

SESSIONS

MB-01 TUTORIAL: Creating Business Value with Technology: Metrics and Outcomes**Monday, 7/21, 10:00 AM – 11:30 AM****Room: Pavilion East****Speaker: Eliezer Geisler; Stuart Graduate School of Business**

How does technology contribute to the creation of business and commercial value to organizations? What do companies want from the investments in their technology, and what can technology deliver? How do we measure the outputs from technology and the contributions they make to the creation of business value? This tutorial introduces the metrics we use to measure business value, and the methods to apply these metrics in organizations. The focus is on discussion of what and how to measure, and what are the strengths and the weaknesses of the metrics and methods in the arsenal of today's organizations. It's not enough to know that we gain value with our investments in technology. The difficult task is to know how to measure these gains. Furthermore, the tutorial expands the various categories of business value that can be created with technology and how best to measure them.

MB-02 TUTORIAL: Closing the Strategic Plan / Implementation Gap: The Logitech Benchmark**Monday, 7/21, 10:00 AM – 11:30 AM****Room: Pavilion West****Speakers Donald E White; Cal Poly University, San Luis Obispo****John R Patton; Cadence Management Corporation****Spencer Johnson; Logitech****Nolan Perry; Logitech**

The authors have spent 3 years researching the critical links between the strategic plan and the implementation of projects identified in it. The paper will first review the most common differences in perspective between executives and professionals in project management. This will be followed by a brief review of the Strategic Management By Projects (SMBP) model, and the Critical Integrative Links (CILs) for closing the gap between the strategic vision and project implementation. The authors will also present research results to-date based on the SMBP model. Two-thirds of the paper and session will be devoted to reviewing the benchmark study of Logitech, a company that has successfully implemented the SMBP model. Logitech has achieved tight linkage through the CILs and other processes of the SMBP model. As a result, the benchmark company has attained a high-velocity, flexible, and focused strategic implementation process. This process has led to significant improvements in competitive advantage and business results. Both the general model for closing the strategic vision / implementation gap and the pragmatic Logitech benchmark will be presented. The benchmark case will enable participants to take away major lessons learned, do's and don'ts, and the critical success factors for applying the general SMBP model to their organizations.

MB-03 PANEL: A Credo for MOT**Monday, 7/21, 10:00 AM – 11:30 AM****Room: Broadway-1**

Panelists: Rias J van Wyk; Center for the Development of Technological Leader
Akio Kameoka; Japan Advanced Institute of Science and Technology
Marthinus W Pretorius; University of Pretoria
Hugo Tschirky; Swiss Federal Institute of Technology Zurich
Rosalie Zobel; European Commission, Belgium

MOT does not have a well-defined domain. In the course of 2001-2002 a debate on the TIM network sought to clarify the dimensions of the domain. The outcome of this debate was a suggested "Credo" for MOT. It covered five points. (1) Technology is important enough to justify academic programs that teach MOT to managers. (2) Such programs should consist of generic managerial knowledge as well as specialized knowledge of technology. (3) Technology should be addressed both at the operational and at the strategic level. (4) Specialized knowledge of technology should include a theory of technology. (5) Explicit steps are needed to enhance MOT as a profession. In November 2002 this suggested Credo was placed on the IAMOT website. It drew many comments. This panel will evaluate the Credo and explore its implications for MOT.

Note: [R] = Research paper; [A] = Industry Application

MB-04 R&D Management-1: Managing R&D in China**Monday, 7/21, 10:00 AM – 11:30 AM****Room: Broadway-2****Chair: Max von Zedtwitz; IMD****MB-04.1 [R] Managing Foreign R&D Laboratories in China***Max von Zedtwitz; IMD, Switzerland*

Local R&D laboratories are traditionally a primary source of information and technology involving local talent and intelligence. This paper focuses on R&D units established by foreign companies in China, investigating their R&D mission, laboratory management, integration with the parent organizations, and overall performance. The research is based on 28 qualitative expert interviews with local R&D directors and managers conducted in 2001 and 2002, using a semi-structured research questionnaire. The implications focus on findings pertaining to the special Chinese environment: cultural influences on R&D management, location advantages, expatriate involvement, and organizational evolution of local laboratories.

MB-04.2 [R] The Core Processes of Technical Innovation in a Chinese State-Owned Bus Company*Li Qin Ren; University of Twente, Netherlands**Guangya Xie; Beijing Polytechnic University, China**Koos Krabbendam; University of Twente, Netherlands**Jihong Liu; Hunan Sanxiang Bus Group, China*

This paper addresses an investigation of technical innovation to a Chinese state-owned bus company, its current core processes of technical innovation, in particular. Based on a Western technical innovation audit tool, it gives a detailed description about the core processes of innovation in this company, including new idea generation, product innovation, process innovation and technology acquisition. It will be seen that relevant innovation mechanisms are somewhat used in this Chinese state-owned bus company, but not yet to a deep extent. The world-class good practice can be applied as benchmarking in order to bring innovation success in the long run.

MB-04.3 [A] The Internationalization of R&D of Chinese Firms: A Case of HW Ltd.*Jin Chen; Zhejiang University, China**Jingsong Jing; Zhejiang University, China*

Leading firms of China are trying to internationalize their R&D. This paper introduces the mode of internationalization of R&D of HW Ltd., one of the biggest communication equipment manufacturers of China. Objectives of HW Ltd are mainly technology scan and technology learning. The way of internationalization of R&D of HW Ltd includes four phases: establishing technological alliances with a foreign company; establishing R&D units in technological excellence centers of the world; establishing R&D units in its subsidiaries abroad; going to global innovation. With the development of internationalization of R&D of HW Ltd, the resources of R&D change from centralization to decentralization, and the organization of R&D changes to network gradually.

MB-04.4 [R] The Core Competence-Based Pattern of Internationalization of Technological Innovation of Chinese Companies*Jin Chen; Zhejiang University, China**Jingsong Jing; Zhejiang University, China*

This paper argues internationalization of technology innovation is the effective way of fostering and improving technological core competence of Chinese companies, advances the strategic framework and three phrases pattern of the core competence-based internationalization of technological innovation of Chinese companies. In our ideas, the path of the core competence-based internationalization of technological innovation of Chinese companies is as follows. From the start of technology scan, technology learning, scientific and technological resources exploitation, improving technological core competence based on utilizing worldwide science and technology resources to innovation is the emphasis in first step. Expanding the scope of core competence and enhancing technological core competence-based international operating capabilities is the objective in second step. Improving global competition advantage roundly with the interaction of internationalization of technological innovation and internationalization of business is final objectives in third step.

SESSIONS

MB-05 Management of Technical Workforce-1**Monday, 7/21, 10:00 AM – 11:30 AM****Room: Broadway-3****Chair: Robert W Eder; Portland State University**

MB-05.1 [R] Deterritorialization Enables Globalization, and Vice Versa: Japanization and Flexibility of Taiwanese Human Resource Management*Meiling Wong; National Chinyi Institute/Tunghai University, Taiwan**Ren-Jye Liu; Tunghai University, Taiwan*

With the growth of new markets worldwide, and increased levels of competition and globalization of business, there is a strong need for more multinational human resource management (HRM) studies which is presented as being context-specific. De-territorialization is not just the hybridity of global culture in spite of time and space, it is also partly the architecture constructed of the value in developing economy. The investigation of fifty Japanese affiliated firms and local enterprises in 1990s' Taiwan, which has shown the advanced Taiwan production status characterized with factors of the technology in workshops, high technology, a production cooperation network, and an international division of labor. And Taiwanese HRM system, formed in adapting itself to the industrial development, with its three characteristics including: (1) professional skill-oriented sustained by individual motives; (2) responsive in large-variety and small-lot production system, and (3) flexible outsourcing labor force with high changeover rate has been essentially influenced by Japan. Japanization in Taiwan, a deterritorialization paradigm, delineates the main distinctive facets associated with national factors, contingent variables, and organizational and human resource strategies and policies, analyzing the nature of different determinants, "culture-bound" or "cultural free," and its regional settings as an integrated framework for Taiwan HRM.

MB-05.2 [A] A Case Study on Achieving Return on Critical Talent in Technology-Intensive Organizations*Joyce A Thompson; Walden University, United States*

Research shows that purposeful, well-executed talent management is a critical source of competitive advantage and can predictably improve organizational performance. This presentation includes insights from a research study that focused on identifying and managing talent in a highly competitive, technology-intensive environment. The goal was to create a culture and management discipline that can foster improved business performance and support rapid organizational growth. The comprehensive study sought to define the critical talent of the organization, identify how it can measurably contribute to the business, and provide specific recommendations for how management can more deliberately leverage that talent to meet the needs of customers and the business. Specific business results from the application of the findings will be presented. Implications for pursuing Return on Critical Talent (RoCT) in other technology-intensive organizations will be outlined.

MB-05.3 [R] Managing the Human Side of Technological Innovation: Issues and Answers*Robert W Eder; Portland State University, United States*

This paper describes a five-year effort to document the issues and concerns that define the scope of a course on managing the human side of technological innovation and the search for key recommendations in the current literature to address these concerns. A multi-year survey of 157 graduate students generated 118 non-redundant, specific topics of interest or concern that students wanted the course to address. A subsequent search for relevant current literature offers a sampling of key recommendations grouped around six distinct sub-topics. Implications for course development are discussed.

MB-06 Information Technology (IT) Management-1**Monday, 7/21, 10:00 AM – 11:30 AM****Room: Broadway-4****Chair: Peter Flynn; University of Alberta**

MB-06.1 [R] Managing Technology Intelligence in Financial Institutions*Dana E Ceausoglu; Ecole Polytechnique Federale de Lausanne, Switzerland**Peter Ryser; Ecole Polytechnique Federale de Lausanne, Switzerland*

This paper presents the findings of an exploratory research, which focuses on the management of technology intelligence in support of strategic and tactical management of technology in financial institutions. Our literature review as well as expert interview feedback suggested that there is a great potential to improve the management practice in this area. Our research has two objectives: (1) Identify how senior corporate technology managers of diversified financial corporations look at — and manage technology intelligence (TI), i.e.: • Where does management see the greatest contribution from TI to the definition of information technology (IT) strategy and tactics? • What is the prevailing philosophy regarding effective management of TI? • Whose responsibility is to pursue and promote TI? • What management mechanisms are used primarily to manage TI? (2) Explore broad differences in pattern in these areas among different financial institutions. We investigated a sample of six various financial institutions: we observed their technology intelligence processes, interviewed different levels of management, and carried out focus group discussions. Our presentation will follow the objectives and answer them in order. We will conclude with a discussion of drivers of effectiveness in TI practices. Besides technology managers in the financial service industry, the results of this study could be of interest to other managers in knowledge-intensive capacities such as R&D, information technologies and knowledge management.

MB-06.2 [R] The Effects of IT on Improvements in the Financial Services Sector*Ferhan Cebi; Istanbul Technical University, Turkey**Sitki Gozlu; Istanbul Technical University, Turkey**Dundar F Kocaoglu; Portland State University, United States*

The objective of this study is to investigate how IT affects competitiveness of organizations in the financial service sector including banking, insurance and stock brokerage firms. A survey was conducted to evaluate the impacts of IT and its integration in the organization. The research question was whether the integration of IT in the organization affected the achievement of the organization's goals regarding operational improvements. The results show that there are significant relationships between the degree of integration of IT into the organizations and the benefits realized by the organization. As the degree of integration of IT increases, the achievement level of the goals also increases.

MB-06.3 [R] The Role of Entropy in the Design of Management Support Systems*Yukika Awazu; UFJ Bank Limited, United States**Kevin C Desouza; University of Illinois — Chicago, United States**Tobin Hensgen; Loyola University of Chicago, United States*

The idea of management support systems (MSS) is relatively commonplace in most organizations today. Similar to decision support systems, these MSS are specifically designed to aid middle to upper level managers in their selection of strategic choices. Much has been written about how such systems should be calibrated, but one component, entropy, is unaccounted for. Entropy has many definitions depending on the field of reference, we choose to address it in the following context — entropy in a signal is inversely proportional to compressibility: the greater the entropy, the smaller the factor by which the data can be compressed. This is because entropy measures uncertainty in a system. Much of the literature in the field on MSS deals with summarization, compression, and the reduction of data to make it more presentable to managers. We argue that some of the critical data elements are likely lost due to conditions that allow entropy to achieve its maximum state in an information system. This results in the loss of value to the information or data presented under conditions that may be irreversible.

MB-06.4 [A] Power Sector Development: The Role of IT and New Technologies*Rahul Tongia; Carnegie Mellon University, United States*

Technology for power generation has been improving at a few percent per annum (in terms of price/performance), but information technology (IT) has seen improvements an order of magnitude higher. In this presentation, we present a case study focusing on developing countries (looking in detail at a utility in India) where IT systems can help transform the current system into one with significantly lower losses and higher efficiency. Developing countries today face tremendous power shortfalls, and are often not fiscally (or operationally)

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SESSIONS

sound to garner additional private investment. By developing a communications-enabled, controllable, "smart" network for power delivery and distribution, the utility can reduce costs and enhance services. This is especially attractive when new investments are considered, and a leap-frog opportunity exists. We show that by using PowerLine Carrier (PLC) technology as a possible communications means, utilities can aim for investment paybacks on the order of 6 years with just a few percent improvement (or much less if greater operational benefits are seen). We also indicate how simply having digital meters for accuracy will not allow the same level of benefits to accrue to the utility.

MB-07 Collaborations in Technology Management-1

Monday, 7/21, 10:00 AM – 11:30 AM

Room: Forum Suite

Chair: William T Flannery; University of Texas — San Antonio

MB-07.1 [A] Getting "Birds of a Different Feather to Flock Together:" Achieving Integration of Knowledge in Technology Alliances

George Tovstiga; Arthur D. Little, Switzerland

David W Birchall; Henley Management College, United Kingdom

Successful alliances targeting the acquisition, merging and integration of new knowledge streams do not just happen by chance. In fact, most attempts to merge knowledge streams between two alliance partners fail. Competitive knowledge, typically embedded in the strategic capabilities brought to the table by alliance partners, is sticky. It is inextricably bound to the inherently non-tradeable 'soft' assets of each of the partner organizations. 'Soft' assets include the values, culture, and the depositories of tacit knowledge in the form of hard-won experience of each of the respective partners. Due to their complex and tacit nature, these capabilities generally cannot be 'acquired'; successful alliances have shown, however, that knowledge streams can be successfully merged to form new strategic portfolios. Merging the knowledge streams of two alliance partners to form a new portfolio of strategic capabilities involves a series of complex organizational transactions. The authors, in previous work, have described the overall process in terms of a trajectory that results in the integration and assimilation of the two streams and results in a portfolio of capabilities of enhanced competitiveness. Successful mergers of strategic capabilities require deliberate engineering. They depend on a number of critical factors that must not be left to chance. In this paper, the authors identify and describe three of the most critical factors. These include achieving (1) complementarity of capabilities, (2) fit of organizational culture, practices and processes, and (3) continual organizational learning. A conceptual framework describing the role and interplay of these factors is developed. The paper closes with an application of the framework to the Syntheseas, the new joint venture between ABB and Schlumberger that is targeting improved efficiencies and economics of subsea oil and gas development by providing customers with integrated technology solutions.

MB-07.2 [R] Industry and Academe Working Together: Factors That Give Life to Initial and Continuing Success

Stephen C Betts; William Paterson University, United States

Michael D Santoro; Lehigh University, United States

This paper stresses that industry and academe can successfully work together to advance learning and new technologies. In order to help stimulate these potentially powerful linkages, this exploratory study examined the key determinants for establishing and sustaining these relationships along with the subsequent learning and technology outcomes generated. Results using LISREL analyses reveal that several determinants are particularly important for advancing learning and technology outcomes in the initial and continuing stages of the relationship. These determinants include: trust, flexible university policies for intellectual property rights, effective communication and the presence of champions. The implications for these findings are also discussed.

MB-07.3 [R] Effective Communication in Virtual Teams

Jill E Nemiro; Cal Poly University, Pomona, United States

A key challenge facing virtual teams is how to effectively communicate with one another across the miles and different time zones. The purpose of this application paper is to describe

the communication behavior of nine successful virtual teams. Team members from these teams were interviewed individually over the telephone and filled out a background survey on various aspects of the virtual team. Survey results yielded a series of overall trends in the usage of different communication methods. Out of the interview data, four dimensions of communication behavior emerged: (1) the degree of structure used in communication behavior, (2) the appropriate matching of communication methods to specific purposes of messages, (3) how the nature of the team's work impacts the choice of methods used, and (4) the evolution of communication methods used. Finally, a list of recommendations are offered (based on the lessons learned from the nine virtual teams) for those setting out to design communication plans for their virtual teams.

MB-07.4 [R] Innovation Obstacles for SME's and Contributions of Universities — A Match?

Thorsten T Teichert; Institute for Innovation Management, Switzerland

Innovation obstacles are of especially high importance to small and middle-sized enterprises (SMEs). They impact both the long-term success of these companies as well as the economic development of entire regions. From a macro-level perspective, both industry clusters and collaboration with regional universities are regarded as a means to overcome individual innovation deficits. This article assumes a micro-level perspective and investigates whether SMEs are actually interested in cooperation with universities, which modes of collaboration are preferred and which specific demands the universities fulfill. In a large-scale empirical study, SME-specific needs in the innovation process are analysed and contrasted against sought contributions from universities. A joint profiling of specific obstacles and possible contributions reveals five distinct collaboration types. The long-term collaboration potential is assessed and the risks of free-rider effects revealed. Conclusions concerning the need for a public support of university-SME collaboration are made.

MB-08 TUTORIAL: Reshaping Technical Organizations and Their People for the 21st Century

Monday, 7/21, 10:00 AM – 11:30 AM

Room: Council Suite

Speaker: James M Ragusa; University of Central Florida

We are living in a changing and very dynamic world filled with economic uncertainties, fierce global competition, shrinking budgets, changing political systems, and global terrorism. With entry into the 21st century there has been a realization that we are evolving from an information age to one that requires that knowledge be developed and managed in technology workers. Required to support innovation and sustained development success will be organizations that are more proactive, agile, organic, and responsive to a full range of stakeholder needs. A challenge will be to integrate technologies of varying degrees of maturity with knowledge workers through the development of a complementary and supportive implementation strategy. This tutorial focuses on the drivers, needs, and directions of our contemporary global society from a technology management perspective. Identified are several new organizational environment considerations and strategies, and technology worker management systems, processes, and methods derived from several case studies and contemporary management, organizational, and behavioral research. Illustrated and discussed are transformation strategies, foundations, methods developed, and lessons learned as these organizations successfully refocused and moved from physical to virtual, distributed environments to improve productivity, and shrink time-to-market times and costs while working with reduced resources.

