

## A new society in the making: A COST Interdisciplinary Strategic Initiative in the wake of the Digital Revolution

### COST Foresight 2030

#### Summary

*The world is traversing very innovative times. From user virtual communities to new financial instruments, the creative power of individuals is being fostered at proportions previously unseen. The main driver enabling such a pace of innovation, scientific progress, and user adoption is undoubtedly the digital revolution. Therefore, interrelationships between science, technology and society are increasing in complexity. Hence it is becoming more and more important to think, to debate and to shape the future in order to make the investments in science and technology more fruitful and successful and to translate these investments into innovation, competitiveness and quality of life in a long-term perspective.*

*COST Foresight 2030 is an initiative designed to explore a broadly-shared vision for a future world beyond 2030 permeated and shaped by the digital revolution. It will encompass a set of events presenting long-term perspective in the following selected fields -Computer and Communication Sciences and Technologies (CCST), Energy, Food Security, Environmental management, Life enhancement and Society- which play fundamental roles in human life and which are envisaged to be highly influenced by CCST-enabling technologies.*

*The outcomes of the COST Foresight 2030, in the form of Proceedings and Policy Recommendations, will be a valuable tool for researchers, policy-makers, industry, consultants, and strategy managers alike.*

**Keywords:** Digital Revolution, Research and Innovation, Future Cities, Societal Impact, Life Enhancement, Energy, Food Security, Natural Resources Management

#### Introduction

The world is traversing very innovative times. From user virtual communities to new financial instruments, the creative power of individuals is being fostered at proportions previously unseen. The main driver enabling such a pace of innovation, scientific progress, and user adoption is undoubtedly the digital revolution.

Surprisingly, though, even if the large contribution of the Information and Communication Technologies (ICT) sector as a share of world's GDP is well understood and recognized, the actual impact of all Computer and Communication Sciences and Technologies (CCST) as an enabler of innovation and progress in Society and Services for our citizens is largely overlooked.

In this context, the COST Foresight 2030 Workshops will aim at stimulating discussions on potential future scenarios in a world permeated and shaped by the digital revolution.

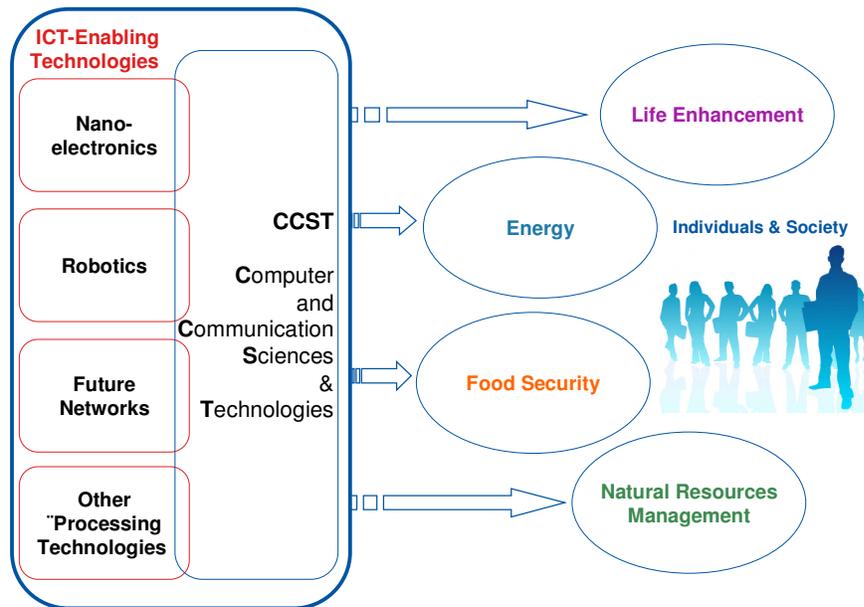
The past twenty years have been characterised by significant changes on political and technological level. It is expected that also the next twenty years will bring massive changes in the way our world is functioning. In particular, these changes will result from enormous

advances in the field of technology, especially information and communication technologies. As The Economist states in his “Foresight 2020”, Knowledge Management will become the major element for productivity. In this sense, numerous studies agree that the major factors determining future innovation are the individual technical skills, the quality of the country’s telecommunication and IT infrastructure.

