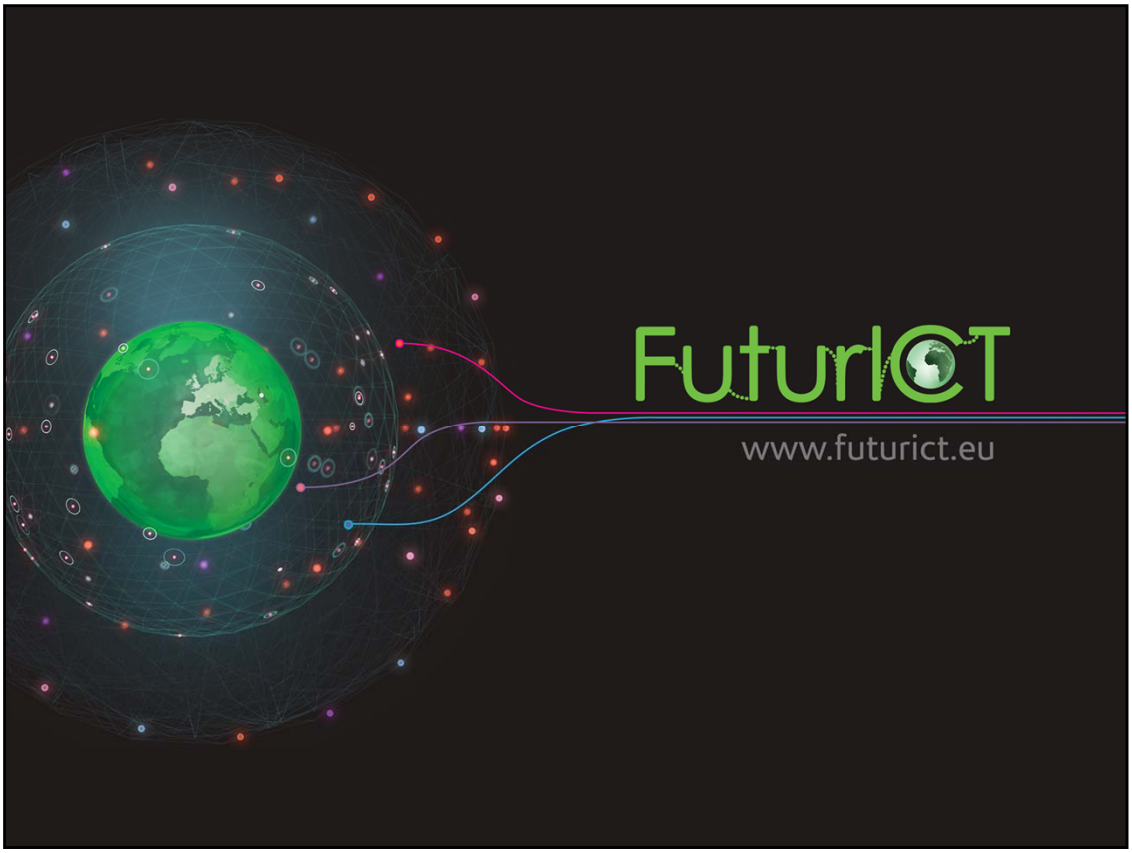
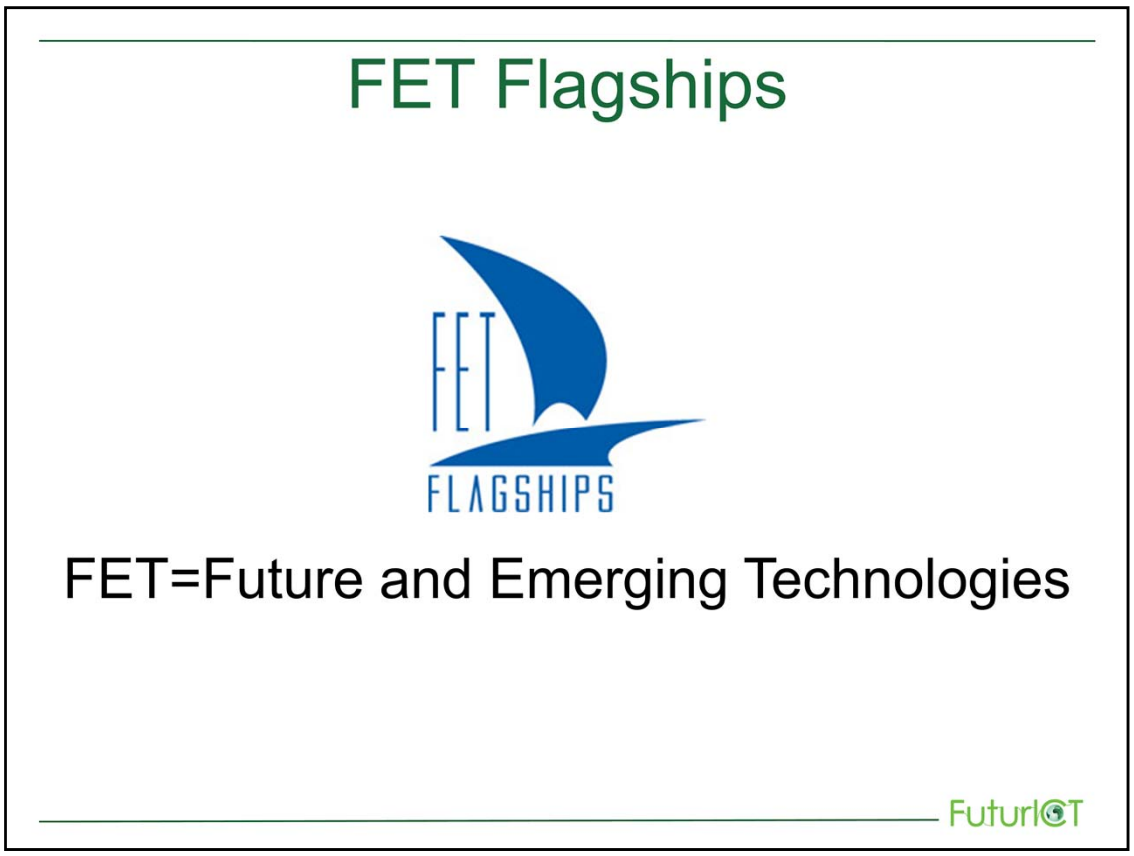
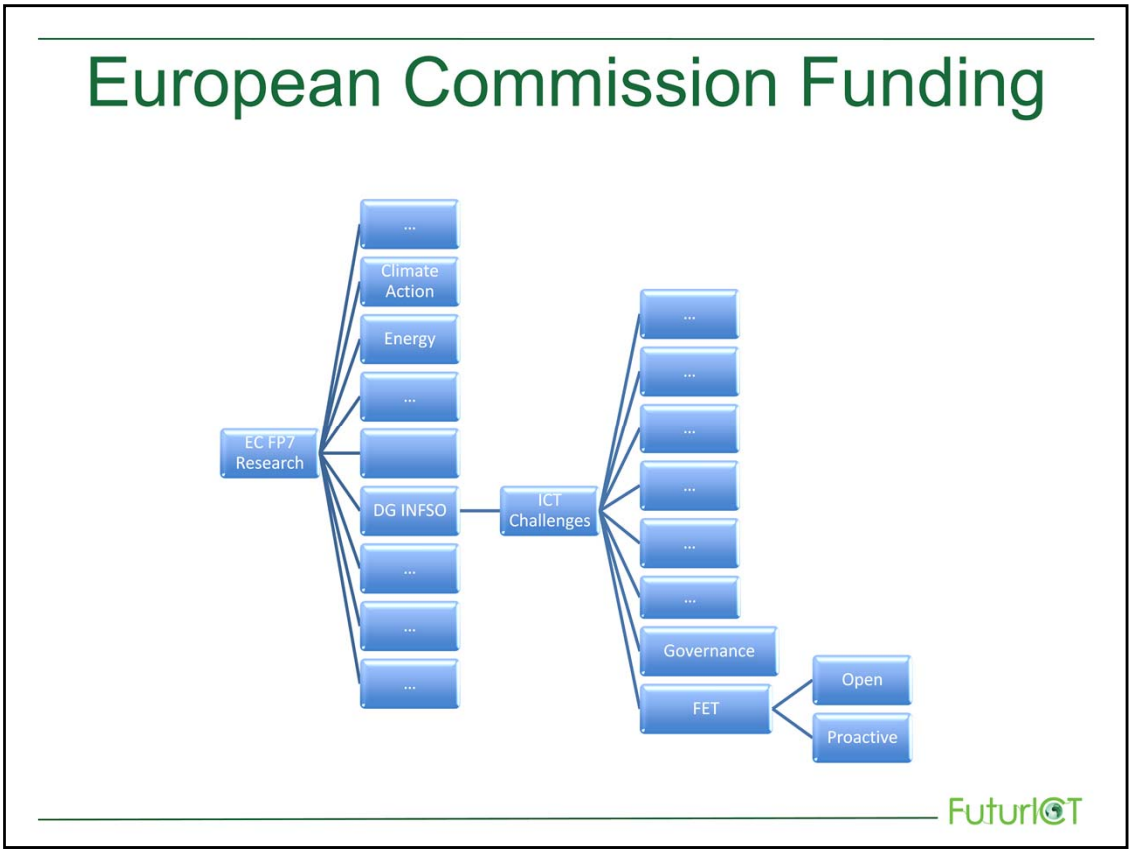


This is a general talk about the FuturICT project.



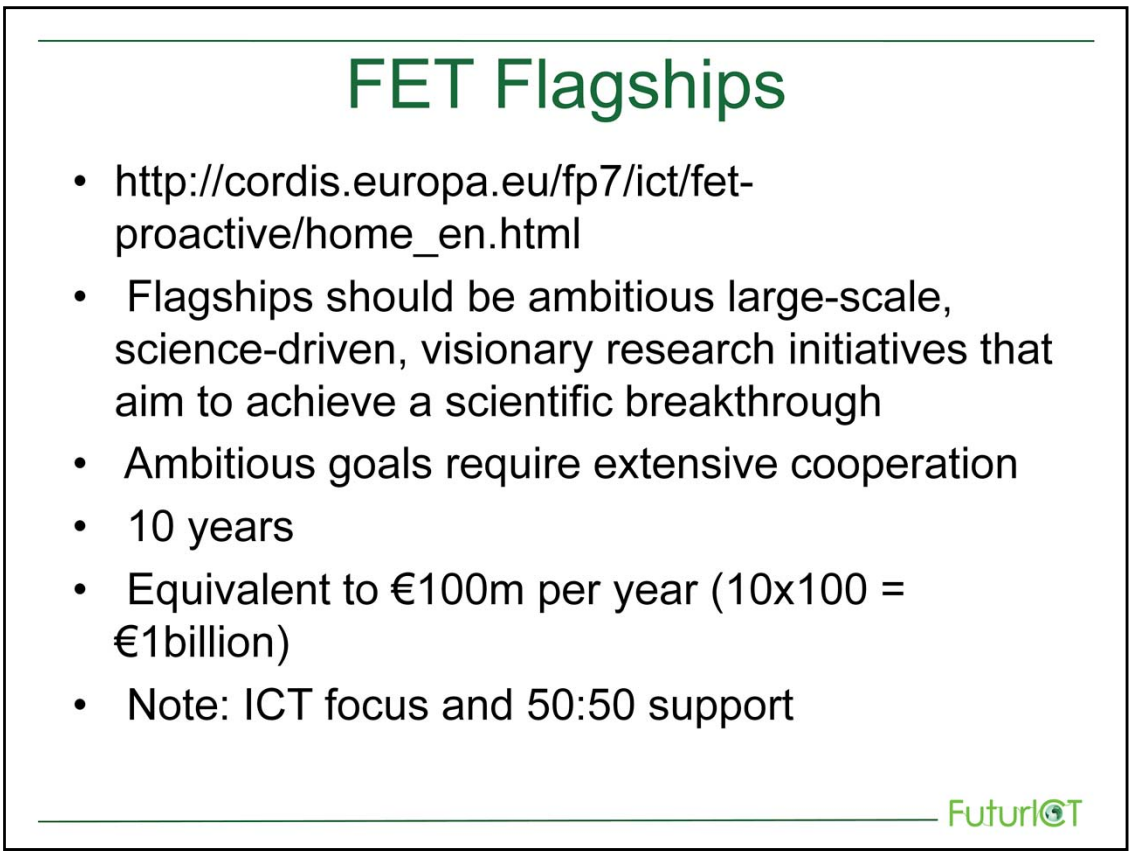
FuturICT is a project which is responding to a call put out by the Future and Emerging Technologies (FET) division of the European Commission (EC).

The process was started in 2009 leading to a call for a project to support ambitious, science driven initiatives that require a federated effort across Europe to provide a basis broad for technological innovation as well as novel benefits for society.



As background - FET is a division within the EC's funding structure under FP7, the current framework Programme. There are two parts to FET. The flagship concept is proposed by FET Proactive. FET itself is within the Directorate which covers Information and Communication Technologies (ICT), although the formal acronym is DGINFSO – standing for Information, Society and Media.