MB-10 TUTORIAL: Planning and Implementing International Technology Transfer in Developing Countries

Monday, 7/21, 10:00 AM – 11:30 AM

Room: Studio Suite

Speaker: Krishnamurthy Ramanathan; University of Western Sydney

The liberalization of many developing economies and greater emphasis on the protection of intellectual property, has led to firms in developing countries regarding international technology transfer (ITT) as an important vehicle for acquiring technology that would enhance their competitiveness in both local and global markets. In today's international business

SESSIONS

setting, depending on the attributes of the technology, its intended use, and the motivations of the transferee and transferor, a wide range of ITT modalities are available to transferees of technology. Unfortunately, many transferees in developing countries tend to regard ITT as a relatively predictable process whereby transferee organizations acquire, assimilate, and then improve foreign technology, often with government assistance. However, evidence exists to show that there are many areas of concern and adequate attention is often not paid to critical managerial issues, technical details, and internal organizational processes when planning and implementing ITT projects. This tutorial will present a systematic approach for planning and implementing ITT in a developing country setting. The approach will focus on the transferee (buyer) perspective and will be illustrated through the use of two brief case studies. Important guidelines will also be outlined that could facilitate the effective planning and implementation of ITT projects.

MB-11 Technology Diffusion-1

Monday, 7/21, 10:00 AM – 11:30 AM

Room: Executive Suite

Chair: Ho Kim; ETRI

MB-11.1 [R] International Diffusion of Software Technology and Information Systems: A Comparative Analysis

Najmul Huda; Tallinn Technical University, Estonia

Nazmun Nahar; University of Jyväskylä, Finland

Jaak Tepandi; Tallinn Technical University, Estonia

Kamrun Nahar; Assasuni Girls School, Bangladesh

P. S Deo; S.N. Bose National Centre for Basic Sciences, India

In order to study software technology transfer (STT) and diffusion, commonly researchers have reviewed the literature of diffusion of information systems (IS) and investigated IS diffusion in organizations. Actually, software technology diffusion is different from diffusion of IS. STT and diffusion require specialized knowledge and technical expertise of software production from the end users of the software technologies, it needs special training of longer duration and intensive technical support from the supplier. The research question addressed in this study is: What are the similarities and dissimilarities between international STT and diffusion, and information technology transfer and diffusion, and how? This research was executed through a) analyzing diffusion of innovation theory, b) reviewing the literature in the fields of STT and its diffusion, and IS diffusion, c) interviewing researchers and practitioners, and d) carrying out a multiple case study method. This research contributes to the scientific understanding of both the international diffusion of software technology and IS. At the practical level, the research results will help international STT project managers to put efforts on those factors that can enhance the success of diffusion and avoid risks. Similarly, international IS project implementations will be benefited. At the theoretical level, the research results can be used as a basis for further research.

MB-11.2 [R] Class of Fractals Linked with Complex Dynamic Systems

Ladislav Lukas; University of West Bohemia, Czech Republic

The paper deals with complex dynamic systems, and issues a new large family of fractals closely related by their generators to the classic Mandelbrot set. From analytical point of view such generalized generators preserve self-squaring power in state space. However, they allow much more general influence upon parameter defined at parameter space. The main idea is to introduce a parameter modulating function, which acts in multiplicative way upon the parameter itself. Such approach enables to handle both deterministic and stochastic cases, as well. Piecewise bilinear modulating scalar field defined over regular mesh is discussed in detail. Special focus is devoted to modulations built by pseudo-random generators. Some specific features of used numerical procedure are discussed in detail. The computer code implementing the numerical procedure, which enables to generate Mandelbrot-type or Julia-type fractals, is briefly described, too. Some numerical experiments are presented.

MB-11.3 [R] Residential Broadband Access: A Tutorial on Cable Modems vs. DSL

Cherian S Thachenkary; Georgia State University, United States

Mahesh Chandrasekhar; Scientific Atlanta Inc., United States

This paper reviews the state of the art of residential broadband services, and the diffusion and adoption patterns of different access technologies. Specifically, broadband technology deployment and access media choice (Cable Modems vs. DSL) will be examined. The paper concludes by discussing several issues that currently hamper greater broadband diffusion.

MB-11.4 [R] Factors Affecting Innovation Diffusion: The Case of Turkish Armed Forces

Tayfun Çagan; Yeditepe University, Turkey

Atilla M Öner; Yeditepe University, Turkey

Nuri Basoglu; Bogazici University, Turkey

It is inevitable that organizations have to adopt speedily changing market conditions in order to sustain their existence. Improving an innovative management manner is also required for this adaptation. Pursuing new technologies, trends, and adopting improvements has become the major rule of the competitiveness. The concept of Innovation Diffusion which is the indicator of the rate of application of innovation to the process of organizations is getting importance. The models and analyses formed, play an important role in the strategic decision making and planning facilities. The political authority, social, political, cultural, and organizational structure, commitment of top management and employees, and the function, performance, and the cost of the new and old technologies affect diffusion of technologies at several levels. In this study it will be introduced, at which level and how, organizational structure, including communication dimensions, information sharing, and commitment to innovations, influences the Innovation Diffusion. Turkish Armed Forces (TAF) is also using an innovative management system in order to adopt to the new technologies. Examining Innovation Diffusion in TAF's structure will provide an advantage in strategic decision making and planning. In the present study we will first discuss how the innovation diffusion is performed and which models are being used. After inspecting the importance of the organizational structure among aforementioned factors, the effect of the critical aspects of structure of the TAF on innovations, newly adopted to the system, will be investigated. At the end of the study, it will be tried to reveal which type of organization structures is suitable for fast innovation diffusion. As a conclusion, it will be tried to determine which properties must be gained to the structure of TAF to spread the innovations easily to all units of the system.

MB-12 Cultural Issues-1

Monday, 7/21, 10:00 AM – 11:30 AM

Room: Senate Suite

Chair: Dragan Z Milosevic; Portland State University

MB-12.1 [R] A Case Study of Using Culture and the Build Environment to Improve Outcomes in Healthcare Organizations

Larry Mallak; Western Michigan University, United States

David M Lyth; Western Michigan University, United States

Suzan D Olson; Western Michigan University, United States

Susan M Ulshafer; Bronson Healthcare Group, United States

Frank J Sardone; Bronson Healthcare Group, United States

This case study concerns the relationships among culture, the built environment, and outcome variables in a healthcare provider organization. Healthcare organization outcomes are a function of many variables. A culture survey composed of existing scales and custom scales was used as the principal measurement instrument. Several innovative culture measurements were developed and deployed in this study, including a revised Competing Values Framework and a novel application of the critical incident technique. Results supported culture strength's links with higher performance levels and identified the built environment's role as a moderating variable that can lead to improved processes and outcomes. Job satisfaction and patient satisfaction were found to be significantly and positively correlated with culture strength and with ratings of the built environment. This case study concerns the relationships among culture, the built environment, and outcome variables in a healthcare provider organization. Healthcare organization outcomes are a function of many variables. A culture survey composed of existing scales and custom scales was used as the principal measurement instrument. Several innovative culture measurements were developed and deployed in this study, including a revised Competing Values Framework and a novel

SESSIONS

application of the critical incident technique. Results supported culture strength's links with higher performance levels and identified the built environment's role as a moderating variable that can lead to improved processes and outcomes. Job satisfaction and patient satisfaction were found to be significantly and positively correlated with culture strength and with ratings of the built environment.

MB-12.2 [R] ISO9000:2000 Matching Culture to the Task

David M Lyth; Western Michigan University, United States

Larry A Mallak; Western Michigan University, United States

Over the past fifteen years, thousands of firms have had their quality systems registered under the ISO-9000 guidelines. Starting in 2001, a significant revision of the standard was implemented. This new version has a significantly different structure, and compliance to the new version of the standard requires significant changes to a firm's existing system. Two studies of the effect of corporate culture on both attaining and maintaining ISO-9000 registration have been conducted. This study identifies the differences in cultural characteristics between firms just attaining registration and those completing a three year cycle of registration. As firms pursue registration to the new standard, cultural characteristics supporting maintenance of registration need to be modified to return to the cultural characteristics that firms held when they first attained registration.

MB-13 Intellectual Property-1

Monday, 7/21, 10:00 AM – 11:30 AM

Room: Cabinet Suite

Chair: Stephen D Hendricks; Alaska Orthopedic Labs

MB-13.1 [R] Intellectual Property Management Practices

Nilanjana Bhaduri nee Chakraborty; Indian Institute of Science, India

Mary Mathew; Indian Institute of Science, India

The increased competitive environment has driven organizations to bank more upon their intangible assets than on their traditional assets in order to sustain their competitive advantage. This requires organizations to gear up their intellectual property (IP) management practices. Organizations need to have clear-cut commercialization policies with respect to their IP portfolios. Deployment strategies of licensing, cross licensing, selling out, donating, using for mergers and acquisitions, and maintaining for core competency, infringement monitoring can lead to considerable revenue income. Six case studies conducted in Bangalore, India, highlight the practices followed by some of the organizations leading in their industry in this regard.

MB-13.2 [A] Technology Intellectual Property — Management with Patents, Non-Disclosure Agreements, and Licensing

Stephen D Hendricks; Alaska Orthopedic Labs, United States

Inventions may be created by employees or by individuals outside of a company. When the latter event occurs, it is important for the inventor and the company that they may choose to collaborate with, to understand the potential relationship between them and the intellectual property. New technology often qualifies under the criteria that would permit a patent to be awarded which would, if managed correctly, serve to protect the intellectual property rights of the inventor. The management of intellectual property that originates outside of a company by the use of Patents, Non-Disclosure Agreements, and Licensing, can serve to benefit both the inventor and the company that develops the concept, markets the design, and sells the idea. These same patents, agreements and licenses can be complicated devices and the key to their use is understanding the relationships between them. This presentation provides the introduction to these interrelated concepts and the foundation to pursue additional knowledge on this topic.

MD-01 Bringing Technology and Innovation into the Boardroom

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Pavilion East

Chairs: David R Probert; University of Cambridge

Hugo Tschirky; Swiss Federal Institute of Technology Zurich

MD-01.1 [R] Challenging the European Paradox: A Joint Initiative of Technology Focused European Universities

Hugo Tschirky; Swiss Federal Institute of Technology Zurich, Switzerland

David Probert; University of Cambridge, United Kingdom

On a global scale the competitiveness of Europe is lacking innovativeness in direct comparison to the US and Japan. Since a number of years the European Commission is referring to this critical situation. Calling it the European Paradox reference is made to the discrepancy between the high level of scientific achievements and the capability to convert these into marketable products and services. As a result of this analysis the promotion of technology and innovation management is recommended. Facing this challenge a group of representatives from six technology focused European universities founded the European Institute for Technology and Innovation Management (EITIM) with the purpose to actively contribute to overcoming the paradoxical gap. With the vision "bringing technology into the boardroom" the EITIM is undertaking efforts in research, teaching and dissemination in order to demonstrate today's possibilities to master the manageability of technologies more effectively than in the past.

MD-01.2 [R] Technology Management Control Systems

Hans-Helmuth Jung; Swiss Federal Institute of Technology Zurich, Switzerland

Hugo Tschirky; Swiss Federal Institute of Technology Zurich, Switzerland

Accelerated technological change has become a fact and involves the evaluation, development, implementation and substitution of technologies within enterprises. Strategic and in particular technology management needs to address these issues. Management control has experienced a fundamental change and in parallel, the question arises whether current management control systems can adequately cope with complex technology issues in technology-based enterprises? Previous technology management control approaches in literature are fragmental. The call from industry in turn, shows the importance of research of technology management control systems in technology-based enterprises. Enterprises pursue technology management control activities, but these are imperfectly structured and most enterprises wish to give the activities more structure, such as through a technology management control system. The aim of this paper is to make a major contribution towards closing these gaps. Based on a strategic management control approaches, an appropriate technology management control system is adapted and enhanced with technology issues.

MD-01.3 [R] Technology Management Systems: A Structured Integration of Processes

David R Probert; University of Cambridge, United Kingdom

Clare Farrukh; University of Cambridge, United Kingdom

Rob Phaal; University of Cambridge, United Kingdom

With the increasing pace and intensity of technological change, companies often struggle to integrate technology issues into their business decision making. In practical terms, such companies require a technology management system, which consists of processes and resources to tackle this challenge. Such systems may be assessed for comprehensiveness and effectiveness by means of the framework described in this paper. The framework results from research into, and collaborative development of, technology management systems in large technology-intensive organisations. Examples of two such technology management systems are given, together with a review of their structure in the light of the framework.

MD-01.4 [R] Customizing the Technology Roadmapping Approach

Rob Phaal; University of Cambridge, United Kingdom

Clare Farrukh; University of Cambridge, United Kingdom

John Mills; University of Cambridge, United Kingdom

David R Probert; University of Cambridge, United Kingdom

Technology roadmapping is a powerful and flexible technique for supporting strategic planning in a wide range of situations. The approach must generally be customized to suit the particular application, in terms of both architecture and process. This paper highlights some of the key learning that has emerged about how to customize the roadmapping method, based on more than 35 applications of the T-Plan 'fast-start' approach, which aims to economically initiate roadmapping in organizations. Customization requires careful planning, focused on a collaborative design activity that brings together both application and process domain knowledge.

SESSIONS

MD-02 Project/Program Management-1

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Pavilion West

Chair: Matthew J Liberatore; Villanova University

MD-02.1 [R] Project Management as an Enabler of Dynamic Capabilities

Justin M Reginato; University of California, Berkeley, United States

Recent years have seen increased interest in building capabilities as a source of competitive advantage. During much of the same period, many companies have initiated programs to improve project management processes and procedures in an effort to be more competitive in their respective marketplaces. Project management maturity (PMM) is a popular method of assessing and improving project management sophistication. PMM, while capable of building firm-specific project management capabilities, may alone not be adequate in creating a competitive advantage or executing strategies in highly innovative markets. To assess project management as a competitive advantage in innovative markets, this paper suggests using a dynamic capabilities approach. Present PMM methodologies are conducive to current resource-based views of competences and adequately measure project management's sophistication in established, predictable industries where efficiency is emphasized. However, projects in highly innovative industries are uncertain, and therefore determining project management's value as a strategic asset must account for its ability to negotiate ambiguous environments. Project management in innovative markets is often positioned at the nexus of many firm specific processes, positions, and paths and thus is better suited as a builder of dynamic capabilities.

MD-02.2 [A] Strategic Project Leadership: Leading Projects as Strategic Competitive Weapons

Aaron J Shenhar; Stevens Institute of Technology, United States

Strategic Project Leadership™ is a new approach to project management. Its goal is to focus projects on creating competitive advantage, providing value to customers, and winning in the marketplace. In contrast to the traditional approach, which is focused on getting the job done and meeting time and budget goals, Strategic Project Leadership™, or SPL, suggests that projects are done for business results, and that just 'getting the job done' is not enough. SPL provides a mindset, a framework, and a practical, step-by-step methodology on how to connect project management to business results, and how to turn projects into powerful competitive weapons. This methodology is being implemented by leading organizations such as 3M, US Army — Picatinny Arsenal, Trane, AT&T, and others, with a great level of success.

MD-02.3 [R] Project Strategy: The Key to Project Success

Michael Poli; Stevens Institute of Technology, United States

Aaron J Shenhar; Stevens Institute of Technology, United States

This paper introduces and defines the concept of Project Strategy. Nike's "Just Do It!" is the prevailing attitude around projects. Schedule and budget dominate the measures of project success. To take advantage of opportunities, projects must be more than just tactical or operational. Building market share, extending product lines, increasing revenue, satisfying customers, and building for the future are more important measures of project success. Projects should be an active element in the implementation of a company's strategic intent, achieve better results, and increase the company's competitive advantage or value. Project Strategy focuses the project on the desired strategic results. It is an overarching set of guidelines to be used by the project in making decisions and taking action in alignment with corporate, business, marketing, and operational strategies. Existing frameworks and models offer insight in defining Project Strategy.

MD-03 SPECIAL SESSION: Engineering & Technology Management Journals

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Broadway-1

Speakers George Farris; Rutgers University

Timothy G Kotnour; University of Central Florida

Abbie Griffin; University of Illinois at Urbana — Champaign

Harold A Linstone; Portland State University

Kathryn Stecke; University of Texas at Dallas

Editors of the leading journals in Engineering and Technology Management will discuss the philosophy and strategies of each journal, and answer questions from the audience.

MD-04 R&D Management-2

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Broadway-2

Chair: Al H Rubenstein; IASTA

MD-04.1 [R] New Management System of Korean Public Research Institutes

Sunyang Chung; Sejong University, Korea, South

The role of Korea's public research institutes has been changed since the beginning of their histories. Since the beginning of the 1980s, Korean companies have increased their own research institutes and in the 1990s Korean universities have increased their R&D capabilities. As a result, Korean public research institutes had to redefine their mission, structure and strategies. Most dramatic change was made in March 1999. Korea adopted a new management system of public research institutes. According to innovation process, three research councils were established under the Office for Government Policy Coordination (OPC). Major public research institutes should belong to these research councils. In this paper, we evaluate this new management system of public research institutes and discuss some strategic issues which are discussing nowadays in Korea. According to our studies, the research council system has secured Korean public research institutes a significant level of research freedom, even though there are some problems. There has been hot discussion about how to improve the research council system in Korea, especially confronting with the changes in governmental administration this February. We will identify some problems in this new management system and discuss the strategic issues to enhance the competitiveness of Korean public research institutes.

MD-04.2 [R] Critical Success Factors in R&D Project Management in Military Systems Acquisition and A Suggested R&D Project Selection Methodology for Turkish Armed Forces

Ilhan Kaya; Yeditepe University, Turkey

Atilla M Öner; Yeditepe University, Turkey

Nuri Basoglu; Bogazici University, Turkey

Turkish Armed Forces have developed a military systems acquisition strategy based on local R&D work. The first objective of this study is to determine critical success factors in R&D project management in the military system acquisition in Turkish Armed Forces (TAF) as seen from the perspectives of different stakeholders of the national defense industry. In order to accomplish this, surveys were applied to R&D project manager/members from Ministry of National Defense Undersecretaries for Defense Industries and project officers from TAF, defense industry firms that do business with TAF, and military officers who are selected for graduate education at Yeditepe University system engineering faculty. The second objective is to propose an R&D project selection methodology to determine whether there are Army technologies suitable for collaboration with industry. The proposed methodology is applied to laser technology. This paper is the first paper to report on the decision models of various stakeholders on project success factors and project selection criteria in the Turkish defense industry.