The areas of interest and application of ICT as an enabler for future development are numerous. In order to be able to deliver promising insights and results, along with the COST tradition, the COST Foresight Workshops will focus on societal-driven research topics and favour interdisciplinary exchange. Hence, the Workshops will focus on the following fields:

- **Computer and Communication Sciences & Technologies**
- **Life enhancement**
- **Energy**
- **Food security**
- **Natural resources management**

The concept of COST Foresight 2030 is depicted in the figure below.



*Figure 1: The role of ICT and CCST as enabling technologies and sciences, respectively, and their impact on different fields relevant for the individuals and society as a whole.*

The outcomes of the COST Foresight 2030, in the form of Proceedings and Policy Recommendations, will be a valuable tool for researchers, policy-makers, industry, consultants, strategy managers, etc. COST, with its huge community of outstanding scientists and its tradition of cooperation across disciplines is the perfect arena for this kind of exercise at the frontiers of today’s scientific knowledge.

### ICT: Enabling Technologies

An important trend in the history of computer hardware is described under the term Moore's Law. It states that the number of transistors that can be inexpensively placed on an integrated circuit is increasing exponentially, doubling approximately every two years.

The observation was first made by Intel co-founder Gordon E. Moore in a 1965 paper. Notably, the trend has continued for more than half a century and is not expected to stop for another decade at least and perhaps much longer.

Furthermore, almost every measure of the capabilities of digital electronic processing devices is linked to Moore's Law, namely processing speed, memory capacity, even the resolution of digital cameras. All of these are improving at (roughly) exponential rates as well. This has dramatically increased the usefulness of digital processing elements in nearly every segment of the world economy.

The same pervasiveness of digital processing technologies applies to scientific fields that are outside Computer and Communication Sciences and Technologies. In areas as far apart as Archaeology and Quantum Physics, ICT is the driving force of scientific and technological change in the late 20th and early 21st centuries, with a high likelihood that its impact will also grow exponentially in the next decades. Over the next twenty years, it is envisaged that a new wave of both technology and science-based innovation will arise and significantly affect our ICT-empowered Society.

A sample of building blocks in terms of relevant ICT enabling technologies, in the sense that they increase both the processing power and the memory capacity of electronic (intelligent) hardware, is reported below:

- **Nano-electronics**

Micro- and nano-electronics will continue to drive the technological innovation in the years to come, not just in terms of integration of increasingly complex systems on chip. In fact, by

2030, a bifurcation from current Moore's Law is expected to occur, leading to an important differentiation of technology roadmaps regarding (micro and) nano-electronics: i) "More of Moore" for continued miniaturization of technologies related to CMOS on one hand, and, on the other hand, ii) "More than Moore" which combines different technologies including MEMS/NEMS (micro/nano electromechanical systems) and sensor technologies.

- **Robotics**

Nowadays robotics is moving away from the traditional industry automation applications. Notably, swarm robotics is a new approach to the coordination of multi-robot systems which consist of large numbers of relatively simple physical robots. The goal of this approach is to study the design of robots such that a desired collective behaviour emerges from the inter-robot interactions and the interactions of the robots with the environment, inspired but not limited by the emergent behaviour observed in social insects, called swarm intelligence.

Potential application for swarm robotics include tasks that demand for extreme miniaturization (nanorobotics, microbotics), on the one hand, as for instance distributed sensing tasks in micromachinery or the human body. On the other hand, swarm robotics is suited to tasks that demand for extremely cheap designs, for instance a mining task, or an agricultural foraging task.

- **Future Networks**

Over the next twenty years next generation networks will be able to transport all information and services (voice, data, and all sorts of media such as video) by encapsulating these into packets, like it is currently done on the Internet. Future developments and new functions are foreseen also for mobile communication devices which will get closer to computers in their functionalities by incorporating more processing power, and will support novel nomadic applications. Likewise, as a consequence of the More of Moore trend, the pervasive presence of networked devices (a.k.a. the 'Internet of Things') able to interface with the environment to support context-aware services, can be envisioned. The result will be the arising of extremely large-scale, dynamic, possibly disconnected, pervasive networks providing a huge variety of services, able to enhance the users experience by exploiting context-awareness capabilities.