Because the flagship is funded under this ICT banner any proposal must have a strong focus on ICT.

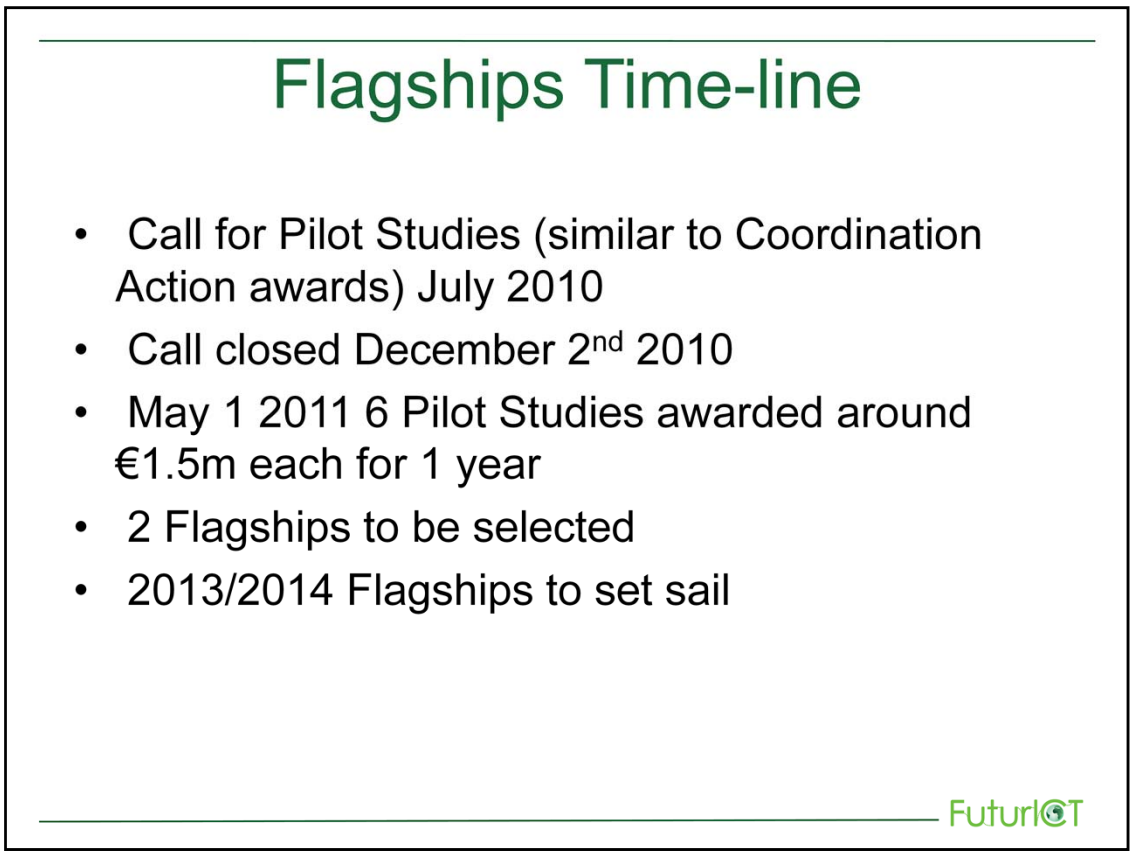


Full details can be found on the FET website.

The 1 billion tag sparked imagination but this is now largely avoided since the EC themselves will not put this much into the project. Perhaps at least half will have to come from matching funds provided by national funding agencies, governments, etc.

However, it is worth noting that although business involvement is important so that any initiatives can be exploited, the FuturICT project is primarily focussed on the scientific vision at this stage. Since it falls under future and emerging technologies the project is looking far ahead.

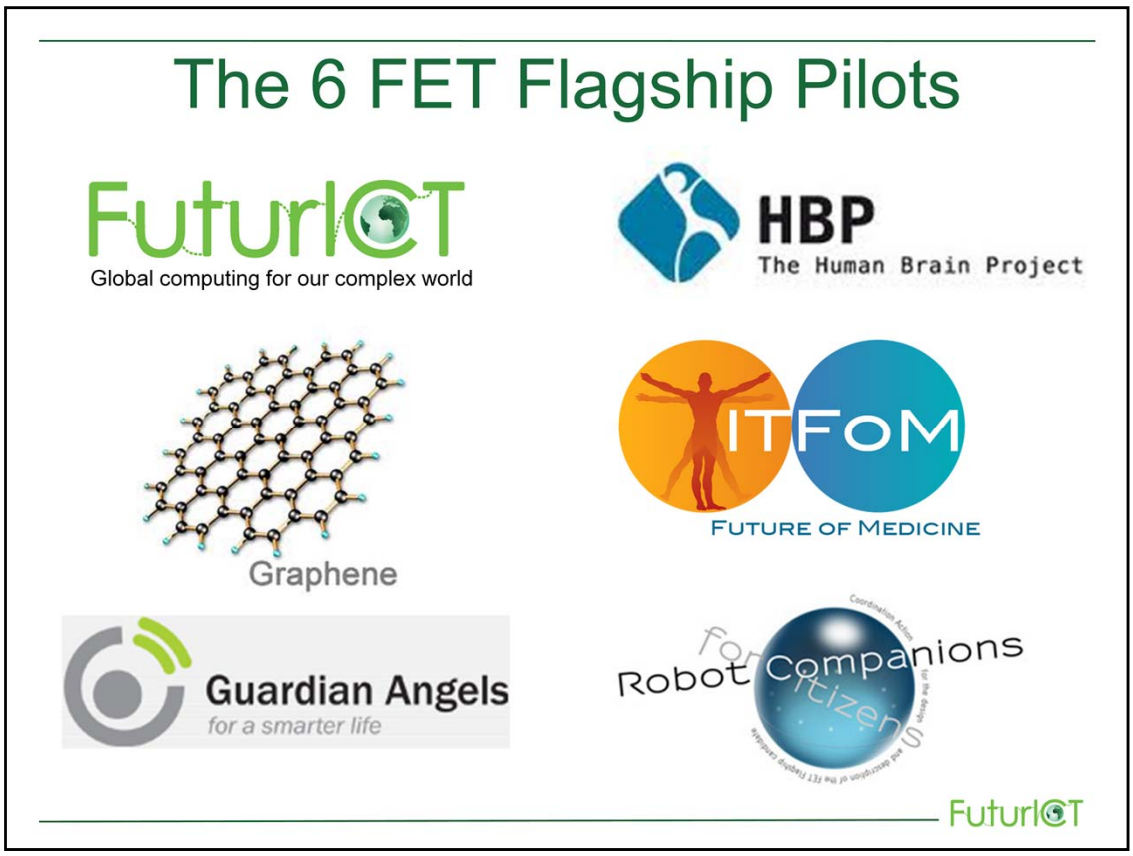
The FET unit have incorporated the flagships into the next framework funding which is not entitled FP8 but instead Horizon 2020 to try and indicate a break with previous funding concepts.



Of the 26 bids for the pilot project, FuturICT was rated top in the rankings – so we really are the forerunners.

We are now half way through the pilot stage. FET now say that they will fund two flagships.

But whereas at the start of the process we were asked to come up with our own governance and funding structure, now the EC say that they will develop a programme of research within a topic area and the flagships will form a core project within this area.



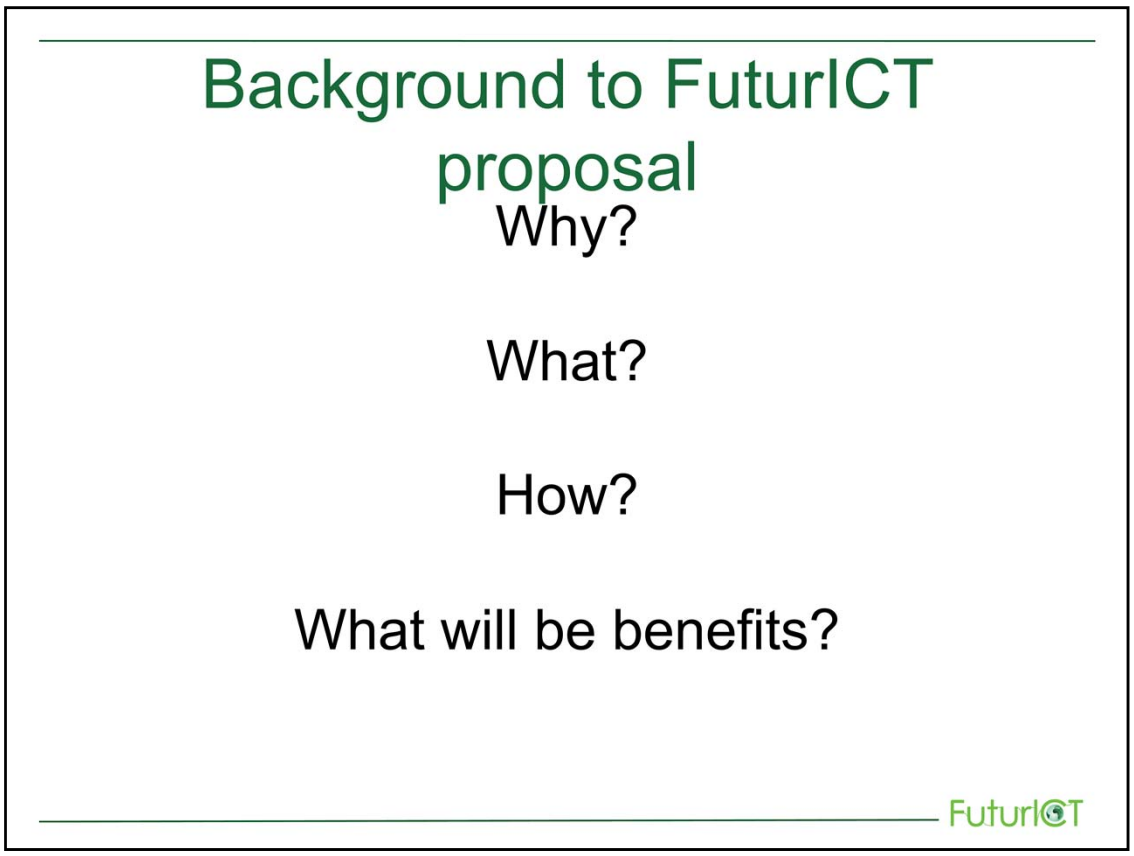
The other five Pilot projects are shown here.

Of the six pilots, three have a health dimension with one of these sharing an interest in nanotechnology with the Graphene project.

Robocom is a robotics proposal.

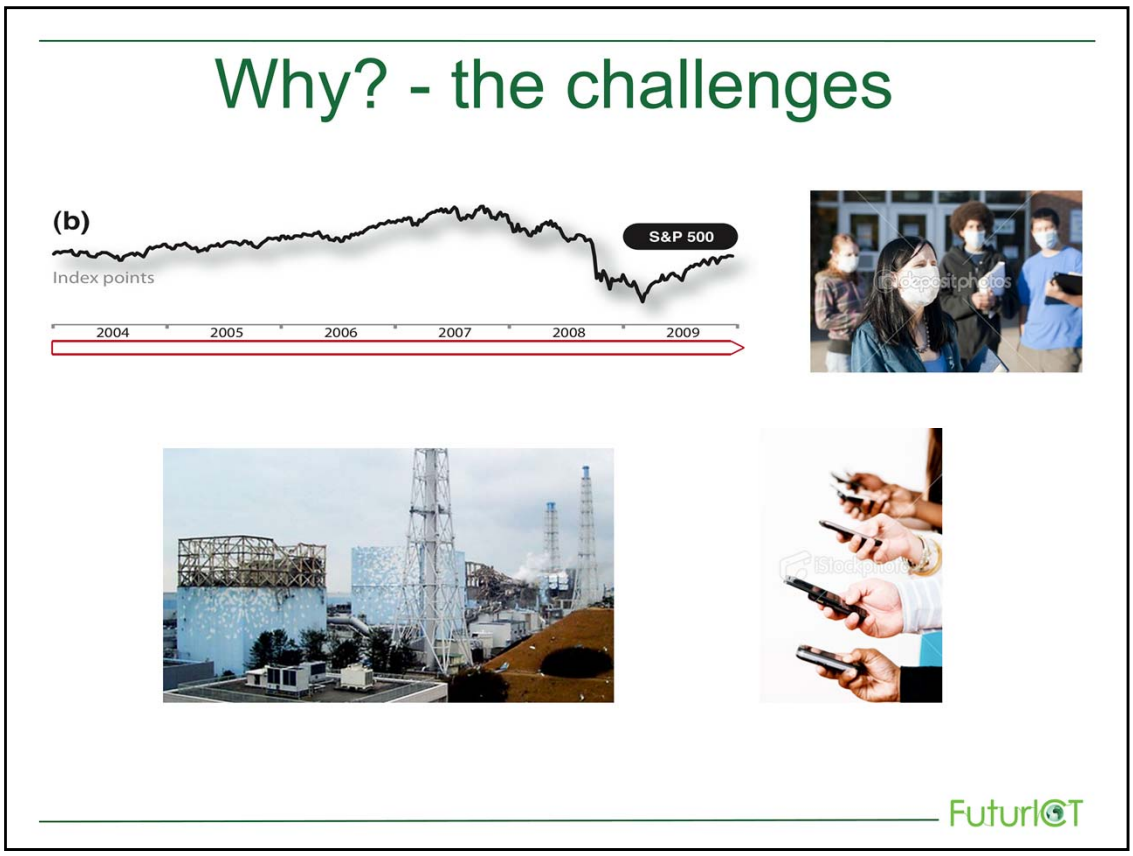
FuturICT is the only proposal that aims to target some of the grand societal challenges of today.

