agenda, Horizon 2020, Internet governance, policy, security, privacy, IPv6, broadband, socioeconomics, etc.).
- Promote the formation of and attract members to the national FIF chapter, in line with the EU-FIF ethos.
- Report to the FIF on their own national strategic research activities/priorities.
- Engage all stakeholders in this national initiatives such as
 - Government departments (IT, employment, research, industry, enterprise, etc.)
 - Government Agencies (research funders and strategists, NCPs, etc.)
 - Large industrial orgs
 - SMEs
 - Independent Research groups (such as max-Planck institute, CERN,...)

(C) ESTABLISHING NATIONAL FIF CHAPTERS

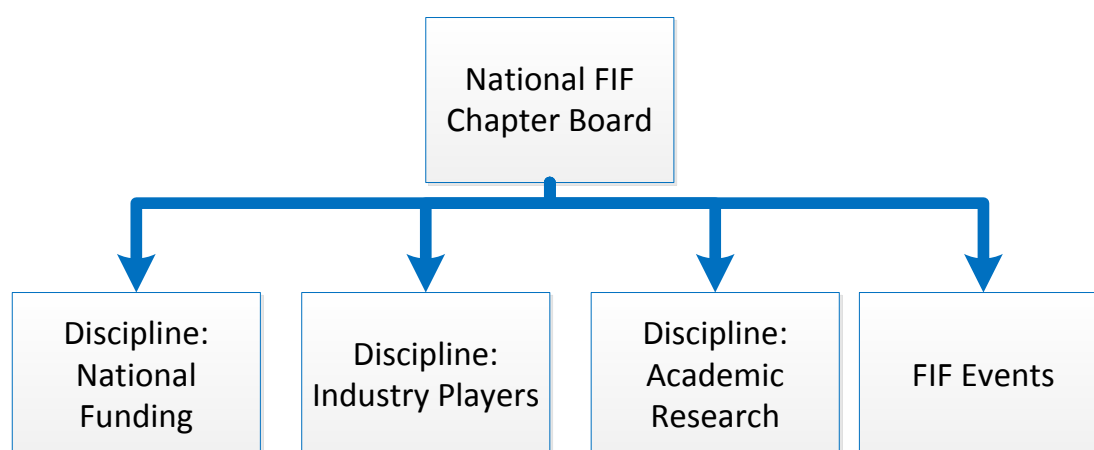


Figure 6- Example Hierarchy of the National FIF Chapter

Lead contacts for different aspects of the Future Internet already exist within some Member States. These can include National Contact Points (NCPs), Research Council Directors, academic and industry groups, as well as Government Ministries, Regulators, Consumer Groups, etc.

The National FIF chapter concept could prove to be a good vehicle to address the interdisciplinary dimension by attracting more actors to be the interface for different channels. The Chapter could for example, nominate a certain number of people for different tasks. The National FIF Chapter board could nominate a chair and Working Group chairs for the strategic disciplines representing the national stakeholders. The Chapters may be defined as affiliated members of any follow-on FIF Co-ordinated

Support Action. This follow-on CSA would provide an annual support budget to cover participation in European Future Internet initiatives such as workshops, conferences, maintenance of websites and the generation of support material. The national agencies could be requested to provide matched funding.

(D) CLEAR AND CONSISTENT MESSAGE

FIF members should decide how best to carry out the National FIF Chapter role in their own Member State. This could include determining the level of intensity required and the best methodologies for interaction with national stakeholders (e.g. plenary meeting with all stakeholders, followed by individual thematic meetings where necessary, or a series of bilateral meetings, etc.)

While National FIF Chapters would localise their message, a unified message is nonetheless required that describes the EC's overall goals for the Future Internet. The EC's unified message could be supported by slide sets and background documents, as well as general action points and examples of best practise vis-à-vis Future Internet research and deployment.

3.2. Proposals for Future Development 2: Finding the appropriate collaboration mechanisms

There is a portfolio of possible mechanisms available for Member States who wish to collaborate. These include ERA-NET, ERA-NET+, Joint Programming, Joint Technology Initiatives, EUREKA, CELTIC, etc., as well as more informal arrangements. While the starting point of the project was to look at the operation of an ERA-NET+, it nevertheless became clear as discussions progressed, that other collaboration models and mechanisms were worthy of closer investigation. Therefore in this section, while an ERA-NET+ is examined, other cooperation mechanisms are also looked at. These have been guided by the discussions at the ceFIMS-organised workshops and the discussions at the FIF.

As a starting point, a useful guiding principle for whatever mechanism chosen, might well be “Start small on a given theme; identify interested parties; build the community.” This initial ‘low profile’ cooperation could be extended through a series of next steps, including the topping up of national projects to add a European dimension, to more formal contacts on national research initiatives and groupings of interested Member States cooperating on research topics and initiatives. This starting point has only been arrived at following lengthy discussions over the lifetime of this project, yet seems to reflect a widely held view among Member States. A staged approach, focusing on a limited number of aspects and a more bottom-up approach with an emphasis on collaboration tools that are assessable and inclusive (especially for SMEs).

Also it is worth keeping to the fore, the advantages offered by transnational collaboration. These include:

- Pool resources: more research/work for less outlay

- Reduce duplication: benefit from the exposure to state-of-the-art (e.g. integrate/import the solution rather than re-invent it)
- Address issues that require a cross-border solution - more coordinated response to common challenges
- Access a larger market for research expertise - scale your solutions
- Long(er)-term perspective for research strategies
- Stimulation of innovation/growth - creation of jobs and transnational partnerships

In examining collaboration mechanisms, let us start with what was the initial focus of the ceFIMS project at the time of writing our Description of Work, the ERA-NET+

3.2.1. **ERA-NET+**

Briefly before considering the ERA-NET+, it is worth briefly introducing the ERA-NET. The objective of the ERA-NET scheme is to step up the cooperation and coordination of research activities carried out at national/regional level in European Member States. This is done in two ways: (1) Networking of research activities conducted at national/regional level, and (2) Mutual opening of national/regional research programmes. Examples include:

Acronym	Full Name	Link
CHIST-ERA	European Coordinated Research on Long-term Challenges in Information and Communication Sciences & Technologies ERA-Net	http://www.chistera.eu/
MNT-ERA.NET	Micro & Nanotechnologies for a highly competitive European industry	http://www.mnt-era.net/MNT
SEERA-EI	South East European Research Area for eInfrastructures	http://www.seera-ei.eu
NuPNET	Nuclear Physics infrastructures	http://www.nupnet-eu.org

In cases with high European added-value, the European Union offers extra financial support to facilitate joint *Calls For Proposals* between national and/or regional programmes - these are called ERA-NET+ actions. That is, the EU provides an incentive for organising Joint *Calls* between national or regional research programmes by 'topping-up' joint transnational funding with Community funding. Examples include:

Acronym	Full Name	Link
PIANO+	Photonics-based internet access networks of the future	http://www.pianoplus.eu/
NanoSci-E+	Basic nanoscience research	http://cordis.europa.eu/fp7/coordination/pdf/nanosci-eplus.pdf
MATERA+	Materials Research	http://www.materaplus.net/

PIANO+ (Photonics-based Internet Access Networks Of the future) is a recent example of an ERA-NET+ in the ICT domain. It is a particularly interesting example for a future FI ERA NET+ and a representative from the PIANO+ was invited to present at the ceFIMS-organised workshop in Aalborg. The PIANO+ Call topic is *‘Photonic technologies & system architectures for radical, cost-effective enhancement of the Access Network’* and the participating countries are Germany, UK, Israel, Poland, and Austria. It has a total funding of €22.3m (€14.9m from countries + €7.4m ‘top up’ from the EC). To date, 13 projects have been selected for funding - Grant Agreements have been issued and the projects are running.

The Joint Calls under the ERA NET+ programme involve awarding grants to third-parties participating in calls for proposals launched under the ERA-NET+ actions. These actions require programme owners or programme managers from at least five different Member States (or Associated States) to plan a single joint call, with a clear financial commitment from the participating national or regional research programmes.

The Community contribution will be limited to a maximum of 33% of the total contributions to the Joint Call budget. Proposed projects must be transnational and are funded from THE ‘virtual’ common pot, made up of two-thirds national funding and one-third EC funding. The national research agencies decide on the funding levels. The combined national/regional and Community contributions to the Joint Calls have to reach at least EUR 5 million. Proposals to establish an ERA-NET+ must also meet the following overall eligibility criteria:

- A single Joint Call should be planned with a clear financial commitment from the participating national or regional programmes.
- A fixed common set of general evaluation/selection criteria (excellence, European added value, etc.) should be part of the common evaluation criteria of the Joint Call organised by the national programmes.
- A common peer-review mechanism for evaluating the proposals submitted to the Joint Call shall be foreseen.

- Each project financed out of the Joint Call shall be transnational (i.e. have a minimum of two partners from different countries).

One of the key outcomes of any ERA-NET+ is the issuing of a transnational Call for Proposals. Those who would submit project proposals to such Calls are research, development and innovation performers. The 2010 report on ‘Mapping ERA-NETs across Europe’¹⁶ found that, while applied research seems to be the most common type of research covered by the ERA-NETs, the main target groups eligible for funding (i.e. the research performers) are the traditional performers of basic research: Higher Education Institutions (HEIs) and Public Research Organisations (PROs). See Figure 2:

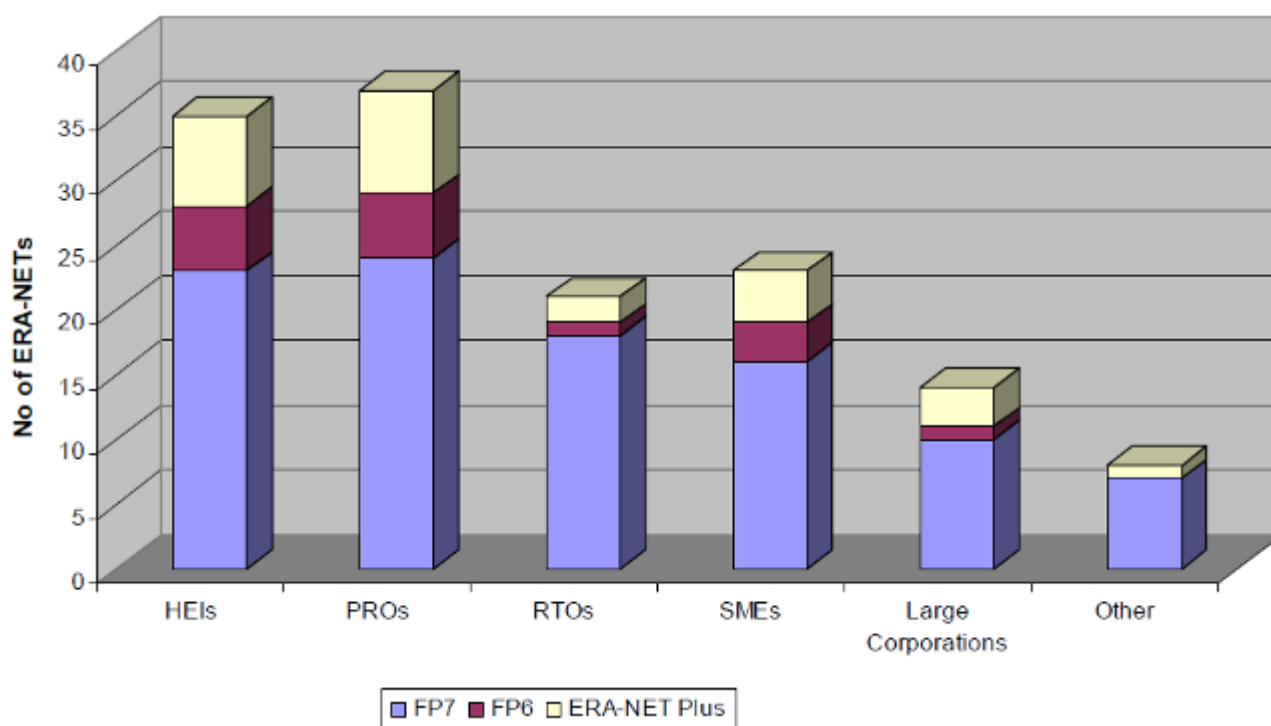


Figure 2 - ERA-NETs' target groups eligible for funding

3.2.1.1 ERA-NET(+) Industry Involvement

Though industry involvement (large, medium and small enterprises) is critical to exploit and commercialise research results, they seem less predominant as target groups eligible as beneficiaries of the joint activities of the ERA-NETs. The ‘Mapping ERA-NETs across Europe’ report states it would be desirable that future ERA-NETs increase the proportion of industry partners involved in performing research, in order to be closer to market necessities and foster the execution of research in public-private

¹⁶ Prepared by the Institute for Prospective Technological Studies (IPTs) of the European Commission's Joint Research Centre (JRC)

partnerships (PPPs). In this regard, the current FI-PPP initiatives could be an interesting source of potential industry partners.