- **Other ICT Technologies**

It is evident that the list of ICT enabling technologies reported above is by no means exhaustive and that other current and future technologies will play an equally important (or even greater) role by year 2030. For instance, as a bi-product of the More than Moore technology diversification, Lab-on-Chip technology carries the promise to revolutionize personal healthcare in the coming decades, by making it more efficient and cost effective. Efficient medical monitoring and therapeutics will be achieved by novel implantable devices, which are capable of continuous bio-monitoring and drug delivery functions. In the future, these systems will incorporate much more control and sensing functions, including physical parameter (e.g. pressure) inside the body, and therefore will be applicable for a new range of therapies which are not addressed today.

### CCST: Enabling Science

The enabling technologies described above will contribute to define CCST in turn as an enabling science for other fields.

Future developments in Software Science and Technology will yield more and more intelligent and efficient uses of state-of-the-art processing technologies. Examples of this trend include Distributed Databases that will allow for Large-Scale Data Management, embedded systems, which are becoming ubiquitous and key for real-time applications, the Semantic Web and Web 2.0 that will further unleash the usage of CCST in other disciplines. Already now, new disciplines are emerging at the frontier of CCST and other Sciences, like Bio-inspired Computing & Networking and Bio-informatics & Computational Biology. Moreover, effective multidisciplinary research with CCST components will necessarily include Computer and Communication Scientists, with the effect of bringing new ways of scientific thinking into other disciplines, yielding innovation through such cross-fertilisation.

In the specific context of COST Foresight 2030, we will concentrate on envisioning possible scenarios of four scientific fields that will be enabled by the accelerated growth of ICT/CCST both in terms of Hardware and Software evolution.

Ultimately, the overall enabling power by ICT/CCST on other fields and disciplines will be defined by the following factors:

1. User-centric design: The degree of acceptance of a new technology by the users, will be crucial in determining the successful deployment of the technology itself;
2. Cost-effectiveness: Only cost-effective technologies can guarantee a wide diffusion and adoption among society, thus preventing potential digital divide gaps.
3. Sustainability: The capacity of defining and implementing innovation processes that are viable in the long term from the economical, environmental, societal, etc. viewpoints.

## Fields of Interest

### **A) Life enhancement**

Life enhancement is based mostly on a digital biology-orientated concept. The key areas that define the discipline of digital biology are: scientific data integration, multi-scale modelling and networked science. First and foremost, digital biology will enable the accommodation of data at various levels of abstraction – molecular, cellular, pathway, organ and organism- and also at different stages of analysis. Digital biology will enable the combination of heterogeneous data into a unified form, more simplified understanding and knowledge of scientific experiments and behaviour. The generation of a platform containing a vast amount of information that is easily accessible and searchable will enable efficient data mining for studying and understanding on human health and disease. Database analysis of human brain will have an immediate impact on ‘intelligent’ machines – new architectures and performance enhancement for computers.

Digital biology will enable analysis of genetic variation in disease and drug response so clinicians will be able to predict individual disease risk and tailor therapies. In addition, large scale biomedical science collaborations via emerging cyber infrastructure will enhance diagnosis, doctor-patient interaction and other aspects of health care delivery. Computers will enable the conduct of clinical research by accelerating the pace of discovery and application of clinical findings. In addition, linking basic and clinical research through networks will enable scientists to characterise the function of genetic networks in processes of cellular development, health and disease (Ref. 13)

Digital biology will provide computer-based models of biological processes: real-time, photo-realistic interactive simulations of biological phenomena. In such a way visualisation and better understanding of hard to observe natural phenomena or difficult to explain biological concepts will be possible. The interactive simulations will allow for the acquisition of answers when ‘what if’ phenomena are applied; i.e. scientists will have the ability to probe and model complex biological phenomena. This has implications to cancer research, drug development etc.

It should be stressed that standardisation of data content and format is needed, whereas new algorithms that will enable format interoperability are also necessary. Education and training is needed to facilitate the evolution of biology. Multi-disciplinary expertise for the development of integrated systems models is also a prerequisite. Mathematical biologists and biological mathematicians should be trained. Better networking that will allow people to collaborate and share data more efficiently is required. Strong partnerships between scientists, governments and industry need to be set and a variety of policy and organisational issues should be addressed- data dissemination, data integrity and validation, protection of human data, operational efficiency, intellectual property, ethics, openness etc (Ref. 14).

Finally, as the newspaper *The Economist* writes in its first 2008 edition: Dr de Grey’s reason for thinking that some people now alive may see their lives extended indefinitely is based on the hope that those few extra years will see further discoveries based on (the logic of disposable-soma theory). Noticeably, Dr de Grey is a Computer Scientist, working in Cambridge, UK.

