

FuturICT

Global computing for our complex world

What is FuturICT?

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

Revealing the hidden laws and processes underlying our complex, global, socially interactive systems constitutes one of the most pressing scientific challenges of the 21st Century. Integrating complexity science with ICT and the social sciences, will allow us to design novel robust, trustworthy and adaptive technologies based on socially inspired paradigms. Data from a variety of sources will help us to develop models of techno-socio-economic systems. In turn, insights from these models will inspire a new generation of socially adaptive, self-organised ICT systems. This will create a paradigm shift and facilitate a symbiotic co-evolution of ICT and society. In response to the European Commission's call for a 'Big Science' project, FuturICT will build a large-scale, pan European, integrated programme of research which will extend for 10 years and beyond.

Why do we need it?

Today, society and technology are changing at a pace that often outstrips our capacity to understand and manage them. It seems that we know more about the universe than about our society. Therefore it is time to use the power of information to explore social and economic life on Earth and discover options for a sustainable future. As the recent financial crisis demonstrates, the systems that we have built to organise our affairs now possess an unprecedented degree of complexity and interdependence among their technological, social and economic components. This complexity often results in counter-intuitive effects driven by positive feedbacks that lead to domino-like cascades of failures. Neither the precepts of traditional science, nor our collective experience from a simpler past, adequately prepare us for the future. It is simply impossible to understand and manage complex networks using conventional tools.

We need to put systems in place that highlight, or prevent, conceivable failures and allow us to quickly recover from those that we cannot predict. We need this insight to help manage our financial markets but also to tackle other risks, such as flu pandemics, social instabilities, or criminal networks. At the same time, policy-makers are currently faced with major decisions of how to plan the general infrastructure of services to cope with the demands of the future, and what is more, to do so in a sustainable manner. The same decisions are also posed to individuals who wish to improve their own lives.

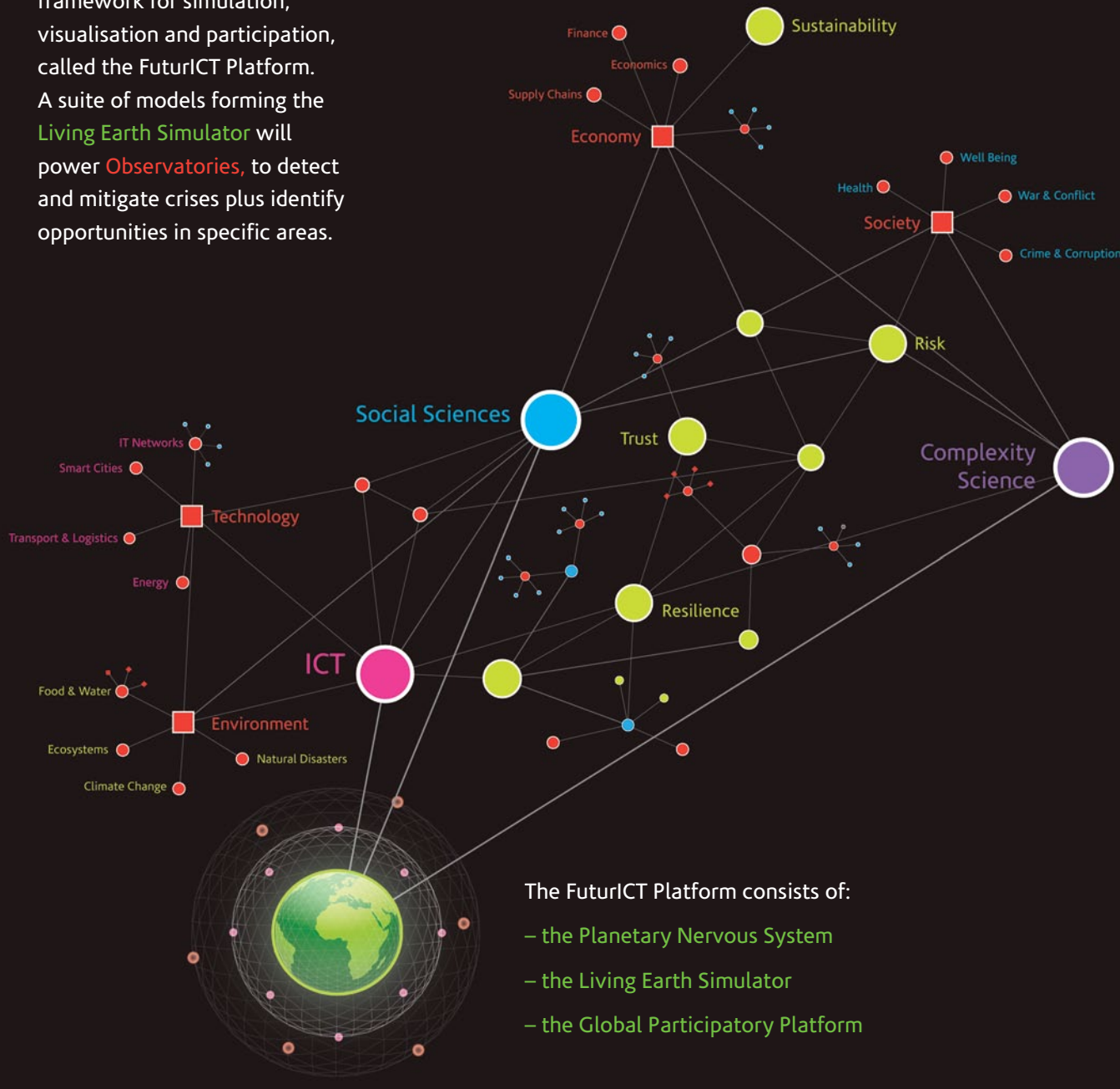
Thus now is the time to create a paradigm shift moving from a focus on the system components and their properties towards evaluating their interactions. These interactions are often hard to measure but create collective, emergent dynamics which are characteristic of strongly coupled systems.