Ultimately, however, the ERA-NET+ funders will set out the criteria for the research performers required. It is expected that targeting industry involvement (large corporations and SMEs) will be important for research funding agencies, with much emphasis on innovation and development. Additionally, large corporations could be leveraged to increase the involvement of SMEs.

3.2.1.2 ERA-NET(+) Review

In February 2010, an Expert Review Panel was set up by the EC to review the ERA-NET+ instrument¹⁷. The recommendations returned by the Panel will provide a broad background framework for the next phase of ceFIMS work, with regard to preparing the ground and gaining critical mass for an ERA-NET+ on the Future Internet. The Panel recommended that:

- The instrument remains “agile”, and able to respond to specific needs for research within a relatively short timeframe; i.e. not for multiple calls which would require long-term strategies and funding commitments from stakeholders.
- There should be an option to use EC’s contribution to help cover management costs throughout the life of the project. And that other lessons learned (formalise agreements, launch calls, evaluate bids, etc.) are recorded and passed on through the ERALEARN project¹⁸.
- The level of funding at the start of the second phase should be the maximum permitted. This would remove further interim payments, and thus, administrative overheads for the EC and other funding partners.
- Resources for networking within an ERA-NET+ action should not be provided, but the action should be “owned” by or have links with established networks.
- The decision to set up an ERA-NET+ should involve weighing up the potential benefits from using the instrument compared with those arising from an open call in the Framework Programme.
- Appropriate criteria should be developed against which the impact of the instrument can be measured.

¹⁷ ftp://ftp.cordis.europa.eu/pub/fp7/coordination/docs/era-net-plus-review-2010_en.pdf

¹⁸ <http://netwatch.jrc.ec.europa.eu/nw/index.cfm/static/eralearn/eralearn.html>

3.2.1.3 ERA-NET+: Pros & Cons

A number of ‘Pros and Cons’ were identified during the ceFIMS workshops discussions and the subsequent engagement with FIF Members. Firstly the **Challenges**:

- Time required: Call preparation, launch, two-stage evaluation, implementation of projects
- Complexity of management: national/regional particularities, financial calculations, synchronisation of Grant Agreements
- Matching of funding: financial commitment required, sophisticated selection procedure (over-subscribing, balancing), exact EC contribution unknown until the end
- Reporting & monitoring: joint monitoring/reporting (in addition to national duties), reporting of national/regional sponsors to the EC

However, a number of **Benefits** also accrue from involvement with an ERA-NET+:

- Complements national as well as EU funding (FP7, EUREKA)
- EU ‘top up’ (one-third of total budget) is an important motivation at national level to get involved in transnational actions
- Make contact between industry peers from different countries
- Funding agencies also connect with transnational counterparts
- Focus on smaller groups of countries, who have similar interests

It is clear from Member State views that a balance must be struck between the scheme not being overly complex but not too lightweight for coherence. One size does not fit all. An ERA-NET+ could encompass multiple Calls, multiple topics, and a non-static participation list. It should be available all the time (e.g. FET Open Calls).

The narrow initial focus in the early stages has again been re-emphasised at the FIF meeting in Warsaw (September 2012) where the ‘start small’ message has again come to the fore with a call for an future FI-ERA NET+ being limited in focus at its outset. The preferability of having an accompanying CSA was also mentioned where the CSA could help administer a diversity of funding instruments, which could be applicable in different scenarios. This CSA could assist the EC and the Member State Ministries and research councils could, in identify topics¹⁹ for any proposed ERA-NET+ on the Future Internet. Additionally, the following entities could be consulted by the CSA when defining state-of-the-art research topics:

- Relevant European Technology Platforms

¹⁹ Cash contribution and/or ‘in-kind’ contribution

- National industry initiatives (technology platforms, interest groups)
- Trade and Standards associations (TIA, Eurescom, CENELEC, EUROISPA, GSMA, etc.); also, the CONCORD FI-PPP project
- Governmental and non-governmental organisations (EU-Regulators (IRG), ITUT, ETSI, W3C, IETF, ISOC, RIPE, etc.)

Given the diversity of views and the continually evolving policy context and available resources and budgets, it is prudent to look beyond the ERA-NET+ collaboration mechanism in this document. These could include ‘Joint Programming’ and ‘Joint Technology Initiatives’, both of which are described now.

3.2.1 Joint Programming

Joint Programming is a process that combines a strategic framework, a bottom-up approach and a high-level commitment from Member States. It builds on experience gained from existing schemes that coordinate national programmes.

A high-level group comprising nominees from Member States and the European Commission (EC) identifies suitable Joint Programming areas, following a thorough consultation process. Based on this group’s recommendations, the EC proceeds to propose a number of areas in which to implement priority Joint Programming. Member States who participate in such initiatives then form groups amongst themselves, which may subsequently lead to more formal partnerships. The overall aim of Joint Programming is to pool national research efforts in order to make better use of Europe’s public R&D resources and to tackle common European challenges more effectively. Examples include:

Name	Link
City of the Future	http://www.era.gv.at/events
Ambient Assisted Living	http://www.aal-europe.eu/
More Years - Better Lives	http://www.jp-demographic.eu/documents/synthesis-paper

The prospect of Joint Programming has been discussed by Member States in the ceFIMS project and at the FIF. A number of Member States indicated at the FIF meeting in Warsaw (September, 2012) that any Joint Programming should be a soft, ad-hoc approach fostering flexibility, inclusion and bottom-up initiatives. This has been a recurring theme and is also carried through to other potential collaboration mechanisms discussed in this roadmap.

3.2.2 Joint Technology Initiatives

The EU supports a number of Joint Technology Initiatives (JTIs) in its current Framework Programme for research, technological development and demonstration activities. In the ICT field, the ARTEMIS and ENIAC JTIs were established in 2007 as Joint Undertakings (JUs). These two bodies constitute public-private partnerships between industry, a number of EU Member & Associated States, and the European Union. Their aim is to implement, by means of a budget from both the EU and participating Member States, a research agenda defined by the European research communities (industry and academic/research organisations) in their respective fields. Details of ARTEMIS and ENIAC are as follows:

Acronym	Full Name	Link
ARTEMIS	Advanced Research & Technology for Embedded Intelligence & Systems	http://www.artemis.eu/
ENIAC	Public-private partnership in nanoelectronics strengthening European competitiveness & sustainability	http://www.eniac.eu/web/index.php

While the ERA-NET+ structure was initially targeted as being the first option to consider for supporting cooperation between the Member States in the ceFIMS project, it is evident that other collaboration mechanisms beyond the ERA-NET+, Joint Programming and Joint Technology Initiatives, should also be looked at. A number of Member States have inputted interesting ideas for alternative cooperation mechanisms. Most of these are ‘lighter’ than a full ERA-NET+ yet hold the potential for supporting practical and fruitful collaboration among Member States - these are now examined.

3.2.3 Member State interaction with PPP and large-scale infrastructural deployment

The Future Internet Public Private Partnership (FI-PPP) offers exciting opportunities for Member State interaction. To increase the participation of MS in the EU-wide FI-PPP process it is necessary to raise awareness of national policy- and decision-makers regarding this research and innovation scheme throughout EU Member States. It would be useful to consider the creation of similar national or regional R&D programmes related to FI-PPP to boost national players onto this European field. A new future EC Communication to develop national and regional FI-PPP programmes funded by Structural Funds or national resources would give a spur to this effort. Pilot projects would also speed up the involvement of FI-PPP model in the innovation system of the Member States and help to localise the FI-PPP approach.

Member States can play a useful role in facilitating and supporting end-users in utilising the ICT infrastructures offered by the FI-PPP. The FI-PPP offers a new added dimension for Member States to

consider in fixing their national FI investment strategies and in particular, to see how Member State investments can complement FI-PPP infrastructures. However from the information gathered on a large number of investment infrastructures at European, National and Regional level in the INFINITY project, it is evident from an analysis of these investments that they are driven by national and regional priorities with little reference to similar investments in other Member States. This is despite the fact that part of the funding may be from the European Development Fund or other Europe investment sources. A good example here is the large number of national and regional Smart City initiatives. This issue has also emerged regularly at ceFIMS-organised workshops and from an analysis of the ceFIMS database and points to the need for strategies to identify interfaces for Pan-European collaboration with particular emphasis on supporting greater collaboration between national research funding and infrastructure investment programmes.

In many cases we see the same multinational organisations involved in multiple testbeds. However their participation appears to be driven by the decision of the national branches / offices of the multinational organisation. While this should bode well for the availability of testbeds and infrastructures for public research and commercial exploitation, nevertheless it often proves to be the case that because of different governance models, access to these testbed networks is often limited resulting in their underutilisation, in particular by SMEs (especially those who are not business partners of the large multinationals). This illustrates the paradox of large scale infrastructural investment (especially through FI-PPP) but limited access and availability for SME users. Infrastructure managers will need to identify a commercial model that addresses the concerns of the SME community and in particular, help overcome the difficulties for SMEs to engage in infrastructure trials. Member States can play a valuable role in creating this bridge to SMEs.

The research lifecycle also needs to be considered here. There is a need to align public infrastructural investment with the research lifecycle i.e. from long term research (for instance funded through FETS) to pre-commercial innovation and market validation through to the delivery of market-driven commercial solutions. Each phase of the research lifecycle can require the availability of different infrastructures with different funding models e.g. early stage “Blue Sky” research and supporting infrastructure will require greater government investment than later stage investment. Coupled with this, there is often an unreasonable expectation that infrastructures can be self-funding within a short period of time and an absence of a realistic business model). There is a need for increased recognition of a research, innovation and commercialisation lifecycle model in Member State investments. The national research agencies can play an important role in making sure that this happens. Industry too has a role to play here.