### **B) Energy**

Energy is a key issue for growth and development. It is predicted that in 20-30 years about two thirds of new energy demand will come from developing countries (especially from China and India) whereas the economic activity in developed countries will remain the major source of carbon emissions. Hence now is a crucial time to make long-term infrastructure decisions to address the need of reducing greenhouse gas emission and the growing energy demand. ICT will be crucial in transforming the way to manage energy, playing a key role in decentralised generation and use of energy (distributed energy) that will however coexist with centralized distribution. For example renewable energy could be use both to generate

electricity and to store energy in the form of hydrogen, which would be then distributed through smart power grids. The developing countries would be the biggest beneficiaries of this transition from a fuel-based to a hydrogen-based economy.

It is expected that by 2020 biologically produced hydrogen technology will be viable, whereas methane and methanol-based fuels will be produced by 2018 with non-fossil hydrogen. In the same line, gasification of plants, wood and straw is expected to be commercially viable within 15 years and of forest biomass by 2018. All these developments though require international co-operation which can only be achieved in an efficient way through ICT (Ref. 17). In addition to this, it is anticipated that by 2010 20% of the area used for agricultural purposes is expected to generate alternative energy sources and bio-plastics, biomaterials. As a result it is expected that space will be needed for the growth of biomass and crops for industrial use, which will compete with the space needed for food production. This clear bottleneck can be overcome through maximisation of productivity for food security through the application of ICT. It is envisaged that recycling wood and increasing the durability of wooden materials will lead to a 50% reduction in the need for trees by 2015. ICT in collaboration with integration technology for wood and non-wood materials, manufacturing techniques for high-strength and versatile composite materials which are easy to shape and process will be available by 2015 (Ref. 17 and references within).

In particular ICT can act as an enabler to improve energy efficiency, covering the whole energy life-cycle, i.e. from energy generation and transformation to its transport, distribution and end-use and thus contributing to sustainable growth. Moreover, with ICT it is possible to remotely monitor energy infrastructure and perform preventive actions before failures (natural hazards or system failures) occur, ensuring stability and reinforcing security. ICT will enable data collection from a large number of sensors, modelling, prediction and strategy support systems and real-time optimisation. All these taken together will facilitate decision making, since decisions will be based on highly reliable networks and heterogeneous information taken from a complex event environment.

The main promising sector for further ICT applications will be the construction of energy-smart, networked homes and buildings with user-friendly interfaces for control and command (domotics), able to learn and adjust to user-preferences. This will have an impact on energy consumption and will help the identification of areas where saving can be made. These ICT-based solutions will increase energy awareness and hence will be an instrument to change consumers' behaviour.

### **C) Food security**

According to the UN Food and Agriculture Organisation (FAO), food security is stated as 'the situation when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active life'. Globally there will be enough food for a growing world population by the year 2030, but hundreds of millions of people in developing countries will remain hungry and many of the environmental problems caused by agriculture will remain serious, according to the summary report of "World agriculture: towards 2015/2030", a study launched by FAO. Generally, in 20-30 years an increased food production with decreased losses and minimum impact on both biodiversity and environment are required.

Solutions should involve, among others, global socioeconomic development, maintenance and improvement of farmers' rights, trade and regulatory frameworks via a global system. Traditional methods may no longer be effective enough to tackle the problem since there are factors that limit their applicability. These include decreasing area of land available for agriculture due to the increasing population, deforestation and desertification, reduction in water quality and availability, and changing environmental conditions. Living in a digital world will enable solutions that are based on components that are less labour intensive and time-consuming and are thus more efficient and effective. A better way to tackle the problems may help optimally match needs and resources worldwide in real time (Ref. 2-4).

One promising developing area is digital agriculture, also called informational agriculture or intelligent agriculture, which is the 'expression, design, control and management of the modernised agricultural high-tech, dealing with the digitisation and visualisation of objects and whole processes related to agriculture' (crop production, forestry, aquatic industry etc) (Ref. 5). All information stored in a database will be multi-source, multi-temporal, multi-dimensional, and multi-scale. Through digital agriculture it should be possible to simulate and make a virtual reality of agricultural natural phenomena, e.g. agricultural chemicals in soil residual, production, e.g. crop growth, and economic processes, e.g. product market distribution.

ICT will develop business opportunities for farmers by linking rural producers to global markets, to create data standards that allow production information that will boost regional and production specificity, to encourage producer associations, access to government services and bridge the knowledge gap between developing and developed countries (Ref. 6).

