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Monograph: 2010 - Emerging Information Technologies (I)

(published jointly with Novática*)

Guest Editors: *Alonso Álvarez-García, Heinz Brüggemann, Víctor-Amadeo Bañuls-Silvera, and Gregorio Martín-Quetglas*

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Presentation

The Future is getting Closer

Alonso Álvarez-García, Heinz Brüggemann, Víctor-Amadeo Bañuls-Silvera, and Gregorio Martín-Quetglas

"There can be no prediction of the course of human history by scientific or any other rational methods."
Karl Popper

"Prediction is very difficult, especially about the future."
Niels Bohr

There are many quotes stressing the impossibility of predicting the future. This fact has not deterred humanity from trying to open a window into the future. The truth is that few tasks - recognized beforehand as impossible - have attracted more attention and consumed so much effort, which tells us that people really do believe that we can see into the future.

Guest Editors

Alonso Alvarez-García graduated as a Computer Engineer from ICAI, Madrid, Spain, and the *Universidad Politécnica de Madrid*, UPM. In his career of over 20 years he has participated in several projects, especially in the Internet area: content management, P2P e-commerce, digital home, ambient intelligence, networked car, etc. He is currently in the Technology Observatory at Telefónica I+D, carrying out applied foresight activities. He is the author of 12 books and numerous technical articles. He is also a senior member of ATI (*Asociación de Técnicos de Informática*, Spain) and co-editor of the "Technology Trends" section of its journal *Novática*. <aag@tid.es>.

Heinz Brüggemann received his diploma as a Telecommunications Engineer in 1973. He is currently Director of Celtic, a EUREKA cluster. Previously he worked as a telecommunications engineer at Deutsche Telekom in service management and professional education. For several years he worked as an expert/senior expert for service management and professional education with ITU (International Telecommunications Union - a UN organization) on telecommunications development projects. He was also a program manager and technical manager at Eurescom, Heidelberg, Germany. He has been involved in about 50 R&D projects in telecommunications services, network management, and security. <brueggemann@celtic-initiative.org>.

Víctor-Amadeo Bañuls-Silvera is a Professor of Information Systems at the *Universidad Pablo de Olavide*, Seville, Spain, and Visiting Research Scholar at New Jersey Institute of Technology (NJ, USA) and the Information Management Department of the University of Tilburg (The Netherlands). Dr. Bañuls has led various R&D projects and has several publications with impact factor on foresight models, information systems for emergency management, evaluation of information systems and hybrid learning, as well as a book. <vabansil@upo.es>.

Gregorio Martín-Quetglas received his PhD in Mathematics in 1975. Since 1992 he has been a Full Professor of Computer Science at the *Universidad de Valencia*, Spain, where he has directed several research groups, related to various computer applications: biomathematics, advanced instrumental cardiology, artificial intelligence in the control of transport systems, and developments based on XML languages addressed to public services. He has published seven books and more than two hundreds papers related to his fields of experience. During part of his professional life, he has been active in collaborations between the worlds of business and academia, being the Spanish representative on several European Union technical committees, including some related to the various Framework R&D multi-annual programs. He is currently on a sabbatical year at the *Universidad Politécnica de Valencia* to research into Service Engineering. <gregorio.martin@uv.es>.

Note from the Chief Editor

Emerging Information Technologies: A Monograph in Two Parts

When we talk about trends in technology, there are many perspectives from which to look at them. For example, different technologies may have different development rates, and their impact on people, on the economy, on society, on businesses, etc. might be different too. The subject is so broad that the Editorial Team of **UP**GRADE and the Guest Editors of the monograph decided that it was impossible to compress all the materials into just one issue of our journal. Accordingly, the monograph has been split in two different parts.

In the first part (this issue) we will cover the general spectrum of new emerging technologies while in the second (July-August issue we will focus especially on the impact of those new technologies on businesses. In the second part we will also publish some interviews with important people from institutions and large enterprises, in which we will be asking them what they are expecting from the emerging technologies in the coming years

In the Information Technology and Communications industry (ICT), this need to think about future trends has become even more evident in recent years. We live in a world of accelerating change driven by phenomena such as globalization and supported by the rapid development of ICT which accelerates the transmission and use of information and knowledge. In this context it is clear that not only do ICT investments need proper monitoring, but also that decision makers should be able to identify the scientific areas in this strategic industry with the greatest economic and social impact. In this context, developing tools for the analysis of developments in the field of ICT becomes a first-order scientific priority, because of the importance of this sector as well as its dynamic and changing nature.

In this new environment, the actors of national innovation systems faced a growing degree of uncertainty in the prioritization of science and technology investments and business development keys. **Technology foresight** has been a response to this challenge, establishing itself as a support tool for decision making and prioritization of science and technology policies. In order to achieve this aim, Technology foresight exercises are not limited to predicting future technological expectations. On the one hand, technology foresight describes a range of potential futures according to the participants, especially stakeholders; on the other hand, these processes are more focused on the process rather than results.

In this sense, technology foresight methodologies are aimed at systematizing the collective thinking that underlies the process, and achieving consensus among experts. Such tools are often based on technological forecasting tools. In particular, expert panels, the Delphi method, and scenario generation methods have been used, nearly always in combination, to systematize expectations. However, there are other techniques used in Technology Foresight exercises such as bibliometric and patent analysis, aimed at the detection of key and emerging areas of research.