Engagement of the key stakeholders (investment agencies, academics and industry and consumer groups) in the pre-commercial infrastructure scoping and investment prioritisation process can ensure a greater balance between short, medium and long-term investment priorities and build a bridge between the pre-commercial infrastructure platforms as represented by the FI-PPP core platform and the more commercial platforms operated by commercial industry. This engagement process requires greater emphasis on

promoting open solutions that are standards-based and are both industry and consumer focused. Industry could usefully be encouraged to engage in early stage research infrastructure investment and early-stage research collaboration to promote better transfer of the research advances in pre-commercial R&D and more effective uptake of research outputs and their validation in pre-commercial prototypes and trials. Policies are required to encourage service providers (and particularly SMEs) to invest in open source and/or standard solutions. Likewise, there is a need for the development of a model for investment by State bodies that recognises the need for greater state investment in early-stage research infrastructures, particularly in universities and nationally funded research centres. The research lifecycle can therefore become a catalyst for greater co-ordination between public and private infrastructure providers to ensure that their business models are complimentary and maximise the overall impact of their collective investments at each stage in the research lifecycle, thus optimising the utilisation of the combined infrastructures by users (especially SMEs).

There is a strong imperative to engage SMEs actively in the investment process. This is a complex question and while recognising that national supports for SMEs are Member-State specific with each Member State supporting a multitude of research and innovation grants depending on industry size, market focus and location, there are nevertheless some general observations that can be made in this regard. There is often a low level of awareness and poor take-up of research infrastructures by SMEs. The massive combined European, national and regional infrastructural investment is not being adequately exploited by European SMEs. Feedback from SMEs acting as third party service providers raises concerns about the SME engagement policies as promoted at European and National levels. There appears to be a mismatch between the focus on technology issues associated with most infrastructure investments and the SME need for commercial pathways for product development. There is a gap between on the one hand, the focus of the European and national agencies on infrastructure from a technology perspective and on the other hand, the needs of SMEs for market validation, reference sites and routes to market. Member States and their national and regional agencies, can play a key role in addressing this seeming disconnect between infrastructural investment strategies and the needs of innovative SMEs that are building new business models around new technologies and technological research. There are some interesting initiatives which could reduce this apparent disconnect e.g. the model underpinning the 'FP7 Research for the benefits of SMEs' programme which links SMEs with research providers in bottom-up, technology-agnostic research projects that aim to strengthen the innovation capacity of small and medium-sized enterprises (SMEs) in Europe and their contribution to the development of new technology based products and markets. There are interesting opportunities here for Member States to take similar approaches to reducing the disconnect at national levels.

3.2.4 Added Value Through Innovation Agencies Collaboration

This concept of an 'ad hoc' cooperation between national innovation agencies was raised during the ceFIMS-supported discussions. This is based on the opportunities for Member State cooperation at the

innovation agency level, over and above the good work happening at FP7 level. There are a number of dimensions of added-value cooperation:

- Cooperation for promotion, awareness, soft-alignment: These need focus, not in terms of being narrow, but with respect to deciding what is already known and then focussing on what needs to be done. The ceFIMS project is one example, while in some Member States, a similar road-mapping national activity has been established (e.g. UK IoT Special Interest Group).
- Knowledge base complementarities: Value in cooperation can also be added when the knowledge base in Member States complement each other visibly; e.g. in terms of R&D capability. This may not always be the case, however, and deeper analysis is required. Larger Member States who are very active in the IoT field, for example, may already have a sufficient diversity of ICT skills.
- Emerging standards, common practises, cross-border demonstrators: This is a very fertile area for tangible added value for agency collaboration, both at policy/technology level and at demo/pilot level. In particular, enabling a value chain of data and information as the mantra that brings lots of strands together holds much added value potential.
- Single digital market angle: While this may be the overall ambition, it may be too early to focus on it with respect to IoT, for example.

There a number of other collaboration mechanisms which were discussed and proposals for new ‘hybrid’ and innovative mechanisms emerged. These include:

- **Collaboration without EC involvement:** Another form of collaboration might be between a group of several countries, and without EC funding or involvement. Funding for this network and its activities (e.g. funding research and validation of research) could come from funding agencies together with national ministries and global or European businesses.
- **Making use of Structural Funds:** Using structural funds for ICT research is a recurring topic. One suggestion to achieve this is to ear-mark a portion of structural funds and then establish appropriate metrics to monitor the use of same. For example, sample metrics could include: number of new start-up companies, number of Ph.D. trained, type of products developed, etc. This approach may require EU-level direction, however, and could see the setting up of a pilot national strategic project for ‘Future Internet Structural Funds’
- **New forms of sharing value in projects.** Companies, public institutions and universities are undertaking Future Internet projects in diverse contexts, exploring different angles and thus achieving different types of results. There are various kinds of **intangible assets** that could be shared with increased value to partners besides the common exchange mechanisms defined for tangible assets. In fact, if tangible results are easily accountable, non-financial transactions must be considered for addressing intangible assets such as knowledge and ideas, which are a strong component in the new networks that are being established.

Possible non-financial transactions include **providing value** back to the Member State and generating knowledge from within the project itself (e.g. sharing IPR, influencing standards and regulatory frameworks, sharing testbeds and pilots, sharing knowledge and experience, etc.). New forms of sharing

value in common activities should be streamlined, and the correspondent accountability is critical for leveraging the benefits to take out of common activities at European level.

- **Liaison with the FuturICT:** In 2013, two large Future Emerging Technologies (FET) Flagships will be launched by the European Commission together with support (in kind or in cash contributions) from Member States. These large initiatives will run for 10 years and will be examples of what is called “Big Science”. Currently, there are six pilots competing to become one of the two Flagships; the selected two will be announced in early 2013.

FuturICT²⁰ is one of these six pilots and it is very much related to Future Internet research. FuturICT will bring together the disciplines of social sciences, complexity, economics and computer science. Based on big data and multidisciplinary research, scientists, industries, governments and citizens can observe and influence planetary movements when it comes to financial, social and biological developments. In many ways this pilot can be linked to the Future Internet theme. The internet will be an important source of information as well as the medium where the developments can be overseen.

There are a number of ideas for possible liaisons between the FuturICT and the FIF. The ultimate goal of the FuturICT flagship project is to understand and manage complex, global, socially interactive systems, with a focus on sustainability and resilience. Revealing the hidden laws and processes underlying societies probably constitutes the most pressing scientific grand challenge of our century and is equally important for the development of novel robust, trustworthy and adaptive information and communication technologies (ICT), based on socially inspired paradigms.

While liaison with FuturICT is an enticing prospects for the FIF, the following must also be borne in mind:

- FuturICT is a 10 year project looking at more basic research areas. The FIF is working exclusively on applied projects carrying out research and development of the Future Internet.
- Given the size of FuturICT, it may prove difficult for the FIF to liaise with such a large project.
- FuturICT has a focused scope, this could narrow the scope of the FIF into specific areas. The FIF should consider all aspects of the Future Internet.
- A liaison between the Future Internet Assembly and FuturICT, supported by the FIF may exploit synergies.

- **ERA-NET combined with Living Labs:** There is a need in Europe for a large-scale innovation lab that can simulate and model behaviour, decision-making, legal issues, and social inclusion. This lab will be a playground and testing facility for research teams incorporating scientists within academia and industry from multiple angles. The virtual lab will host data from different sources, such as open government data and private network data. These data can be combined and layered according to the needs of the research teams.

²⁰ <http://www.futurict.eu/>

Such a large-scale lab as this does not currently exist. The main reasons for this can be that no such thing has been proposed before and that combining different data sets from different sources and countries is a challenge - there are privacy, organizational and legal barriers.

- **Liaison with European Institute of Innovation & Technology (EIT²¹):** Although not explored in any detail yet by the FIF, the EIT/KIC could hold potential for enhancing Member State collaboration. The most relevant element of the EIT to the FIF and hence the establishment of the National FI Chapters is the EIT ICT Labs²² Knowledge and Innovation Community (KIC), whose focus is centred on the future Information and Communication Society. Their main mission is to turn Europe into a global leader in ICT innovation, through:

- Networking and collaboration: EIT ICT Labs speeds up ICT innovation by bringing people together from different countries, disciplines and organizations via mobility programs and co-location centres.
- By developing and applying innovation catalysts, EIT ICT Labs leverage on existing regional, national and EU-level funding instruments to speed up innovation in Europe. Its catalysts focus on integrating the three elements of the knowledge triangle - Education, Research and Business.
- Education: it equips students, researchers, academics and business people with skills for applying creativity, risk-taking spirit and entrepreneurial capacity. It aims to empower top talents to lead Europe into a new ICT age.

The EIT ICT Labs became operational in 2010 and has six key focus areas: smart spaces; smart energy systems; health & wellbeing; digital cities of the future; future media and content delivery; intelligent mobility; and transportation Systems. Where applicable, it would be possible for the Member states initiatives that have highlighted these thematic areas of focus to capitalise on a collaboration with the EIT ICT Lab's network of nodes located in Berlin, Eindhoven, Helsinki, Paris, Stockholm and Trento.

The EIT ICT Lab plays a central role in the Future Internet research through its knowledge triangle methodology by creating an effective interaction surface between the academic institutions, researchers, and the industry players. To achieve maximum synergy between the EIT ICT Labs and Member States initiatives, there could be an opportunity for collaboration where the prioritised topics of Member States overlap with those in the EIT ICT Labs. Potential challenges that would need to be addressed with this liaison could be a Member State whose priority topic(s) match with an EIT ICT Labs node (or number of nodes) that is (are) in another Member State(s), managing the collaboration between the two or more Member States could be difficult. Conversely, if the Member States topic matches well those of the EIT ICT Labs node already in that same Member State, then the impact achieved due to the liaison with the respective EIT ICT Labs node could be high.

²¹ <http://eit.europa.eu>

²² <http://www.eitictlabs.eu/>

3.2.4 The Emergence of Collaboration Cohorts

A number of collaboration cohorts have emerged during the ceFIMS project. The background here is that in order to help preparations for the ceFIMS workshops and the supporting discussion papers, an ad hoc Working Group of FIF members was established. This Group came about as a result of direct contact between the ceFIMS Secretariat and FIF member(s) from each European Member & Associated State. The majority of FIF members responded when the Secretariat requested information on their country's Future Internet priorities. In addition, a number of FIF members also engaged in discussions with the Secretariat and have expressed an interest in collaboration with other countries. ceFIMS formalised this group into a Working Group to help prepare for the workshop in Aalborg. From this Group, a number of champions were selected.

The workshop consolidated this Group, and there is now a cohort of FIF who:

- Have expressed an interest in collaborating with other countries;
- Are engaging with ceFIMS/FIF;
- Are exploring the benefits of collaborating on sample research/innovation topics and a mechanism for any such collaboration. It should be emphasised that this Group is **NOT** closed; rather, it is just an informal cluster of individuals who are to the fore in engagement. Moreover, ceFIMS is working to engage with all other FIF members who might not yet have had too many interactions with the project and the roadmapping process.

The collaboration cohorts and emerging 'communities of interest' have identified a number of possible areas for potential research collaboration. Some possibilities are outlined in 3.3 below. In addition there has been some discussions on end-use / applications as a basis for collaboration. Two examples of this were presented at the FIF meeting in Warsaw, September, 2012. These include:

- **IoT in Harbours:**

Harbours offer a particularly interesting scenario since they cross many functional areas - land, sea, shipping, etc. - with only partial information available about each one. An ecosystem like harbours requires many different sources and entities. IoT in harbours could be in interesting area for a number of Member States to collaborate

- **ICT for Agriculture**

ICT for Agriculture is an increasingly important area for the EU as its agricultural sector expands. The sector traditionally has had a relatively low uptake of ICT and opportunities now exist for Member State collaboration to drive the adoption of ICT in the sector. One could imagine cooperation among Member States with similar farming sectors and structures (e.g. dairying on family farms)

3.3. Proposals for Future Development 3: Finding suitable research and innovation topics.

A number of research/innovation topics which hold potential for collaboration have been identified using the ceFIMS data-gathering and analysis work, together with direct feedback from FIF members. The topics as set out below, are designed to stimulate and advance discussions, rather than be exhaustive and capture the current state-of-the-art. Similarly, it is acknowledged that overlaps will exist between some topics.