In addition, mobile mapping system precision agriculture can enable agriculturist to collect and analyse data on the spot (soil moisture, soil fertility, weed, plant disease, status of crops seedling growth etc) and based on the new acquired information to implement decision-based precision agriculture. This can in turn have environmental implications; for instance herbicides application is minimised and confined only to a specific area of the farmland, whereas irrigation can be closely controlled reducing water logging, salinization etc (Ref. 7). Moreover, a reduction of the environmental impact will be obtained by the use autonomous robotic systems (which derive from integrated research on the fields of precision and digital agriculture, agricultural automation, and intelligent agriculture) that will increase precision and efficiency in the care and management of crops and animals. Furthermore, agricultural bioinformatics and macromolecular structure dynamic simulation will enable innovative more effective agricultural chemicals to be designed.

The creation of a global information platform will enable the identification of the best sustainable bio-energy crop for diverse regions and provide both business and entrepreneurs with new technologies and systems to convert grasses, wood and biomass to usable, renewable energy with minimum environmental impact.

As far as the fish industry is concerned fish provides consumption is expected to rise due to health and diet quality concerns. ICT can be employed to bring answers to immediate concerns over resource use and could significantly contribute to increases in aquaculture outputs and stabilisation of fish prices (Ref. 9).

ICT and robotic technology in agriculture will enable food security and maintain EU competitiveness in the agro-food industry. ICT will be an integral part of the whole production chain, managing and tracking, from raw materials to final products and the optimisation of logistics aspects and management. In this way, the value of the products is increased, the customer is satisfied and food production and sustainability is achieved. In a more global aspect, more than half of the developing world's population live in rural areas and are economically dependent on the performance of agricultural production. ICT input is vital for improving agricultural performance which is a prerequisite for economic growth. Therefore, by bridging the rural digital divide (Ref. 12), poverty reduction and food security can be achieved in developing countries (Ref. 13).

#### **D) Natural resources management**

The OECD Environmental Outlook to 2003 identified future environmental challenges which are of increasingly complex or of global nature. The most urgent challenges are climate change, biodiversity loss, the unsustainable management of water resources and the health impacts of pollution and hazardous chemicals.

Population growth and the rapid pace of agricultural, urban and industrial development will place increasing pressures on the global and regional environment. Factors affecting the environment and mankind's management of natural resources are many and varied, and

these may change as development takes place. In order to maintain and even enhance life quality and economic growth in Europe a well thought environmental management strategy has to be implemented. We require tools and methods of analysis which help us to gather, analyse, model and monitor diverse data in a rapid and flexible manner. These tools should also allow scientists to communicate readily to decision and policy makers these analyses and their implications. Through ICT a platform of information gathered from remote areas through sensors can be analysed and based on models and simulations actions to prevent or limit an arising problem can be identified. Especially for very complex and broad environmental issues, ICT can improve international cooperation and help the creation of trans-national integrated information space. ICT can contribute to a safer, cleaner and healthier global environment by enabling the prediction and better management of the environment and its resources (Ref. 15). Hence, there are significant opportunities for improving environmental sustainability through ICT. The already existing Geographical Information System (GIS) (Ref.16) might allow emergency planners to calculate emergency response times in the event of a natural disaster. Real time sensor data linked to 3 dimensional GIS with applications both inside and outside buildings and also underground will be the tool that will enable risk and crisis management individuals to evaluate an emerging situation and be able to handle this in an accurate and effective way.

Through ICT cities can have a network of urban environmental management that will enable them to participate in common actions for monitoring and managing of pollutants for air, water and soil and this will improve the capacity to assess population exposure and health risk.. Both public and corporate decision makers will be able to compare policy options quickly, cost-effectively, obtain detailed information on experiences from elsewhere and determine the most suitable intervention. Also ICT can enhance the local government's actions in urban environmental management by improving local governmental activities, setting up communication with relevant stakeholders, creating partnerships. Through ICT residents can participate, get educated on the environment, and have as individuals their own impact on urban management.

Emerging digital technology can positively affect the environment by providing power-efficient technologies. It can contribute to make passenger and freight transport more efficient or even can reduce the need for travel and transportation of goods by bridging distance. It can increase efficiency and innovation by allowing people to work in more flexible ways, promoting virtual mobility applications. All these will help to save energy and lower carbon emissions.