MD-04.3 [R] Payoffs from Government-Sponsored R&D in the U.S. and Japan

Al H Rubenstein; IASTA, United States

This paper presents some significant issues and questions about the needs for and attempts at measuring the long-term outcomes and impacts of major national R&D programs. It also discusses important barriers to the flow from R&D inputs to social and economic impacts far downstream. One of the deficiencies of many of the periodic attempts to analyze this complex process is that they try to take too big a bite of the problem. They try to directly link the cost of R&D input resources at the far upstream end of the R&D process to far downstream economic and social impacts. This approach ignores many of the problems of identification, measurement, complexity, imputation, attribution, and parsing of outcomes at each stage. An approach to analysis and measurement of the flow is presented, based on several decades of research and consulting on these issues for a wide range of technical fields, government agencies, and industrial firms. Three specific examples are given, in the form of

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

stage models, barriers/facilitators, and indicators/measures of outputs at each stage. They are based on analysis by the author and his colleagues of agricultural, environmental, and fire research, supported by major government agencies. The recommended approach to such analysis includes the following steps: (1) Select key sectors of R&D supported by national governments; (2) Identify major transition stages in the R&D to market or application process; (3) Identify key barriers and facilitators along the flow; (4) Develop indicators and metrics for the outputs and impacts at each stage; (5) Develop relationships between the inputs and outputs at each stage; (6) Identify gaps and weak spots in the flow for each sector; (7) Recommend ways of dealing with the gaps and weaknesses; (8) Suggest approaches to monitoring short-term performance and long-term impacts.

MD-05 Entrepreneurship/Intrapreneurship-1

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Broadway-3

Chair: Charles M Weber; Portland State University

MD-05.1 [A] Integration of Technology Incubator Programs with Academic Entrepreneurship Curriculum

Carmo A D'Cruz; University of Central Florida, United States

Tom O'Neal; University of Central Florida, United States

Engineers are excellent sources of high growth-potential entrepreneurial ventures, with their creative product and technology ideas. However, this resource has not been effectively tapped by academia in general. This paper reviews Entrepreneurship, the debates over teaching Entrepreneurship and critical success factors for new venture creation. Also described is an innovative, holistic inter-disciplinary Engineering Entrepreneurship program backed by the resources and activities of a technology incubator. This provides engineering students and researchers with tools and opportunities for entrepreneurial success, establishes deeper and more meaningful community ties, and facilitates the incubation of investable technology-based start-ups. Packaging the "incubator concept" into a series of graduate, undergraduate and continuing education short courses is a unique feature of UCF's entrepreneurship program, which offers practical insights, tools, objectives, case studies, strategies and actions that one can apply to any stage of an entrepreneurial or intrapreneurial venture from initial idea to growth and profitability. Guest lectures and interaction / networking opportunities with successful or struggling technical entrepreneurs, corporate intrapreneurs, angel investors, venture capitalists, technology incubator directors, attorneys, financial advisors, consultants, and other business service providers are added benefits of this program. This program has received very favorable reviews from local, state and national organizations.

MD-05.2 [A] Florida Tech Senior Design Commercialization and Entrepreneurship Program

Carmo A D'Cruz; Florida Institute of Technology, United States

Ken Ports; Florida Institute of Technology, United States

Muzaffar Shaikh; Florida Institute of Technology, United States

Florida Tech's Engineering Management program has offered pioneering courses in Technical Marketing, High Tech Product Strategy, Fast Cycle Time Product Development and Launch and Engineering Entrepreneurship for the past 5 years. In these case study courses, students develop real world marketing and business plans for commercializing innovative new products and technologies. Some of the innovative product development and technology commercialization ideas have won accolades at regional business idea pitching competitions. Concurrently, Florida Tech's intensive undergraduate engineering programs (in ECE, CS, ME, CE, ChE, AE and Ocean Engineering) have resulted in a number of outstanding Senior Design Projects. The Florida Tech Senior Design programs are now becoming highly coordinated across all engineering departments and structured for improved effectiveness. To facilitate increased, sustainable product realization success, "Senior Design" for engineering majors at Florida Tech now begins in the Spring Semester of the Junior Year. This paper describes an innovative new program that is a synergistic combination of Florida Tech's technology commercialization-related course offerings in the Engineering Management program and its Senior Design program. This "Senior Design Commercialization and Entrepreneurship Program" is designed for the subset of senior design course undergraduates who desire to

leverage their design course experience by commercializing their innovative products and technologies and creating start-up companies. In addition to providing an experiential learning environment, this course provides a networking forum for inventors, corporate sponsors, investors and business service providers and is designed to facilitate the creation of start-up, technology-based, revenue generating ventures in the area. There has been tremendous response and enthusiasm about this program.

MD-05.3 [R] Effective Technology Management: Necessity for Sustainable Development of SSI in India

Vijay P Wani; National Institute of Technology, India

T. K Garg; National Institute of Technology, India

S. K Sharma; National Institute of Technology, India

The entrepreneurial movement led by small firms has contributed significantly in the economic growth, job creation, and exports. Entrepreneurship underlies the competitiveness and propensity that characterize the economics of many of the world's democratic societies. It can drive innovation, economic growth and deliver new ideas, correct approaches and innovative technology to the market place. It's not enough to have a great idea if the ideas are not going to pay off in profitable products and technologies. It needs a strategy that develops the market and beats the competitor for individual unit's sustainable development. Managing a successful technology and product strategy provides an innovative and powerful approach for developing technologies and products that people want to buy. The paper tries to elaborate strategies for development of entrepreneurial skill and approach among engineers to identify the profitable projects for their entrepreneurial career and find how to capture the value of their individual project for its sustainable growth. The paper discuss the strategy to be adopted for developing a culture of entrepreneurship in the hi-tech sector to give engineers the skills and know-how to increase entrepreneurial opportunities in their career either of self-employment or wage-employment for sustainability of the firm for which they will be working. In the era of liberalization, privatization and globalization, where the technology is changing at a faster rate and product lifetime cycle is shrinking at a faster rate, the effective management of the technology can be the viable pursuit. Therefore, today it is the technology that drives the economy, and since engineers creates this stuff, they are the real masters of the society. Therefore, the developing entrepreneurial vision among engineers can be the right way for the sustainable growth and development of the SSI sector in developing countries like India.

MD-06 TUTORIAL: Investigating the Effect of Knowledge Practices on IT Project Success

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Broadway-4

Speaker: Blaize Reich; Simon Fraser University

In this tutorial, I would be engaging the audience in a dialogue about a new applied research streAM – one that combines elements from information technology, project management, and knowledge management. The research premise is described below. In this research program, we propose that a re-framing of IT projects as knowledge creation and collaboration sites might suggest new ways to increase their success rate. Although traditional project management research and practice suggests that factors such as lack of executive commitment and user involvement are stumbling blocks to success; knowledge management literature would suggest that combining the knowledge bases of team members and managing the creation and utilization of new knowledge as the project progresses are much more difficult problems. If information systems projects are re-conceptualized using knowledge management concepts, an investigation of practices such as communities of practice, experimentation, shared problem solving, and dialogue may shed surface new ideas to improve their success rate. The tutorial presentation would include existing research plus models that combine existing frameworks such as the knowledge life cycle, knowledge typologies (e.g. company-specific knowledge, process knowledge, cultural knowledge, software product knowledge), the project life cycle, and KMS typologies. Also to be presented would be a research agenda to investigate this topic. It would be the express purpose of this tutorial to generate reflection and dialogue on the topic, models, and research agenda and to solicit feedback from the audience.

SESSIONS

MD-08 Technology Management Education-1**Monday, 7/21, 1:30 PM – 3:00 PM****Room: Council Suite****Chair: Hannu Jaakkola; Tampere University of Technology, Finland**

MD-08.1 [A] Development, Content and Delivery of MBA in Technology and Innovation Management*James A Albers; Pacific Lutheran University, United States**Catherine Pratt; Pacific Lutheran University, United States*

Companies are more clearly recognizing that management needs to address both the financial and technology aspects of the business. There is an increasing demand in business education that integrates both the business and the technology in a holistic way. This paper describes a Master of Business Administration (MBA) with specialization in Technology and Innovation Management (TIM) at Pacific Lutheran University (PLU) School of Business launched in 1996. The MBA TIM is inherently interdisciplinary, multifunctional, and emphasizes a strategic management and global competitive perspective. This paper will provide an update on the program changes and the delivery experience over the last six years. Lessons learned include the importance of (a) integrating business and technology content, (b) early student completion of business discipline content, (c) models of integration such as the business ecosystem, (d) appropriate use of technology to enhance program delivery, (e) frequent use of guest speakers from local industry, (f) opportunities for real-world consulting projects, and (g) using a variety of delivery tools and experiences to examine technology management issues.

MD-08.2 [A] B-School Students Placements Prospects: A Case Study*Sadhana Ghosh; NITIE, Mumbai, India**S. K Nair; NITIE, Mumbai, India*

In most developed countries like the United States, etc., the initial screening of candidates for the Master's programme in business administration to the institutes of higher learning is through GMAT and GRE. These exams are continuously validated to ensure the suitability of the candidates to the specific programme. The educational system also provides the flexibility to change from one programme to another depending on the aptitude and the interest of the candidate. In developing countries like India, the student has to appear in many entrance examinations for a post-graduate programme. Different agencies conduct these entrance examinations. This results in non-uniformity in the screening process. Moreover, very little effort is made to validate the exams as per scientific methods and procedures. Thorndike (1964) and Anastasi (1966) have recommended the validation methods. The validated exam should select the right candidate and the scope of rejecting the right candidate should be minimized. Today, just an engineering degree does not help in a faster career growth. Many realize this after being into the job a year or more. The management institutes attract a good number of candidates with experience. The aspiration of the candidate is for fast-track career growth. On the other hand, its people drive any organization. They invest substantially in identifying the right people. People process is of immense importance to different organizations (Morgan, R.B. & Smith, 1996). In this paper an attempt has been made to find the associations between the organization's perception and the student's background viz., work experience, stream of engineering, and involvement in the extra curricular activities.

MD-08.3 [R] Training Needs in Software Companies*Mikko Santanen; Tampere University of Technology, Finland**Paula Wahlberg-Eklund; Tampere University of Technology, Finland**Hannu Jaakkola; Tampere University of Technology, Finland*

This study describes training needs of the software industry in the Satakunta region in Western Finland. The selected survey group consists of software companies using the training and consultant services of software process improvement network in Satakunta region (SataSPIN). SataSPIN activities are coordinated by CoSE (Centre of Software Expertise) that is the mediator between education, research, software companies and development programs. Training needs of software companies were collected by using a web survey technique. The results of this study are training needs of the SataSPIN related software industry. This study also presents roles benefiting from the needed training.

MD-09 Supply Chain Management-1**Monday, 7/21, 1:30 PM – 3:00 PM****Room: Directors Suite****Chair: Janice L Forrester; NIKE**

MD-09.1 [R] An Integrated Decision Model of Supply Chain Management*Byunghak Leem; The Pusan University of Foreign Studies, Korea, South**Jamie Rogers; University of Texas — Arlington, United States*

This study proposes an integrated decision model of configuring multi-echelon supply chain networks in the context of a global supply chain. The model will consist of three phases: Analytic Hierarchy Process (AHP) Analysis, Data Envelopment Analysis (DEA) Analysis, and Transshipment Analysis. Phase one, AHP Analysis, attempts to quantify and analyze the current supply chain network using subjective information in an uncertain environment. Phase two, DEA Analysis, selects the supply chain partners with the best-of-breed competencies. Phase three, Transshipment Analysis, configures a feasible supply chain network integrating the partners chosen in phase two. This approach combines the subjective and objective information for supply chain networks.

MD-09.2 [R] Structure Analysis for E-Government Applications*Alptekin Erkollar; University of Applied Sciences Wiener Neustadt, Austria**Birgit J Oberer; University of Applied Sciences Wiener Neustadt, Austria*

Electronic Services, like inquiry possibilities which are made available to citizens by administration authorities, are the most apparent proof of changes in the public sector because of modern information and communication technologies. Electronic Government causes an improvement of the relationship between administration, citizens and business. It includes all governmental measures at administrative levels (union, states and local governments) for qualitative improvements in citizen's different spheres of life and for optimization of business processes within the administration. In this work we discuss the eGovernment using from different aspects and we compare different existing applications. On the other hand we analyze the traditional governmental services and a new concept for the transformation of traditional public services in to eWorld especially eGovernment. Additionally, for the discussion of application usability we consider the 7 C factors e.g. content, context, customization, communication.

MD-09.3 [R] Technology and Business Models: Exploring the Processes Synchronization Issue*Victoria E Erosa; Mexican Association for E-Commerce, Mexico**Pilar E Arroyo; ITESM, Mexico*

Collaboration between trading partners is a contemporary initiative from retailers and suppliers to gain efficiencies along the supply chain. Under this new approach, supporting technology is a strategic element for managing real time purchasing, dispatching, receiving, inventory replenishment and invoicing. This paper presents the results of an exploratory study performed in Mexico with the objective to identify the current use of the key technologies -product identification and business communication standards- that facilitate the efficient goods' movement across the supply chain in the retail industry. The study focuses in the way retailers and manufacturers work together, using Product Identification Standards and EDI as enabling technologies, and e-Commerce as integrator of business practices. Under this view, the client-supplier relation is moving from an alignment perspective (one-to-one-relation) to a synchronization perspective (many-to-many relation). Findings suggest that parallel worlds coexist in the commercial relations among retailers. While large clients use sophisticated systems based on EDI messages to align their business processes; there are smaller retail business and suppliers that have not yet adopted the technology, creating inefficiencies for the supply chain as a unit. Results have important implications for the design of technology strategies oriented to the synchronization of trading partners' business processes.

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

MD-10 TUTORIAL: Challenges for Technology Management in Less Industrialised Economies

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Studio Suite

Speaker: Gordon Lister; University of Cape Town

Less industrialized economies (LIEs) need to dramatically increase productive skill and employment levels to encourage economic growth and reduce poverty levels. Skill scarcity must be overcome for products and services to be produced efficiently for competition in global markets. Labour creation requires increasing demand for, and output of, either current, or new, products or services and the use of labour-intensive economically competitive work methods, often within a legislative environment. To use indigenous skills and exploit niche markets, innovation and entrepreneurialism is required to originate marketable products and services. Domestic demand volumes for products and services in LIEs are normally low. Workers must often be multi-skilled; production and outputs must be flexible while minimizing costs and capital inputs. The technology management challenge in such environments is to apply the discipline appropriately, so that new opportunities for providing employment growth are identified and exploited without the need for large capital investment. It requires the continuous provision of appropriate education and training, often in difficult circumstances, and the encouragement of innovative and entrepreneurial activities. Education and skills training of new entrants must suitably prepare them for the economic and social environments in which they will work. To achieve this educators in “developing countries” must overcome a dearth of resources, and avoid discipline “fundamentals” that may not be appropriate to the local environment and students. This tutorial will discuss technology challenges in less industrialized economies. Examples from industry and education in Kenya and South Africa will be used to illustrate and suggest successful approaches in such environments.

MD-11 TUTORIAL: Technology Roadmapping: Developing a Needs-Driven Technology Strategy

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Executive Suite

Speaker: Olin H Bray; Sandia National Laboratories

Technology roadmapping, a needs-driven technology planning process, has gained acceptance in the US and internationally. This tutorial explains what a technology roadmap is, its benefits, when it is appropriate, the key concepts, the steps in developing a roadmap (at either the industry or corporate level), and the contents of a technology roadmap. It also identifies the lessons learned from customizing a generic technology roadmapping process for specific applications. Technology roadmapping helps decision-makers with strategic technology planning and selection decisions. These decisions drive the scope of the roadmap, which determines the critical system requirements. The technology roadmap provides a strategy and plan for satisfying those requirements. The core team develops the framework, without which the components of the roadmap cannot be coordinated and integrated. Technology areas provide a way to decompose the problem into manageable areas, each with its own technology drivers/metrics and alternatives. The tutorial concludes with lessons learned from customizing and applying the generic approach. Olin Bray, a Principal Member Technical Staff at Sandia National Laboratories and one of the developers of the generic roadmapping process, has customized it for many applications. He has presented roadmapping papers and is working on a roadmapping book.

MD-12 TUTORIAL: Understanding Culture, Language, and Communication Styles: A Key to Business Success in Global Markets

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Senate Suite

Speaker: German Nunez; Oregon Health and Science University

That different cultures use different styles and forms of communication is a well known fact that has been noted by numerous social scientists. Edward T. Hall has postulated that communication styles range from low-context to high-context depending on how topics unrelated to the main object of the interaction are either brought in or filtered out of the communication. Geert Hofstede has studied how organizations operate in different cultures. He has

determined that the operation styles vary depending on whether the host culture is individualist or collectivist. While the communication style in most of the business in the USA can be characterized as low-context within very individualistic organization, the communication style of societies in many of the emerging markets such as Latin America, Africa, and China follow styles more closely identified with high-context, collectivist societies. Such cultural divergence in communications, can not only slow down partnerships, market development, and hinder business processes, but sometimes also create unnecessary misunderstandings that can result in business loss to competitors that are more sensitive to the nuances of the different cultures where they operate. This workshop will present an overview of cultural communication styles and their impact on business development strategies in global markets. Topics will include, but will not be limited to: Brief concepts related to culture. The culturally dependent notion of time, money, profit, “the bottom line,” long term investment, short term investment, and other business concepts. Hierarchy structures and decision making styles germane to various cultures. (Who is doing business? Who will make the final decision?) Control - Who is in charged? Identification of some of the business Do's and Don'ts of various cultures, including attiring, communication and courtesies that are gender specific. Identify, where pertinent, social and political expectations that will impact business decisions. Help identify indicators of communication style to assist individuals to effectively interact with business associates in private, multinational, or government organizations. The use of local language in business interactions: Pro's and Con's. Cases. Discussion.

MD-13 TUTORIAL: Intellectual Property

Monday, 7/21, 1:30 PM – 3:00 PM

Room: Cabinet Suite

Speaker: Julie L Reed; Marger Johnson & McCollom

Intellectual property has become a critically important aspect of technology management. Technology managers need to convert an organization's intellectual capital into intellectual property, use of the intellectual property to further the organization's goals, and plan the intellectual property acquisition and leveraging process. This tutorial provides an overview of the basic forms of intellectual property in the United States, and gives examples of typical processes in US companies on how to capture intellectual capital in the form of intellectual property. Different approaches for both the offensive and defensive uses of intellectual property are covered, as well as the need for and considerations in the strategic planning and management of intellectual property. The tutorial will also include a brief discussion of the differences between key types of intellectual property in the US and other countries and issues companies from outside the US may need to address when protecting intellectual property in the US.