When selecting topics for collaboration, many Member States have indicated (at ceFIMS workshops and FIF meetings) their desire for an initial narrow focus and ‘low profile’ collaborations. There is a need to retain a level of flexibility in choosing collaboration topics. The process of choosing topics should be dynamic, and flexible, particularly focusing in areas that address market failures (FIF Meeting, Warsaw, September 2012). The ‘drivers’ for the choice of collaboration topics should be based on wide thematic benefactor areas (especially those relating to SMEs), rather than technological progress. With this in mind, and taking account of the results of the EC questionnaire to FIF members, we could take two high-level messages on topics for collaboration:

- **Technical** topics mostly in the fields of IoT, Networks and the Cloud
- **Societal** and user requirements that are mostly Smart Cities related

Drilling down into these top-line messages and in an effort to tease out some specific potential collaboration topics, the following section looks at some of these topics in more details.

3.3.1 *e-Infrastructure*

The critical policy-level issues in e-infrastructure are long-term sustainability, interoperability & integration, and joined-up thinking. At national level there are normally a number of initiatives and entities involved (e.g. national e-infrastructures in Ireland include among others, SmartBay, IMS @ TSSG, Digital Repository of Ireland, ICHEC, Exemplar, DUBlinked, HEAnet, e-Inis). These are funded by a number of different Government Ministries and Agencies (Dept. of Education & Skills, Dept. Enterprise, Jobs & Innovation, Environmental Protection Agency, etc.). This distribution of funding and projects across various entities may be mirrored elsewhere at national and EU levels, and could be the cause of duplication of effort. Hence, collaboration could be beneficial at several levels.

3.3.2 *Smart services, smart cities, green tech*

Standardisation offers great potential in the domain of smart services, smart cities and green technology. An interesting WHAT/WHO/WHY/IMPACT analysis of these three areas, was presented by the Norwegian FIF delegate - it is summarised below. Many Member States already have initiatives running in these areas and collaboration on standardisation could yield valuable results.

	WHAT?	WHO?	WHY TRANSNATIONAL?	RESULTS & IMPACT
Smart Services	Service delivery; scalability; interoperability; security & privacy; etc.	Industry & researchers; regulatory bodies	Standardisation	Standards; digital single market
Smart Cities	Waste management; transport & logistics; etc.	Municipalities; industry & researchers; regulatory bodies	Small opportunities in technology; huge potential in field of regulation	Exchange of best practise, knowledge & experience; regulation
Green Tech	Transport & logistics; energy efficiency; smart grid; etc.	Industry & researchers; regulatory bodies	Standardisation	Exchange of best practise; standards

3.3.3 Internet-of-Things

The Internet-of-Things (IoT) can be treated generally as being new platforms, applications and services, which are based on having more information about our environment and physical objects. It is of major interest to all national FI funders and stakeholders and some specific collaboration topics have begun to be advanced:

Paradigms addressing heterogeneity of sensors, devices, etc.

- Media independent handover framework (IEEE 802.21 standard)
- End-to-end connectivity
- Scalability
- Re-use of objects across multiple domains

Support Technologies

- Secure acquisition & transfer of data between objects
- Software to analyse environment & context when data is collected/distributed
- Place filtering & decision-making closer to the edge of the network

Some estimates suggest that value-added services using the IoT could reach \$200 billion annually, and that the machine-2-machine communication market alone is worth \$100 billion per year. A new study published by Cisco refers to a 14.4 \$ Trillion value in the Internet of Everything (not just IoT). There are several

roadmapping initiatives already looking at technical and market challenges, and a number of Member States as referred to earlier, are beginning to identify specific topics for potential collaboration within this domain.

3.3.4 Security, Privacy and Trustworthy ICT

While the Internet has become the critical infrastructure of the Information Society, 89.1% of emails sent in 2010 were spam (junk/unsolicited emails). In parallel, there are several different types of network attack methods (malware, worms, phishing, spyware, viruses, adware, rootkits, Trojans, etc.) and new ones are emerging all the time. Thus, security (together with trust and privacy) is a central issue for the Future Internet. If we take the basic design principle that the Internet is maintained as an open system, then we can look at security at several levels: architectural, technological, application, psycho-sociological, legal/regulatory. The overall goal, however, must be to foster user trust in the applications/services which will comprise the Future Internet. This trust goes hand-in-hand with privacy, the basic tenet of which is the right of the individual to possess their own personal data and not have anyone use it without their permission. Collaboration on security for the Future Internet does not need to address all of these challenges; rather it should focus on a particular area/topic where Member States are interested in doing joint R&D. One such example might be IPv6-based applications and services, which may have their own issues (like any new protocol), but does offer people a point of focus on which to collaborate.

3.3.5 Underlying/Enabling Technologies

We could usefully revisit the fundamentals of the Internet. This does not necessarily mean a total clean-slate approach, but it does call for a re-examination of primary Internet elements - including security, mobility, languages, etc. Suitable **testbeds** could be used, in this regard, to jointly investigate enablers (e.g. IPv6) and potential applications (e.g. social networks, home environments, health, new media, etc.). This has been picked up by a number of Member States and as previously described, we are likely to see increased Member State interaction with pan-European and other Member States testbeds.

Generating energy in a more efficient manner to power ICT demands is another area that holds high potential. Such **green ICT** would complement many of the smart energy initiatives currently in place, where energy distribution and consumption are monitored by autonomous management systems. This green ICT would require collaboration with a number of research disciplines, including materials science, etc.

3.3.6 Use Cases & Applications

A 'smarter', more dynamic Internet should be able to adopt and evolve as time progresses. Advances in **augmentation**, **reasoning** and the **semantic web** could lead to programmable architectures that would deliver services-on-the-fly to users. A dynamic approach to contacting applications areas directly (e.g. the oil industry) also offers potential, as do **education services** - where there is scope to develop digital library content and multimedia platforms.

In general, use cases and applications have different potential and support in different Member States. For example, tourism and health in Spain; bio-informatics and ICT-agriculture (sensor networks) in Latvia; energy, sustainability and climate change in Sweden. Harbours are a particularly interesting area since they cross many functional areas - land, sea, shipping, etc. - with only partial information available about each one. This topic could be considered for phase 3 of the PPP. An ecosystem like harbours requires many different sources and entities requiring expertise on security, cargo, etc.

3.3.7 *Pan-European*

There are a number of applications whose pan-European appeal renders them high potential. A number of specific Member State initiatives could be developed and aligned in a pan-European environment. These include: Germany's recently rolled out **e-identity management system**; Hungary's **National Technology Platform**, which allows its researchers to engage more easily with their peers in other Member States; Romania's **single sign-on facility**, giving access to their e-infrastructure. **Networked, open data** also has potential, but it must be in an interoperable format to advance current data-sharing efforts.

Europe's diversity presents a number of high potential areas. **Standards**, for example, could be developed and robustly tested across Europe's heterogeneous landscape. Since the Future Internet is a field where new services and applications will be developed, then the standardisation of services could be one relevant area to be specially promoted and encouraged through appropriate reference to the European standardisation work programme.

The **diverse expertise** available across different Member States' Science Agencies could also be taken advantage of, should the EU and/or other Member States require specific consultation. Furthermore, having a large number of Member States means there is potential to develop several small clusters of Member States who could work together on **pilot initiatives** and subsequently report on what issues (barriers, time-scales, objectives, mechanisms, etc.) might need to be resolved at EU level.

It is important to also consider the most appropriate approach. Some ideas emerging from ceFIMS discussions include:

- **Multidisciplinary vs. Technology-only Approach**

The **EU 2020 Digital Agenda**, with its commitment to reducing the digital divide, provides the background to the multidisciplinary aspect of this potential collaboration theme. Care must be taken, however, to balance technology-driven and user-driven developments, since too much consultation may lead to inertia and the loss of competitive position. Indeed, a number of Member States express primary interest in technical advances such as infrastructures, testbeds, routing, etc.

Additionally, involving users in a multidisciplinary approach can be difficult. To this end, a non-hierarchal, user-centric framework might be useful. Such a framework could give rise to a two-way interaction between providers and users, and would circumvent traditional approaches, where rigid domains restrict innovation. **Agile development**, for example, could be examined in this regard since it would iteratively take account of user needs.

Finally, a multidisciplinary approach should encompass **sociological culture barriers**, ethics, sector-specific applications and horizontal applications. These are rarely addressed in unison, however, and there is opportunity here (for SMEs) to develop business models to fill this gap.

As well as the traditional balance between technology and user-centric developments, a new **social dimension** is becoming more involved in the innovation process. It is recognised that the social evaluation of research provokes many contradictory perspectives, but success of any RTDI activity should require a check against the social benefits, social acceptance and social value.

- **Living Labs vs. Testbeds Approach**

More information is required on current testbed infrastructures available across Europe. The recently started INFINITY PPP project is addressing this gap in knowledge and it will present its findings in due course. There is a school of thought, however, that says we should actually move away from testbeds (in isolation) and consider the **Internet a living labs testbed** itself. This approach would help involve users and could test the market to identify barriers. Testbeds can again be restrictive or limited in this regard, and, therefore, a living labs approach might better support innovation and new businesses.

Parallels exist between this potential collaboration theme and the ‘multidisciplinary vs. technology-only’ theme. While a multidisciplinary approach is generally advised, there will be some issues that will only be resolved through technology. Likewise, while a living labs approach may be the ideal in many instances, issues will still arise where testbeds will provide the solutions.

Note however that Europe has a natural advantage with regard to any living labs approach, since it comprises a large number of heterogeneous users. The INIFINITY project is tracking the testbeds across Europe.

- **Traditional vs. Innovation-led Business Models**

Novel business models are required to fulfil pan-European potential and move it beyond the domain of Governments and public bodies, both at national and at pan-European level. There is a need to open up access to market funded initiatives and technology systems under development, in order to constructively advance through the pilot phase and on to the everyday usage. **Novel, flexible market- and services-oriented mechanisms** need to feed into novel business models. These business models should be able to integrate all parties and values of different nature involved in the networked transactions. They should also stimulate openness in the applications market for attracting investment.

For example, smart city projects typically involve a series of new services generated from the large-scale open networks developed. New business models should, thus, be structured in line with that novel structure of data and value transactions. This discussion is to be integrated as a critical component in the effort of taking the most benefit out from complementary and synergetic national Future Internet activities.

3.4 Societal & Economical Challenges

Finally, it is important not to lose sight of the importance of Societal and Economic challenges facing Europe. This is an important backdrop to all collaboration efforts. Europe currently faces many economic and social challenges. One of the ambitions of a new European Future Internet research/innovation network must be to confront the current problems and boost new possibilities and innovations in Future Internet. Possible societal and economic areas might include:

- “Smart Europe”: how to best use national forces (and even weaknesses) to complement each other? For example, how to distribute (national) resources, the expertise of citizens, etc.? How can “Smart Europe” operate next to, and use, the Smart City concept?
- Pervasive computing & Ambient Intelligence: how to incorporate different sources of media and data? How can crime prevention and social inclusion profit from this?
- Open Data & Privacy, Identity & Trust: How to combine an open European society with the notions of privacy, identity and trust? Legal and Governance issues will play an important role in the building of the Future Internet.