By applying these foresight methodologies, we can predict key technology trends. These trends are the backbone of the technology foresight process and are used by the experts for building scenarios. These scenarios are not just forecasts; they describe the possible alternative future paths for which we should be prepared. These scenarios allow us to test the future and describe its consequences, so that we can prepare specific actions for when and if they materialize.

Traditionally, technology foresight exercises have addressed ICT trends as a representation of a future vision of society in general. The most prominent exponent of this approach is NISTEP's foresight activity on Japan's technological future. A different approach can be found in the 'critical technologies for national competitiveness' approach. Examples of this approach are the national foresight exercises performed in France and the USA. The criteria for consideration as a critical technology in each country vary; for example in the case of the USA it is economic prosperity and national security, while in the French case it is the relative position of the country, industry attractiveness and critical success factors.

In some cases, trends and/or critical technologies studies are complemented by in-depth research reports on the ICT industry. These studies may focus on the current state of the sector, such as the contributions of the ITEC Group Technologies to the UK foresight program or the reports on the content industry and the digital economy of the Catalan Institute of Technology in Spain; or the Australian case, based on scenarios. Other reports also take into account global technological developments in the generation of future scenarios. In particular, we note the report of the British Ministry of Defence with a time horizon of 40 years, including technological ubiquity and mobility, along with key social and economic trends, or the Atlantic Council for the United States Government.

In recent years there have also been some specific European initiatives, such as FISTERA (Foresight on Information Society Technologies in the European Research Area), which is a specific thematic network supporting agents involved in the Technology Foresight process in the ICT sector, or RISEPTIS (Research and Innovation for Security, Privacy and Trustworthiness in the Information Society). As we can see, the ICT industry plays a very important role in Technology Foresight exercises.

Technology-based companies also conduct foresight studies to anticipate the alternatives in the evolution of their sector, and several make them partially public. Some of the most important are the studies carried out by IBM, Deutsche Telecom, and Telefonica I+D. Especially important is the report that Ericsson has developed for 2020 (published in part), which is based on a refined methodology. This study has involved a large number of experts. It articulates a broad, not merely technological, vision and sets out several alternative scenarios.

This special issue of **UP**GRADE and **Novática** aims to make a contribution in this direction, by publishing a series of papers on major trends in several areas of the ICT industry. The issue focuses on identifying key technology paths such as:

- "*The Challenge of Future Communications*", which involves the integration of social communications and mobility with more conventional means such as voice communications. ***José-Luis Núñez-Díaz*** and ***Óscar-Miguel Solá*** are the authors of this paper.
- "*Building the Future Telecommunications: Services and Networks of Internet*", by defining the new Internet paradigms of the 21st century and its orientation to people, objects or content, as well as the evolution of the Internet. Paper authored by ***Heinz Brüggemann, Jukka Salo, José Jiménez, and Jacques Magen***.
- "*Engineering Future Network Governance*", which analyses the automation of communications infrastructure management as well as 'autonomic' and 'zero touch' solutions and their application to conventional OSS. The authors of this article are ***Ranganai Chaparadza, Martin Vigeraux, José-Antonio Lozano-López***, and ***Juan-Manuel González-Muñoz***.

■ "*Key Factors for the Adoption of Cloud Technologies by Telco Operators*" and their application in the world of public communications. Paper by ***Juan-Antonio Cáceres-Expósito, Juan-José Hierro-Sureda, Luis M. Vaquero-González,*** and ***Fernando de la Iglesia-Medina***.

■ "*Trends in Natural Language Processing and Text Mining*", on NLP techniques and the combination of the analysis of internal and controlled sources with other publicly available sources over the Internet. By ***Javier Pueyo and José-Antonio Quiles-Follana***.

■ "*Security 2.0: Facing up to the Tsunami*", and the new challenges in network security and systems, including collaborative security management techniques. Article by ***Enrique Díaz-Fernández, Miguel Ochoa-Fuentes, David Prieto-Marqués, Francisco Romero-Bueno,*** and ***Vicente Segura-Gualde***.

■ "*Trust in the Information Society*", a key issue for the effective development of the ICT industry. It is a report from ***RISEPTIS***, Advisory Board of the Think-Trust Project.

This entire process is based on a number of critical tasks: identifying, exploring, and observing technology trends in order to support reflection before action. Only with a reliable set of rich and robust information sources can this challenge be faced. This special issue of **UP**GRADE and **Novática** aims to be a small contribution in this sense and to help identify the dominant trends and most important future technologies, as well as contributing to the definition of future scenarios for the ICT industry.

As usual we have included at the end of this presentation a limited number of useful references (books, websites, articles, reports, etc.) for those **UP**GRADE readers wishing to know more about the subject matter covered in this monograph.

To wrap up the presentation, let us express our gratitude to the authors for their valuable papers and to editorial teams of **UP**GRADE and **Novática** for having offered us the opportunity of editing this monograph, that we hope will be of interest for most of our readers.

Useful References on "Emerging Information Technologies (I)"

The following references, along with those included in the articles this monograph consists of, will help our readers to dig deeper into this field.

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