How will it work?

The FuturICT flagship project will align the research of hundreds of the best scientists in Europe through a 10 year, €1 billion research programme to develop new methods which integrate different scientific models, data and concepts. To build capacity, regional support will be developed alongside educational programmes for young researchers.

FuturICT will build a sophisticated framework for simulation, visualisation and participation, called the FuturICT Platform. A suite of models forming the Living Earth Simulator will power Observatories, to detect and mitigate crises plus identify opportunities in specific areas.

These models will be driven, and calibrated, by data aggregated in real-time, which are gathered by a digital Planetary Nervous System. Both models and data will support the decision-making of policy-makers, business people and citizens, through a Global Participatory Platform which is intended to facilitate better social, economic and political participation.



The FuturICT Platform consists of:

– the Planetary Nervous System

– the Living Earth Simulator

– the Global Participatory Platform

The FuturICT Platform in detail

Planetary Nervous System

The Planetary Nervous System can be imagined as a global sensor network, where 'sensors' include anything able to provide static and dynamic data about socio-economic, environmental or technological systems which measure or sense the state and interactions of the components that make up our world. Such an infrastructure will enable real-time data mining - reality mining - using data from online surveys, web and lab experiments and the semantic web to provide aggregate information. FuturICT will closely collaborate with Sandy Pentland's team at MIT's Media Lab, to connect the sensors in today's smartphones (which comprise accelerometers, microphones, video functions, compasses, GPS, and more). One goal is to create better compasses than the gross national product (GDP), considering social, environmental and health factors. To encourage users to contribute data voluntarily, incentives and micropayment systems must be devised with privacy-respecting capabilities built into the data-mining, giving people control over their own data. This will facilitate collective and self-awareness of the implications of human decisions and actions. Two illustrative examples for smart-phone-based collective sensing applications are the open streetmap project and a collective earthquake sensing and warning concept.