With the above in mind, consider:

- How best to use the overlaps, parallels and complementarities between ceFIMS/FIF and FuturICT²³?
- Will the main challenges in the future be legal, governance and social, as opposed to innovation in technology?
- Is building a network to fund Future Internet research/innovation enough? Would collaboration with a modelling and simulation lab have an advantage? (e.g. solutions and results could be disseminated and validated)

One possible method to advance collaboration would be to get a small group of people together, identify a focal research topic, and slowly build an overall vision from there. Once this group began to show signs of traction, others may then also be more inclined to get involved. For example, it may be easier for SMEs to engage with an ERA-NET+, rather than the standard FP7 instrument, since the former can be more specific in its topic and objectives. The SMEs would also be more familiar with the rules of national agencies (which they would encounter in an ERA-NET+), and they are more likely to see larger successes from relatively smaller efforts. However the current economic situation makes it even more difficult to unlock funds from Member States. However despite this, it is clear that the emerging concept of ad hoc “communities of interest” could be an important way forward whereby each country can identify and become involved in topics of national relevance and expertise.

²³ FET Flagship Pilot: www.futurict.eu

4 Recommendations & suggested Implementation plan

This chapter sets out a number of recommendations based upon the vision described and analysed in Chapter 3 and puts forward a suggested implementation plan and timeline (considered as a suggestion as it would still need to be discussed, ratified and agreed by the FIF and the European Commission). It should be noted that these recommendations and suggested implementation plan doesn't necessarily reflect what will be carried out by the ceFIMS-CONNECT project, which is due to start on 1st March 2014. In other words, some of the recommendation items below would fall outside of the scope of the negotiated ceFIMS-CONNECT project. However, they are mentioned here for completeness and where the ceFIMS-CONNECT project may contribute to the recommendations, this will also be highlighted to the best of our ability here without first discussing and agreeing with the Commission and the FIF members.

Recommendation 1. European Commission to present the Memorandum of Understanding (MoU) to the FIF, discuss, agree and signatures of commitment obtained from the Member States.	
Short description	One of the key outcomes of the ceFIMS project is the setting forth of a framework to support and progress collaboration among Member States and between Member States and the EU in the form of a draft proposal for a Memorandum of Understanding (MoU) delivered in D4.10. We feel the next logical step is for the European Commission to present the draft MoU to the FIF members for their agreement and signature. The signing of this MoU would be a major step forward and is crucial to drive the necessary framework for two way collaboration between Member States and Member States and Member States and EU.
Suggested implementation steps	<ol style="list-style-type: none">1. European Commission to present the MoU to the FIF members;2. Discussion and agreement on the MoU by the FIF;3. MoU signature by FIF Member States.
Suggested Timeline	<ol style="list-style-type: none">1. FIA Athens, March 2014, or better yet before this date if an additional FIF meeting is held before FIA 2014 as discussed at the ceFIMS-CONNECT negotiation meeting in Brussels.2. Discussion and agreement (March 2014 + one month)3. MoU signature (March 2014 + two months).

Recommendation 2. Determine, agree and make institutional changes to establish National FI chapters.	
Short description	A decision to be made on the institutional changes required to create and operate National FI Chapters.
Suggested implementation steps	<ol style="list-style-type: none"> 1. Identify exactly where the MSs are with regard to the setting up of National FI Chapters to see whether their existing framework(s) can be replicated/used in other MSs. 2. Providing support to MSs where Chapters are already up and running or in the process of being set up. 3. Agreement on what is required to develop an effective network of institutionalised National FI Chapters, taking account of the national contexts, that can reach out to a wide range of national and regional Future Internet stakeholders. 4. Actively recruit and engage a core team of “organising champions”²⁴ for the National FI chapters as a first step for setting up the National FI Chapter; 5. The terms of reference to be drawn up and agreed, detailing the roles and responsibilities of the Chapters to go beyond acting as ‘Ambassadors’ and instead cater for a wider responsibility with a central focus and longer term sustainability model. This should include the flexibility for the setting up of dynamic expert groups/work groups/advisory groups on an “as-needed” basis.
Suggested Timeline	<ol style="list-style-type: none"> 1. As ceFIMS-CONNECT starts on 01 March, 2014, this analysis could start after this; 2. Ongoing task from March 2014 onwards (WP3 of ceFIMS-Connect); 3. Could be aligned with MoU signature (March 2014 + two months); 4. Aim to be completed by May 2014 (resp. of FIF members); 5. Aim to be completed by May 2014 (depending on all of the above steps getting carried out in time, this could coincide with D3.1, ceFIMS-CONNECT Guidelines report, due Month 03, which is May 2014.)

²⁴ By “organising champion”, we mean key stakeholders with the correct level of influence, enthusiasm, knowledge, wide network, position, role and decision making powers to set up an National FI Chapter.

Recommendation 3. Set up National FI Chapters in MSs based on new model and Terms of Reference (ToR), including setting up mechanisms for effective knowledge and information sharing.	
Short description	Once the institutional model is decided, National FI chapters will be set up and replicated in each Member State (MS) based on the agreed model and terms of reference. This model and ToR should be sufficiently flexible to take account of the varying national contexts.
Suggested implementation steps	<ol style="list-style-type: none"> 1. Using the “organising champions” already engaged in R2, seek to identify and actively engage with key national Future Internet stakeholders including national actors, activities and programmes. Note: some of these are already in place and will be built upon. 2. Set up resourcing models and support from EU-FIF and/or EC and/or national bodies; 3. Establish, build up, and strengthen relationships to other national and international initiatives, e.g. NCPs, other National FI Chapters; 4. Closely liaise with existing pan-European groups and forums and recognising initiatives already launched in other regions of the world, work towards maintaining Europe’s position as the global Future Internet leader; 5. Create appropriate communication interfaces that can support enhanced information-sharing, identification of thematic areas of common interest in Future Internet and lay the foundation for enhanced collaboration; 6. Communicate the views of national and regional FI stakeholders to the European FIF and other relevant European-level forums, in order to secure greater synergies between Future Internet planning and investment at National and European levels and the sharing of best practices, solutions, applications and services. Develop and support the role of the national FIF Chapters to act as an effective two-way communication bridge between EU and national levels including acting as communication facilitators between the European-level FIF and the national FIF organisations. Act as a two-way communications channel between the European-level Future Internet ecosystem and national Future Internet stakeholders. 7. Provide inputs to the strategic direction of European-level R&D&I initiatives and programmes, based on analysis of national priorities in order to secure closer alignment between Member States and EU-level Future Internet infrastructural and research investments.

Suggested Timeline	<ol style="list-style-type: none"> 1. Identify and actively engage with key national Future Internet stakeholders including national actors, activities and programmes; <i>where stakeholders are not already identified at national level, initial stakeholders could be reported by September 2014 - could form part of D2.3 ceFIMS-CONNECT FIF Work Plan & reports, due Month 06, which is Sept. 2014;</i> 2. Set up resourcing models and support from EU-FIF and/or EC and/or national bodies: <i>Very difficult to pinpoint a date for this as dependent on FIF MSs procedures; A status could be reported in Sept. 2014 in D2.3.</i> 3. Establish, build up, and strengthen relationships to other national and international initiatives, e.g. NCPs, other National FI Chapters; <i>(same issue as no. 2 - status can be reported in Sept. 2014 in D2.3);</i> 4. Closely liaise with existing pan-European groups and forums and recognising initiatives already launched in other regions of the world, work towards maintaining Europe's position as the global Future Internet leader; <i>(same issue as no. 2 - status can be reported in Sept. 2014 in D2.3);</i> 5. Create appropriate communication interfaces that can support enhanced information-sharing, identification of thematic areas of common interest in Future Internet and lay the foundation for enhanced collaboration; <i>This can be set up for Sept. 2014 if all MSs agree.</i> 6. Communicate the views of national and regional FI stakeholders to the European FIF and other relevant European-level forums, in order to secure greater synergies between Future Internet planning and investment at National and European levels and the sharing of best practices, solutions, applications and services. develop and support the role of the national FIF Chapters to act as an effective two-way communication bridge between EU and national levels including acting as communication facilitators between the European-level FIF and the national FIF organisations. Act as a two-way communications channel between the European-level Future Internet ecosystem and national Future Internet stakeholders. <i>On-going activity probably starting in Sept. 2014.</i> 7. Provide inputs to the strategic direction of European-level R&D&I initiatives and programmes, based on analysis of national priorities in order to secure closer alignment between Member States and EU-level Future Internet infrastructural and research investments. <i>On-going activity probably starting in Sept. 2014.</i>
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Recommendation 4. Decision on collaboration mechanism(s).	
Short description	A decision needs to be taken on the appropriate collaboration mechanism(s) for Member State collaboration. It is understood this is not a straightforward action and will take considerable time to organise and implement. In addition to looking at the ERA-NET+ mechanism, a number of other potential mechanisms were discussed during the workshops of ceFIMS and there needs to be a thought and decision process in place to crystallise on the most suitable mechanism(s), or set of mechanisms for the effective realisation of increased Member State and Member State - EU collaboration.
Suggested implementation steps	<ol style="list-style-type: none"> 1. Chapters should identify interested parties, build a community and identify appropriate collaboration models and mechanisms²⁵, including novel and 'soft' ways of sharing value, the development of communities of interest and pilot initiatives. 2. Support national FI chapters in taking the bottom up "Community of interest approach" and/or other soft forms of collaboration that could lead to more longer term structures, as outlined in chapter 3; 3. Further consultation with the European Commission, FIF members and other institutions/agencies of relevance regarding other more formal options for collaboration mechanisms, e.g. ERA-NET+, FI-PPP, EIT-KIC, and others.
Suggested Timeline	<ol style="list-style-type: none"> 1. Identification of the parties should be occurring around September 2014 when enough chapters are up and running. 2. Support for the initial collaborations would be taking place towards the end of 2014 and onwards. The ceFIMS-CONNECT project can support these activities within WP3 (Support to Member State and Associate State Future Internet activities). 3. This can be done in parallel with numbers 1 and 2 during Sept. 2014 - March 2015 and can feed into D2.4 FIF Work plans & reports (M12) and/or D3.1/3.2 Interim reports of the National FI Chapters (M15).

²⁵ Possible collaboration mechanism include but are not limited to, ERA-NET+, Joint Programming, EIT/KIC, ad hoc' cooperation between national innovation agencies and communities of interest, ...

Recommendation 5. Decision on collaboration topic(s).	
Short description	The National FI Chapters should decide on the most suitable collaboration topics for the building of research and innovation projects related to Future Internet (FI). These topics will need to be balanced between technical and societal elements. Within ceFIMS, a number of potential topics have been identified already from survey questionnaires and specifically during FIA Aalborg in May 2012 (see deliverable D4.6 and also summarised in chapter 3.3 of this report). This work will need to be reviewed and taken forward in the National FI Chapter structures, and selected for the building of real projects.
Suggested implementation steps	<ol style="list-style-type: none"> 1. Setting up of national expert/working/advisory groups to review the ranking and prioritising of research topics for national collaboration projects; 2. National FI Chapters should share knowledge, experience and best practices on Future Internet initiatives, experimental and test infrastructures and national Future Internet strategies. 3. National FI Chapters should actively contribute information to European-level databases and data-gathering initiatives (such as ceFIMS database) on national initiatives, e.g. national FI projects, investment programmes, research agencies / councils that are engaged in supporting Future Internet research, and national strategies identifying national research priorities in the area of the Future Internet. 4. National FI Chapters should explore areas of common research interest (including technological and end-use applications) based on national and European-level thematic priorities and challenges²⁶. 5. Chapters should engage in the process of analysing this information in order to identify potential synergies, and identifying areas for bi-lateral and multi-lateral collaboration.
Suggested Timeline	<ol style="list-style-type: none"> 1. This step involves setting up of national expert/working groups to review and take forward the earlier work on prioritising and ranking topics can start in parallel with other activities from the previous recommendations, probably as early as June 2014. Note: while ceFIMS-CONNECT could provide some coordination support to the chapters, funding for this aspect was removed from the re-negotiated budget of ceFIMS-CONNECT so it would have to be funded by the Member States FIF and/or other relevant projects with available and budgets to provide funding for organising and resourcing these expert/working groups. 2. - 5. Timelines for the remaining steps of this recommendation would depend on when the National FI chapters are fully up and running and are difficult to pinpoint at this point in time.