Moreover, ICT-supported systems could play an important part in recycling and remanufacturing (the practice of recovering spare part of end-of life goods and re-engineering them back to produce reusable products) of municipal solid waste in general and waste from electrical and electronic equipment in particular.

### **E) Future societal organization**

Taking all the four points of focus together we are left with the question how future cities are going to be. The major debate is on whether the ICT will lead to a more balanced spatial environment or to more concentrated cities. This is difficult to foresee since ICT is highly involved in administrative and political processes, business workflows and short and long distance communication between people. In the same line, economic, cultural, demographic, political and environmental trends are factors that shape cities and should be considered when developing potential scenarios. Two major scenarios are foreseen. According to the scenario "Strengthening of the global Cities" as headquarters for Competence, Knowledge and Information, firms find personal instead of virtual contacts better, with a need for a higher education level and better infrastructure conditions. In this scenario ICT will then lead to a reinforcement of the existing dissimilarities between large cities and peripheral regions. On the other hand, according to the "Deconcentration" thesis, enterprises will be free to choose their location because they use ICT to communicate, interact and transact. Consequently, face-to-face contacts will not be seen as important as today leading to a form of neutralization of the traditional advantages that agglomerations had

so far (Ref. 18). Although plausible, these two scenarios do not consider other crucial factors that should be taken into account for foreseeing the future cities such as the strategies that the local or regional actors (citizens, business, politics, and administration) will follow. Will these actors have an influence on the ICT driven world or will they remain passive? ICT will gain and transmit knowledge on different fields, governments will use ICT to improve their service, spread information on political and administrative work, build networks with other cities and regions, give people more power in defining objectives etc. Major impacts and changes are foreseen in education, training, employment, security, sound physical infrastructure (transportation, water supply, energy, water disposal), knowledge and technology, business, health and quality of life.

ICT has currently already a strong impact on education and it is probably in this field that it will have the greatest impact by leading to new models that will emphasize social inclusion, participation and consensus. ICT-based education and learning will indeed allow for a greater proportion of society to participate in learning regardless of age, gender, and location with direct effects on job creation and wealth, social inclusion, and competitiveness. ICT will also enable to provide new learning opportunities in remote regions, rural areas, specific communities and groups as well as to physically challenged individuals and immobile groups creating new ways of education and training which consequently may lead to new business models. Indeed, by enabling the continuous expansion and creation of virtual work environments, virtual teams, and organisations, ICT will provide individuals, including physically challenged people or immobile groups, and companies also in disadvantaged remote regions with new opportunities to integrate more efficiently and more effectively in the economy. In addition to this increased inclusion, additional benefits as a result of increased use of ICT will be: faster product development, cost and overhead reductions, faster and more reliable transactions, better relationships with customers and suppliers, improved levels of customer service and support, and enhanced collaboration opportunities. To date ICT has the strongest impact on manufacturing and retailing; the next revolution will most likely be in service industries, including public services such as healthcare. ICT will indeed enable healthcare to be delivered better, quicker and earlier. Patients will be better informed and have high expectations of healthcare systems: new technologies will extend life and improve health and well-being, opening the way to more personalised treatments. This will lead to a shift from traditional healthcare to "well-being for all". Demands for new treatments and therapies, better monitoring, more personalised care, and preventative health management will all make intensive use of ICT, in close combination with medicine and genomics. Last but not least, ICT will have a strong impact on interpersonal relationships and human behaviour. While on one hand there is a feeling that face-to-face communication, social gatherings and 'neighbourliness' will decline with the rise of ICT leading to an impoverishment of our lives and communities. On the other hand an increasing influence of ICT in daily life will bring also major benefits by offering the right tool to some categories of people for increasing their social inclusion.

ICT will for instance play a prominent role in ameliorating the negative effects of physically fragmented communities and reinforce/extend existing social networks and communities, from the family level, through local communities up to nations and cultures by providing the capability to share information and to communicate in faster and easier ways. This so-called community-based knowledge building environments will therefore facilitate the development of a 'collective', 'living' or 'community memory' whatever the physical location of the individuals will be.

In this complex scenario, where ICT will have impacts on many different levels, government will have the difficult task to regulate and coordinate this new world.