ME-01 Innovation Management-1

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Pavilion East

Chair: Nina Ziv; Institute for Technology and Enterprise

ME-01.1 [A] New Perspectives on Innovation Management in the Media Industry: The Walt Disney Company and Pinnacor as Cases in Point

Nina Ziv; Institute for Technology and Enterprise, United States

This presentation offers some new perspectives on innovation management in the media industry. Two case studies: The Walt Disney Company, a traditional media company, and Pinnacor (formerly ScreamingMedia), a New Media company, both successful in the industry, are presented. In 2003, the media industry is undergoing profound change because of the flourishing of content innovation and the changing nature of what delineates a content company. The presentation outlines the enduring, evolving, and new imperatives of modern innovation management as they pertain to the media industry including building an optimal organization which reflects the heritage of a company and the new digital/wireless content being produced; being agile and continually reassessing the marketplace; and using technology strategically. Disney, which was faced with the challenge of developing an online offering in order to compete with New Media companies such as Yahoo!, made a successful transition into the digital world by building a hybrid organization, leveraging its brand, using technology strategically and engaging in a continual learning process. Pinnacor, initially a ‘pure play’ New Media company, evolved into a successful hybrid technology/content

SESSIONS

company by being agile, balancing professional management with entrepreneurship, and tapping into various sources of innovation.

ME-01.2 [R] Innovative Capability Building of Small Team: The Case of Korean Soccer Team's Absorptive Capacity

Jong-in Choi; Hanbat National University, Korea, South

Having no previous wins in the World Cup, Korea entered the 2002 tournament with the stated goal of reaching the semi-finals. No Asian team has reached the World Cup semi-finals before in the 72-year history of the tournament. How can Korea soccer team establish this historic success in a short time, after Korea's Dutch coach Guss Hiddink managed Korean players? This is compared to the Korean economic miracle, magnificent growth in the 30 years after the Korean War. Some mentioned the causes of success, like the leadership, never-say-die spirit of players, seven million supporters on the streets, and so on. But these are only the contents that explain the success factors separately. This paper provides the process of historic success through the absorptive capacity (ACAP) model and explains why this kind of success happened to the Korean soccer team. Using the Absorptive Capacity (ACAP) model, I suggest that how can Korean team's potential capability explore and what is the input, facilitator in this process. This study is focused on the unit of team and explores the dynamic interactions among the several factors in the team. Research shows the integration of separated factors for success and finds further efforts to maintain and upgrade the Korean soccer team's capability.

ME-01.3 [R] Evaluating Technological Innovation Management Indicators: The SPRING Software Case Study

Mariana A Bressan; Instituto Tecnológico de Aeronáutica, Brazil
Jose Ivan Garcia; Instituto Tecnológico de Aeronáutica, Brazil
Elton Dietrich; Instituto Tecnológico de Aeronáutica, Brazil
Cibele A. C Deonísio; Instituto Tecnológico de Aeronáutica, Brazil
Elaine Nuci; Instituto Tecnológico de Aeronáutica, Brazil
Marcos R Flores; Instituto Tecnológico de Aeronáutica, Brazil
Ronaldo Emerick; Instituto Tecnológico de Aeronáutica, Brazil
Carlos S Pivetta; Instituto Tecnológico de Aeronáutica, Brazil
Daniéla C Fernandes; Instituto Tecnológico de Aeronáutica, Brazil
Jose Henrique S Damiani; Instituto Tecnológico de Aeronáutica, Brazil

Technological innovation comprises both the product as well as the processes required to reach a technologically viable solution for a problem arising from a customer need or from a technology opportunity, two dynamics known as Market Pull and Technology Push respectively. The adoption of technological innovation by a research institution results from the adoption of certain pro-active initiatives by its administrative staff. The goal of this paper is to apply concepts of technological innovation to software development, and to present these in the form of indicators in order to group the various innovation categories, thus allowing for the identification of ways to improve the managerial process. Indicators were elaborated as a function of the interaction features that exist between the user and the software. This case study is based on software known as SPRING (Processing Geo-Register Information System), designed by the National Institute of Space Researches (INPE), which is the institution in charge of the development of this type of geographic information system. A proper evaluation by a group of indicators will provide a qualitative model with which to measure the level of innovation adopted by research institutions with a high level of user interaction.

ME-02 Project/Program Management-2

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Pavilion West

Chair: Thomas G Lechler; Stevens Institute of Technology

ME-02.1 [R] A Macro Approach to Modeling Projects with Uncertain Network Structures

Bruce Pollack-Johnson; Villanova University, United States
Matthew J Liberatore; Villanova University, United States

This paper presents an approach for modeling and analyzing project uncertainty at the network, rather than at the activity, level. This approach is applicable for project schedule risk

analysis and contingency planning. The suggested approach requires that a set of project network scenarios be able to be identified, each with an assessed probability of occurrence. These scenarios might differ according to the results of uncertain events that could occur during the course of the project, uncertain activity durations, finite loops, or a combination of these. In this paper we present a general approach for modeling and analyzing the set of network scenarios. An advantage of our approach is that it uses standard methods, such as critical path analysis and probability analysis, to solve project planning problems with uncertain network structures. Our approach also leads to the development of new project network uncertainty measures, including expected and conditional activity criticality and slack, and early and late start and finish times for repeated activities resulting from looping. A second benefit is greater accessibility and likelihood of the use of uncertainty analysis in project planning, since the data needs and the analysis are focused on the key scenarios driving schedule uncertainty. Several examples are presented to illustrate the proposed approach, including random events, loops, and random activity times. Suggestions for future research include field testing the proposed approach and determining the conditions under which it is preferable to simulation.

ME-02.2 [R] Fuzzy Multiobjective Programming Application for Time-cost Trade-off of CPM in Project Management

Shing-Ko Liang; National Chiao Tung University, Taiwan
Kuo-Lung Yang; National Chiao Tung University, Taiwan
Peter Chu; Central Police University, Taiwan

In pragmatic project management cases, many complex resources and large-scale related activities are involved. Moreover, when situations are under the conflict and incommensurate of time and cost, it becomes more difficult for managers to make their decisions. Hence, we construct fuzzy multiobjective programming model from CPM technique. Through emphasizing the selectable flexibility among the feasible projects, we describe the decision problem brought from uncertainty and complex in project. In our research, taking the conflict and incommensurate of time and cost as two major factors, we measure weight and priority to denote the importance degree between the objectives. Adopting Tiwari et al., we also develop the result when trading off the decision vs. the vague environment of time and cost and the past 'single objective' method has become the exceptional case of multiobjective models. Secondly, we broaden the consumed time and cost of activity events when assumptions are certain to merge the practical situation. We applied fuzzy number to express estimate time and cost. It based on Lee and Li method to solve this problem. Finally, we employ numerical example to explain it with LINGO package to calculate.

ME-02.3 [R] Project Effectiveness and Efficiency Can Be Measured: A Study of Inter-Rater and Inter-Project Reliability

Timothy M Phelan; Stevens Institute of Technology, United States
Richard R Reilly; Stevens Institute of Technology, United States
Aaron J Shenhar; Stevens Institute of Technology, United States

Effectiveness and efficiency are two of the most fundamental concepts in describing human activities and work. Effectiveness means doing the right things. It is the extent of the working on and accomplishment the right ends. Efficiency is doing things right. It is the economics of doing things in the right way, using the right means. Surprisingly, and in spite of their importance, empirical studies of effectiveness and efficiency have been rare. This lack of empirical grounding limits the theoretical understanding of these two concepts and places a serious constraint on our ability to use them for better management of organizations in general, and projects in particular. This research is a first step towards operational definition and measurement of these concepts in a project management context. Content analyses of project meeting minutes were used to measure the level of effort invested in effectiveness and efficiency during the conceptual phase of projects. The results demonstrate that effectiveness and efficiency can indeed be operationalized and measured from this type of archival material with acceptable levels of inter-judge reliability for both constructs, and that these measures can be used to reliably differentiate among projects. Implications of these findings for further research are discussed.

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

ME-03 New Product Development-1

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Broadway-1

Chair: Tony J Bailetti; Carleton University

ME-03.1 [R] A Model of New Product Success and Accelerated Learning in Collaborative New Product Teams

Ajax Persaud; University of Ottawa, Canada

This paper proposes a conceptual model of the relationship between accelerated team learning and new product success in a technology-intensive environment. The research integrates the organizational learning and new product development literature with in-depth personal interviews with twenty-six new product team members and three R&D vice presidents of three companies within the electronics and telecommunications industry to develop a conceptual model. Our research shows that the commonly held view of a positive, unconditional relationship between learning and new product success is not tenable and that other contingencies must be considered. Also, learning activities must be strategically selected and managed. However, before passing judgment on the extant research or the logic underlying a positive relationship, our model needs to undergo rigorous testing in replication studies to establish its validity.

ME-03.2 [R] Creating a Learning Organization to Manage Complex Projects

Jongbae Kim; Silla University, Korea, South

David Wilemon; Syracuse University, United States

With rapid technological and market change, product development (NPD) complexity is a significant issue organizations face in their development projects. The inability to recognize and manage complexity can cause the best-intentioned projects to fail. By creating a learning organization, however, companies are more likely to have the knowledge and skills essential to respond competently to the complexity challenges encountered. In this paper, we first define complexity in NPD and then briefly examine the major sources of complexity. Next, we report our findings from an exploratory research study on organizational learning about product development complexity. The study is based on 32 field interviews with project leaders and team members on their experiences in dealing with complex issues; the transfer of learning to subsequent projects; and the factors that minimize/block the transfer of learning from one project to the another. We develop a model of how organizations can identify the potential complexities they encounter in their development efforts. We also examine how companies can capture, store, and use the learning resulting from their complexity experiences. Finally, we advance several suggestions for implementing a learning organization designed specifically to capitalize on the experiences of development firms' efforts in dealing with complexity and its consequences.

ME-03.3 [A] Triggered Learning Process from Production to Product Development

John R Voit; Delphi Corporation, United States

Ram Akella; State University of New York at Buffalo, United States

Rajiv Kishore; State University of New York at Buffalo, United States

R. Ramesh; State University of New York at Buffalo, United States

In a multi-project new product development (NPD) environment, there is large variation across projects in the use of lessons created by downstream operations as a result of failure modes encountered while fabricating, installing, operating, and maintaining the current products and processes. The authors have developed an ontology-supported triggered learning process (TLP) at a large tier one automotive supplier to capture lessons learned in downstream operations and re-use them in new product (or process) development activities. Early acceptance of the TLP in the United States and Mexico, and planned expansion to Europe, validate the merits and the approach.

Note: [R] = Research paper; [A] = Industry Application

ME-05 Science and Technology Policy-1

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Broadway-3

Chair: Deok S Yim; Science and Technology Policy Institute

ME-05.1 [R] A Trial of Target Systematization for Science and Technology (S&T) Policy

Fujio Niwa; National Graduate Institute for Policy Studies, Japan

In Japan the S&T Basic Law was enacted in 1995, and two S&T Basic Plans based on the law have already been in operation. These Basic Plans have become gradually improved. However, it seems to be insufficient yet from the viewpoint of target systematization. There is a fact behind this that methodologies by which we can form scientifically S&T policy have not been sufficiently developed. This study aimed to try to systematize targets of S&T policy in order to prove it possible. The participants in the experiment were members of The Committee on Technology Policy (CTP) of the Engineering Academy of Japan (EAJ), and the number of regular participants was nearly 10. The period of the experiment was about two and a half years, from the mid-year of 1997 to the beginning of 1999. The method mainly used was discussion, but frequently we adopted several so-called soft technologies, such as IMS (Interpretative Structural Modeling), pair comparison, cluster analysis and so on. Finally, we obtained a system of S&T policy targets. The system obtained is composed of five layers, namely, (1) major targets, (2) medium targets, (3) minor targets, (4) examples of measures and (5) sets of science, engineering, and technology (SETs) that contribute to measures. The system has also the following four major targets. (1) To maintain affluent and pleasant living of the public and further improve it (2) To insure for the stable existence and security of the country (3) To contribute to solving the global environmental problems (4) To contribute to the accumulation of intellectual assets of the human beings.

ME-05.2 [R] New Role and Evaluation Management of National Projects in Japan: The Effect of Option Exercise

Masaharu Tsujimoto; Keio University, Japan

This paper discusses national projects in Japan, based on the survey research executed widely by the Ministry of Education, Culture, Sports, Science and Technology on 2001. The main three discussion points are as follows. First, the environment around national projects has been changing. The participating companies require the effect which provides them the competitive new products and commercialization both now and in the near future. Second, national project management in Japan is systematically harmonized and highly rigid. Third, the effective management for accommodation is to enhance the flexibility through exercise of option in the evaluation process.

ME-05.3 [R] An Empirical Research on Import Liberalization and Economic Growth

Yongsang Yoo; ETRI, Korea, South

Jong Yong Lee; ETRI, Korea, South

By using a panel of 36 Korean manufacturing industries for the period 1968-1985, this paper examines the effects of import liberalization policy on total factor productivity, market power, and scale technology. In the presence of economies of scale and imperfect competition, the measurement of productivity would be biased and misleading by assuming perfect competition and constant returns. When we relax the assumption of perfect competition and constant returns, the empirical results show that the market structure of Korean manufacturing industries is characterized by imperfect competition, and that the technology of the light industries is characterized by decreasing returns to scale. Using tariff rates and quantitative restrictions as trade policy measures, we show that import liberalization by lowering tariff rates decreases the market power of domestic firms, and that import liberalization via decreasing quantitative restrictions increases the growth rate of total factor productivity. The empirical results also show that openness to trade leads to a reduction in scale inefficiency, and forces domestic firms to further exploit returns to scale.

SESSIONS

ME-05.4 [R] The Restructuring of Government Research Institutes and Their Performance Factors: Korean Experience

Deok S Yim; Science and Technology Policy Institute, Korea, South
Wook Jin Song; Sang Myung University, Korea, South
Hwang hee Cho; Science and Technology Policy Institute, Korea, South
In young Song; Sang Myung University, Korea, South

The government sponsored research institute (GRI) plays a very important role in one's national development. Sometimes the GRIs are criticized for their poor performance. This paper analyzed Korean GRIs in the context of national innovation system. The main performance factors are identified as organizational format, vision and mission, financial system, and managerial structure. Korea, while suffering from recent economic crisis of late 1990s, has undergone a restructuring process for the whole public sector including GRIs. As a result, the research council system was introduced with new evaluation and incentive system. In addition, the new supporting system has made the GRIs to change their management system and organizational culture. The internal organizational structures became more flexible and short-term oriented organization. It seems too early to judge the results of restructuring process. However, it is true that the responsiveness of GRIs to the demands of industry and government is improved. But, the long-term organizational stability and the public characteristics of research goals have to be sacrificed. The experience of Korea shows that the organizational format and management system of GRIs are critical performance factors and there is a trade-off relationship between the autonomy of GRIs and control of government.

ME-06 Information Technology (IT) Management-2

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Broadway-4

Chair: Pamela Specht; University of Nebraska — Omaha

ME-06.1 [R] A Japan-U.S. Comparative Study of Information Technology and the Real Estate Agent Industry

Hiroaki Itakura; Kagawa University, Faculty of Economics, Japan

Our expectation towards information technology is high in terms of the efficiency in transmitting highly diversified real estate information. However, compared to personal computers and financial e-commerce (EC), real estate EC in Japan has not been analyzed to a sufficient extent. With a focus on its relationship to the social system, we analyzed how the advent of information technology has influenced the real estate industry. We analyzed the current conditions in Japan and in the United States. Since the use of the Internet by agents in real estate distribution is on the rise, information-oriented progress will bring about structural changes in Japanese real estate industry. For this reason, it is inevitable that the very value of keeping certain property data will decline. With some exceptions, Japanese real estate agents have not reached the level where the potential of Internet-like information technology is fully utilized. Behind this backdrop is the characteristic of the industry to protect existing social systems and vested interests. It is urged that they will move in different directions away from the traditional practice of real estate brokerage.

ME-06.2 [R] A Study of the Factors Related to Successful Consolidation of Information Technology Units in Local Government

Pamela Specht; University of Nebraska — Omaha, United States
Angela Patton; University of Nebraska — Omaha, United States

In 2003 thirty state governments declared significant deficits. Unlike the federal government, state governments are required to balance budgets. Local governments are equally facing deficit budgets, and local officials are increasingly considering the consolidation of information technology (IT) services offered by different units to increase efficiency and effectiveness and to decrease costs. No formal research exists on the IT consolidation process in local governments. Information in the literature is mostly informal case studies and anecdotal. Local government consolidations, in general, have a very high failure rate. This research has two main objectives: (1) to add to the knowledge that exists on the consolidation efforts of IT departments within local government and (2) to increase the success rate of IT unit consolidations. The research has been on-going for three years, involving a thorough literature review, a case study of a U.S., mid-western city and county IT department consolidation and

a national survey (n=250) of local government IT units to test hypotheses developed from the literature and case study. This paper presents the results to-date of this on-going study.

ME-06.3 [A] Road Map to Integrate Business Processes Using PMIS

Sadhana Ghosh; NITIE, Mumbai, India
Sushim Jain; Sona Group, India
Yashwant Kumar; NITCO Tiles, Mumbai, India

Information systems are changing the way firms compete, often all levels of the enterprise. Information System (IS), today, has strategic value, and influences the vision of the firm. Information in the modern organizations provides fast and accurate transaction processing, large capacity, fast access storage, and fast communications. IS reduces information overload, spans boundaries within and between organizations, provides support for decision-making, and has become a competitive weapon in the marketplace. Any business organization emphasizes cost reduction and product differentiation. In general, IT has proved itself to be a competitive strategic advantage through addressing and sometimes altering the nature of strategic forces in industry, as well as advancing strategies based on cost and product differentiation. This paper is the outcome of practical experience faced while working on a project in an organization involved in telecom infrastructure development. The vision of the organization is to capitalize on the rapid market growth. During the project a road map is prepared to integrate and synergies its business processes using IT solutions. The paper highlights how information technology can give a cutting edge to an organization and help in achieving its strategic objectives. Issues & challenges faced during the IT implementation are also discussed in the paper.