You are encouraged to seek information on all six pilots so that you can make an informed judgment.



The next slides give a background to the project and provide answers to the three questions – Why, What and How.

We shall also explain some of the potential benefits.



We are certainly in difficult times. Consider the financial crisis, pandemics, the events after the offshore Earthquake in Fukishima, or mobile phone viruses. These are just some examples that demonstrate problems that can arise due to our **complex**, **inter-connected world**. All this because the problems now have a global scale with technology and the environment linked to social behaviour.

For instance, who would have thought that an earthquake off the coast of Japan would lead to a change in nuclear policy in Switzerland and Germany.

We urgently require potential solutions to the major challenges that we **all** face.

Banking and Internet

FuturICT

The current pace of technological change, in particular in the area of information and communication technologies (ICT), is outstripping our capacity to manage the systems that **we** have created.

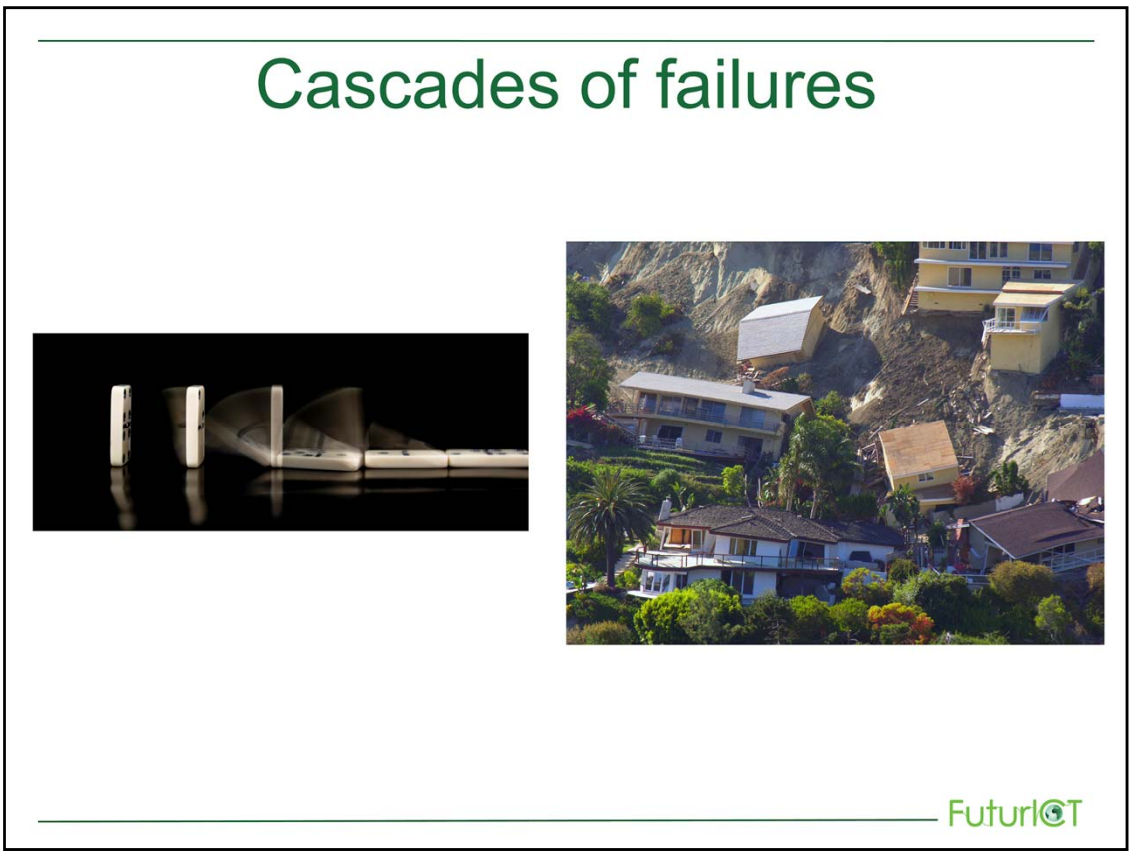
We have invented networks for the internet and our banking systems but we no longer understand the dynamical outcomes that occur as a result of people using them.

It is clear that many of our major problems stem from the global interaction of a wide range of systems with feedback between systems creating surprising (nonlinear) outcomes. Some systems are automated but for others, people interact with them or indeed drive the systems. This leads to cascades of failure that have global effect.

We need to understand how the **systems** work.

In the last 30 years or so we have seen rapid globalisation of systems and companies, and yet we have not developed the science of such global

systems to understand how these systems behave.



To help visualise cascades of failure, you can consider some physical analogies which demonstrate two different types.

Firstly, one fairly obvious cascade is the domino effect analogy where things are too closely connected without, in engineering terms, any redundancy in the system. The system is not resilient to changes and therefore the system as it stood, was not sustainable.

We often see this in our transport systems where the drive for apparent financial efficiency means that they are vulnerable to an initial problem in one place causing knock-on effects elsewhere.

For example, in the summer of 2011 some old ammunitions stored in containers in Cyprus exploded. The problem was that they were stored next to the main electricity station. The knock on effects for power and water systems created havoc for days.

In the UK stock market in 2010 a flash crash was created by automatic trading systems.

For a nice visual demonstration see The End of the World – Dominearth

http://www.youtube.com/watch?v=3jMBNesc-8k&feature=related

which shows **local effects**, or effects that anyone might reasonably have discovered if they had thought about it enough.

Cascades of failures

FuturICT

The other type of failure event is more surprising where the system is connected in ways that we do not appreciate *a priori*.

We can illustrate this by a short film in which a collection of table tennis balls are placed on mouse traps. A perturbation in one area leads to events elsewhere, distant from the initial disturbance which can eventually affect **all** areas.

In this case, **unexpected** knock-on effects occur – we have seen events like this recently for instance when an under sea earthquake leads to closures in Japan's energy production which in turn caused Germany and Switzerland to change their own nuclear policies.

Destabilisation may come from within rather than from outside. Crises start locally, but cascading effects cause them to spread. We need to improve our understand how things work to prevent cascading. In the home we have fuses to stop a problem causing the whole electricity failing – where is the equivalent fuse for our economies?

For a neat example of unexpected consequences see

http://www.youtube.com/watch?v=ORqc1x3_Evg

where table tennis balls are placed on mousetraps. A perturbation leads to **non-local effects**.

But, it is not all bad. Connectivity can also lead to fantastic opportunities.

After the recent London riots, Twitter and Facebook users harnessed the power of social networking to co-ordinate efforts to clean up the capital connecting more than 70,000 people in a just a few hours.

OpenStreetMap is a free editable map of the whole world. It is made by people like you.

Community Seismic Network is a coordinated effort to bring different earthquake data sources together.

While I am sure that you all know about Wikipedia - the free, web-based collaborative encyclopedia project.

We need to inspire new technologies that make use of this collective potential.

We need the power of large datasets and predictive models to be a public good. And yet we need to create open systems which still allow, and indeed encourage enterprise and innovation.

Good News II

HM Government

data.gov.uk BETA

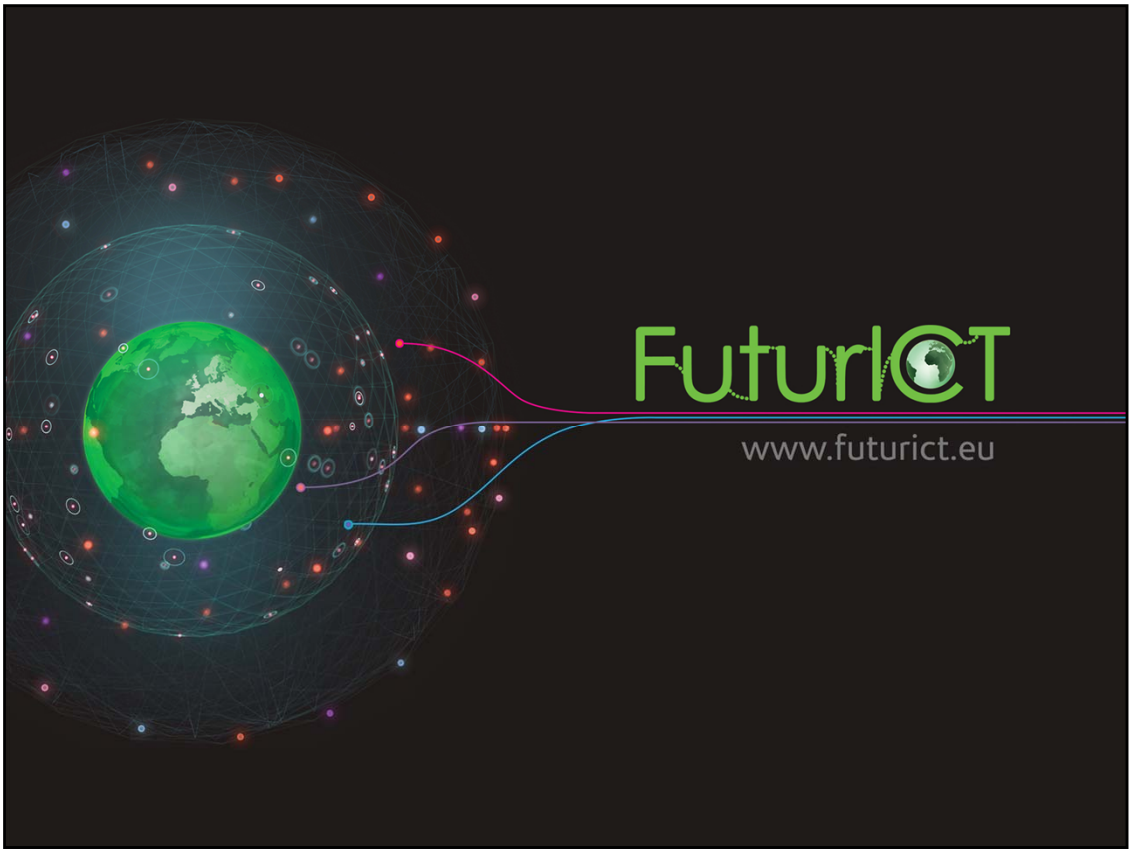
Opening up government

FuturICT

Furthermore, knowledge of how we behave as groups can be useful

The Jamaraat Bridge near Mecca is a place where pilgrims gather every year in Saudi Arabia. Over the years there have been crushes of people that have lead to many fatalities. Knowing how crowds might behave has allowed us to design a new bridge to prevent such occurrences. Dirk Helbing was part of at team to redesign a bridge in a 1 billion Euro project.

The other good news is that data is becoming available from a variety of sources. For instance, www.data.gov.uk aims to promote innovation though encouraging the use and re-use of government data-sets, but only non-personal, non-sensitive data – information like the list of schools, crime rates etc.



The emergence of a science of complex systems has already helped to describe and understand situations like these. For example, it has been used to develop large-scale models of epidemics, economic risk analyses, and intelligent crowd control. Yet these are just the beginnings. To scale up the scope of such an approach, to promote a better understanding of the critical issues, and to move from understanding to a capacity to predict and manage, a new alliance with social science and ICT is necessary.

To understand and perhaps even forecast events and effects involving our socio-economic systems and their interaction with technology and the environment, we need a new kind of science – a science of global systems to improve our understanding of these networks.

We need novel socially interactive ICT that fosters stability, transparency, respect for individual rights, and inclusive participation in political and economic processes. In this way we will have better knowledge of the high-level concepts of risk and its perception, trust, contagion, resilience and sustainability.

We need better models. This means both quantitative mathematical descriptions and modes of qualitative, conceptual thinking.

