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## Introduction: future technology and engineering management

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**Biographical notes:** M.R. Riazi is currently a Professor of Chemical Engineering at Kuwait University. Previously he was an Assistant Professor of Chemical Engineering at Pennsylvania State University where he also received his MSc and PhD Degrees. He was also visiting professor at the following universities: Trondheim (Norway), Illinois (Chicago, USA), Texas (Austin, USA), Wright State (Dayton, USA) and McGill (Montreal, Canada). He is the Editor of *International Journal of Oil, Gas and Coal Technology*, an Associate Editor of *Journal of Petroleum Science and Engineering* (Elsevier), editorial board member of *Journal of ASTM International* (ASTM, USA) and Regional Editor of *World Review for Science, Technology and Sustainable Development*. He is the author and coauthor of about 70 refereed papers in international journals, 30 conference papers, five book chapters and author of two books. He also has conducted extensive consulting services to the petroleum industries.

Philippe Geril is presently the Executive Director of ETI Ltd (The European Technology Institute), a company dedicated to promoting European research and development. In 1994, he became the Co-founder and Executive Director of SCS Europe Ltd. He left the company in 2002. In 2003 he set up ETI Bvba and was instrumental in creating EUROSIS. He was a Scientific Advisor for Ghent University from 2003 to 2006. Since 1985, he has created and run over a 100 simulation and simulation related conferences in Europe, The Middle East and North-America, each of which have become a well-known and respected brand in their own right. He has edited some 100 scientific proceedings to date and has edited several journals and newsletters (such as *Simulation News Europe* (1985–1990), *Inderscience* (2006-)) in the field of computer simulation.

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In the last two decades, the world has witnessed the dawn and spectacular growth of new issues such as electronic communications and business, advances in computer tools, the use of computers in business, trade and management, the emergence and advancement of new technologies such as biotechnology and nanotechnology in different fields, new standards and environmental regulations, technology transfer, industrial accidents caused by human errors, natural disasters, and political and geographical

changes that affect our daily lives and where simulation and integrated knowledge management can help. It is for this reason that it is important to devote a special issue of this journal to recent research activities related to such developments.

As simulation and integrated knowledge management are regarded as the driving forces behind some of the world's largest and most successful organisations the special issue of WRSTSD on Future Business and Technology aims to push business technology research onto the next evolutionary step beyond the building blocks of present day business practices such as 'Operations Research' or 'Business Process Simulation'. This issue is meant to integrate them all into an even higher-level, enterprise-wide framework with its new work roles, responsibilities, reward systems methods and tools. In other words, attaining true knowledge management is about radical and fundamentally new ways to create, retain, share and leverage the knowledge of people and organisations in ways that were simply not possible before.

Finally, besides business simulation and knowledge strategies, areas related to future technology on environment and pollution reduction in the petroleum industry, hydrogen production for fuel cells, the application of nanotechnology in medicine as well as the area of transfer of natural gas, where up-to-date extensive knowledge is of vital importance, have been included in this issue.

In summary, the papers submitted for this issue fall within the following areas of research:

- simulation and optimisation of processes
- simulation in operational research and knowledge management
- applications of new technologies such as nanotechnology
- modelling consumer demand
- sustainable development simulation
- business process modelling
- hazard identification and operability study (HAZOP)
- human error analysis
- maintenance of technical facilities
- use of new technology in simulation of problems related to environment, energy and medicine.

Another idea behind this special issue was to provide an opportunity for the researchers and scientists who are working in the areas of future technology and future business, especially for the participants of the *3rd Annual Future Business Technology Conference 2006* (FUBUTEC2006, <http://85.255.195.219/conf/fubutec/fubutec2006/index.html>) that was held in Athens, Greece, from April 17–19, 2006 to publish their papers in WRSTSD. The call for papers for this issue was announced in December 2005 and it was scheduled to be completed by the summer of 2006.

Twenty five papers were received from 12 different countries in North America, Europe, the Middle East and India. The papers were distributed into two double-issues, one for the journal of *World Review of Science, Technology and Sustainable Development* (WRSTSD) and a second double-issue for the journal of *World Review of*

*Entrepreneurship, Management and Sustainable Development (WREMSD)* both by 'Inderscience' publishers. The focus of Part I as appears in this issue was '*Future Technology and Engineering Management*' with emphasis on economical and environmental concerns while in Part II to appear in WREMSD the focus area would be '*Business Simulation and Knowledge Management*'.