²⁶ Also taking account of potential areas identified through the work of FIF and ceFIMS.

Recommendation 6. Encouragement of the MSs and EU mind-sets towards collaboration dealing with both societal and economic challenges for the betterment of both the MSs and the EU as a whole.	
Short description	National FI Chapters should clearly identify and elaborate the steps on which they will focus specifically on the societal and economic challenges facing both their Member States and also Europe as a whole. This is critically important because it will concretely identify common areas and opportunities for collaboration in which they can work collectively in order to confront the societal and economic ailments in both their own MS's society and the EU as a whole. This would enable the boosting of new possibilities and innovations via the Future Internet. This recommendation would also help in the identification of the necessary mechanisms for this - e.g. collaboration cohorts, ERA-NET+, EIT ICT Labs (KIC), others.
Suggested implementation steps	<ol style="list-style-type: none"> 1. Chapters should support greater engagement of national industry (paying special attention to SMEs) in European FI initiatives such as the FI-PPP and Horizon 2020; 2. Chapters should support increased awareness of the FI-PPP process and other European-level initiatives²⁷ among national policy-makers to ensure greater awareness of these initiatives in setting national investment priorities; 3. Chapters should consider how best to optimise the FI-PPP model in the innovation system of the Member States.
Suggested Timeline	These are longer term strategy recommendations and it is difficult to pinpoint a time frame for these steps as the National FI chapters would have to be up and running. An initial estimate could be coinciding with Month 15 deliverables of ceFIMS-CONNECT, which would be around June, 2015.

²⁷ Including FET Flagships (FuturICT), EIT/KIC, Horizon2020 and Structural Funds.

Recommendation 7. As a longer term strategy, the FIF and newly built National FI chapters should begin to look further abroad outside of the EU and start building strategic international cooperation models with Future Internet initiatives throughout the globe.	
Short description	<p>There are a number of initiatives similar to that of the EU Future Internet Forum in other regions in the world, particularly in North America and Asia. Once at a mature level, it would be very beneficial for the FIF and National FI chapters to collaborate with initiatives outside of Europe to take a more leading position in coordinating the global effort to define and develop the Future Internet and synchronise European efforts in Research and Innovation in this area. For the same reasons that it makes sense to coordinate the Future Internet activities and initiatives across Europe, a multi-lateral co-ordination mechanism worldwide would also reduce duplication and accelerate progress on a global scale. A number of these initiatives are already identified in section 2.2.1 in this report.</p>
Suggested implementation steps	<ol style="list-style-type: none"> 1. Chapters should identify the most relevant FI initiatives they would have significant mutual benefit in cooperation with and learn about their modes of operation, how they currently organise, what are their mechanisms for operating, and identify their current and future activities; 2. Chapters should make contacts with these initiatives in a coordinated way; 3. The majority of the cooperation models to date have been based on a more bi-lateral (or tactical) basis. As a longer term strategy, a multi-lateral (or strategic) cooperation model should be developed with the EU- and MS- based Future Internet activities at the core. 4. Chapters should identify bi-lateral activities already underway in countries in relation to ICT/Future Internet activities that could be used as a model that could be customised into a strategic multi-lateral cooperation model²⁸.
Suggested Timeline	<p>These activities are outside the scope of ceFIMS-CONNECT and it is a longer term strategy recommendation and, therefore, it is difficult to pinpoint a time frame for these implementation steps as the National FI chapters would have to be up and running first.</p> <p>An initial estimate could be coinciding with Months 20-30 of the ceFIMS-CONNECT project, unless something could arise within H2020 sooner than that.</p> <p>However, we felt it was important to mention this recommendation as it is raised in the roadmap deliverable in chapter 2 as a key activity to take this outward looking, global perspective view.</p>

²⁸ An example would be the Science Foundation Ireland International Strategic Cooperation (SFI ISCA) programme which provides mobility funds for bi-lateral cooperation between Ireland researchers and researchers in Brazil, India, China, & Japan. <http://www.sfi.ie/funding/funding-calls/closed-calls/sfi-international-strategic-cooperation-award-2013.html>

5 Conclusions

This road-mapping report has outlined the major issues to be considered for future coordination in the area of the Future Internet and has proposed a number of clear cut recommendations with a suggested implementation plan and timeline. The document has set out the current thinking on a wide range of relevant aspects. There are a number of actions which are strongly supported by Member States (development of a European network of National FIF Chapters: the organisation of national workshops aimed at bringing together key national FI stakeholders: continuation of data-gathering and data-sharing activities).

There are other more complex topics that require further discussion (identification of suitable topics for collaboration: appropriate collaboration mechanisms: how Member State collaboration fits with existing European-level initiatives). Progress has been made on clarifying some of the issues around these during the lifetime of the project. Progress has been made on engaging Member States on these issues and towards finding mechanisms that could support collaboration and add value. Discussions on these issues needs to continue, and will be continued within the follow up ceFIMS-CONNECT project, which starts on 1st March 2014. It is hoped that this document (when taken together with other project deliverables) has served to shine some light on the relevant issues and has contributed to the debate by looking in some detail at these issues from a multi-faceted perspective.

These are complex heavy topics that require in-depth discussion. Member States (and the national FI communities) need adequate time for reflection and discussion. It is hoped that the national workshops referred to here and in the FIF discussions, will serve to bring together the views of the national-level stakeholders and secure their buy-in to this process.

It appears from current discussions that the best way of securing buy-in and ensuring worthwhile outcomes is to build on the emerging idea of ‘collaboration cohorts’ or ‘communities of interest’. The early signs of these have already begun to emerge during the ceFIMS project. Member States with similar research needs are beginning to talk. The scope of possible collaboration topics is being narrowed and active plans are being made. The methodology (focused workshops, data exchange, bi-lateral dialogue) which led to these tentative discussions, can be reproduced to deliver additional communities of interest. This ‘start small’, focused approach on a given theme offers one of the most promising ways forward. This ‘light’ collaboration over time, has the potential to lead to more ‘heavy’ coordination (opening up of national research programmes: thematic alignment; Joint Programming). It is also imperative as this process evolves to remain focused on optimising synergies between Member State collaborations and large European initiatives. The FI-PPP offers enormous potential in this regard, and should as it progresses through its phases, maintain close contacts with Member State in terms of their infrastructural priorities and national FI investment strategies.

A recurring theme in putting together this roadmap, is how to minimise duplication in research and infrastructure investments and how best to provide the opportunity to support greater strategic impact through the development of mechanisms for greater information-sharing and collaboration between these instruments in support of a more integrated approach. At a national and regional level, each Member

State supports a complex array of funding programmes supporting research and innovation at multiple levels. The national funding structures vary from Member State to Member State and in the main, reflect national economic and political structures. Our analysis in ceFIMS has suggested that the approach to funding academic research appears to be converging across Europe particularly since the establishment of the Europe Research Council and the recognition of the importance of the European Research Council as a benchmark for research excellence.

Analysis of national investment strategies indicates that the Future Internet is an area of strategic importance in all Member States and receives a large percentage of the total investment funds available for academic research, industry research and innovation and strategic-oriented collaborative research between industry and academia. As a community of Member States, attention now needs to turn to how investment strategies in infrastructures can promote the transfer of solutions in order to minimise the duplication in investments and optimise the uptake of research results. Will this be based on the promotion of standards and open source or should government funding agencies focus their investments on supporting solutions that are portable. How can this be achieved? - in particular how can SMEs be incentivised to look at service portability and to overcome constraints to portability where technical solutions are in many cases bespoke solutions that are not portable without major additional development requirements. Here we should cast the net wide and consider for example the programmes of DG-Regio, established to support regional economic development and innovation across Europe. European Development Fund is an instrument for regional infrastructure development: Marie Curie actions for Industry to support the flow of people and ideas between industry and academia on a European-wide basis: The European Institute of Innovation and Technology and the associated ICT labs can reinforce European innovation capacity particularly through the translation of research to products and services.

Data-sharing will continue to play an important part in this process of increased collaboration and alignment. The data-gathering and information-sharing initiated in projects like ceFIMS need to be further developed and 'institutionalised' with appropriate levels of support with a view to arriving at a fully-integrated information base on all Future Internet support initiatives irrespective of their origin and/or funding instruments. To this end, the Future Internet Forum has played an important role in increasing cooperation levels among Member States and the establishment of national FIF Chapters would undoubtedly increase the involvement of Member State stakeholders in FI activities in Horizon 2020 and strengthen pan-European cooperation in the field.

Finally, this road-mapping report sets out seven key recommendations based upon the analysis and vision gained within the ceFIMS project. In addition, a suggested implementation plan and timeline is presented, including highlighting where ceFIMS-CONNECT, which is due to start on 1st March 2014, can potentially contribute towards the fulfilment of many of the implementation steps of the recommendations.

6 Appendix 1

Austria

Research Agencies

[The Austrian Science Fund \(FWF\)](#) [external link]

[The Austrian Research Promotion Agency \(FFG\)](#) [external link]

[The Austrian Council for Research and Technology Development](#) [external link]

Research Strategies and Priority Areas

[KT 2020](#) (Link to full document and executive summary) [external link]

[EU Commission Review of FP7 funding](#) (see bullet point 7) [external link]

Estimated Public Funding of ICT Research 2013

€300 - €350 million.

Best Estimate: €320 million

Organisations

[IT-NET Austria](#) [external link]

[Austrian Federal Ministry of Transport Innovation, and Technology](#) [external link]

[Future Internet Austria](#) [external link]

Belgium

Research Agencies

[Fonds de la Recherche Scientifique](#) [external link]

[Fonds Wetenschappelijk Onderzoek](#) [external link]

[Het federaal wetenschapsbeleid](#) [external link]

[Het agentschap voor Innovatie door Wetenschap en Technologie](#) [external link]

Research Strategies and Priority Areas

[Flanders: Policy Note 2009-2014; Scientific Research and Innovation.](#) [external link]

[Wallonia: The Marshall Plan 2 \(2009-2014\)](#) [external link]

[Wallonia: EU Commission Review](#) (see p.128, point 8) [external link]

Estimated Public Funding of ICT Research 2013

€210 - €270 million.

Organisations

[iMinds](#) [external link]

[FITCE Belgium](#) [external link]

Czech Republic

RESEARCH AGENCIES

[The Czech Science Foundation](#) [external link]

[Academy of Sciences of the Czech Republic](#) [external link]

[Research, Development and Innovation Council](#) [external link]

Research Strategies and Priority Areas

[The National Research, Development and Innovation Policy of the Czech Republic \(2009-2015\)](#) (Link to PDF on bottom of page. See “Information Society” section) [external link]

[National priorities of oriented research, experimental development and innovations](#) (Link to PDF on bottom of page.) [external link]

[National Innovation Strategy](#) (Link to PDF on bottom of page) [external link]

[EU Commission Review of FP7 funding](#) (See 8th bullet point on p.1) [external link]

Estimated Public Funding of ICT Research 2013

Best Estimate: circa €130 million

ORGANISATIONS

[CESNET](#) [external link]

[University of Wollongong’s Information and Communication Technology \(ICT\) Research Institute](#) [external link]

Denmark

RESEARCH AGENCIES

[Danish Ministry for Science, Innovation and Higher Education](#) [external link]

[Danish Council for Independent Research](#) [external link]

[Danish National Research Foundation](#) [external link]

[Danish Council for Strategic research](#) [external link]

Research Strategies and Priority Areas

[Research 2020](#). (See “Digital Opportunities and Solutions” section; p.51f) [external link]

[EU Commission Review of FP7 Funding](#) (See 8th point on p.1) [external link]

Estimated Public Funding of ICT Research 2013

€210 - €240 million.