ME-07 Decision Making in Technology Management-1

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Forum Suite

Chair: Antonie de Klerk; University of Pretoria

ME-07.1 [R] Product Development Model: Integration of Market Selection and Product Design in the Decision Process

Margaret F Shipley; University of Houston — Downtown, United States
Madeline Johnson; University of Houston — Downtown, United States
Andre deKorvin; University of Houston — Downtown, United States

In this paper, market selection and product design sub-models are developed and integrated into a product development model. The market selection sub-model evaluates market attractiveness in terms of (1) perceptions of the company's and its competitors' fit in the target market, (2) consideration of environmental issues both external and internal, and (3) determination of previous market share and future strategic initiatives. A product design sub-model is developed that incorporates into an algorithm customer needs as related to technical requirements and product competitive position in the decision to affect design change to a technical criterion. Thus, for any market(s) identified by the highest attractiveness score(s), the product design sub-model utilizes the QFD House of Quality tool to determine design changes for the product under consideration. After evaluating all highly rated markets across all products at a point in time, the iterative product development process would be continued between market selection and indicated design changes. Given the uncertainty involved in the knowledge base addressed by the input of customers, managers, technicians, and other decision makers as experts, fuzzy sets are used in development of all models.

ME-07.2 [R] An Exploration of the Decision-Making Process of a Scheme of Appropriation of Technology

Victoria E Erosa; Mexican Association for E-Commerce, Mexico
Estela Uribe-Iniesta; Universidad La Salle Mexico, Mexico

This is an exploratory study about the process to select a scheme of Appropriation of Technology. This concept encompasses stages from the full appreciation of a new technology's potential to the appropriation of benefit from its application within specific business models. Selecting an appropriation scheme for a new Technology is done by committees integrated ad hoc. Decision-making theory provides an approach to the elusive and complex strategic case. From the specific conceptual standpoint, Resource-based Management

SESSIONS

locates Technology among an organization's strategic resources. Management of Technology and Strategic Management have further analyzed the Technology function in the business. The present research includes in addition findings in the state-of-the-art and feedback from experts. Data gathered by means of a questionnaire created ex profeso was fed into an Exploratory Factor Analysis process. Top management inconsistencies, need for a clear business diagnose, complex technological and political information, a strive for strategic assurance and sustained competitive advantage, uncertainties in the environment and fears regarding badly needed partnerships derive as main characteristics of the current process of decision-making of a scheme of Appropriation of Technology. Some suggestions to improve the way the decision-making process is carried out are advanced, hoping to contribute to innovation initiatives' results.

ME-07.3 [R] The Extension to Cook-Seiford Social Choice Function and the Choice of Key Information Technologies in Guangdong Province of China

Jianmei Yang; South China University of Technology, China

Tang Xijin; Academy of Mathematics and System Science of China, China

He Zheng; South China University of Technology, China

The usual Social Choice Functions deal with problems of group decision-making with single criterion. In this paper the Cook-Seiford Social Choice Function (CSSCF) is extended in two ways to process group decision-making problems with multiple criteria. Then, by using the function, a choice-analysis is made to key technologies for IT industries of Guangdong province, China, in the years 2005 – 2010.

ME-08 Technology Management Education-2

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Council Suite

Chair: Herman Migliore; Portland State University, United States

ME-08.1 [R] A Framework and Empirical Analysis of Competence Building Related to Engineering Education

Kumiko Miyazaki; Tokyo Institute of Technology, Japan

In this paper, a conceptual model of the factors affecting competence building in an Engineering School is developed. The extent to which each faculty member can exert his/her potential to the fullest has a profound impact on the overall competences in an Engineering school. Identifying the bottlenecks in the system, which are the inhibiting factors, would lead to concrete solutions to strengthen competences. Having put forward a conceptual model, a detailed case study of competence building analysis in an Engineering School in Japan, Tokyo Institute of Technology (TiTech) is presented. The study was carried out as a 2 step process. At first, the ranking surveys by the media were reviewed to assess how TiTech was evaluated by external agents. Secondly, a comprehensive questionnaire survey was carried out within the Engineering School in the main areas affecting competences, namely admissions process, teaching, research, internationalization, contribution to society and organizational administrative processes. In this paper, we have focused on the analyses of teaching and research competences. The data obtained was used as a basis to provide concrete policy recommendations to top management of the university to strengthen competences. Among the national universities in Japan, this study marks the first time that such an innovative, in-depth survey has been carried out. This approach may be readily adapted to be used as a strategic management analysis tool in other types of research institutions such as national research laboratories or corporate basic research laboratories.

ME-08.2 [A] Reinventing the University: Comments on Institutional 'Branding,' University Alliances, the Business Model and Cultural/Political Consequences

Judith A Schalick; Communications Strategies, United States

Alliances in a global economy alter organizational and institutional models. Universities, long immune to change by virtue of their role as societal institution, are challenged by the rapidity of business modeling. New 'brands' of learning follow on the e-commerce model. The trend to alliances between the university and business is seen as crucial to the survival of both. The trend to alliances between universities creating global 'brands' of education is new to

the post-modern university form. Technology and alliances that integrate efforts change the very nature of the university experience, its content and delivery. The 'Business' model with all its attendant linguistic and operational sequences is visible in its application to the dissemination of learning and of information as 'product.' Operations effectiveness vs. strategic positioning is well known to business competitors. Now, the university is not just a repository in legacy terms, but innovator and change agent on the social and value scales of vastly differing global partners and 'customers.' Cradle to grave learning is newly seen as product rather than process, and the core value of monetizing information has challenged the very nature of the university as societal force for preservation of legacy and incubator of ideas for the future. Nation states and their cultural histories, forms of government, and approaches to economic development are gravely challenged. The branding issue raises global cultural challenges of an unprecedented sort.

ME-08.3 [R] Qualitative Research Covering the Effects of Both Faculty Advisor Interaction and Different Design Techniques When Applied to Small University Teams

Bradley Dickerson; University of Colorado at Boulder, United States

Rochelle Young; University of Colorado, United States

By studying team performance, a qualitative research project has been undertaken at the University of Colorado in Boulder. The study addresses questions of why certain design teams always appear to excel, while others seem to consistently flounder. The premise for this research began when sighting consistent improvement in the University's Society of Automotive Engineers, Mini Baja team. One goal of the research is to determine if other university teams achieve comparable results by applying similar standards of design. Adding to this project is how a faculty advisor's interaction with the team contributes to the overall successes of the team. Based on conventional versus creative problem-solving design techniques, the research explores student and faculty perspectives on determining the best approach for the design and implementation of student projects. The research is focused on small university design teams and pays close attention to the interactions between the team and the team's faculty advisor. The research should show relations between this interaction and the design techniques used and how, together, they affect the overall achievements of the design teams. Future plans for this research include written surveys, literature research into different design theories, data analysis, and then a research paper explaining the findings.

ME-09 Supply Chain Management-2

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Directors Suite

Chair: Stephen Singam; Portland State University

ME-09.1 [R] Object-Oriented Modeling Framework to Design Adaptable Enterprise Business Process (AEBP): The Case of a Manufacturing Supply-Chain

Jinho Kim; The University of Texas at Arlington, United States

Jamie Rogers; The University of Texas at Arlington, United States

With the market environment changing dynamically and rapidly, the flexibility of the business model becomes a survival factor not a competitive advantage for the success of enterprise. The business model should adapt itself to new market environments easily and smoothly, but traditional modeling methodologies cannot fully satisfy this demand. To meet such demands, this paper proposes a methodology for modeling an adaptable and flexible business process using an object-oriented concept and knowledge-library to enable reusability of the model. One key benefit of the approach is to reduce model-coding effort and improve model flexibility and adaptability to new and unpredicted change of business environment. We apply this methodology to the modeling of a generic manufacturing supply-chain process because this is critical to all manufacturing enterprises. Finally, an implementation method for this model as an enterprise software is described.

ME-09.2 [R] Effective Classification of Warranty Returned Parts in a Supply Chain

S. Gary Teng; UNC Charlotte, United States

SESSIONS

S. Michael Ho; ArvinMeritor, Inc., United States
Debra Shumar; ArvinMeritor, Inc., United States

An effective way to handle warranty returns in a supply chain is to identify warranty return problems more accurately at customer service centers of the original equipment manufacturers (OEMs). It is usual to get a significant amount of warranty data from service centers which showed that the returned products did not function as designed. But manufacturers/suppliers routinely find a large portion of the returned products met the designed function(s)/specifications after testing was done at warranty centers or suppliers' testing facilities. It reveals that some valuable and unrecoverable information is missing from the communications among the customers, the OEM, and/or different layers of suppliers in the supply chain. This paper discusses the need of a process that can apply available warranty data to evaluate useful measuring factors, and then use these factors to distinguish the true warranty good from warranty fail parts. The result of the process provides correct warranty failure information to companies in the supply chain for accurate distribution of warranty repair cost, correct identification of warranty return cause(s), and further improvement of the product design.

ME-09.3 [R] Simulation as a Tool for Evaluating Strategic Policies for Flexible Supply Chain Systems

Janice L. Forrester; NIKE, United States
Wayne Wakeland; Portland State University, United States

The emergence of flexible supply chain systems (FSC) has sparked increased interest in real-time planning, scheduling, and logistics—with particular consideration for strategic implications and overall cost control. Important aspects of an FSC include forecasting, production, materials handling, transportation, and distribution center inventory. There exists a variety of software applications for addressing tactical issues, such as adaptive scheduling, and short term forecasting. However, these programs typically do not permit the user to assess the strategic implications of different policies for flexing capacity and making alternative commitments to manufacturing plants. Recently there has been increased interest in the use of simulation models for strategic policy analysis. Simulation compares favorably to purely analytical methods that often fail to capture the complex interactions of a particular FSC. The challenge is to create an FSC simulation model that is general enough and flexible enough to allow the user to analyze the overall costs and benefits of different policies. This paper presents just such an FSC model, implemented in a system dynamics modeling language. The model is specifically designed to help the user evaluate different policies for scheduling production in the factories and policies that govern factory capacity...in terms of their impact on overall production cost and inventory turns. Preliminary results include new insights regarding the conventional wisdom that minimizing the incremental amount that a factory can fluctuate at any given point in time will reduce cost. The model suggests the contrary, that requiring larger fluctuations actually reduces the frequency and overall magnitude of the changes without adverse impact on factory utilization.

ME-10 Technology Transfer-1

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Studio Suite

Chair: Corrado Lo Storto; University of Naples Federico II

ME-10.1 [R] Necessary Conditions for Military to Private Sector Technology Transfer

Richard M Franza; Kennesaw State University, United States

Technology transfer has become an increasingly important mission of military laboratories, with results that benefit the government, private companies, and the nation's economy. However, the performance of this mission over the past decade has been a mix of successes and failures. The purpose of this research is to improve this performance by identifying the characteristics found to be common among successful military to private sector technology transfers. Detailed case studies of nineteen U.S. Air Force technology transfers to the private sector are examined to determine these "necessary conditions" for successful transfer. Necessary conditions include upper management support of technology transfer in the military laboratory, project champions in the military laboratory, shared personnel of the mil-

itary and private organization throughout the transfer project life-cycle, acquiring organization technical capability and resources, and an acquiring organization business plan for commercialization.

ME-10.2 [A] A Methodology for Analyzing and A Methodology for Analyzing and Measuring the Success of International Technology Transfer (ITT) in Defense Joint Ventures in Turkey

Hamdi Kaykusuz; Yeditepe University, Turkey
Atilla M Öner; Yeditepe University, Turkey
Timur O Çelikkürek; Yeditepe University, Turkey

Because of the differences between defense industry and civilian industry, International Technology Transfer (ITT) success measurement models that are being applied to civilian joint ventures are not sufficient and efficient enough to be used in defense ITT. In this study a new methodology has been developed in order to measure and analyze the success of ITT in defense joint ventures in Turkey from the transferee government and firm point of view. This methodology has been offered as an alternative for the Added-value Model that is being used by the Government of Turkey as a local content indicator in order to measure the success of ITT in defense joint ventures.

ME-11 Technology Diffusion-2

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Executive Suite

Chair: Cherian S Thachenkary; Georgia State University

ME-11.1 [R] From Closed Codes to Open, Patented Codes

Jukka Mäkinen; Tampere University of Technology, Finland
Hannu Jaakkola; Tampere University of Technology, Finland

The main aim of this study was to inspect the distributions of "software" patents (temporal distribution, distribution of ICT-developers as assignee, distribution of typical examples of software). Timing is important; too often significant results are expected too early. Nowadays, development is faster than one hundred years ago — understanding is needed about the speed of development. In this paper a method is used for measuring the speed and acceleration of technical development by mapping the possession of patented artifacts. The possession of patented software artifacts is identified by using an on-line patent database. The number of patents is illustrated by a function curve during a given time. The speed is assessed from the number of patents by derivating the existing function. Acceleration is the second derivative of the function of the number of patents. By applying Dr. Marasco's method it is possible to understand the forces in a pace of change and a patent field status [1]. There are some very interesting issues which are all connected to the patenting of software; they are: open source code, security, return of investment to software development, and the patentable combinations of hardware and software. Open code development is a strong signal — it is a question of initiating a new era of software development, where timing plays an important role for those who do not want to stop making open code. It is not a surprise that this study can be seen as a ramp to a highway that could be called a road to 'hell of concepts.' Software is a written code — is it possible to patent a written code? Yes, it is — but, the devil is in the details.

ME-11.2 [A] Demand Forecasting for the Public Wireless LAN Service in Korea: Combining Analogy and Survey

Ho Kim; ETRI, Korea, South
Wonsoo Hong; ETRI, Korea, South

In this paper, we forecast demands for the public wireless LAN(PWLAN) service in Korea. The PWLAN service is a brand-new service which has been provided commercially since Feb., 2002. Forecasting demands for new services is two folds: (1) to predict the diffusion speed, (2) to estimate the market potential of the service. First, to predict the diffusion speed of the PWLAN service, an analogy method is used. That is, we search analogous services of the target service from a set of existing services. By analyzing diffusion processes of analogous services, we infer the diffusion speed of the PWLAN service. Second, to estimate the market potential, the choice model will be applied to a surveyed data. Based on the choice mod-

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

el, we will develop a model which estimates the market potential of the PWLAN service. By combining the diffusion speed inferred from analogous services with the market potential estimated from the surveyed data, we forecast demands for the PWLAN service in Korea.

ME-11.3 [R] Knowledge Migration and Firm Development: The Case of Taiwan's Imaging Industries

Yee-Yeen Chu; National Tsing Hua University, Taiwan

Wen-Lung Cheng; National Tsing Hua University, Taiwan

Chao-Chi Su; National Tsing Hua University, Taiwan

This paper illustrates the co-evolution patterns of knowledge and firms in Taiwan's imaging industries. It first explores the structure of the knowledge and the strategies the set of firms used for the migration of engineering knowledge in the evolving scanner technology system in the 1990s. It then examines the ways the knowledge are configured and deployed in these firms to shape the product and process development competence. Further, supported by industrial data collection and interviews with industrial experts, the paper illustrates a knowledge migration model that drives the development paths and market impacts. The model postulates a set of firm-level dynamic capacity and mechanism for driving technology innovations and knowledge diffusion. It is used to highlight the insights gained in the system structures and interaction processes on knowledge diffusion, industrial innovation and knowledge asset deployment. The model is then used to explore the migration patterns, i.e., the firms' further reconfiguration, transfer, and migration of their knowledge in two areas: (1) transition and diversification to another industry, digital still camera, and (2) spill over across the regional boundary, i.e., to these firms' regional operations. The paper finally examines the two patterns, which were initiated in the latter part of the 90s, and so far have been successful in garnering the fruit from these firms' dynamic capabilities in knowledge migration and diffusion, in light of the implications in knowledge development strategy.

ME-11.4 [R] The R&D Inter-Industry Spillover in China: On the Analysis of 1999 IO Table of China

Hongxia Zhang; Chinese Academy of Sciences, China

The R&D spillover effect in China is analyzed in this paper by input-output technology, based on the 1999 input-output table of China with 40 sectors. First, the backward and forward R&D-flow-coefficient-matrix are defined and computed. Second, some important indexes derived from R&D-flow-coefficients-matrixes, MCR&D, SCR&D, and MDR&D, are computed and analyzed to show the inter-industry R&D spillovers. The main results are as follows. Generally, there are three kinds of sectors: (1) some sectors have large R&D spillover to other sectors, while accept little spillover from other sectors, such as scientific research, petroleum and natural gas extraction, metals mining and dressing, chemicals industry, etc; (2) some sectors have almost equivalent R&D spillover flowing from other industries with respect to dedicating to other industries, such as petroleum refining and coking, electronic and telecommunications, production and supply of power steam and hot water, transport equipment, etc; (3) other sectors, such as agriculture, coal mining and processing, metal products, accept more R&D spillover flow than dedicating to other sectors. The high-technological industries, such as IT industry, chemicals industry, and scientific research, have high R&D spillovers in the economy of China.

ME-12 Technological Changes-1

Monday, 7/21, 3:30 PM – 5:00 PM

Room: Senate Suite

Chair: Igal Karim; Sapir Academic College

ME-12.1 [A] What Will Be The Future of Optical Storage Technologies?

Pisek Gerdstri; Portland State University, United States

James Cheng; Portland State University, United States

Seiji Shinriki; Portland State University, United States

Ying-Tz Ho; Portland State University, United States

Kittinan Boonserm; Portland State University, United States

This presentation will project the future development progress of various storage technologies by applying different technology forecasting methods including Patent Count Analysis,

Fisher-Pry and Volterra Lotka. The approach of this study is structured in two parts. The first part analyzes the number of patents to determine the growth and substitution pattern of each storage technology. The second part applies the number of unit sales along with the assumption of some initial values of two different technologies at a time into the Volterra Lotka biology model to determine their competition and succession pattern of one over another. The analogy analysis approach is also applied to justify the assumption values based on various possible scenarios.

ME-12.2 [A] Maintaining Flexibility in Strategy Formulation Through Evolution Toward Internet-Based Business Models: Four Case Studies

Igal Karim; Sapir Academic College, Israel

The purpose of this paper is to explore how a firm's flexibility in formulation of organizational strategy might be enabled by adoption of Internet technology. At the basis of this work are four case studies of firms, acting in either local or global markets, which adopted Internet technology and whose managers preferred an evolutionary rather than a revolutionary change from traditional business models to more innovative Internet-based ones. This preference for an evolutionary transition seems related to the limited experience with the Internet, the organizations' continuous exploration of new strategies, their wish to maintain strategic flexibility, and the prudence generally required with innovation.