ICT is therefore highly involved in all these parameters of our daily life. Nevertheless, if the role of ICT in our lives will not be well understood then it is possible to have the worst case scenario in the future where elderly will not be 'connected' to the world and thus marginalized owing to their lack of choice or preference to remain 'steeped in tradition', demographic imbalances will occur, there will be pressures on physical infrastructure (housing stock in

particular and affordability), the ethos will become the 'survival of the smartest', law and order will be a 'big brother surveillance' where society will be 'protected' using various systems including electronic tagging, DNA database monitoring, CCTV tracking, GPS tracking etc, hence there will be loss of individualism, people will be more socially isolated and moving away from public life, adopting a more individual approach to daily life etc.

In conclusion, there is a need for alternative planning approaches that will take into account the key role that ICT plays and will play in our lives so as to tackle the inherent short-termism of traditional policy making frameworks so as to formulate long-term strategies for sustained urban growth (Ref. 19).

### Objectives and Foreseen Outcomes

- To identify fundamental and transformational driving forces (emerging technologies, scientific developments, research priorities and innovation systems) that will affect Europe and the world in the next twenty to thirty years.
- To encourage groundbreaking and critical thinking concerning long-term developments and future innovation and in particular to create insight and vision regarding long-term perspective of the above-mentioned areas, taking the digital revolution as a starting point.
- To involve different stakeholders (research organizations, public authorities, non-governmental organizations, industry) and hence to promote the discussion and dissemination of results among a wide audience focusing on the role and contribution of science and scientific cooperation.
- To merge state-of-the art multi-disciplinary scientific teams and therefore to promote collaboration among areas of research which have currently limited interaction. This encouraged interdisciplinary approach will be an incentive and a starting point for future COST Trans Domain Actions resulting in enhanced European scientific multidisciplinary.
- To construct multiple scenarios and examine alternative paths of development on the basis of a thorough comprehension and analysis of the subject in its broadest and interdisciplinary perspective.
- To help shaping the future by influencing policymakers dealing with research, innovation and strategic decisions. The outcomes of this series of workshops in the different fields will enable policymakers to identify possible future problems and give input of how these could be dealt with.

### Time-frame and Overview of Events

#### **Advisory Group Meetings, 4 December 2008**

The format of the different workshops and list of participants will be determined by the High Level Advisory Group which will be formed by about 6-9 persons that between them must be aware of the state-of-the-art in the field of ICST, Energy, Food Security, Natural Resources management, Life enhancement and Society.

#### **Strategic Workshop ICT/CCST, 1 to 3 April 2009**

The first workshop will include approximately 20 experts in the field of Computer and Communication Sciences and Technologies. The aim of this workshop is to set the scene with the presentation of the state-of-the-art as well as the foreseen wave of technologies and scientific novelties by 2030 in this field.

Before the beginning of the workshop, keynote speakers are expected to submit a paper in their area of expertise. These documents will be used as a base for discussions of the three day workshop. In order to make discussion more fruitful, the participants will be divided into three working groups, with each working group addressing specific thematic areas.

#### **Four Parallel Strategic Workshops Energy, Food Security, Natural Resources management and Life enhancement, 30 June to 2 July 2009**

Based on the outcome reached by the first workshop, keynote speakers in the four fields of interest will submit papers in which they will describe the expected development in the various areas that will be enabled by the progresses in the ICST field.

Every workshop (three days) will involve approximately 20 experts (in total about 80 persons) and the participants will be split into three working groups with six to seven persons each. All workshops should end with a plenary session where the main ideas should be summarized. Since the selected fields are closely linked with each other, a rapporteur from each working group of the different workshops will discuss together for an additional half a day. This interdisciplinary session will allow an exchange of the major conclusions and a comparison of the results achieved in the different fields, a discussion of common topic from different perspectives that will allow the identification of key open points. The open points will also serve as a base of discussion during the Wrap up in December 2009.

#### **Strategic Workshop Societal Organization, 7 to 9 October 2009**

Based on the conclusions of the previous five workshops, approximately 20 experts will try to envisage the society of 2030, especially focusing on future cities, health, education, business, impact on human behaviour.

#### **Wrap up, January 2010**

A committee formed by one rapporteur from each working group of the six workshops will analyse the various conclusions obtained and elaborate this information for the preparation of a final conference.

#### **International Dissemination Conference, June 2010**

The international conference will be a major dissemination event. It will last for three days and will involve experts from academia, industry, and policy-making and will serve as a mean to gather all major outcomes of the six workshops and to present those to the members of the current society.

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