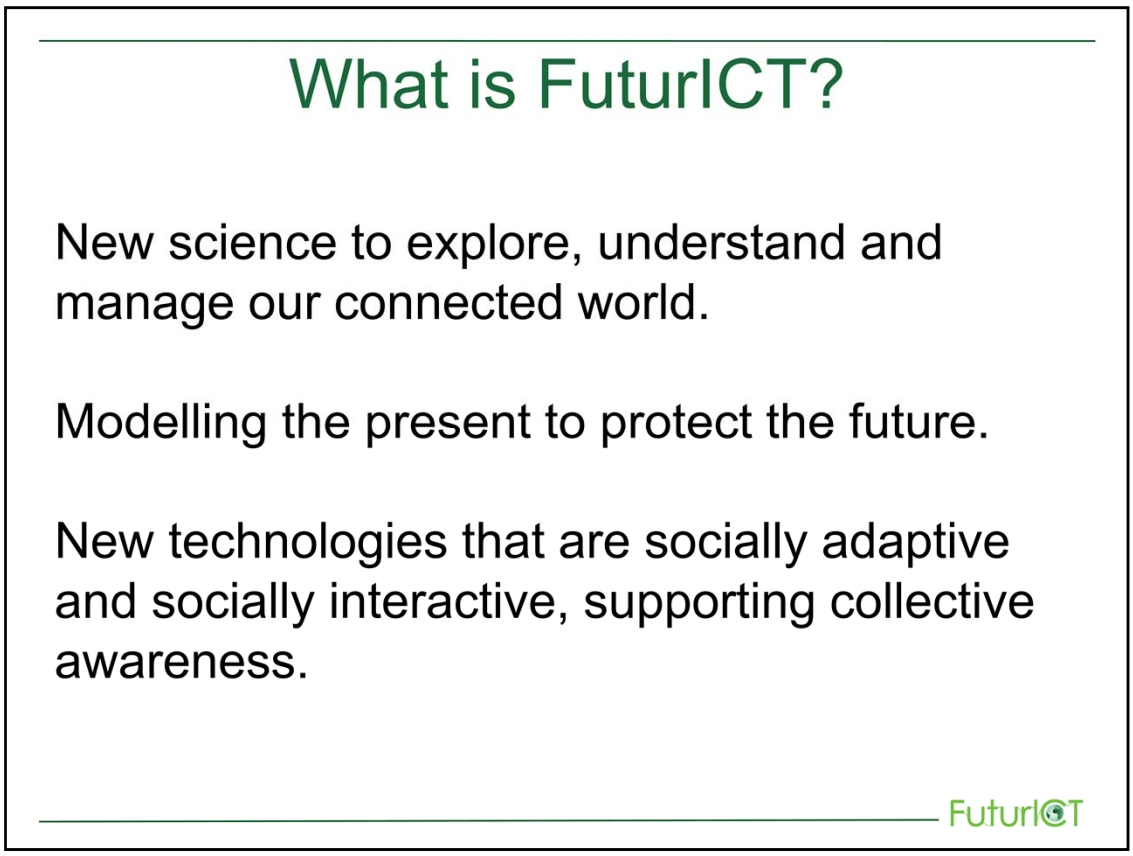
We need better ways of harvesting the massive amounts of data that are available to us now and could be available in the future as people freely offer up their data. This is not just data in raw form but we need data at levels that we can understand – meta data.

However to arrive at systems we trust, we need to consider issues of anonymity, privacy and other ethical issues right from the start as we define our systems not just as something to add-on in an *ad hoc* manner.

We need technology that helps ordinary citizens, businesses and policy makers engage with both models and data so that are informed by the processes and are involved in generating information which forms them.

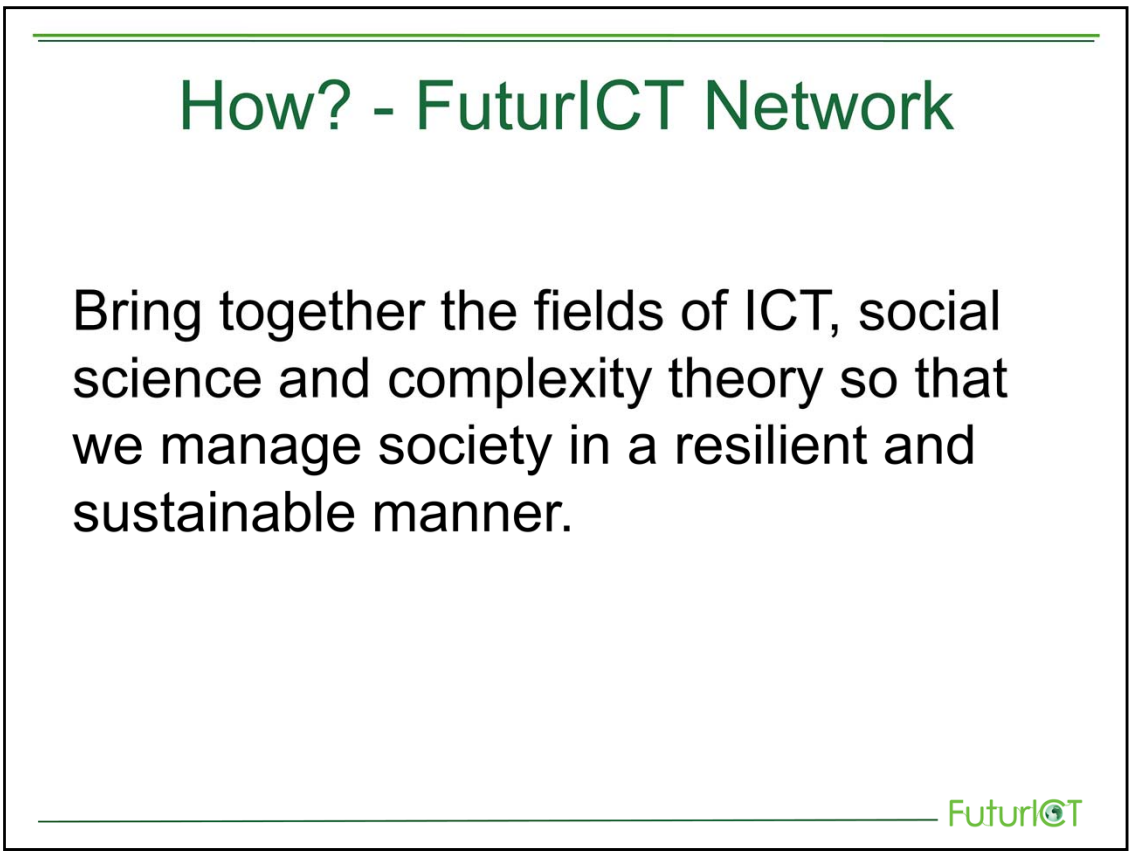
These thoughts are precisely what has driven a group of people to develop a response to these challenges, perhaps the greatest challenges of the 21st Century.

FuturICT is the future of ICT.



These are the societal challenges that the project will address.

FuturICT is a visionary project that will deliver new science and technology to explore, understand and manage our connected world. This will inspire new ICT that are socially adaptive and socially interactive, supporting collective awareness.



The overall aim is to bring together the currently fragmented fields of ICT, social science and complexity theory so that we can manage our society in a resilient and sustainable manner.

To achieve this, first we need lay the groundwork by creating a physical and virtual network of scientists.

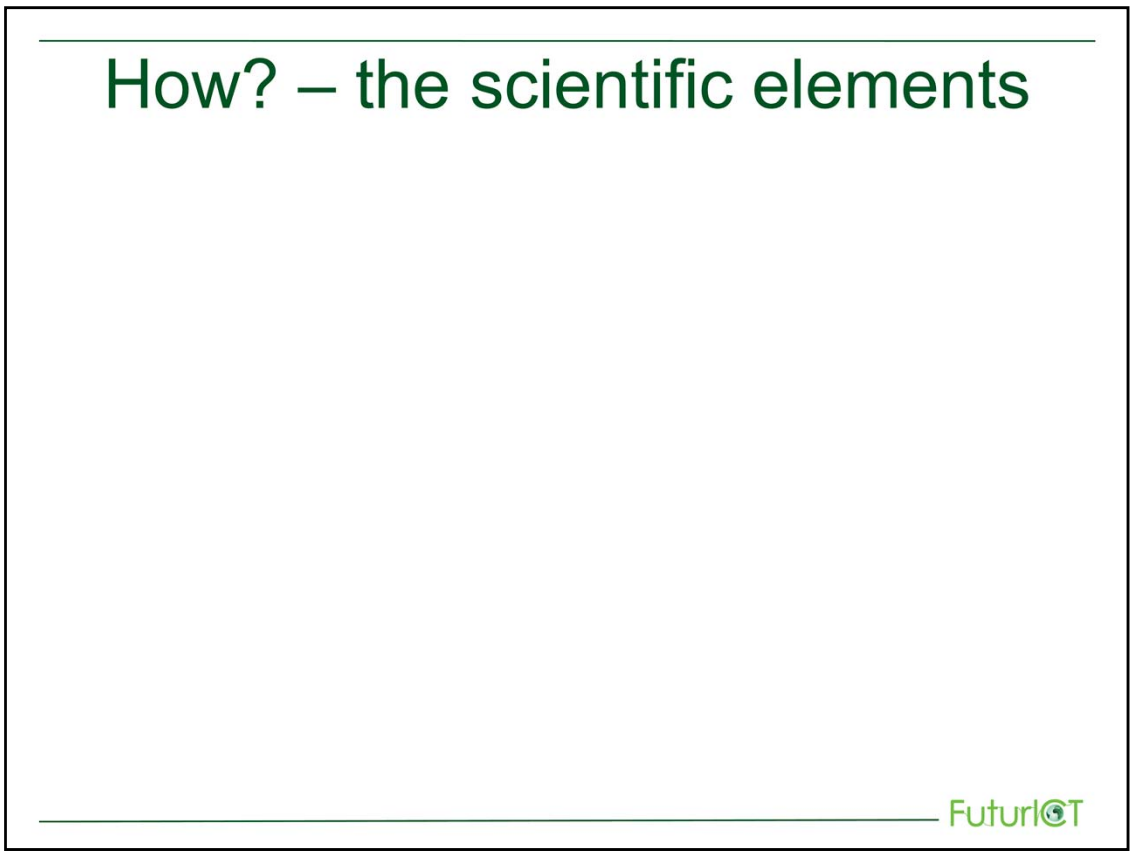
How? - FuturICT Network

The overall management and leadership will initial fall to the teams in London and Zurich.

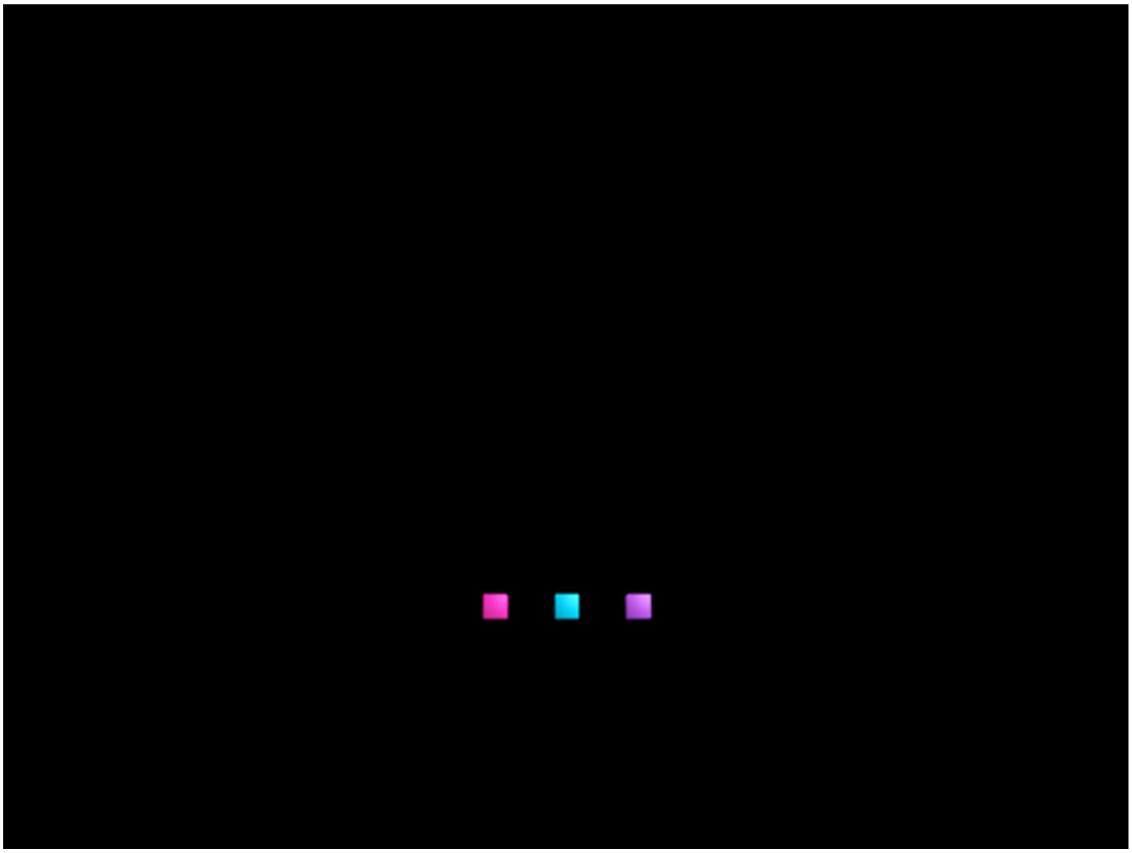
Hubs have already been set up within countries to provide support action for the FuturICT community linking to a network of excellence. Many have their own websites already to help in the dissemination and integrate people into the project.

The project is linked with a range of similar initiatives around the world, in China, Japan, US and Singapore.

Play Network map Movie



Let us turn to the scientific elements



Play FuturICT Platform Movie

On the science front, in simple terms - Our vision is to create **new models**, linked to **new data** and allow ways for **people to participate** in the process.