In addition to the introductory paper the nine papers that are presented in this issue are from the following countries: one from the USA, three from the UK, one from Italy, one from Kuwait, one joint paper from the USA and Iran, one joint paper from Canada and Kuwait and one paper from Romania. The technology oriented papers for this special issue are:

- *Paper 1*: 'Introduction: future technology and engineering management', by M.R. Riazi and P. Geril (Kuwait and Belgium)
- *Paper 2*: 'Sustainable engineering management: end-of-life vehicle models with recycling in mind', by Rinaldo C. Micheline (Italy)
- *Paper 3*: 'The incentive behind the adaptation process of high-technology product: an empirical research', by Danilo Hamann and Maktoba Omar (UK)
- *Paper 4*: 'Evaluation of the queuing network equilibrium based on clustering analysis and self-organising map', by Dimitar Radev, Izabella Lokshina and Svetla Radeva (Bulgaria, USA)
- *Paper 5*: 'Model of a non-isothermal tubular ammonia reformer for fuel cell applications', by Klaus Hellgardt, David J. Richardson, Paul A. Russell, Geoffrey Mason and Bryan A. Buffham (UK)
- *Paper 6*: 'Traffic Equilibrium in a stochastic transportation network', by H.M. Soroush (Kuwait)
- *Paper 7*: 'A multi-criteria decision approach for choosing and ranking SO<sub>2</sub> emission reduction measures for a network of power stations', by S. Al-Gharib, A. Elkamel, and C. Baker (Canada and Kuwait).
- *Paper 8*: 'Nanotechnology in cancer prevention and treatment: bright future lies ahead', by G.A. Mansoori, P. Mohazzabi and E. Strashnov (USA)
- *Paper 9*: 'Natural gas transportation: NGH or LNG?', by J. Javanmardi, Kh. Nasrifar, S.H. Najibi, M. Moshfeghian (USA and Iran)
- *Paper 10*: 'Nuclear energy development in Romania', by I. Prisecaru and D. Dupleac (Politehnica University of Bucharest, Romania), T. Chirica and A. Havris (SN Nuclearelectrica, Romania).

After the introductory paper for this issue, the second paper by Professor Micheline and co-workers from the University of Genova (Genova, Italy) deals with end-of-life recovery regulations and outlines, modelling and simulation paths, to assess problems in reverse logistics for items collection and process data management. In conclusion, they establish characteristics and facts driven by economic instruments such as producers' responsibility; economic instruments for process effectiveness with return on investment; design-for-dismantling/recovering rules and the operation set-ups, leading to enhanced usability and reverse logistics achievements for environment protection and

eco-sustainability. They discuss the economic instruments, starting aids for the method innovations of the knowledge-driven entrepreneurship; in that context, they address ambient intelligence as a noteworthy option to enrich the delivery of extended artefacts, supported by extended enterprise organisations, with concern of the producers' responsibility principle, expanded to cover the products lifecycle operation, including environment impact and conformance-to-use checks. They also discuss the ambient intelligence tools to fulfil the monitoring and vaulting duties, already required by the EU environmental policy with the compulsory recovery (reuse/recycle) targets.

The main aim of Paper 3 by Hamann and Omar is to discover consumer's behaviour in terms of adaptation of high-technology products in order to improve the way in which marketing strategies for high-technology brands are developed. Branding of high-technology products has evolved along with the development of mass-production and mass-marketing. The issues discussed in this paper are:

- discovering consumer's behaviour in terms of adaptation of high-technology products in order to improve the design of marketing strategies for high-technology brands
- analysis of people's buying behaviour and determination of the main drivers for adapting high-technology products
- to examine a change in the generational perception and involvement regarding high-technology products
- discovering and evaluating the perception of branded and non-branded high-technology products.

A part of the main findings in this survey is to show that the proven increased frequency of high-technology adaptations requires a new thinking regarding the design of branding strategies for high-technology products. The authors make recommendations to managers to not focus on, or invest in, single product campaigns or price competition, but more on general image building and strengthening. An apparent way of implementing this rather general recommendation would be introducing product families and reflecting a brand image and its philosophy on new and existing products.

Paper 4 is presented by Radev and his co-workers from Bulgaria and the USA. In this paper, a new approach to the steady-state numerical solutions for queuing networks is recommended and the neural networks approach has been used for performance evaluation of real computer and communication systems.

The fifth paper by Hellgardt et al. of the Chemical Engineering Department of the Imperial College of London discusses production of hydrogen for fuel cells from ammonia. It seems that fuel cells will play an important role in the production of energy in the future. Methods of hydrogen production are usually use methane; however, because ammonia can be stored as a liquid, it is more attractive than natural gas when used to produce hydrogen for fuel cell applications. The authors present a model based on experimental data for determination of reaction kinetics and temperature profile in the reactor, which are important in design and operation of tubular reactors for production of hydrogen, using ammonia.