Living Earth Simulator

The Living Earth Simulator will enable the exploration of future scenarios at different degrees of detail, integrating heterogeneous data and models and employing a variety of theoretical and modelling perspectives, such as sophisticated agent-based simulations, multi-level mathematical models, and new empirical and experimental approaches. Ideas from complexity science will be compared with graph theoretic approaches and other techniques based on concepts from statistical physics. Exploration will be supported via a 'World of Modelling' – an open software platform, comparable to an app-store, to which scientists and developers can upload theoretically informed and empirically validated modelling components that map parts of our real world. This will require the development of interactive, decentralised, scalable computing infrastructures, coupled with access to huge amounts of data. Large-scale simulations and hybrid modelling approaches will require supercomputing capabilities that will be delivered by several of Europe's leading supercomputing centres.

Global Participatory Platform

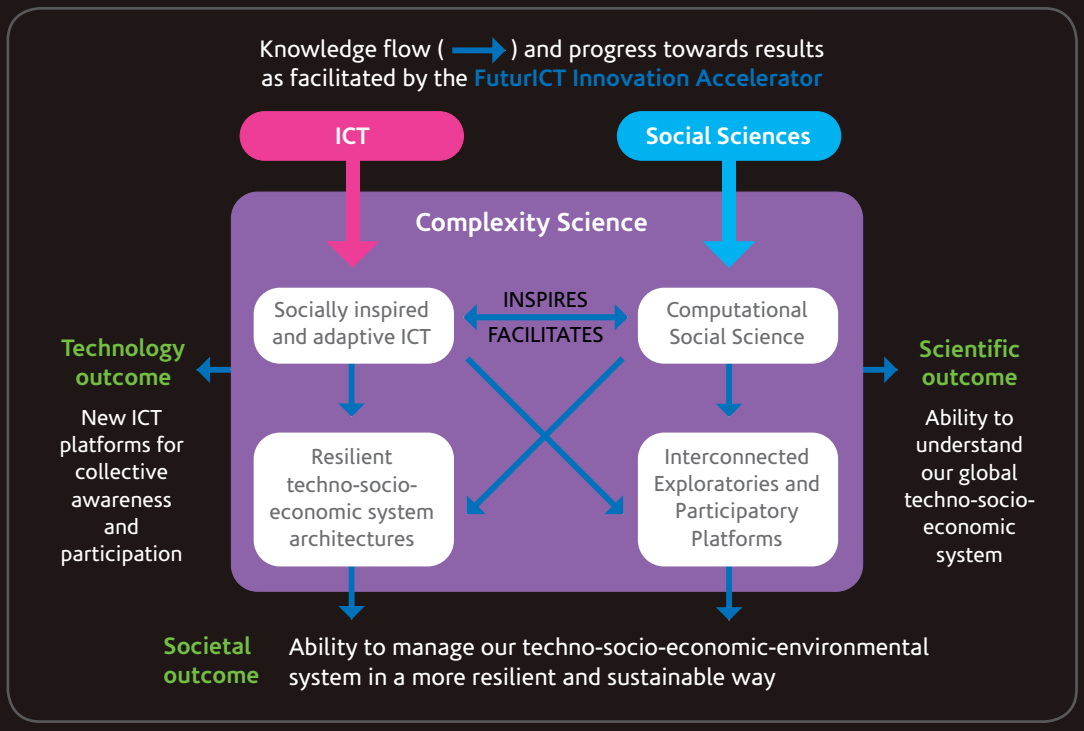
The Global Participatory Platform will be an open framework for citizens, businesses and organisations to be able to share and explore data and simulations, and debate the potential implications. It will democratise 'big data', promoting responsible use of information systems and opening up the modelling of complex systems to non-experts. Next generation decision arenas for policy-makers will be developed to evaluate the consequences of interventions, and then opened up and tuned to the needs of the diverse stakeholders. This will enable (1) software developers to add value, e.g. mobile apps that exploit specific datasets or upload data; (2) develop information visualisation tools, e.g. for policy analysts, citizens and researchers; (3) create semantic web services for distributed e-science, and platforms promoting reflective, participatory online debates. This participation will harness and shape the emerging global, social computing infrastructure to tackle various problems. In addition it will equip different scales of collective agent to more effectively sense their environments, interpret signals, debate the assumptions and implications, and make better informed, more collectively owned decisions.