Models will be used to **simulate and forecast**. Data will be mined to **measure and make sense** of the information. Platforms will allow people to **interact and explore** both the models and data.

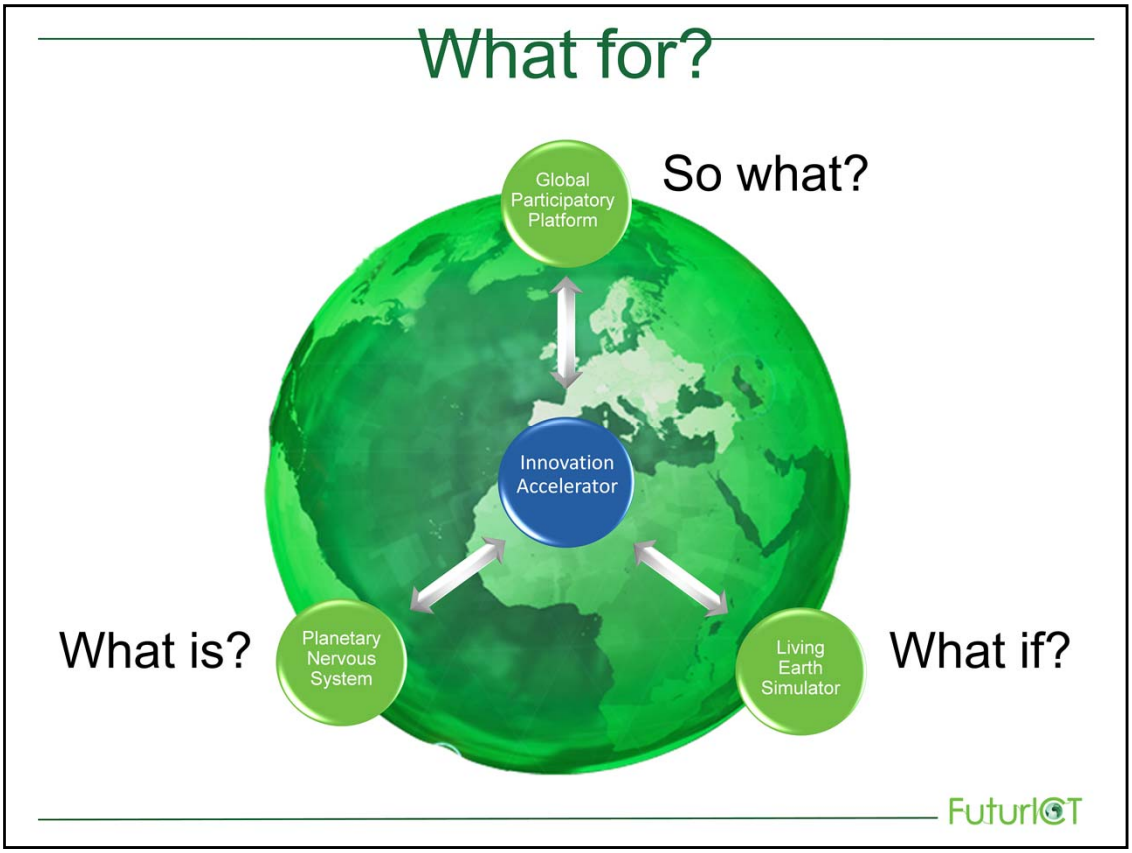
The data will be measuring the state of our social systems giving us vital information and thus, when all sources are integrated, it forms a **Planetary Nervous System**.

The mechanisms to allow many people, from different walks of life, to interact openly with the data and the models will form a **Platform for Global Participatory**.

people meaning citizens, businesses, NGOs and policy-makers plus the so-called Third Sector – not for profit communities.

Models will be driven, and calibrated, by data aggregated in real-time. If these range from individuals, to groups, up through cities to planetary scale then these would form a **Living Earth Simulator**.

Together these will form a FuturICT Platform, from which we can build capacity to both solve problems and innovate.



Thus the models will allow us to explore ‘what if’ scenarios/

The data will allow us to know ‘what is’ the state of the systems

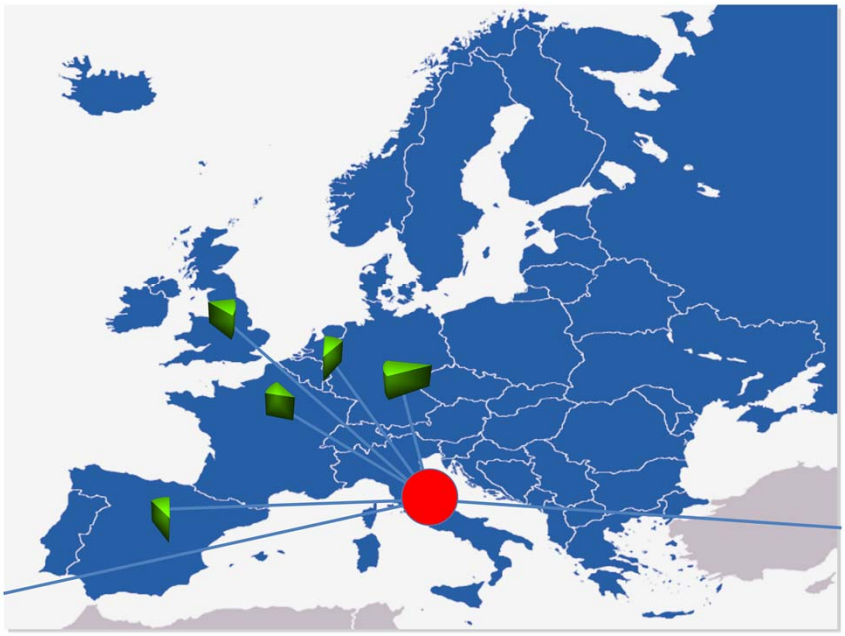
And the participation elements will allow us to interpret the relevance of the models and the data.

Models – will provide ‘what if?’ potential future scenarios.

Data will tell us ‘what is?’ the state of our technological world.

While the participation with allow us to answer the question ‘so what?’ by allowing interaction with both data and models.

How? Observatories

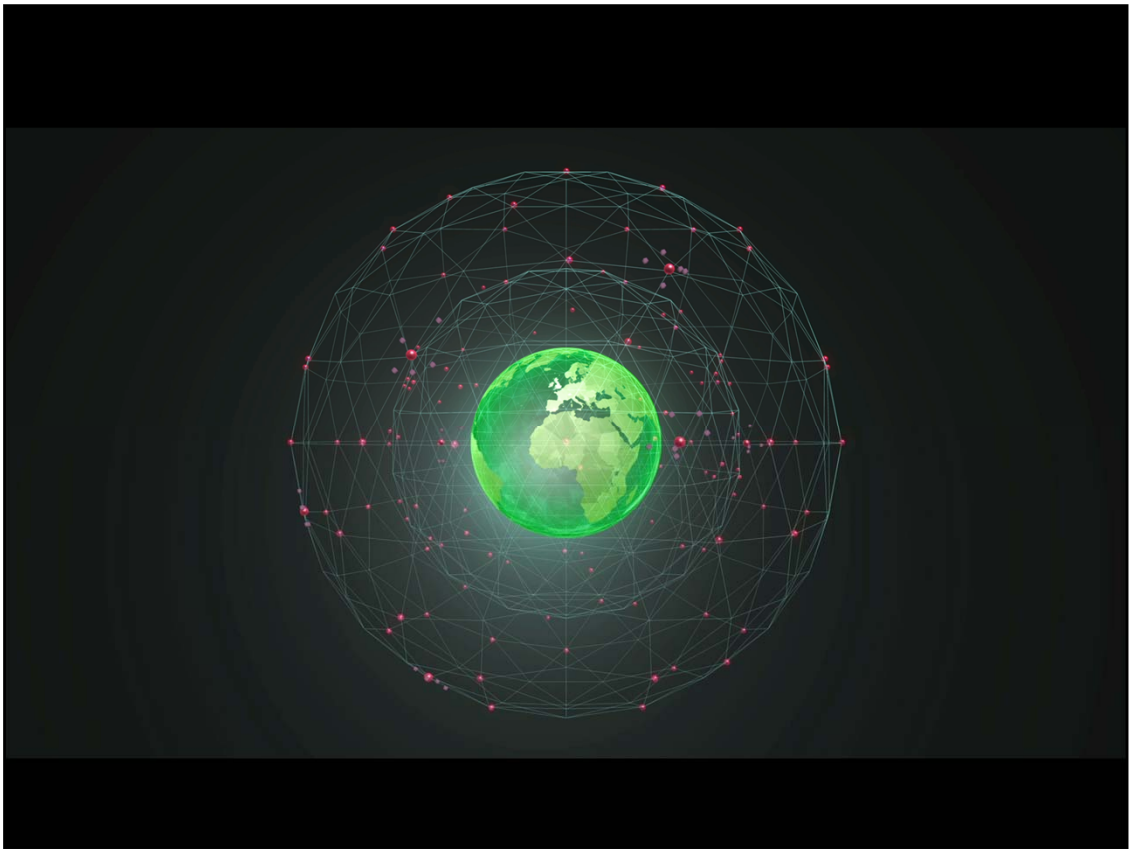


FuturICT

As well as these core scientific elements, we will create **observatories** in areas such as crime, conflict, financial markets, smart cities and more.

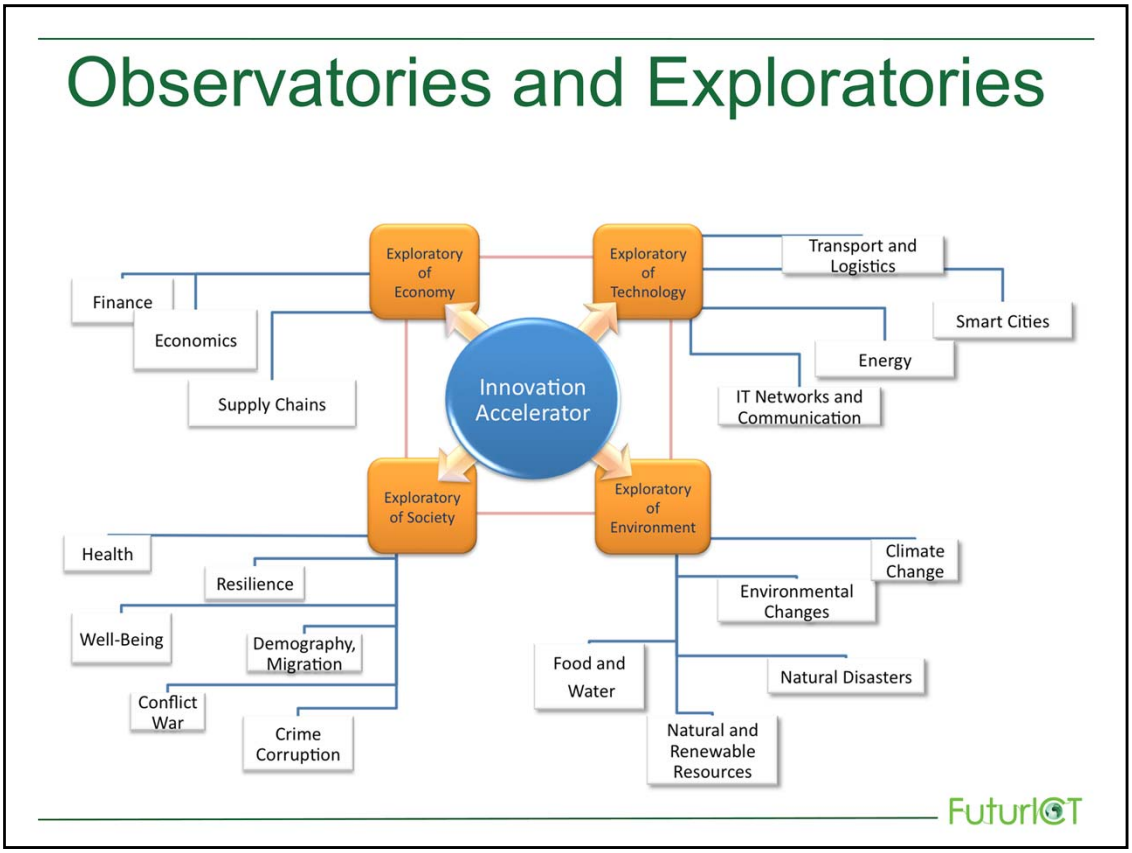
The idea is for Observatories to detect and mitigate crises plus identify new opportunities

Observatories will have a core group located in a specific location but this will be linked with other groups with similar, or complementary expertise across Europe.



Play Observatories movie

Each observatory will have to develop their subject specific knowledge but additionally, in order to integrate with other areas, they will need to posses expertise in ICT, complexity science and the social sciences. Plus they will need to understand the ethical debates as well as being able to see how any results can be used in a policy setting.



This slide shows some of the observatories planned for the start of the project. The observatories to be considered may change as the project proceeds when some have achieved their aims or when new areas emerge.