ME-12.3 [R] The Push-Pull Model of Technology Spatial Communication

Hsing Chau Tseng; Chang Jung University, Taiwan

Dispute on whether technology interaction results from technology push or from market pull has frequently occurred among scholars in the technology management field. Proponents of technology push declared that technology itself created market demands, while proponents of market pull claimed that only technology of applied science, which relied on market needs, initiated this effect. This paper studied the mixed effect of quantified technology push model (which applied the power of an organization's R&D expenditure to estimate its total technology diffusion afterwards), and market pull model (which considered the influence of distance impact and scale impact); both were proposed after consideration of spatial interact studies by most scholars, and derived market pull by dividing power of the relative distance within the designated regions by power of technology receiving region's local manufacturers' total sales. Finally, a push-pull model of technology spatial interaction, integrated by market pull model and technology push model, was derived in this paper, and shown useful in estimating the technology communications of an organization in all related areas. Moreover, we collected related technology communication data of ITRI's, Taiwan's largest domestic R&D organization, and applied them to estimate the technology push coefficient, market pull coefficient and distance friction coefficient, and then discussed their application thoroughly.

ME-12.4 [R] Better Business and Technology Evolution Forecasting Using Systematic Innovation Methods

Darrell L Mann; CREAX nv, United Kingdom

It often seems that the only sure thing about any form of technology forecast produced by any of the currently known techniques is that they will be wrong. The biggest single cause why they are wrong is that they assume the world to be mappable using linear models. Prevailing logic dictates that non-linearities are fundamentally non-predictable. While this may be true in certain instances, in the large majority of cases, research on systematic innovation methods has demonstrated that non-linear disruptions can be reliably and accurately predicted. The basis for this — perhaps difficult to believe — claim emerges through a programme of research built from the analysis of over 3 million patents and scientific advances. This research — part of the biggest study of creativity ever conducted — has demonstrated that systems evolve through a number of distinct and predictable stages. Thus far, 35 known trends of evolution have been uncovered. The paper demonstrates how these trends could have been used to predict disruptive technology shifts like the digital camera, ultrasound-based washing machines, and many others, and, more importantly, how leading companies are beginning to use them to systematically identify new disruption opportunities. The uncovered trends offer a very clear picture of the 'what's' of disruptive innovation. Using these

SESSIONS

trends as the foundation, the paper then proceeds to examine how they can be used in conjunction with business and market trends in order to also predict the 'when's.' In discussing the subject of innovation timing, the paper defines the tension between market pull and technology push as the principle disruption driver. With regard to 'market pull,' the paper further demonstrates that even when those market forces are hidden (as was the case with the digital camera), disruptions can still be uncovered in a systematic and reproducible manner.

TB-01 Innovation Management-2

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Pavilion East

Chair: David Wilemon; Syracuse University

TB-01.1 [R] Team Leadership Toward Innovative Results

Hans J Thamhain; Bentley College, United States

Virtually all managers recognize the critical importance of innovation for overall team performance. However, in technology-intensive situations, only one-out-of-eight managers feels capable of effectively engaging team members toward innovation and sustaining innovative behavior under time and resource pressures. Yet, many team leaders produce highly innovative results, even under extremely tight time and resource constraints, a phenomenon that has been further investigated. The Findings of a two-year field study of 34 technology-intensive projects, their leaders and 1,425 team members, illuminates the criteria that foster innovative project team behavior. The results show that effective team management toward innovative results involves a complex set of variables related to task, people, and organizational environment. Correlation of these variables suggests that many of the performance criteria have their locus outside of the team organization. Yet, managerial leadership style, at both the project level and senior management, has significant impact on the creativity that ultimately affects project performance. The findings provide team leaders with an insight into project-based innovation processes, including methods of bench-marking and factors that influence the behavior and performance of the project team toward innovation and creativity.

TB-01.2 [A] Caravelli & McGuire, Inc.: A Corporate Case Study

R. Keith Martin; Fairfield University, United States

This case describes the founding, development, and near demise of a manufacturing company whose products were highly regarded in the marketplace. Begun by immigrants, and based on their individual skills, the company grew from a small, privately held operation doing business only in the United States, to a publicly held company with operations in several foreign countries. As the company's business expanded, the inadequacies of the founders' management's competencies, and the lack of effective corporate information systems, resulted in serious organizational and operational problems. The case illustrates the problems that can develop quickly when an organization does not have defined goals, effective management, and supporting information systems.

TB-01.3 [R] A Generalised Innovation Management Model for Large Organisations

Andrie J Roelofse; University of Pretoria, South Africa

Marthinus W Pretorius; University of Pretoria, South Africa

Innovation is a concept that large organisations sometimes struggle with in today's fast changing and competitive world. In order to understand the fundamental need for innovation, economic and technology lifecycles need to be understood. This paper describes a generalised innovation model. The model is mainly an integration of existing models and practice in industry and the purpose is to use it as a basis for a future research project on innovation in large organisations.

TB-02 Project/Program Management-3

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Pavilion West

Chair: Margaret F Shipley; University of Houston — Downtown

TB-02.1 [R] Project Uncertainty and Transformational Leadership: Contextual Influences on the Impact of Project Manager Leadership Behavior

Zvi Aronson; Stevens Institute of Technology, United States

Peter Dominick; Stevens Institute of Technology, United States

Thomas G Lechler; Stevens Institute of Technology, United States

This paper offers a framework for analyzing how a project manager's leadership behavior is likely to impact project performance. Although there is growing recognition within existing project management literature of the importance of a project manager's leadership role, to date there have been only limited efforts to apply existing theoretical models of leadership. In this paper we consider how one such theoretical model, transformational versus transactional leadership, applies to project management. Using this model, the paper argues that a more complete understanding of project leadership can be determined by considering the moderating effects of project characteristics. In particular the most salient characteristics are likely to be those relating to the extent of complexity and uncertainty that is inherent in project-based work. Implications for advancing project management theory and general leadership theory are discussed. In addition, suggestions for future empirical investigations are also discussed.

TB-02.2 [R] Understanding Conflict in Project Teams: An Investigation of Organizational, Task and Team-Level Determinants

Patricia J Holahan; Stevens Institute of Technology, United States

Ann C Mooney; Stevens Institute of Technology, United States

Cognitive conflict is usually associated with effective decision outcomes in project teams, while affective conflict is associated with poor decision outcomes. Moreover, the two conflict types are typically correlated. Thus, the challenge for project teams is to gain the benefits of cognitive conflict while avoiding the costs of affective conflict. This paper tests a theoretical model of the determinants of cognitive and affective conflict in a sample of 56 project teams. Cognitive conflict is hypothesized to be a function of organizational, task, and team characteristics and to spiral into affective conflict under conditions of low trust. Support is found for team-based rewards, goal clarity, and behavioral integration as predictors of cognitive conflict. Trust is found to moderate the relationship between cognitive conflict and affective conflict, supporting the notion that under conditions of low trust, high levels of cognitive conflict degrade or spiral into high levels of affective conflict.

TB-02.3 [R] A Framework for Manufacturing Ramp-up

Erik van der Merwe; University of Cambridge, United Kingdom

Gerry D Frizelle; University of Cambridge, United Kingdom

Novelty in various guises drives the performance improvement curve that is observed during the initial introduction of new products to manufacturing. The management of the introduction of both new process technology and new products into manufacturing presents serious challenges to companies. A framework using the concept of learning to link novelty to this performance curve is developed from the literature and validated through a case study. Although the literature specifically pertaining to initial commercial, or ramp-up, manufacturing is sparse there is a consensus in academia and industry that this period is crucial to many products' success. The framework development therefore draws heavily on the numerous studies of new product introduction, learning and manufacturing, and the impact of design on manufacturing.

TB-03 New Product Development-2

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Broadway-1

Chair: Gloria Barczak; Northeastern University

TB-03.1 [R] Educating the Guess: Strategies, Concepts and Tools for the Fuzzy Front End of Product Development

Antonie J Jetter; Aachen University of Technology (RWTH), Germany

Many companies lack efficient management of the early phases of new product development (NPD) — the so-called fuzzy front end (FFE). Rather than on structured methods, decision makers rely on "gut-feel" or "guessing." In an attempt to "educate the guess," this paper discusses the activities and challenges of the FFE, as well as strategies to manage them successfully. It then briefly presents traditional and recent approaches to front-end management support. Based on the identified strengths and weaknesses of existing front-end solutions,

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

the framework of a new management support system for the FFE is presented. Conceptually, the system is based on psychological findings about the process of action-regulation in complex decision environments. Methodologically, it uses Fuzzy Cognitive Maps (FCM) for modeling and simulation.

TB-03.2 [R] Investigating the Effect of Decisions in New Product Development: A Complex Systems Approach

*Christos D Tsinopoulos; University of Warwick, United Kingdom
Ian P McCarthy; Simon Fraser University, Canada*

Whilst manufacturing excellence helps to maintain the current survival of companies, the development of new products is a critical process for ensuring future survival. The efficiency and effectiveness of the new product development (NPD) process depends on the integrated decision making ability of the system, but current NPD frameworks focus on managing the co-ordination activities and transfer of information. These existing frameworks achieve cost and lead-time reductions, but at the expense of innovation. Using a case study methodology this paper introduces a framework that seeks to address this trade-off issue by using a complex systems approach to explore and better understand the characteristics of emergence and non-linearity and their impact on NPD. One of the key findings of this paper is that the decisions taken by the members of the organisation at the operational level are responsible for the emergent behaviour of the NPD process.

TB-03.3 [R] Multi-Objective Optimization Model for Modular Product Architecture: A Framework

*Bimal P Nepal; Wayne State University, United States
Leslie Monplaisir; Wayne State University, United States
Nanua Singh; Wayne State University, United States*

Increasing product varieties for responding to the heterogeneous needs of the customer may provide firms with a number of challenges in terms of performance of its internal operations. Pursuing modularity in the design of product architectures can mitigate the negative impact of product variety on operational performance. The literature on product development shows that nearly 80% of the costs and problems are accounted for design decisions that have direct relationship with product architecture. Despite the product architecting process being a key-determining factor in both cost savings and in the ability to offer product variety, there lacks a systematic approach since it is largely developed through heuristics. Regardless of type of architecture e.g., modular or integral, the product architecting process is typically a complex problem with multiple goals such as minimization of cost and cycle time, and maximization of product quality and reliability. A single objective optimization technique may not adequately address the complexity of the problem and thus result into a sub-optimal solution. This paper presents an ongoing research work that deals with development of a multi-objective optimization framework for accomplishing optimal modular product architecture with special focus on module selection. The framework utilizes goal programming model for optimization process and fuzzy logic models for estimating performance metrics such as quality, reliability, manufacturability, and cost.

TB-04 R&D Management-3

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Broadway-2

Chair: John O Aje; University of Maryland

TB-04.1 [A] National R&D Performance Measurement: Case Study of Advanced Infrastructure Technology Program in Korea

Byoung N Lee; ETRI, Korea, South

The Advanced Infrastructure Technology Program, sponsored by the Ministry of Information and Communication in Korea, has made great achievements since its inception in the early 1990s. Major technologies have been successfully developed such as digital switching technology, high-density semiconductor technology, and digital mobile telecommunications system technology. Recently, the issue of national R&D program's performance and its measurement has received much attention from policy-makers in Korea. Many ministries and agencies in Korea have implemented their own R&D programs and have come under pres-

sure to be accountable for their R&D expenditures. The Ministry of Information and Communication published its first report on R&D performance evaluation in 1998. The author has been engaged in developing indicators and measures for the outputs and impacts of the national R&D program since then. The purpose of this paper is to present the current practice of the performance measurement of the Advanced Infrastructure Technology Program for review by experts concerned and to introduce the experiences of Korea in order to exchange the ideas with other countries. The R&D planning and management processes of the program are described in detail. Also provided are the trends in R&D expenditures of the program by technological area, by performing sector, and by character of work. The performance output indicators have been developed and categorized according to the character of downstream process of R&D and to the nature of measurement. Some indicators such as the number of publications, patents, and technology transfer are illustrated.

TB-04.2 [R] Measurement of Quality and Maturity of R&D Processes — Towards Innovation Quality: Methodology, Benchmarking and Case of a Medium Sized Finnish Company

*Pekka Berg; Helsinki University of Technology, Finland
Jussi Pihlajamaa; Helsinki University of Technology, Finland
Juha Nummi; Helsinki University of Technology, Finland
Juuso Seppälä; Helsinki University of Technology, Finland
Udo-Ernst Haner; University of Stuttgart, Germany*

Continuous improvement of the effectiveness of R&D requires an adequate and comprehensive assessment and measurement system. The present method, Quality and Maturity Method QMM, for assessing the quality and maturity of R&D examines R&D from six viewpoints. From the corporate level the R&D as part of business strategy, R&D as part of product and technology strategy, and strategic implementation of R&D are assessed. From the viewpoint of project level the R&D as a business section, R&D outputs, and implementation of R&D-projects are assessed. Procedures in each of the six viewpoints are assessed and scored using five maturity levels. The verifying of the preliminary QMM method in four pilot-companies has shown that the viewpoints used in the assessment describe factors pertaining to the quality and maturity of R&D quite well, and they indicate central development needs. Consequently, there is a need for further developing of the quality maturity method applied in the case studies and for considering the larger impact of it on the overall innovation attempt within companies, reaching towards the establishment of innovation quality.

TB-04.3 [R] Measuring Customer Value as a TQM Tool in Corporate R&D: A Longitudinal Business Case

*Frances T.J.M. Fortuin; Wageningen University, Netherlands
Onno Omta; Wageningen University, Netherlands
Jos Bras; Wageningen University, Netherlands*

The fast development of technology, combined with the increased global competition and more stringent customer demands, strongly pressurizes companies to improve the pace and quality of their R&D activities. Therefore, R&D management increasingly converts to a quality-based approach by applying Total Quality Management (TQM) concepts to their R&D organization. This paper describes the development of an instrument for assessing the in-company customer perception of the service quality of the R&D organization and presents the first results of a longitudinal study in which the instrument was applied in a large multinational supplier company in the automotive industry. It is concluded that measuring in-company customer value is a fruitful way to assess R&D quality, that the regular feedback provided by the instrument can be used as steering information for the alignment of R&D to the business unit interests, and that the systematic measurement of the gap between the customer's perception of R&D quality and the self-perception of the R&D staff adds to the power of the instrument.

TB-04.4 [A] An Analysis on the IT R&D Investment and Effects in Korea

*Yun-Bong Auh; ETRI, Korea, South
Ilseue Roh; ETRI, Korea, South
Kum-Ju Kwon; ETRI, Korea, South*

SESSIONS

Korea's information technology (IT) industry has been rapidly growing as a core industry in a national economy supported by the government's active R&D investment drive and technology innovation efforts in the private sector. The results of IT R&D investment analysis show that to continue development and secure competitiveness in the IT industry, the government should continuously increase IT R&D investment, and especially concentrate on basic research field and core technology field.

TB-05 PANEL: Technology, Entrepreneurship and Regional Economic Development

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Broadway-3

Panelists: Fred Y Phillips; Oregon Health and Science University

Jong-in Choi; Hanbat National University

Carmo A D'Cruz; University of Central Florida

Tom O'Neal; University of Central Florida

Krishnamurthy Ramanathan; University of Western Sydney

Yu-Shan Su; International Business/ National Taiwan University

Heike Mayer; Portland State University

New knowledge about industry clustering and new trends in globalization affect localities' strategies for attracting, starting, and retaining technology companies. How can metropolitan regions best specialize, incentivize, network, and invest to grow a stable technology-related job base, infrastructure, and tax base? What kinds of new cross-sector partnerships and marketing programs bring success? Experts from Portland and other regions represented at PICMET will share their best practices and lessons learned.

TB-06 Information Technology (IT) Management-3

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Broadway-4

Chair: Eliezer Geisler; Stuart Graduate School of Business

TB-06.1 [A] Business and Information Technology Strategies and Their Impact on Organizational Performance

Fuat Gunes; Yeditepe University, Turkey

Nuri Basoglu; Bogazici University, Turkey

Hande Kimiloglu; Bogazici University, Turkey

Measuring the impact of Information Technology (IT) on organizational performance is a complicated task. Since organizational performance cannot be shaped only by IT applications, other factors such as business strategies and organizational culture should also be taken into consideration while measuring the impact of IT on overall performance. For measuring organizational performance, a long list of tangible and intangible factors can be found in the literature. Following a survey of the literature study, a conceptual model and a measurement instrument were developed. The questionnaire was distributed to the top 500 companies in Turkey and some public organizations. The results of 105 questionnaires were included in the analyses. The relationship between independent variables and organizational performance was analyzed. One of the major findings is that in organizations adopting an innovative and supportive culture, the impact of IT on overall performance is stronger. IS departments scanning IT continuously in various ways make better use of technology and implement applications that reduce operational costs. Most respondents admit that IT enables them to show better individual performance.

TB-06.2 [A] Building a Self-Assessment Diagnostic Tool to Improve SME Performance

Ian Barclay; Liverpool John Moores University, United Kingdom

Keith J Porter; Liverpool John Moores University, United Kingdom

Phillip Spruce; Liverpool John Moores University, United Kingdom

Colin S Wood; Liverpool John Moores University, United Kingdom

The paper considers the role of the Small-to-Medium Enterprise (SME) in supply chains as this concept develops further, and the need for business competence as a basic requirement for the SME to access major supply chains in order to sustain growth. The development of a self-assessment tool, to enable the SME to measure its own capability in key business aspects,

is described, together with an illustration of how the tool was applied to a UK (Merseyside) firm for it to focus on and set priorities for key business areas requiring improvement. The paper reveals the basic construction and workings of the tool, and explains how its application drives out, in priority order, the key business improvement areas. As the tool is driven by the SME, it enables identification of areas requiring business support rather than have these areas force-fitted against a standard consultant's matrix. The tool is thus offered as a self-applied diagnostic method to identify these areas as a precursor to accessing tailored business support, rather than generic, unfocused support.

TB-06.3 [R] Information Integrity: An Emerging Field and the State of Knowledge

Eliezer Geisler; Stuart Graduate School of Business, United States

Paul Prabhaker; Stuart Graduate School of Business, United States

Madhavan Nayar; Unitech Systems, United States

Information integrity is the dependability or trustworthiness of information. More specifically, it is the accuracy, consistency, and reliability of the information content, process, and system. This is an issue with which every organization in business, government, and society is concerned. Failures of information have been perceived until now as a pervasive, universal problem, although it costs the economy many billions of dollars. This paper is the result of a study of the state of knowledge and the intellectual space of the concept of Information Integrity. The study was sponsored by the Information Integrity Coalition. It frames the space of the concept from several perspectives, among which are: prevention, monitoring, and correction of information errors; security audit and control; design, development and operation of information systems for higher integrity; and information integrity requirements of specific industries such as financial institutions, health care, defense, and transportation.