ORGANISATIONS

[IT University of Copenhagen](#) [external link]

[Department of IT Management, Copenhagen Business School](#) [external link]

Estonia

RESEARCH AGENCIES

[Estonian Research Council](#) [external link]

[Estonian Academy of Sciences](#) [external link]

[Estonian Research Portal](#) [external link]

Research Strategies and Priority Areas

[Estonia 2020: National Reform Programme](#) (See Section 9, p.21f) [external link]

[Estonia 2020: Action Plan \(2011-2015\)](#) (See Section 9) [external link]

[Estonian National Strategic Reference Framework 2007-2013](#) (See Section 2.8 “Information Society”; p.37)[external link]

[Estonian Research, Development and Innovation Strategy 2007-2013](#)[external link]

[EU Commission policy brief](#)[external link]

Estimated Public Funding of ICT Research 2013

€6 - €8 million.

ORGANISATIONS

[Estonian Excellence in Computer Science](#) [external link]

[The Institute of Cybernetics \(Talinn University of Technology\)](#) [external link]

[Cybernetica](#) [external link]

[e-Governance Academy](#) [external link]

[The Faculty of Information Technology \(Talinn University of Technology\)](#) [external link]

[The Estonian IT College](#) [external link]

[The Estonian Association of Information Technology and Telecommunications](#) [external link]

[The University of Tartu’s Institute of Computer Science](#) [external link]

[The Centre for Integrated Electronic Systems and Biomedical Engineering](#) [external link]

Finland

RESEARCH AGENCIES

[The Academy of Finland \(AKA\)](#) [external link]

[The Finnish Funding Agency for Technology and Innovation \(TEKES\)](#) [external link]

Research Strategies and Priority Areas

[Finnish Research Roadmap](#) [external link]

[ICT Research Programme Strategy](#) [external link]

Estimated Public Funding of ICT Research 2013

€170 - €190 million

ORGANISATIONS

[Tivit Programmes](#) [external link]

[VTT Technical Research Centre of Finland](#) [external link]

[Research Universities Finland](#)

[Finnish Internet Forum](#) [external link]

[The Finnish Centre of Excellence in Computational Inference Research](#) (COIN [external link])

[The Finnish Centre of Excellence in Generic Intelligent Machines Research](#) [external link]

[Centre of Excellence in Smart Radios and Wireless Research](#) [external link]

[Centre for Wireless Communications](#) [external link]

[The Computational Science Research Programme](#) [external link]

[The IT Centre for Science](#) [external link]

[The IT Centre for Science](#)[external link]

France

RESEARCH AGENCIES

[National research Agency \(ANR\)](#) [external link]

[National Centre of Scientific Research \(CNRS\)](#) [external link]

[National Institute for Research in Computer Science and Control \(INRIA\)](#) [external link]

Research Strategies and Priority Areas

[Ministry of Higher Education and Research Roadmap \(2012-2020\).](#) (See “Digital Sciences and Mathematics” section; p.16f) [external link]

[National Research Agency \(ANR\) Strategy \(2011-2013\).](#) (See “Digital Technologies” section 6.5; p.20f) [external link]

[EU Commission Review of FP7 funding](#) (See 4th bullet point on p.1) [external link]

[CNRS Institute for Information Sciences and Technologies; Research Priorities.](#) (See section “Strategic Priorities”)[external link]

[INRIA Strategic Plan \(2013-2017\)](#) (See p.29f for research strategy and priority areas) [external link]

Estimated Public Funding of ICT Research 2013

€275 - €550 million

ORGANISATIONS

[Cap Digital](#) [external link]

[Thales](#) [external link]

[Information and Communication Sciences and Technologies Department](#) [external link]

[Institute for Information Sciences and Technologies](#) [external link]

Germany

RESEARCH AGENCIES

[Federal Ministry of Education and Research](#) [external link]

[German Research Community](#) [external link]

[Fraunhofer](#) [external link]

Research Strategies and Priority Areas

[High-Tech Strategy 2020 for Germany](#) (See “Communication” section; p.18f) [external link]

[ICT 2020](#) [external link]

Estimated Public Funding of ICT Research 2013

€2.1 - €2.9 billion.

ORGANISATIONS

[Akt Infosys](#) [external link]

[Fraunhofer ESK](#) [external link]

[Fraunhofer FIT](#) [external link]

[Fraunhofer FOKUS](#) [external link]

[Fraunhofer IAIS](#) [external link]

[Fraunhofer ISST](#) [external link]

[Fraunhofer SIT](#) [external link]

[German Ministry of Education and Research](#) [external link]

[Hamburg University of Applied Sciences](#) [external link]

[Heinrich Hertz Institute](#) [external link]

[Helmholtz Community](#) [external link]

[Leibniz Association](#) [external link]

[Luebeck University of Applied Sciences](#) [external link]

[MATHEON \(DFG research Centre\)](#) [external link]

[Max Planck Society](#) [external link]

[SOAMED](#) [external link]

[Software Campus](#) [external link]

[T-Systems](#) [external link]

[Tixel](#) [external link]

Greece

RESEARCH AGENCIES

[The National Hellenic Research Foundation](#) [external link]

[Foundation for Research and Technology Hellas](#) [external link]

[Centre for Research and Technology Hellas](#) [external link]

Research Strategies and Priority Areas

[Strategic Development Plan for Research, Technology and Innovation Under the 2007-13 NSRF Framework \(2006-2013\).](#) [external link]

[Greek Digital Strategy \(2006-2013\).](#) [external link]

[Greek Digital Strategy \(2006-2013\).](#) [external link]

[Greek Ministry of Finance's evaluation of Digital Strategy](#) [external link]

Estimated Public Funding of ICT Research 2013

There are no available data for Greece's public research and development funding since 2007. Research funding was 0.6% of GDP before the economic crisis. The austerity measures inflicted on Greece since the crisis have probably reduced available funding to a negligible level.

ORGANISATIONS

[The Athena Research and Innovation Center in Information, Communication and Knowledge Technologies](#)[external link]

[Institute of Computer Science](#) [external link]

[The Information Technologies Institute](#) [external link]

[The Institute of Informatics and Telecommunications](#) [external link]

Hungary

RESEARCH AGENCIES

[The National Innovation Office](#) [external link]

[The Hungarian Scientific Research Fund](#) [external link]

[National Development Agency](#) [external link]

[Hungarian Academy of Sciences](#) [external link]

Research Strategies and Priority Areas

[Government's science, technology and innovation strategy](#) (2007-20013) [external link]

[Future Internet Strategy and Programme](#) (In Hungarian) [external link]

[The National Innovation Office: ICT Action Plans and Strategies](#) (Several documents available on webpage)[external link]

Estimated Public Funding of ICT Research 2013

€40 - €50 million.

ORGANISATIONS

[FuturICT.hu](#) [external link]

[ICT Association of Hungary](#) [external link]

[ICTS Hungary](#) [external link]

[Institute for Computer Science and Control](#) [external link]

Ireland

RESEARCH AGENCIES

[Science Foundation Ireland](#) [external link]

[Irish Research Council](#) [external link]

[Enterprise Ireland](#) [external link]

[IDA Ireland](#) [external link]

[Health Research Board](#) [external link]

Research Strategies and Priority Areas

[Report of the Research Prioritisation Steering Group](#) (See priority areas A, B, C, D, K; p.45f) [external link]

[Strategy for Science, Technology and Innovation](#) (2006-13) [external link]

[Science Foundation Ireland Strategic Plan](#) (Links to Agenda 2020 and Annual Plan 2013 on webpage) [external link]

[Science, Technology and innovation: Delivering the Smart Economy](#) [external link]

Estimated Public Funding of ICT Research 2013

€35 - €70 million

ORGANISATIONS

[DERI](#) [external link]

[The Innovation value Institute](#) [external link]

[The Enterprise Ireland Technology Gateway Programme](#) [external link]

[LERO](#) [external link]

[Tyndall](#) [external link]

Universities: Dublin (UCD), Limerick (UL), Maynooth (NUIM), Trinity (TCD), Waterford IT (WIT), Cork IT (CIT)

Israel

RESEARCH AGENCIES

[ISERD](#) [external link]

[Israel Science Foundation](#) [external link]

[Technological Incubators Fund](#) [external link]

[The Magnet Fund](#) [external link]

[The Office of the Chief Scientist Fund](#) [external link]

Research Strategies and Priority Areas

[ISERD: objectives for Israeli](#) ICT research in 2013 [external link]

[Israel 2028](#) (Links to various, relevant documents) [external link]

Estimated Public Funding of ICT Research 2013

Best Estimate: circa €150 million

ORGANISATIONS

[The Israel Internet Association](#) [external link]

[YISSUM](#) [external link]

Italy

RESEARCH AGENCIES

[The National Research Council](#) [external link]

Research Strategies and Priority Areas

[National Research Programme](#) (2011-2013) (See p.60; p.89f (particularly p.90); p.148f.) [external link]

[Italian Digital Agenda](#) (initiated 2012) [external link]

Estimated Public Funding of ICT Research 2013

€550 - €600 million.

ORGANISATIONS

[Institute of Electronics and Information Engineering and Telecommunications](#) [external link]

[Institute of Informatic and Telematics](#) [external link]

[Institute of applied mathematics and computer science](#) [external link]

[Create-Net](#) [external link]

[Internet Services Technology Centre](#) [external link]

[Italian IPv6 Taskforce](#) [external link]

Latvia

RESEARCH AGENCIES

[Latvian Academy of Sciences](#) [external link]

[Latvian Council of Science](#) [external link]

[Ministry of Education and Science of the Republic of Latvia](#) [external link]

Research Strategies and Priority Areas

[National Strategic Research Framework](#) (See p.11; p.18f) [external link]

[National Development Plan 2014-2020](#) [external link]

Science in Latvia;

[National Research Programmes](#) [external link]

[Operational Programme: Infrastructures and Services](#) (See p172f “Infrastructures and Services”) [external link]

Estimated Public Funding of ICT Research 2013

€0.75 - €1 million.