But research will not just be carried out in *vacuo* - within silo domains. Instead targetted work will be carried out to guarantee that new designs, tools and solutions are 'fit for purpose'. This will be achieved by **exemplar projects or demonstrator areas** within the first few years that will involve case studies that integrate various disciplines. For instance, this might include a study of the use of ICT for a grass roots citizen science approach to air pollution using low-cost sensors and social networking to enable both facts and opinions to gathered but then to link this to models which can be used for policy decisions, or a study of water shortage in Cyprus which would need to consider the effects on agriculture, economics, water management, social acceptance of reduced demand, an international dimension and more, with ICT paying a prominent role in one or more of these areas.

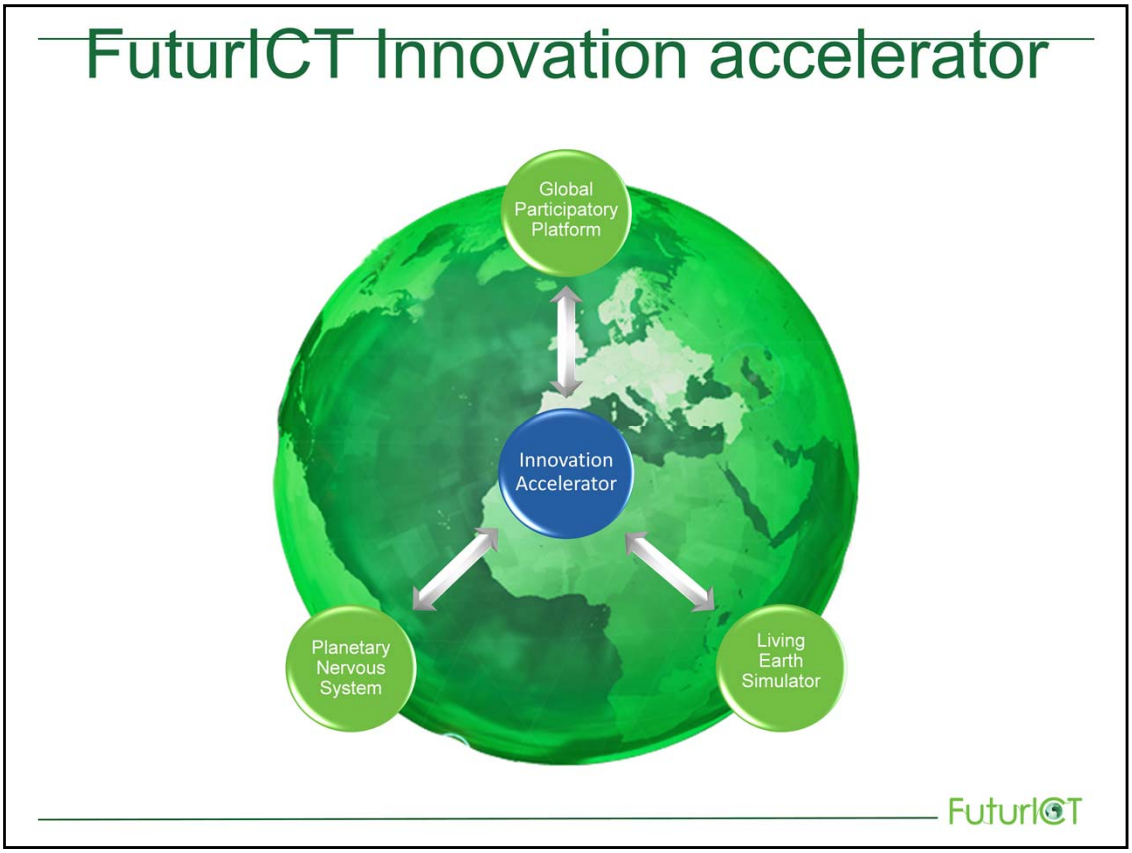
Exemplar projects will involve collaboration with the relevant observatories

in the core areas – technology, environment, society and economy - plus other experts from the areas of modelling, data and participation.

The idea is that each exemplar will enhance our knowledge, find solutions to a specific relevant issue of the day and also add tools and techniques which will build our capacity in all areas.

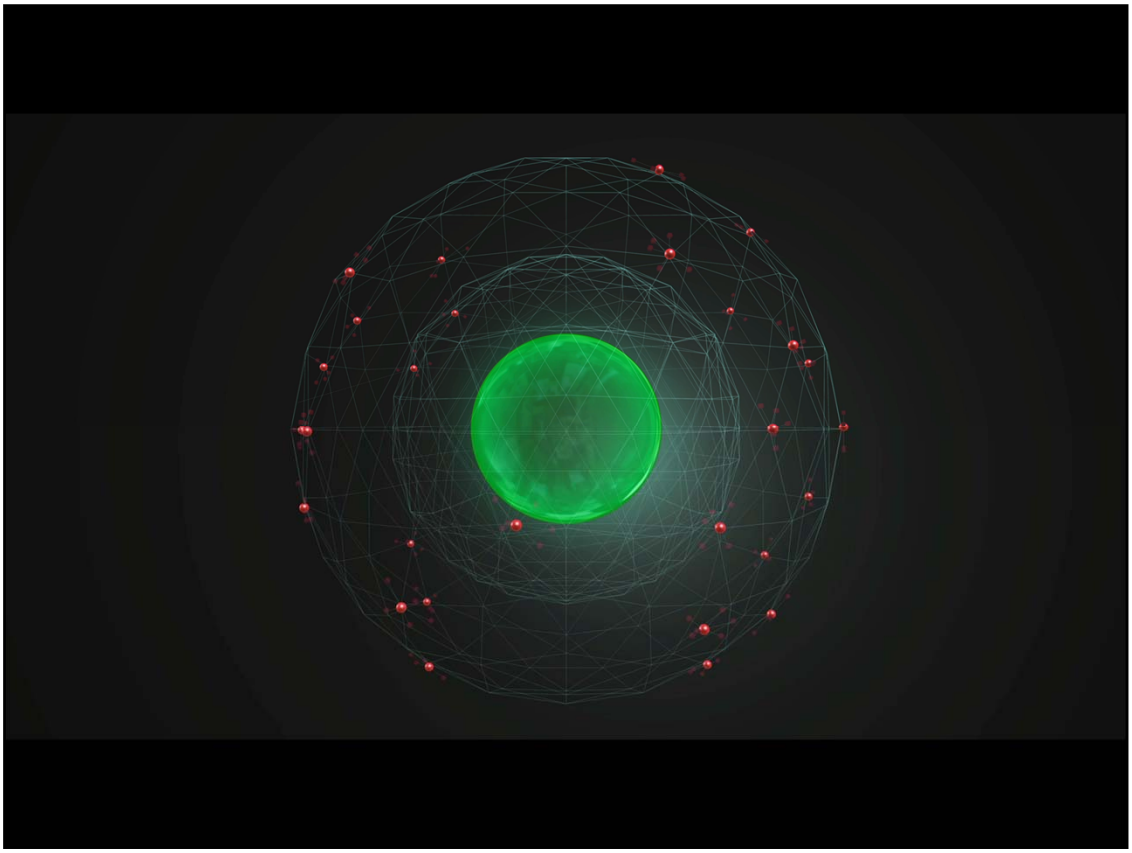
Importantly, we aim to use these exemplars to enable a paradigm shift to **data intensive policy-making or governance**, which we believe is urgently required for us to manage our complex global society in a sustainable manner – and therefore this is a also **Futurist** proposal – so both pronunciations work.

By forming the observatories and disseminating results of the exemplar studies the project will show value for money, particularly when considering the hard choices necessary for large-scale infrastructure projects.



All of this technology and science will ultimately accelerate European innovation.

So let's take a look at FuturICT's Innovation Accelerator



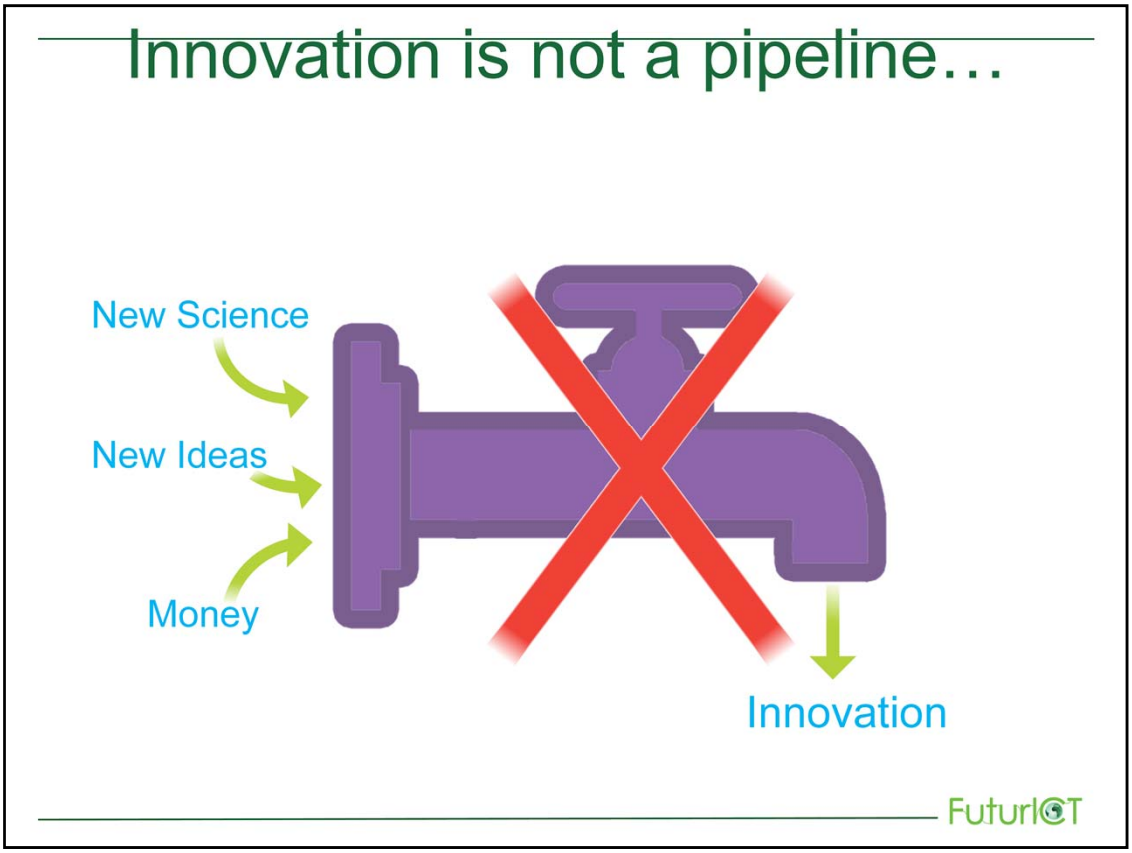
Play Innovation Accelerator Movie

Integration of the Observatories will lead to innovation in two ways.

Firstly, **exemplar, case studies,** to demonstrate best practice, will be carried out, forming **demonstrator areas**. These studies will explore more than one subject domain – hence the term **exploratory**.

Thus the platform, exploring multiple domains, will act as an **innovation accelerator** leading to European wealth creation.

But secondly, the greatest value may come from using information gained to explore and investigate future configurations that integrate the areas to find opportunities that otherwise would be missed.



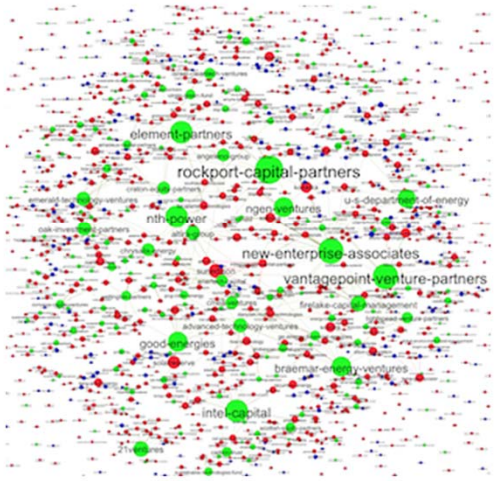
Innovation is *not* a pipeline.

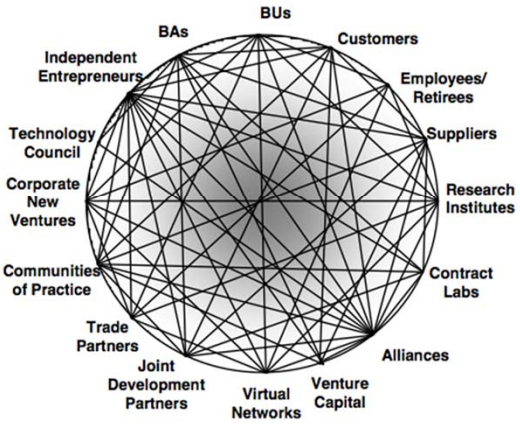
It is not just a matter of scientists putting in fresh ideas at one end, and where at the other end of the pipeline a business innovator somehow consumes these ideas and turns them into a product or service.

And even though we all know that innovation is not like that, too many science projects behave as if it is.

But if innovation is not a pipeline, then what is it?