TB-07 Decision Making in Technology Management-2

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Forum Suite

Chair: Jeffrey H Smith; Jet Propulsion Laboratory

TB-07.1 [R] Assessment of the Impacts of E-Commerce Technologies on Overall Business Processes: An Analytic Delphi Process

Stacey E Ewton; Portland State University, United States

The Internet has dramatically changed our lives and the way we do business. With the innovation of e-commerce companies can reach customers and sell products almost instantaneously. As an outcome, e-commerce has grown tremendously and the rapid changes taking place in information technology in conjunction with the dynamic nature of the market provide rich opportunities for research. This research assesses emerging e-commerce technologies and the impact of these technologies on overall business processes. The methodology utilized is an analytic Delphi study where experts assessed the adoption of e-commerce technologies and the impacts of these technologies on overall business processes. Delphi offered a mechanism to make these assessments via a panel of experts and was the chosen methodology because the Internet is a relatively new technology and thus, sufficient historical data were not available to effectively utilize other traditional forecasting methodologies. Once the initial e-commerce technologies were identified via traditional Delphi, the Analytic Hierarchy Process was used to quantify experts' judgments. The research methodology required a team of twelve e-commerce experts to respond to three sets of research instruments. The results of the research quantify the impact of major e-commerce technologies and business change agents as identified by the experts in the study.

TB-07.2 [A] Building a Pathway to Mars: Mars Technology Program Analysis and Case Study

Jeffrey H Smith; Jet Propulsion Laboratory, United States

Benjamin Dolgin; Jet Propulsion Laboratory, United States

Charles R Weisbin; Jet Propulsion Laboratory, United States

The exploration of Mars has been the focus of increasing scientific interest aimed at addressing a number of enduring questions about the planet and its relationship to Earth. These include determination of existing life on the planet, evidence of any earlier living organisms (e.g., fossils), and global climate processes. NASA's Mars Exploration Program is formulated

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

to link scientific goals and objectives to those sets of missions that will best enable the fulfillment of scientific goals while retaining resiliency to unexpected events such as unforeseen discoveries, random failures, or budgetary uncertainties. This paper focuses on the analysis and identification of technology development portfolios designed to meet the scientific and mission objectives of the Mars Exploration Program. A multi-criteria decision-making approach was developed to address the question, "Given a Mars exploration program and budget composed of candidate mission concepts dependent on a variety of alternative technology development programs, which combination of technologies would enable missions to maximize science return meeting the largest number of scientific objectives under a constrained budget level?" A number of R&D portfolio planning techniques were employed to address this question. Technology contribution to missions was measured using decision analysis techniques. Uncertainties in the capability requirements of each technology were captured using performance attributes and their probability distributions to represent development outcomes. Technology developers and program managers assessed the likelihood of achieving technology-capability performance requirements. Monte Carlo simulation of technology development outcomes was simulated for each mission portfolio examined. The scientific value of each portfolio was computed based on each portfolio's contribution to a strategic exploration goal. Finally, the total cost of each portfolio was computed and tested against a technology budget constraint. Different budget profiles over a twelve-year planning horizon were examined and sorted by cost to remove portfolios exceeding the budget constraint. Solutions were found by searching all possible portfolios for the maximum science value at the lowest cost. These calculations were performed for every possible combination of portfolios (2047 cases). Example solutions, implications, and observations are discussed.

TB-07.3 [R] A Hybrid Approach for Corporate Basic Research Project Evaluation and Selection

Yasuo Kusaka; Dokkyo University, Japan
Masao Hirasaka; Teijin Limited, Japan

This study proposes a hybrid approach for corporate basic research project evaluation and selection, which combines a normative aspect of modeling with such experience or intuition as being important but difficult to incorporate into model for practical business situations. It aims to bridge the gap between theory and practice. The approach consists of three types of project evaluation and selection for three stages up to development research: "the first evaluation" making project alternatives and roughly selecting some project alternatives, "the second evaluation" evaluating them and determining optimal combination alternative (CA) among all CAs so as to maximize total performance under total cost constraint and "the third evaluation" revising the optimal CA from some practical viewpoints. This study mainly focuses on the second evaluation proposing important theoretical framework in selecting optimal CA, and the third evaluation revising optimal CA. In the model, a set of criteria for research project evaluation is selected through theoretical and case analyses, and the criteria are weighted by the pairwise comparison method of AHP. Then, evaluation for each project is made, and optimization model is built and analyzed by integer programming and branch and bound method (BBM). Cost Performance Curve (CPC) method proposed in the previous studies is also used to offer useful information in decision-making. The proposed method is also applied to a practical problem and some important viewpoints in the hybrid approach are clarified.

TB-08 Productivity Management-1

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Council Suite

Chair: Timothy R. Anderson, Portland State University

TB-08.1 [R] Evaluating Technical Efficiency in a Dynamic Environment: A System Dynamics Approach

Warren K Vaneman; Virginia Tech/ System Performance Lab, United States
Konstantinos Triantis; Virginia Tech/ System Performance Lab, United States

Realistically, organizational and/or system efficiency performance is dynamic, non-linear, and a function of multiple interactions in production. However, in the efficiency literature, system performance is frequently evaluated considering linear combinations of the input/output variables, without explicitly taking into account the interactions and feedback mechanisms

that explain the causes of efficiency behavior, the dynamic nature of production, and non-linear combinations of the input/output variables. Consequently, policy decisions based on these results may be sub-optimized because the non-linear relationships among variables, causal relationships, and feedback mechanisms are ignored. This paper introduces a methodological approach that combines system dynamics modeling with the measurement of productive efficiency. System dynamics is a modeling paradigm that evaluates system policies by exploring the causal relationships of the important elements within the system. This paradigm is coupled with the fundamental assumptions of production theory in order to evaluate the productive efficiency of a production system operating within a dynamic and non-linear environment. As a result, a subsystem within the system dynamics model is introduced that computes efficiency scores based on the fundamental notions of productive efficiency. The framework's ability to combine prescriptive and descriptive modeling characteristics, as well as dynamic and combinatorial complexity, can potentially have a greater impact on policy decisions and how they affect system efficiency performance.

TB-08.2 [R] Use of DEA to Evaluate Non-linear and Imprecise Information in Construction Contractor Performance

Gerald H Williams; Portland State University, United States
Timothy R Anderson; Portland State University, United States

This paper explores the use of Data Envelopment Analysis as a tool to evaluate the efficiency of building construction projects in Oregon where the inputs, including, "reported information" available prior to pricing and contractor selection is imprecise or at least, cannot be entirely or accurately captured by exogenous measures. This work builds on prior work in the field that evaluated missing, imprecise or non-existent information in DEA models and has broad application to the service sector of the economy where information is the prime input in the system.

TB-08.3 [R] Using DEA to Measure and Evaluate Relative Efficiency of Distributors: A Case Study

Ferhan Cebi; Istanbul Technical University, Turkey
Sitki Gozlu; Istanbul Technical University, Turkey

This study aims to measure and evaluate comparative efficiency of distributors, which are members of distribution channels of a Turkish firm producing different kinds of consumer goods by utilizing data envelopment analysis (DEA). The aggregate technical and scale efficiencies of thirty-six distributors in different territories in Turkey are determined. Variables that reflect the expectancies of the firm from the distributors depending on the firm's goals and objectives are selected as outputs. Variables that are thought to affect these outputs are included in the analysis as inputs. The inputs, which the firm directly allocates to the distributors, are considered as the controllable inputs, while the inputs representing the characteristic of territories are identified as the non-controllable inputs. The results of the study have shown that the firm to allocate and adjust its resources among distributors and also to make decision on its distribution channels can use this approach.

TB-09 Supply Chain Management-3

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Directors Suite

Chair: Kathryn Stecke; University of Texas at Dallas

TB-09.1 [A] Cross-National Evaluation of Small Manufacturers to Qualify Them for Global Supply Chains

Gene R Simons; Rensselaer Polytechnic Institute, United States
Robert Trachtenberg; Central N. Y. Technology Development Organization, United States

The QuickView expert system model was developed as a primary assessment and business planning tool between 1990 and 1992 by NEMTC (Northeast Manufacturing Technology Center) under grants from the U.S. Department of Commerce and the New York State Department of Economic Development. QuickView is a simple, but effective, evaluation process designed to help small and medium-sized manufacturing companies (SME's) better understand the problems and opportunities confronting their operations. An SME's responses to a questionnaire are entered into a database that compares them to over 3,500

SESSIONS

SME's from the U.S. and Puerto Rico. The latest version of QuickView includes an analysis of 12 operational areas from Management Practices to Quality Management. In 2002, a research project was initiated to determine whether SME's outside of the United States could be evaluated against the 3,500 U.S. SME's in the database. This was aimed at the global supply chain development problems. Two sites were chosen with the cooperation of local governments: Dalian in the People's Republic of China and The Basque region of Northern Spain. This paper describes the issues encountered at both sites during the training and application of the model using local personnel. This is a work in progress. Neither sample is complete, but data will be presented at the Conference.

TB-09.2 [A] Forecasting Success Amongst OEM Partners: Building a Strategic Map

W. A Spivey; UTSA, United States

J. M Munson; Santa Clara University, United States

William T Flannery; UTSA, United States

Fu-Sen Tsai; UTSA, United States

Technology managers use many criteria to forecast the success of strategic relationships. This paper expands upon many suggestions by integrating ideas about the balanced scorecard popularized by Kaplan and Norton (1996). To test this neoteric balance, two sets of managers share their views about criteria leading to success. One set works at an American OEM involved in producing a new generation of audio-visual displays. The others work at a Taiwanese supplier. Results imply that a balanced rubric helps prospective partners structure their decision making about an alliance. Five items are key. The first focuses on the Customer Perspective and implies the need to be able to gage impact on enterprise models. The next two keys revolve around the Internal Process Perspective by integrating enterprise equity (Spivey, Munson, and Spoon 2002). The need to clarify strategic intentions beforehand and having the technological ability that helps working with sub-tier suppliers characterize this focus. The fourth key focuses on the Learning and Growth Perspective and implies the need to mesh corporate cultures that engender trust, cooperation, and conflict resolution. In addition, managers' experience highlights the importance of a multi-dimensional Financial Perspective that includes not only revenue, but also productivity.

TB-09.3 [R] The Evaluation Criteria and Location Preferences for Selecting Foundry Service Providers by IC Designers

M. J Tsai; National Chiao-Tung University, Taiwan

Hsiao-Cheng Yu; National Chiao-Tung University, Taiwan

Zon-Yau Lee; National Chiao-Tung University, Taiwan

L. F Kuo; National Chiao-Tung University, Taiwan

Peng-Ting Chen; National Chiao-Tung University, Taiwan

The revenues of IC foundry services skyrocketed in the last five years before 2000. Foundry operators across the globe all prepared to invest capitals to build 12" IC foundries in order to be competitive. Unfortunately, global high tech industry slowed down and foundry overbuilt dragged IC foundry operators into heavy losses. This research uses the Multi-Criteria Decision Making method to study fourteen evaluation criteria from three major perspectives by IC designers when selecting foundry service providers. This research surveyed 398 IC designers throughout the world. Among the three major perspectives, the "foundry processing technologies" was heavily weighted (0.539); the "customer services and logistic support" was the next (0.322); and the "geographical location" was weighted the third (0.139). The relative foundry location preferences are Taiwan (69.0), Singapore (66.6), North America (62.4), Japan (61.7), Europe (57.9), Korea (54.4), and China (48.0). The findings of this paper can provide directions of service quality improvements and adjustments of competitive strategies by global IC foundry operators.

TB-09.4 [A] The Research on Supply Chain Management of Chinese Enterprises in International Operation After They Entered WTO

Yuehong Xu; Renmin University of China, China

Erming Xu; Renmin University of China, China

This paper first describes the new characteristics of enterprises in international operations

after they entered the WTO in order to research the new mechanisms of supply chain. Then the author generalizes and analyzes theoretically the new supply chain mechanisms of enterprises in international operations based on network economic era. Next, how to construct the supply chain mechanisms in enterprise grade is put forward. Finally, an example of telecommunications is given and useful conclusions are drawn.

TB-10 Technology Transfer-2

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Studio Suite

Chair: Seiko Arai; University of Oxford

TB-10.1 [R] The License Payment in Public-to-Private Technology Transfer: Methodology and Implications

Tae-Kyu Ryu; Seoul National University, Korea, South

Jong-Bok Park; Korea Institute of Science and Technology, Korea, South

Jeong-Dong Lee; Seoul National University, Korea, South

Tai-Yoo Kim; Seoul National University, Korea, South

All over the world, the attention on the exploitation of public research, which is mainly achieved by technology transfer, has increased in recent years. Although public-to-private technology transfer occurs via various significant mechanisms, those are largely related to licensing activities directly or indirectly. Licensing as a technology transfer mechanism is frequently accompanied by the conflicts between a public research institute (PRI) and private firms in negotiating the license payment with causing delay to reach a license contract and even a failure in making it. This paper presents the license payment, which especially consists of an initial payment a running royalty, and the minimum payment, through an enhanced mathematical model of public-to-private licensing, not hitherto tried by academics. The model addresses important issues to be applied comprehensively in practice such as determining a royalty rate, balancing between the initial payment and the running royalty, and setting the minimum payment as a screening criterion. Additionally the efficient incentive system for inventors is suggested [argued] in the model. Moreover, the model gives policy implications to the controversial issues in technology transfer from PRIs to private firms, partly employing the comparative analysis between the current stylized licensing practice and the new one suggested in the model.

TB-10.2 [R] Transfer of Technologies: A Meta Taxonomy

Arnold Reisman; Sabanci University, Turkey

Transfer of Technologies takes place among various kinds of players, takes on various kinds of modalities and is done for various motivations. Its literature is very disjoint and disparate transcending several academic disciplines and professions. This paper presents a way to define the field in its entirety and delineate all of its facets in a manner that is parsimonious yet discriminating.

TB-10.3 [R] Organizational Absorptive Capability: How Japanese and German Multinational Companies Absorb Technologies from the US

Seiko Arai; University of Oxford, United Kingdom

During the past decade, multinational companies have made radical organizational and management changes to absorb technologies from abroad. Defining the capability to search, evaluate, acquire, internalize, and utilize R&D knowledge from abroad as 'Organizational Absorptive Capability' (OAC), this research provides a framework to help understand the evolutionary process of internationalization of R&D as well as hypotheses to test the key factors that influence OAC: fluidity, organizational boundaries, institutional differences, central coordination, R&D mission and comparative technological capability.

TB-11 PANEL: Foresight — Providing the Strategic Knowledge for Technology Management

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Executive Suite

Panelists: Guenter Clar; European Commission, Belgium

Harold Linstone; Portland State University

Helena Acheson; Forfas, Ireland

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

Markku Markkula; Finnish Parliament, Finland

Jennifer Cassingena Harper; Malta Council for Science and Technology

Zoya Damianova; Applied Research and Communication Fund

Karel Klusacek; Academy of Sciences

Luke Georghiou; PREST, University of Manchester

A panel of distinguished members responsible for national Foresight exercises, and who have been part of respective High Level Expert Groups of the European Commission, will address the key lessons learnt in their countries. With the objective to give guidance for a more widespread application of this strategic instrument, by all involved in the innovative use and effective management of technology, the panel will focus on — comparative analysis and main recommendations — impact and impact evaluation — Foresight as a tool for improving policy making in general, and, particularly, competitiveness, technology and innovation policies. **BACKGROUND:** Policy making in all fields is deeply influenced by a broad spectrum of technological developments. At the same time, these technological developments are influencing all aspects of our societies. In this context, Technology Management can certainly be seen as having the potential to reshape the world. Technology Management is also having a deep impact on the efficient and effective allocation and use of financial resources available for public and private spending especially at the stage where high risks and substantial investments are necessary when developing competitive technologies for fast changing and globalised markets. Addressing critical issues and strategic dimensions of technology management has, therefore, become of interest to society as a whole. Nevertheless, it has become increasingly difficult to predict emerging trends, as well as their impacts with traditional instruments and in the traditional sense. Therefore, progress is essential in delivering the strategic knowledge needed to improve priority setting in Science and Technology (S&T), and reduce the risks involved. The impacts of technological development result from a complex interaction between the research and the business communities, governments and administrations, and societal stakeholders. In addition, pervasive Information & Communication Technologies (ICT) have contributed to the generation of relevant knowledge outside the traditional R&D and strategic units. Therefore, both 'supply' and 'demand' call for mobilising different stakeholders to share their respective knowledge and give collective thought on priorities of national, regional, or sectoral importance. In the recent past, Foresight type exercises have increasingly been used as policy tools. Not only because of their ability to provide strategic information efficiently but also because they are useful socio-economic mobilisation tools to raise awareness, to create consensus around promising ways to exploit the opportunities and diminish the risks associated with new S&T developments, and to empower countries, regions or companies to actively shape their future.

TB-12 Environmental Issues in Technology Management-1

Tuesday, 7/22, 10:00 AM – 11:30 AM

Room: Senate Suite

Chair: Amy Saberian; Neek-Engineering

TB-12.1 [A] Unocal: The Case of Intellectual Property Rights and Participation in the Creation of Environmental Standards

Nan Muir Bodensteiner; University of Houston at Clear Lake, United States

Darren Kiekel; University of Houston at Clear Lake, United States

As concerns about the degradation of our natural environment arise, society looks to government to mandate and industry to innovate sound and economically feasible solutions. It is not unusual to find that even as preliminary discussions of environmental issues take place, companies in relevant industries are working on technologies to address the environmental problems. Thus when the opportunity to inform and educate government regulators arises, companies want to be actively involved to adequately push for standards they will be capable of implementing. Companies engaged in basic research and developing relevant technology, while simultaneously participating in an industry group consulting with government, face special challenges. Managing the development of new technology, understanding the role the technology may play to address societal concerns, participating in an industry consortium to maintain proactive involvement in the industry/government discussions on standards/regulations, and managing the intellectual property challenges that may arise, will all be important endeavors reshaping our world and ensuring its sustainable develop-

ment. This paper presents a case study of Unocal, based solely on information from secondary sources, developed to illustrate the management of technology and intellectual property issues inherent in collaborative research in an industry consortium founded to address future government regulations.