The sixth paper by H. Soroush of Kuwait University, an expert in operational research, discusses the traffic equilibrium problem in order to predict traffic flows in a transportation network, given the travel demand between every pair of nodes.

In the transportation context, the problem is to predict how many travellers will choose various routes in the transportation network and the resultant traffic flows along the links of the network. Assumptions on travellers' route choices provide the basis for modelling the behaviour of travellers on the network. The author, through case study examples, shows that when the traffic equilibrium problem is addressed through stochastic networks, the models provide traffic flows that are much more realistic than those of the classical models.

The seventh paper proposes a multi-criteria decision approach for pollution reduction from power stations. It is known that power plants are the major source of pollution. In this paper, the authors propose a strategy to reduce sulphur dioxide from power plants in Kuwait by two-thirds. They rank different options for pollution control and show that the best option is to import natural gas for Kuwait's power plants and the next best option is to build a refinery to produce low-sulphur fuel oil for use in power plants. In conclusion the authors recommend the use of the Analytic Hierarchy Process (AHP) method as decision making technique and show its superiority over other similar techniques. The method permits a wise judgement to be made in situations where a group of external or administrative experts prioritise the alternatives in an objective, internally consistent, and clear manner.

The next paper (8th) is written by leading experts from the USA in the new field of nanotechnology and discusses how this evolving new technology can be used in the field of medicine for detection, prevention and treatment of cancer, which has always been a formidable medical challenge. Cancer is considered to be an incurable disease related to age. As the average age of our population increases due to medical advances, cancer will be a major disease of the ageing. In this paper it is discussed that nanotechnology treatments can be used in both the pre-emptive and in the disease-time approaches to dealing with cancer. An important aspect of cancer treatment is its early detection. Authors show that developments in such areas as in nanoarrays, nanosensors, liposomes, monoclonal antibodies, improved nanoparticles (dendrimers, diamondoids, gold-based nanoparticles, magnetic nanoparticles, and quantum dots) and nanoelectronics are making early detection, prevention and treatment with a high degree of accuracy and ease, possible. The ultimate goal is to turn cancer into a manageable ailment that one can treat and live with.

The ninth paper is proposed by M. Moshfeghian of John M. Campbell & Company (Oklahoma, USA) and his co-authors from Iran. They report an economical and comparative study between two methods for transferring natural gas. Availability of vast resources of natural gas in the Middle East (Iran and Qatar), Russia and the USA makes natural gas a good alternative source for producing energy after oil production declines. The worldwide consumption of natural gas, as one of the most important energy resources, is rapidly increasing. In addition, natural gas is much cleaner than oil and is a potential source of energy as well as feed for petrochemical plants in the world for many decades to come. There are several ways to transfer natural gas, including use of pipelines and non-pipeline routes. Western European countries get much of their energy requirement through a pipeline that transfers natural gas from Russia. Another major pipeline that will be developed in the near future will transfer natural gas from Iran to India. Other alternative and non-pipeline ways of transferring natural gas are to convert it into a more concentrated form such as Liquefied Natural Gas (LNG), Compressed Natural Gas (CNG) or to hydrate (natural gas to hydrate, NGH). Natural gas can be converted into a liquid at about  $-160^{\circ}\text{C}$ . Natural gas occupies 600 times less volume

as a liquid than as a gas. Liquefied natural gas is transported mainly by ships. In another method, natural gas may be converted into hydrate and then be transported by ships. Hydrates are molecules of gas (methane, ethane, etc.) dissolved in solid crystals of water. Gas hydrates may be formed at low temperature and high pressure. Large amounts of energy may be buried in gas hydrates which, upon their disassociation of one cubic metre of solid methane hydrate will release approximately 170 standard cubic metres of methane. The authors argue that the competitive advantage of the NGH or CNG routes over other non-pipeline gas transport processes is that they require simpler technologies, and show a cost comparison between these two methods of transportation of natural gas.

Finally, the tenth and the last paper of these issues is authored by four experts in the fields of power plants and nuclear energy from Romania. They give an overall review of energy demand of Europe, in general, and Romania, in particular, and the need for production of electricity from nuclear power plants over the next 20–30 years. As the demand for energy increases and at the same time resources of fossil fuel shrink countries are in search of alternative sources of energy and in particular, nuclear energy. Daniel Dupleac and his co-workers examine the potential growth of nuclear energy in Romania and its capability to construct and commission nuclear power plants, keeping in mind environmental protection and economical competitiveness for the benefit of sustainable development requirements.

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