Innovation is an ecosystem





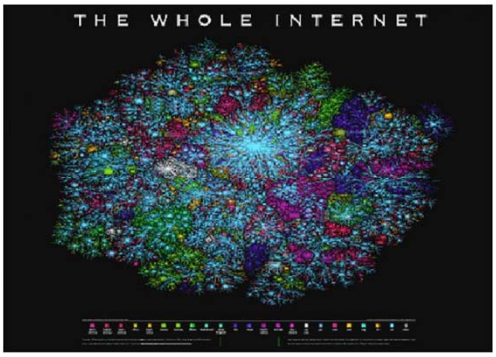
FuturICT

Instead, innovation is an **ecosystem.** It's an ecosystem where many players constantly interact with each other in complicated and unforeseen ways.

On the top left, you see a map of a real innovation ecosystem, in this case in the energy sector. Creating such maps is one of the targets of the FuturICT platform.

On the bottom right, you see a schematic version of an innovation ecosystem, with many different types of players interacting. And you'll notice this is a fully connected graph: everybody interacts with almost everyone else in often unforeseen ways in this ecosystem.

Innovation is driven by platforms

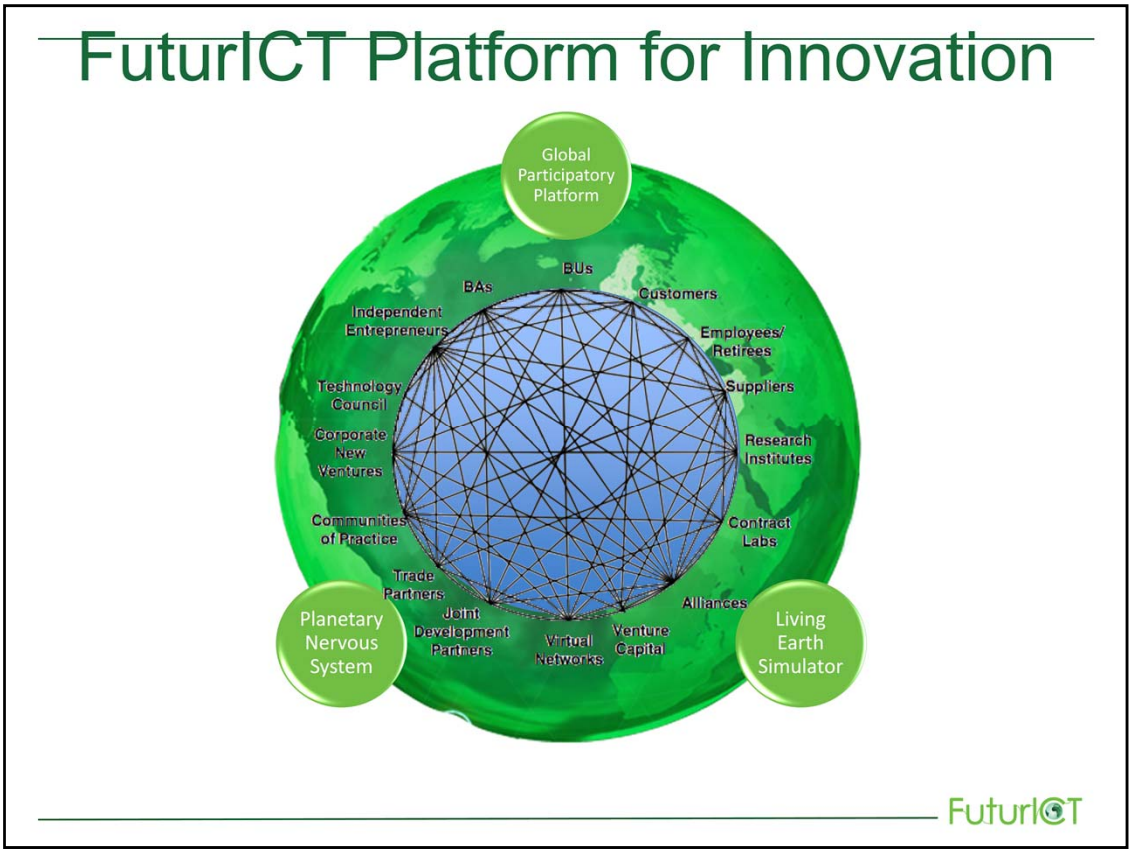


FuturICT

A important observation about such innovation ecosystems is that they are greatly facilitated by **platforms**.

The best known example are of course the internet, and the web. These were not *themselves* innovative “products”, but instead they are *platforms* that allowed many totally unforeseen parties to invent totally unforeseen new products and services.

And more recently: *Amazon* has turned into a platform. It started out as a *single service* for selling books, but it is now a *platform* where countless micro-companies are delivering products and services



So let's look at some how FuturICT will deliver such a platform.

And I'll do that by showing you three examples, each from a different component of the FuturICT platform:

Detect trends & innovation potential early on; find best experts for projects

Current scientometrics results have a 5 year delay

FuturICT will move this to near real time using alt-metrics

FuturICT

FROM THE LES: Detecting trends and innovation potential in science early on, wouldn't we all want that? But currently, it's very hard for industrial innovators to detect trends early on. They can only detect trends long after they happen.

Our current state of the art scientometric tools only show to innovators what *was* going on in science 5 years ago.
because that's how long it takes for new developments in science to show up in the archival literature and become part of our citation networks.

But scientists do much more than publish and cite. They blog, they tweet, they facebook, they sit on programme committees, they get grants accepted, they put out job adverts, and all of these leave traces on the web.

Such large scale world-wide datasets can be used as alternative metrics to discover trends, to discover experts,
and to spot potential for innovators in near real time.

Establish new data publication platforms

Data sharing rates are < 10%

Platforms for sharing data think:
Life-science data for Home-diagnostics start-up

FuturICT

FROM THE PNS: A second example comes from the Planetary Nervous System, where observations and data sets are being collected.

Recent studies show that less then 10% of scientific papers actually publish their underlying datasets (and this was measured on journals that actually encourage data-sharing, so the real percentage is probably much lower).

So, FuturICT will build platforms that enable and encourage scientists to share data including taking care of the right incentive structures for data-sharing.

From incentive to crowd funding

Research projects

Funded by small investors

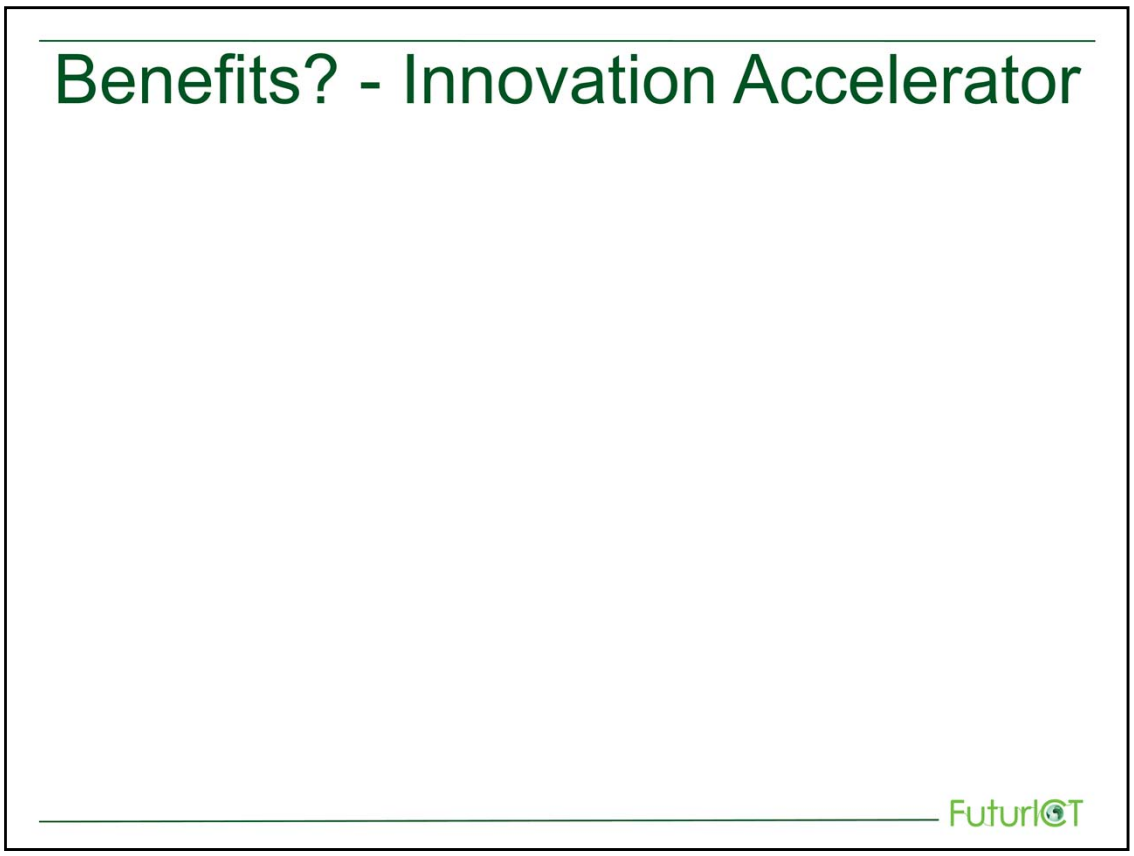
Based on their value to communities

FuturICT

FROM THE GPP: The increasing connectivity of our modern world is now beginning to enable new models of funding science.

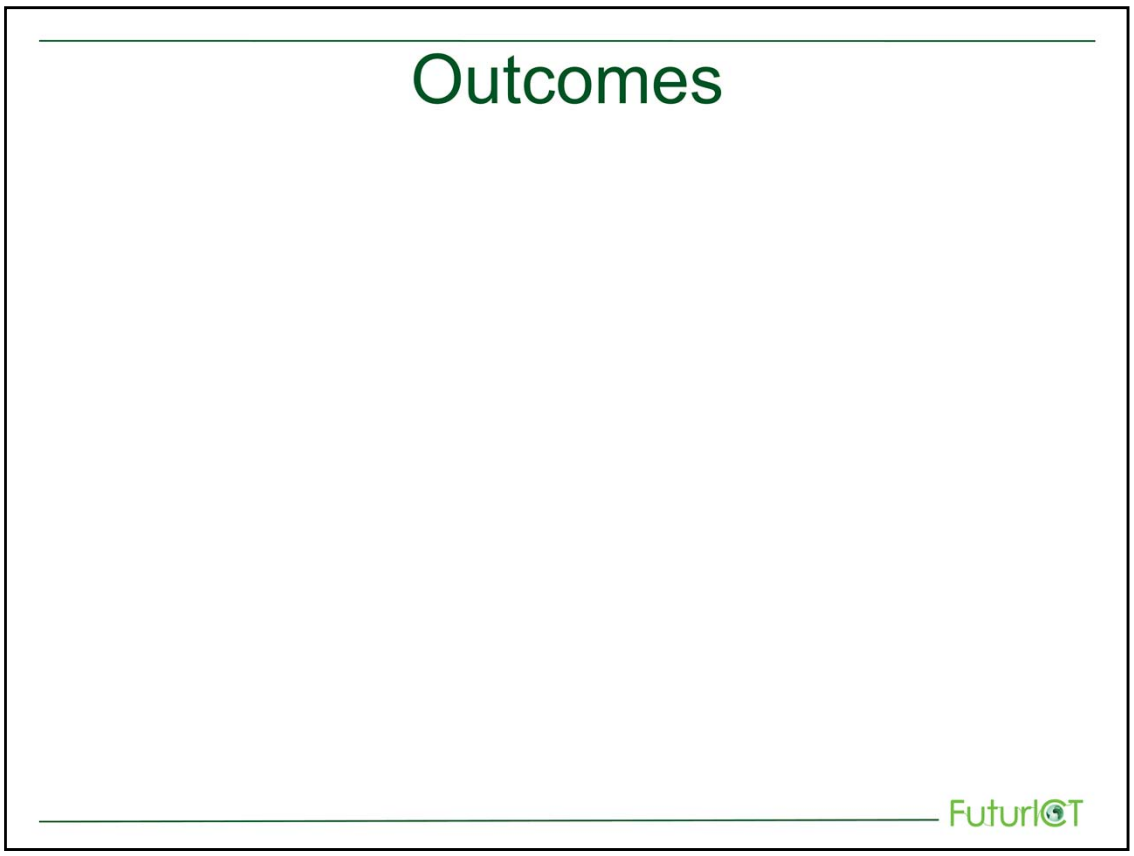
No longer top down from funding funding agencies, but rather bottom up. Many small investors connecting around a research project that is important to a particular community.

So, with the inclusion of our Innovation Accelerator, FuturICT not only *speaks* about innovation, but has actually included innovation as an explicit activity in the very heart of the project.