What will be the benefit?

The FuturICT project will produce benefits for science, technology and society by integrating previously separated approaches. ICT systems of the future will provide the social sciences with the datasets needed to make major breakthroughs in our understanding of the principles that make socially interactive systems work well. This, in turn, will inspire the design of future systems, made up of billions of interacting, intelligent components capable of partially autonomous decisions. One goal is the creation of a privacy-respecting, reputation-oriented, and self-regulating information ecosystem that promotes the co-evolution of ICT with society. The tremendous growth in social media, mobile applications, Open Data and Big Data will enable complexity science to tackle practical problems by uncovering laws of interaction and help us understand the implications of strong couplings, thereby forging a new science of global systems that are more resilient to disruptions.

Furthermore, FuturICT will produce outcomes that are relevant to society, creating systems that help decision-makers assess the implications of alternative strategies. FuturICT's Global Participatory Platform will thus provide something like a policy 'wind tunnel' where the consequences of decisions can be explored. Hence the project will create a focus on resilience and sustainability.

The interdisciplinary concept of FuturICT foresees the integration of expertise in information and communication technology (ICT), complexity and social sciences, to create outcomes in three areas:



Exemplar, case studies will be performed in order to address major challenges such as smart cities or smart energy systems, but also build up our capacity to model systems and understand data. Additionally these studies will improve our understanding of over-arching, key concepts such as risk, trust, resilience and sustainability which are relevant to a wide range of systems, including ICT systems.

Having all this new information in place will allow FuturICT to study interactions among society, technology, environment and the economy through interconnected *Exploratories*. This will allow us to create an Innovation Accelerator that will discover valuable knowledge in the flood of information, help to find the best experts for projects, and support the distributed generation of new knowledge, hence promoting innovation. FuturICT will start an era of social innovation, sparking off novel, socially-inspired technologies, spin-offs and whole new business areas.

Who is involved?

Active collaborations are now taking place among Europe's top universities with hundreds of researchers engaged in the project. Hubs to support regional activities have been created in many European countries. FuturICT communities also exist in USA, Japan, China, and Australia. Individuals and a wide range of scientific organisations have expressed their explicit support, as have small and big businesses.

Each supporter recognises the vital importance of securing funds for this area of research to build European expertise within an integrated project and create an innovation economy based on the digital revolution, while at the same time benefiting humanity. Affiliations with existing complementary projects are being established and new projects are being encouraged.

FuturICT Pilot Consortium

UCL
ETH Zurich
Passau
DFKI
CNR
Oxford University
UCC



Collaborating Institutions include:

Aalto University
Imperial College, LSE, Open
Warwick & Surrey Universities
Cardiff, Edinburgh
EPFL, ZHAW
Vienna University of Technology
Johannes Kepler University of Linz
Swiss National Supercomputing Center
Fraunhofer, Max Planck, Stuttgart
PIK
PoliTO, ISI, Genova, Sapienza
Joint Research Centre (JRC)
UCD, TCD
Irish Center of High-End Computing
University of Warsaw
Warsaw University of Technology
ASE - Bucharest Romania
Bulgarian Academy of Science
University of Thessaloniki
University of Patras
Central European University
BME - Budapest Hungary
Tel Aviv University
Bar-Ilan University
CNRS & EHESS - Paris
INRIA - Grenoble
Tallinn University of Technology
Amsterdam, TU Delft
Catholic University Louvain
Lisbon University Institute
Linköping University
UIB, Universidad Carlos III de Madrid
Barcelona Supercomputing Center
University of Barcelona
Institute of New Economic Thinking

Regional hubs have been set up in many countries to coordinate activities. Some of the collaborating institutes are shown, we envisage different institutes joining the project as it develops. In addition, collaborations have started with Microsoft Research, IBM, Telecom Italia, Yahoo! Research, Disney Research, Telefonica, Mendeley, Springer Publishers, SAP and many others - please see the website for the full list and details of the hubs.

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