ORGANISATIONS

[Baltic ICT Programme](#) [external link]

[Latvian Grid Computing Network](#) [external link]

[LAIFE](#) [external link]

Lithuania

RESEARCH AGENCIES

[Research Council of Lithuania](#) [external link]

[Agency for Science, Innovation and Technology](#) [external link]

[Lithuanian Business Support Agency](#) [external link]

[Ministry of Education and Science](#) [external link]

Research Strategies and Priority Areas

[High-technology Development Programme 2011-2013](#) (See Section VII: “Information Technology”) [external link]

[Lithuania 2030](#) (See Section VII: “Information Technology”) [external link]

[Lithuanian Innovation Strategy 2010-2020](#) (See Section VII: “Information Technology”) [external link]

Estimated Public Funding of ICT Research 2013

€500,000 - €600,000

ORGANISATIONS

[Lithuanian Innovation Centre](#)[external link]

[Visoriai IT Park](#)[external link]

[Kaunas University of Technology, Faculty of Informatics](#)[external link]

[Vilnius University, Faculty of Mathematics and Informatics](#) [external link]

[Vilnius Gediminas Technical University, Faculty of Fundamental Sciences](#) [external link]

[Vilnius University, Institute of Mathematics and Informatics](#) [external link]

Luxembourg

RESEARCH AGENCIES

[Fonds National de la Recherche Luxembourg](#) [external link]

[Henri Tudor Centre](#) [external link]

[Gabriel Lippman Centre](#) [external link]

Research Strategies and Priority Areas

[National plan for smart, sustainable and inclusive growth Luxembourg 2020](#) [external link]

[FNR: CORE Thematic Funding Programme](#) (FI funding appears under the “Innovation on Services” theme)[external link]

[FNR: CORE 2012 Programme Description](#) (see in particular 4.1.3; 4.1.4.a; 4.1.5.b) [external link]

Estimated Public Funding of ICT Research 2013

€35 - €40 million

ORGANISATIONS

[Research In System and Network Security](#) [external link]

[Research In Information and Security Management](#) [external link]

[Validation and verification Laboratory](#) [external link]

[IPv6 Council](#) [external link]

[Luxembourg ICT Cluster](#) [external link]

Malta

RESEARCH AGENCIES

[The Malta Council for Science & Technology](#) [external link]

Research Strategies and Priority Areas

[Report of the Research Prioritisation Steering Group \(Includes 5 “Strategic Priorities” for ICT\)](#) [external link]

[Draft National Strategic Research & Innovation Plan 2011-2020 \(ICT is one of 4 priority areas. See p.9 for Dedicated Research and Innovation strategies \)](#) [external link]

Estimated Public Funding of ICT Research 2013

Less than €250,000

ORGANISATIONS

[Malta Information Technology Agency](#) [external link]

[Department of Intelligent Computer Systems](#) [external link]

The Netherlands

RESEARCH AGENCIES

[Nederlandse Organisatie voor Wetenschappelijk Onderzoek](#) [external link]

[Technology Foundation STW](#) [external link]

[NL Agency](#) [external link]

[The Netherlands Organisation for Applied Scientific Research](#) [external link]

Research Strategies and Priority Areas

[“To The Top” \[Netherlands enterprise policy incorporating Research and Innovation strategies\]](#) (See priority areas A, B, C, D, K; p.45f) [external link]

[NWO Strategy 2011-2014](#) (No specific ICT Research Strategy) [external link]

[TNO Strategic Plan 2010-2014](#) (Includes “Information Society” as one of its themes. See p.93f) [external link]

Estimated Public Funding of ICT Research 2013

€290 - €340 million

ORGANISATIONS

[TNO: Information Society](#) [external link]

[Centrum Wiskunde and Informatica](#) [external link]

[NWO Cyber Security Programme](#) [external link]

[Smart Energy Systems programme](#) [external link]

[IIPCreate](#) [external link]

[IIPS](#) [external link]

[IIPVV](#) [external link]

[IIPSN](#) [external link]

[IIP Durzamme ICT](#) [external link]

[Domotica](#) [external link]

[Centre for Telematics and Information Technology](#) [external link]

Norway

RESEARCH AGENCIES

[The Research Council of Norway](#) [external link]

[Nordic Institute for Studies in Innovation, Research and Education](#) [external link]

Research Strategies and Priority Areas

[Research Council of Norway: IoT and Future Internet Research Strategy](#) [external link]

[Digital Agenda for Norway](#) [external link]

[Norwegian Government ICT Policy](#) [external link]

[VERDIKT \(ICT Programme of the Norwegian Research Council\) Strategy 2005-2014](#) [external link]

Estimated Public Funding of ICT Research 2013

€200 - €300 million

ORGANISATIONS

[VERDIKT](#) [external link]

[Internet of Things Value Creation Network](#) [external link]

[ICT Norway](#) [external link]

[Telenor](#) [external link]

Poland

RESEARCH AGENCIES

[Ministry of Science and Higher Education](#) [external link]

[National Centre for Research and Development](#) [external link]

[National Centre for Science](#) [external link]

[Polish Agency For Enterprise Development](#) [external link]

Research Strategies and Priority Areas

[Applied Research Programme \(2012-2017\) \[text in Polish\]](#) (See Point 3 of programme: Information technology, electronics, automation and robotics) [external link]

[The Strategy for the Development of the Information Society in Poland \(2008-2013\)](#)[external link]

[National Research Programme \[text in Polish\]](#) (See p.13f) [external link]

[National foresight Programme \(Poland 2020\)](#) (See p.1: Information and Communication Technology) [external link]

Estimated Public Funding of ICT Research 2013

€50 - €65 million

ORGANISATIONS

[PL Grid Plus](#) [external link]

[PIONIER](#) [external link]

[Systems Research Institute](#) [external link]

Portugal

RESEARCH AGENCIES

[Innovation Agency](#) [external link]

[Foundation for Science and technology](#) [external link]

Research Strategies and Priority Areas

[Cohesion policy Supporting Research and Innovation](#) [external link]

Estimated Public Funding of ICT Research 2013

€160 - €190 million

ORGANISATIONS

[Instituto de Telecomunicações](#) [external link]

[Portugal Telecom Inovação](#) [external link]

[Grid Computing National Initiative](#) [external link]

[INESC-Lisboa](#) [external link]

[INESC-Porto](#) [external link]

[INESC-Porto](#) [external link]

[Faculdade de Engenharia da Universidade do Porto](#) [external link]

[Faculdade de Ciências da Universidade do Porto](#) [external link]

[UNIVOVA](#) [external link]

Romania

RESEARCH AGENCIES

[National Authority for Scientific Research](#) [external link]

[Romanian Office for Science and Technology](#) [external link]

[National Research Council](#) [external link]

Research Strategies and Priority Areas

[The National Plan for Research Development and Innovation](#) (See p20f: “Communications and Information Technologies”) [external link]

[National Research, Development and Innovation Strategy](#) (See p20f: “Communications and Information Technologies”) [external link]

Estimated Public Funding of ICT Research 2013

€25 - €30 million

ORGANISATIONS

[Faculty of Electronics, Telecommunications and Information Technology, Polytechnic University of Bucharest](#)[external link]

[Faculty of Electronics, Telecommunications and Information Technology, Technical University of Cluj-Napoca](#)[external link]

[ICT Group Romania](#) [external link]

Spain

RESEARCH AGENCIES

[The Spanish National Research Council](#) [external link]

[Ministry of Industry, Energy and Tourism](#) [external link]

[Ministry of Economy and Competitiveness](#) [external link]

[Centro Desarrollo Tecnológico e Industrial](#) [external link]

Research Strategies and Priority Areas

[Digital Agenda for Spain](#) [external link]

[National Research and Development Plan](#) [external link]

Estimated Public Funding of ICT Research 2013

€500 - €700 million

ORGANISATIONS

[Red.es](#) [external link]

[ENISA](#) [external link]

[INETSI](#) [external link]

[Telecommunications and Information Society](#) [external link]

[Polytechnic University of Madrid](#) [external link]

[University of Murcia](#) [external link]

[Public University of Navarra](#) [external link]

[Polytechnic University of Catalonia](#) [external link]

Sweden

RESEARCH AGENCIES

[VINNOVA](#) [external link]

[The Swedish Research Council](#) [external link]

[Swedish Foundation for Strategic Research](#) [external link]

[The Royal Swedish Academy of Sciences](#) [external link]

Research Strategies and Priority Areas

[Swedish Foundation for Strategic Research: Research Strategy 2012-2017](#) (See section 5.4 “information, communication and systems technology”) [external link]

[Swedish ICT Annual Report 2012](#) [external link]

Estimated Public Funding of ICT Research 2013

€400 - €500 million

ORGANISATIONS

[Sunet](#) [external link]

[Swedish National Infrastructure for Computing](#) [external link]

[Vinnova ICT programmes](#) [external link]

[Swedish ICT](#) [external link]; incorporating:

- [ACREO](#) [external link]
- [SICS](#) [external link]
- [Interactive Institute](#) [external link]
- [VIKTORIA](#) [external link]

Switzerland

RESEARCH AGENCIES

[Swiss National Science Foundation](#) [external link]

[Swiss Academy of Arts and Sciences](#) [external link]

Research Strategies and Priority Areas

[The Federal Council's strategy for the Swiss Information Society](#) [external link]

[National Centres of Competence in Research Guide 2013](#) [external link]

[Switzerland's International Strategy for education, research and innovation](#) [external link]

[Swiss National Science Foundation Multi-year programme 2012-2016](#) [external link]

[Service Agreement 2013-2016 between the Swiss Government and the SNSF](#) [external link]

[Annual Report of the SNSF 2012](#) [external link]

[Note on Swiss ICT research strategy \(EU Commission\)](#) [external link]

Estimated Public Funding of ICT Research 2013

€250 - €300 million

ORGANISATIONS

[Swiss Ipv6 Council](#) [external link]

[Science Cité](#) [external link]

[TA-Swiss](#) [external link]

[Interactive Multimodal Information Management](#) [external link]

[Mobile Information and Communication Systems](#) [external link]

[Distributed Systems Group; ETH Zurich](#) [external link]

[Systems @ ETH Zurich Group](#) [external link]

[Integrated Systems Centre; Polytechnic University of Lausanne](#) [external link]

[CO-ME](#) [external link]

[Nanoscale Science](#) [external link]

[Bosch Internet of Things](#) [external link]

Turkey

RESEARCH AGENCIES

[The Scientific and Technological Research Council of Turkey](#) [external link]

[Technology Development Foundation of Turkey](#) [external link]

[Centre for Strategic Research](#) [external link]

Research Strategies and Priority Areas

[Information Society Strategy 2006-2010](#) [external link]

[Research policy in Turkey \(TUBITAK report\)](#) [external link]

[National STI Strategy 2011-2016](#) [external link]

Estimated Public Funding of ICT Research 2013

€100 - €200 million

ORGANISATIONS

[TR-Grid](#) [external link]

[E-Turkey](#) [external link]

[E-Transformation Turkey](#) [external link]

[Turkish National Research and Education Network \(ULAKNET\)](#) [external link]

[Cybersecurity](#) [external link]

[Safe Web for Our Future](#) [external link]

[Turkish Academic Network and Information Centre](#) [external link]

[ILTAREN](#) [external link]

[Informatics Association of Turkey](#) [external link]

United Kingdom

RESEARCH AGENCIES

[Engineering and Physical Sciences Research Council](#) [external link]

[Science and Technology Facilities Council](#) [external link]

[Technology Strategy Board](#) [external link]

Research Strategies and Priority Areas

[Science & Innovation Investment Framework \(2004 - 2014\)](#) [external link]

[ERA Country Report 2011: UK](#) [external link]

[Science and Technology Facilities Council: Annual Report 2011-2012 UK](#) [external link]

[and Corporate Strategy 2010-2020 UK](#) [external link]

[EPSRC Digital Economy Theme](#) [external link]

[and ICT Theme](#) [external link]

[Technology Strategy Board: Enabling Technology Strategy 2012-2015](#) [external link]

[and Enabling Technologies Action Plan 2013-2014](#) [external link]

Estimated Public Funding of ICT Research 2013

€800 - €1,100 million

ORGANISATIONS

[Digital Economy Programme](#) [external link]

[RAPTOR](#) [external link]

[India-UK Advanced Technology Centre](#) [external link]

[Oxford Internet Institute](#) [external link]

[Centre for Secure Information Technologies](#) [external link]

[Scientific and Computing Department](#) [external link]

[Internet of Things Special Interest Group](#) [external link]

[Energy Efficiency](#) [external link]