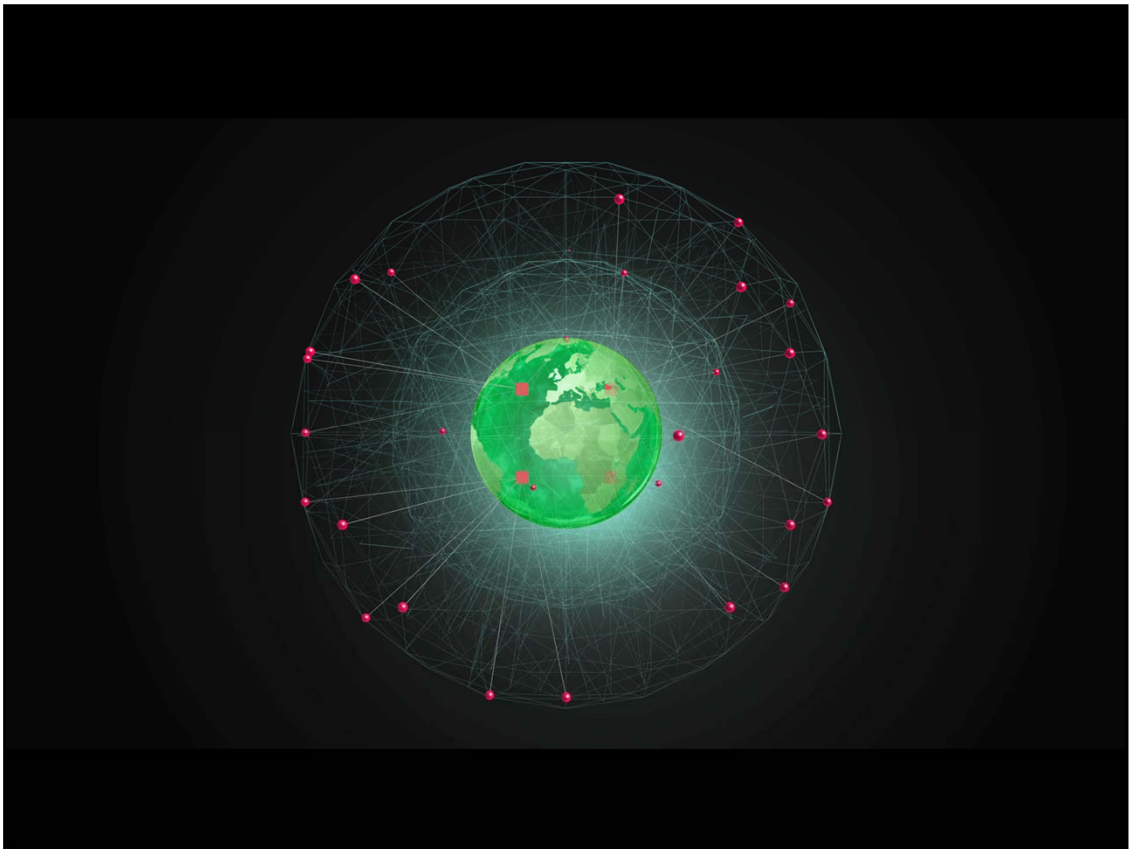
Each exemplar will enhance our knowledge, find solutions to a specific relevant issue of the day and also add tools which will build our capacity in all areas. They will additionally add to our knowledge on the broad concepts of **trust**, **risk**, **resilience** and **sustainability**.

Interestingly, the first user of such an innovation accelerator will be the European Commission itself who will be able to use the techniques developed to optimise their choice of peer reviewers for subsequent proposals to the Commission.



This project is truly innovative. It will deliver outcomes in three specific areas.

Play Outcomes movie

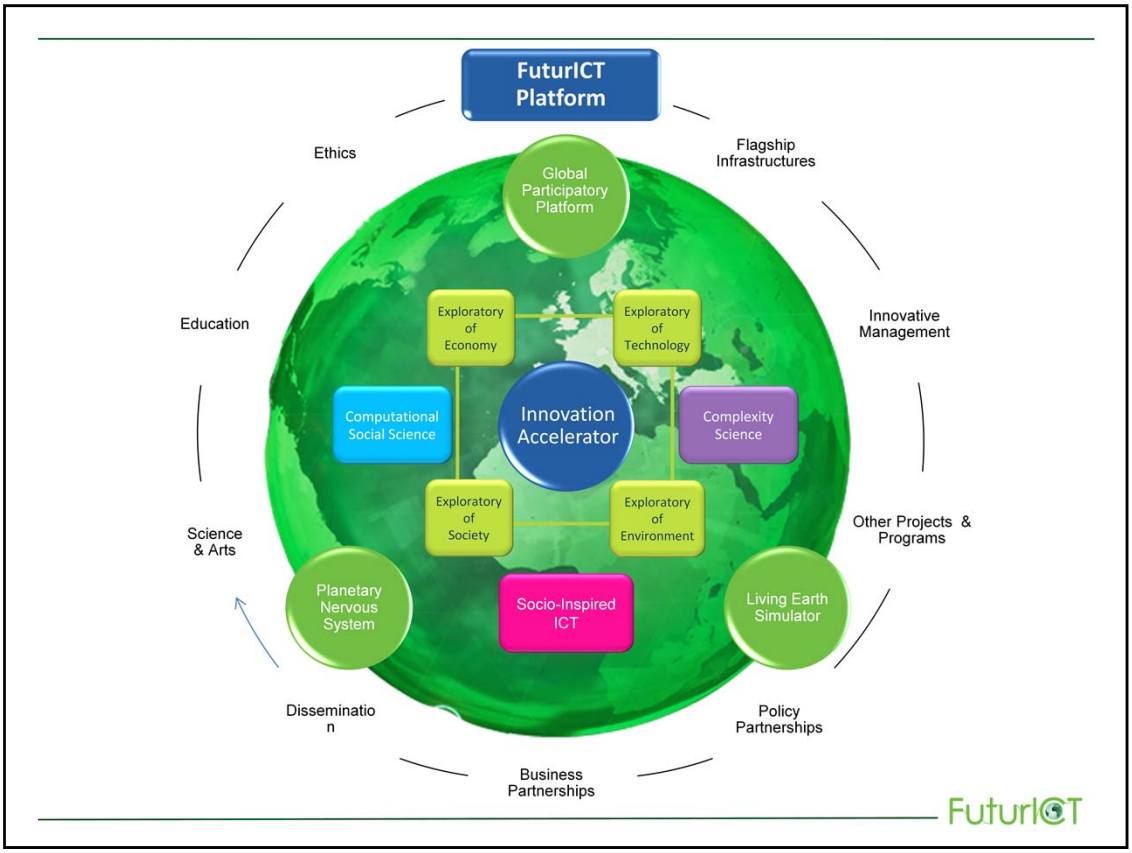


For Policy: It will enable us to manage our global systems in a more resilient and sustainable manner and enable us to respond much better in times of crisis.

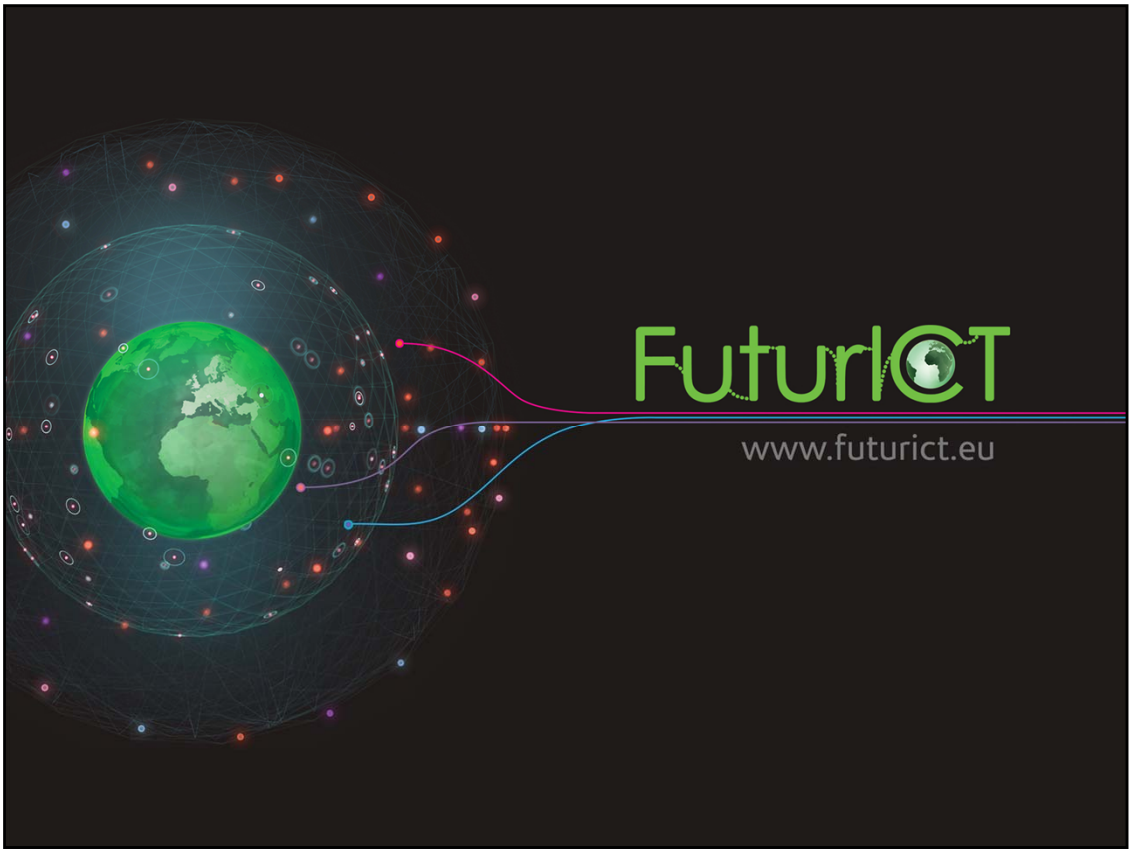
For Science: It will improve our understanding of how our social systems interact with our technological and economic systems.

For Technology: It will inspire new ICT products and produce a platform that encourages collective awareness and wide participation.

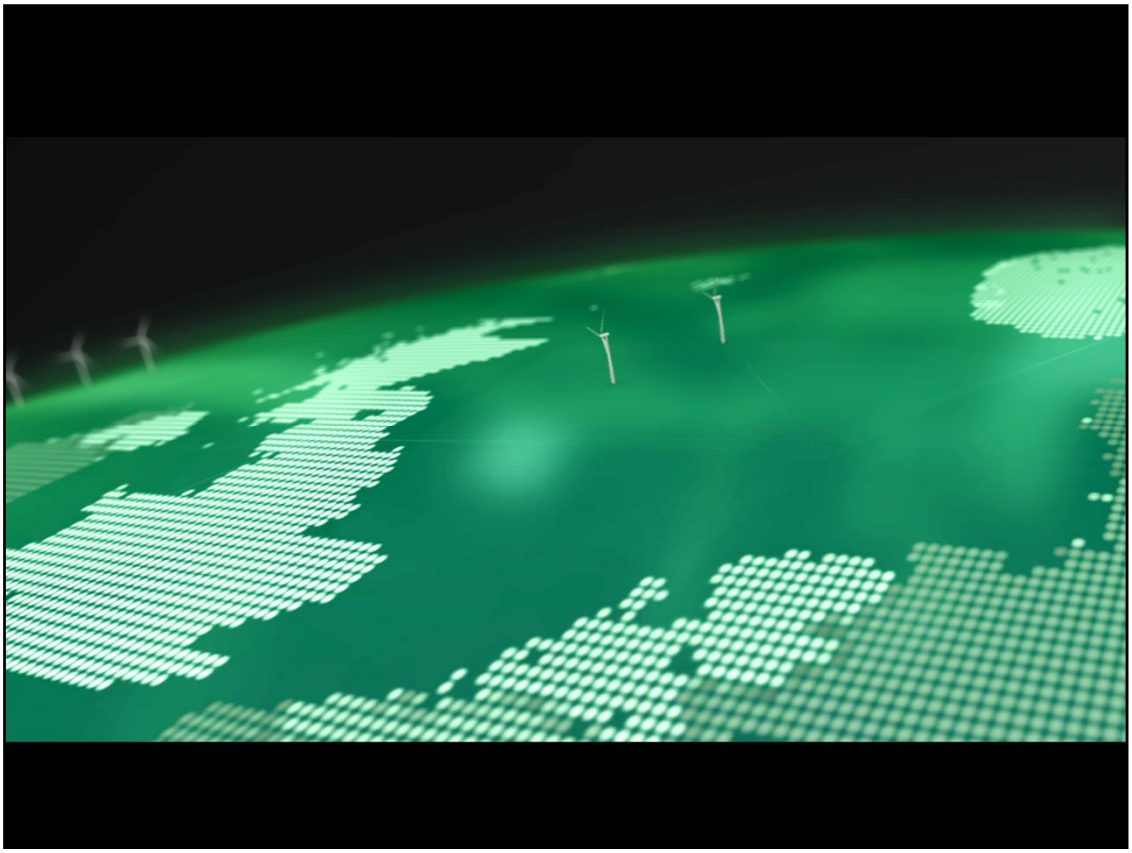
We believe that **now** is the right time to invest in understanding how our society interacts with the technology.



The FuturICT Platform will bring all these elements together alongside aspects such as education, outreach with the public and new connections with business.



Now is the right time to invest in understanding how our society interacts with the technology.



Play FuturICT Ident New Version Movie

All Movies produced by Mark Blackwood and Dave Spare at the Motion Box

www.themotionbox.co.uk