TB-12.2 [A] Integration of Cleaner Production in Environmental Management System

Nese Kemerdere; TUBITAK-MRC, Turkey

S. Ayberk; Kocaeli University, Turkey

This study presents the significance and method of integrating cleaner production (CP) into environmental management system (EMS) for an integrated textile company which is established in the city of Bursa located in the Marmara region of Turkey. The detail of the assessment method of CP in EMS was put forward. The environmental aspects of the plant during its operational stages and services and the necessary environmental procedures to prevent or minimize the environmental impacts were all considered under the EMS. The procedures and policies were determined forming the basis for other detailed studies toward the checklists to conduct the EMS. The survey of the operations included detailed audits for identification of environmental management programs (EMPs). This survey has given a good background for the identification and selection of the problem areas. The EMPs were developed based on CP approach for reducing the pollution. The CP options for implementing CP have been devised under these EMPs. The project created a model suitable for communicating knowledge on CP and EMS.

TD-01 Innovation Management-3

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Pavilion East

Chair: Al Herman; Quantric Corporation

TD-01.1 [R] Technological Innovation by Design: An Information Enhanced Methodology for Accelerated Innovation

John P Dismukes; The University of Toledo, United States

Lawrence K Miller; The University of Toledo, United States

Yogesh C Shiralkar; The University of Toledo, United States

Ruth Miller; Illinois State University, United States

Samuel H Huang; The University of Cincinnati, United States

V. A Ames; Productivity System Innovations, United States

Technological innovation has become increasingly important as a cornerstone for industrial and societal advance over the past 100 years. Factors underlying this phenomenon include (1) the integrating role of industrial corporations, (2) the exponential world-wide growth of science and engineering personnel and R&D funding, (3) the enabling role of governmental regulations in stimulating industry-university-government partnerships, and (4) increased recognition of the importance of Schumpeter's creative destruction paradigm and Kondratiev waves. Literature publications in the field of innovation have exploded since the 1970's, as a result of academic and government as well as industrial interest in stimulating the commercialization of emerging technologies. Studies include the identification of key people roles, case studies of successful vs. unsuccessful innovation to establish best practices, comparative analysis of innovation behavior across different industries, and formulation of mechanisms for innovation. Decreased product life cycles reflecting both shifting customer demand and the introduction of new technologies have affected almost all industries. The need has been recognized for methodologies to achieve innovation in an effective and efficient manner through planned, systematic new product (or process or service) development and market commercialization involving interactive collaboration between different disciplines and business functions. One type of methodology that has received widespread attention and success is the Stage-Gate System, now in its third generation. This technique, involving the structuring of a development and commercialization project as a sequential set of stages (activities) and gates (decision points), has now been successfully adopted by a variety of industrial organizations. The method features a number of best practices, including key "must have" and "should have" criteria for moving sequentially from one stage to the next stage and finally to commercialization. In spite of these successes, current innovation

SESSIONS

methodologies are reaching the point of diminished returns, at a time when the rate of technological advance and the need for more rapid and risk free and cost effective innovation are increasing. Accordingly, new techniques for modeling, simulating and implementing innovation in the 21st century competitive environment are needed. Computer and information technology based techniques for accelerating product and factory design (e.g. CAD/CAM, FEA Simulation, and Virtual Reality) have consistently reduced the time and cost of fundamental development over the past 30 years. The current bottleneck lies in accurate identification of all the elements of a particular innovation, and their rapid and effective integration into a commercial development program. This paper proposes that the new 4th and 5th Generation Methodologies outlined in this paper have the potential to reduce innovation time by factors of 2-10 over that (1-25 Yrs) achieved by current best practices. Extensive case studies and analyses will be required to verify and validate the potential advantages and time savings proposed for these methodologies, and to document the procedures in sufficient detail for efficient and effective implementation to accelerate innovation.

TD-01.2 [R] Value Synthesis: A Targeted Strategic Innovation Tool

Al Herman; Quantrix Corporation, United States

For four decades the theoretical underpinning of many business strategy tools has been the creation and application of internal strengths to exploit opportunities in the business environment. Strategy paradigms that incorporate this view differ primarily in terms of their analytic dimensions. Lately, such conventional strategy approaches have been criticized for their failure to deliver results. A number of articles in the research literature now emphasize the need for "strategic innovation." This article discusses the academic origins and inherent limitations of SWOT derived strategy analysis tools. It then examines four variations on the "strategic innovation" theme and relates them in a way that forms the basis of a new, targeted strategy development approach.

TD-01.3 [R] A Model for Managing Internal Corporate Ventures

David Wilemon; Syracuse University, United States

Many companies are currently faced with stagnant, low growth markets, mature product lines, and intense global competition. One approach for moving beyond the tyranny of today's markets is to establish and effectively use internal corporate venture teams to create new business development opportunities. In the last two decades companies and scholars have learned a great deal about what makes venture teams successful and what can block their performance. This presentation discusses several dimensions of internal corporate venturing including: determining when venture teams are needed; establishing a venture group within a larger, often indifferent "host organization;" creating an effective venturing process; developing and maintaining organizational support; understanding and applying venturing best practices, and developing authentic venture teamwork. The presentation also focuses on some of the major political issues encountered by venture teams as they pursue innovation and change. The findings from a field study of ten (10) corporate venture teams will be examined in the presentation.

TD-02 Project/Program Management-4

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Pavilion West

Chair: Aaron J Shenhar; Stevens Institute of Technology

TD-02.1 [A] Maturity of a World Class IT Project — The Advancement of Projectization

Suhwe Lee; IBM Singapore Pte. Ltd., Singapore

In today's information technology (IT) industry, global sourcing from emerging countries and third party strategic outsourcing have become common practices for IT project implementation. To further improve productivity and global business competitiveness, the IT organization has also transformed itself from a typical matrix organization to a projectized organization. Traditionally, the prime responsibility of an IT project manager in a matrix organization is to insure the balance of triple constraints — functions, schedule, and cost as according to the contract. Now, due to the transient nature of projectization, headcounts have replaced people, and have become a parameter manipulated by the project manager. This dehuman-

ization of projectized organization accidentally acts as the prime suspect of the global exploitation of human welfare, led by the industrial countries. This application paper proposes a maturity framework for the advancement of projectization. This framework has gone beyond the traditional scope of IT project management and recommended an implementation strategy that focuses on balancing business, technology and human resource so that the IT project can integrate and re-align with business and market needs. To be fully beneficial to the overall business in an end-to-end value chain, the same framework should also apply to the business partners, suppliers and customers across the enterprises globally.

TD-02.2 [R] Determinants of Cross-organizational Software Project Success: An Exploratory Study

And Ozbay; Portland State University, United States

Dragan Z Milosevic; Portland State University, United States

Historically, software development projects have been plagued by problems such as significant budget overruns and schedule delays. Even in today's connected world, these problems keep the software project success rate at a lower level than in other industries. Moreover, the trend in the business environment to focus on core competencies has resulted in more collaborated software development efforts. Such a development has brought further complications into software development projects. This paper reports the findings of an ongoing research that aims at identifying determinants of success in cross-organizational software projects.

TD-02.3 [R] Measuring Efficiency of Projects in SME Organizations

Shai Rozenes; Ruppin Academic Center, Israel

Gad Vitner; Ruppin Academic Center, Israel

Stuart Spraggett; Coventry University, United Kingdom

Currently, project control systems often fail to support management in achieving their global project goals. A Multidimensional Project Control System (MPCS) deals with the control of a single project and defines its performances in comparison with the plan. The progression of several projects in parallel is a common situation in organizations; therefore, a comparison of the various project performances is required. It is proposed that a comparison process be performed using the Data Envelope Analysis (DEA) approach. The reference points for examining the performances of different projects and the directions of improvement for the projects are not necessarily found on the efficiency frontier. An algorithm is developed for applying multi-project system control in Small Manufacturing Enterprises (SME), organizations having a relatively large number of inputs and outputs while maintaining the validity of the DEA methodology.

TD-03 New Product Development-3

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Broadway-1

Chair: Tom Long; PriMotive Corp.

TD-03.1 [R] The Role of Trust and Project Commitment in New Product Development Teams

Gloria Barczak; Northeastern University, United States

Edward F McDonough III; Northeastern University, United States

Although trust has been an important focus of much research in the management literature due to its positive impact on performance, an examination of trust in the new product literature has been noticeably lacking. This study investigates the role of trust in new product development, particularly as it relates to project commitment and performance. Using data from both project leaders and team members from 41 NPD projects, the authors test whether trust has a direct or indirect effect on new product performance. The results indicate that project commitment mediates the relationship between trust and market performance. In other words, trust affects market performance but only through project commitment. No relationships are found between trust, commitment and project speed. The results of the study suggest that building trust in NPD project teams is critical to generating commitment by team members to the project which, in turn, is important to new product performance. However, commitment contributes positively only to market performance and not project speed.

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

TD-03.2 [R] Power and Empowerment: The Role of Top Management Support and Team Empowerment in New Product Development

Richard R Reilly; Stevens Institute of Technology, United States

Jiyao Chen; Stevens Institute of Technology, United States

Gary S Lynn; Stevens Institute of Technology, United States

Although recent empirical research shows the value of empowerment and top management support (TMS) for new product development (NPD) efforts, it remains an open question as to whether empowerment and TMS are always beneficial for NPD performance. In a study of a large number of NPD projects we examined this question by (1) assessing the direct contributions of empowerment and TMS to speed and success in NPD, and (2) examining the potential moderating influence of uncertainty on the effects of empowerment and TMS. Our results indicated that empowerment is positively associated with NPD speed under all conditions of uncertainty, but is more highly correlated with overall project success when uncertainty is high than when it is low. TMS is positively associated with both NPD speed and success regardless of uncertainty, but we found some suggestion that sponsorship is less important for speed-to-market in more certain environments, particularly when NPD projects are routine incremental innovations. Our study also indicates Technological uncertainty and Market uncertainty have a different moderating impact on the relationship between team empowerment and NPD success. The implications of these findings for a contingency-oriented view of NPD practices are discussed.

TD-03.3 [R] Senior Managers' Behaviours Which Contribute to Product Development Success

Tony J Bailetti; Carleton University, Canada

Richard Alam; The Lead to Win Program, Canada

Aamer Sajjad; NTG Clarity Networks Inc., Canada

Lien Chen; Carleton University, Canada

The product development literature highlights the importance of senior managers' behaviours to product effectiveness, process efficiency, and financial performance. In this paper, we answer the research question: What are the senior managers' behaviours that increase the commercial success of fast development projects? We first develop a model for the policies that affect development success. We then synthesize research findings into a model for 13 policies and 65 desirable behaviours. Finally, we examine responses from 17 engineers and computer scientists to identify which of policies and desirable behaviours distinguish successful from unsuccessful development projects.

TD-04 R&D Management-5

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Broadway-2

Chair: Kiyoshi Niwa; The University of Tokyo, Japan

TD-04.1 [A] NPO-Driven Decentralized Research System: Three cases of RoboCup, the Systems Biology Institute and the International Rescue System Institute

Shu Ishiguro; Japan Science and Technology Corporation, Japan

Hiroaki Kitano; Japan Science and Technology Corporation, Japan

Kiyoshi Niwa; The University of Tokyo, Japan

The NPO-Driven Decentralized Research System is proposed as a new research system model to promote large-scale and long-term research. In this research system, the NPO has the responsibility of (1) proposing project objectives and plans, (2) promoting world-wide collaboration among researchers from industry, universities, and governments, and (3) contributing to society and industry through making use of the research output. Autonomous participants from industries, universities and governments who share the project goal participate in the project freely and voluntarily, link to like networks, and compete and/or cooperate with each other. Three organizations representative of this system, RoboCup, the Systems Biology Institute, and the International Rescue System Institute, were started and managed successfully by the authors (Hiroaki Kitano and Shu Ishiguro), who were core members of these organizations. These organizations have long-term research goals and have been generating valuable research that contributes to society and industry. This system model is also eval-

uated in terms of factors that negatively affect long-term government-driven R&D projects in Japan. It was found that the research promotion processes based on the essential properties of the NPO, i.e., its competitiveness and selectiveness, "vision-driven" organization, neutrality, openness, ease of start-up, and decentralized nature, can keep in check the problems affecting government-driven projects.

TD-04.2 [R] Initial Directors of International R&D Laboratories

Max von Zedtwitz; IMD, Switzerland

Technology-intensive companies establish new R&D laboratories in regions of high innovation and near centers of scientific excellence. Identifying the right R&D director to head up such greenfield investments is central for success or failure of the new lab. Analyzing 162 interviews with senior R&D managers, we identify eight different directorship profiles. Examples of new R&D sites and their directors include IBM, Daimler, Leica, Microsoft, Xerox, Lucent and Ciba. The initial mission and the intraorganizational and intraregional integration of the new lab are principal factors for director selection, determining expatriate or national management, cultural and ethnic familiarity, as well as local or international transfers. The analysis of succeeding R&D directors indicates a trend towards locally rooted yet organizationally competent R&D managers. The paper concludes with desired qualifications of director candidates for newly established international R&D sites.

TD-04.3 [R] Integrating Market and Patent Portfolios for Market-Oriented R&D Planning

Holger Ernst; WHU — Otto Beisheim Graduate School of Management, Germany

Jan Henrik Soll; WHU — Otto Beisheim Graduate School of Management, Germany

Marketing and R&D strategies need to be aligned to increase the return from investment in new technologies. Various portfolio techniques have been widely used to support strategic planning. In order to balance marketing and R&D in the strategic planning process, it is necessary to integrate different portfolio concepts. A new portfolio approach integrating market and technology portfolios to support market-oriented R&D planning is developed. The integrated portfolio is based on objective market and patent data and empirical evidence that the respective portfolio dimensions impact a company's business performance. This contributes significantly to the relevance of the proposed integrated portfolio approach for strategic planning. It is tested in a practical application in the chemical industry. Based on these experiences, a set of recommendations for the effective use of the integrated portfolio for market-orientated strategic R&D planning is derived.

TD-05 Science and Technology Policy-2

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Broadway-3

Chair: David W Birchall; Henley Management College

TD-05.1 [R] The Dynamic Distributions of R&D Performances in 24 OECD Countries

Sang Sup Cho; ETRI, Korea, South

Myung-Hwan Rim; ETRI, Korea, South

This paper adopts nonparametric methods to investigate the dynamic distribution shape and mobility for 24 OECD R&D performances in R&D sectors over 1981 to 1998. Our results are empirical evidence against Quah's results using cross country income data which are generally accepted emerging twin peaks in the some sectors or group countries. We find no clear evidence of polarization in R&D performance distributions during two decades. The long-run R&D performance density implied by the estimated density function is strongly unimodal. The empirical result, on the one hand, is not consistent with the results of previous studies of convergence in R&D dataset [Jones, 1995, 1998]. We, on the other hand, support Howitt (2000) and Howitt and Mayer-Foulkes's (2002) theoretical implications for a Schumpeterian theory of convergence clubs through R&D implementation. We find the clear visual evidence against the stylized and well-known "Twin Peaks phenomena" when we analyze R&D performance dynamics in 24 OECD countries. Our results, therefore, imply that idiosyncratic country specific factors or club specific factors mainly might not explain long run R&D performance distributions and suggest that permanent shocks to their R&D performance do not

SESSIONS

have permanent effects in 24 OECD countries. Long run growth of R&D productivity is dependent on OECD group's own structural characteristics of the R&D sector, and so is independent of the individual country's R&D policy. We also conduct the robustness of our choice of bandwidth, which is critical to analyze the shape and mobility of nonparametric density functions.

TD-05.2 [R] On the Aggregation of Technological Knowledge Indicators

Yongtae Park; Seoul National University, Korea, South
Juneseuk Shin; Seoul National University, Korea, South
Gwangman Park; Seoul National University, Korea, South
Sungjoo Lee; Seoul National University, Korea, South

Though it has been recognized that the accumulation of technological knowledge be the core competency to reinforce the competitiveness of individual firms and to raise the innovation capability of social and economic systems, only single or fragmentary indicators, such as R&D expenditure, R&D stock, the number of researchers and the number of R&D employee have been adopted to measure the amount of technological knowledge. In this research, we adopt nine conventional technological knowledge indicators under the conceptual structure of input-output framework on technological knowledge. Applying correlation and factor analysis, we examine the relationships among them quantitatively and suggest a new approach for developing of technological knowledge index as aggregated measure.

TD-05.3 [R] The Role of Inventive and Innovation Policies in the Industrial and Technological Development of Less Developed Countries (LDCs): The Case of Iran

Reza Salami; IROST & University of Allameh, Iran

This paper will examine the impacts of effective inventive and innovative policies in the industrial and technological development of Less Developed Countries. Iran has been adopted as a case study to investigate its experience of implementing some inventive and innovative measures to contribute to its national economic and industrial development. Firstly, some of the relevant conceptual issues regarding industrial and technological development of LDCs are reviewed. Iran's past and current industrial and technological development policies have been reviewed. It can be said that the experience of Iran in its industrial and technological development can have policy implications and lessons not only for its own future development planning, and science and technology acquisition strategy, but also for other LDCs. A framework of an appropriate policy and strategy for an effective industrial and technological development of Less Developed Countries (LDCs) will be proposed.

TD-07 Decision Making in Technology Management-3

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Forum Suite

Chair: Nuri Basoglu; Bogazici University

TD-07.1 [A] Keen Mobility's Manufacturing Options: A Startup Company's Dilemma

Phasin Komonchaisek; Portland State University, United States
Richard S Klein; Portland State University, United States
Tassawan Wongsuebchart; Portland State University, United States
Ying-TZ Ho; Portland State University, United States

Keen Mobility is a new company which is releasing its Keen crutch to the public on March 14th, 2003. The company was started 18 months ago with the goal of developing and innovating underarm or axillary crutches. Even with a marketable product change will always occur. In eyeing the initial goal of developing a crutch with specific innovative features the best economical solution was not always pursued. Production for the current product is being done locally with the cost per pair of crutches over \$110. Keen Mobility is currently entertaining offers from numerous companies that have production ties overseas. They claim that Keen Mobility could reduce their production costs significantly and therefore make more net profit, even though there is a significant investment in tooling and fixtures already. Is this really true? What is the best alternative for this young company? The current plan for Keen Mobility is to produce the crutch locally until the beginning of the 4th quarter of 2003. Before

that time a decision will have been made to keep the status quo or produce the crutch overseas and ship it to Keen Mobility in Portland. The paper uses a payoff table outlining the different alternatives and states of nature that will affect the Keen crutch. Expected Monetary Values are used as the basis to decide the best alternative. To determine the probabilities for the states of nature a pairwise comparison is done with the employees of the company.

TD-07.2 [R] 'Make or Buy' Analysis for Local Manufacture or Import Decisions in Defense System Procurements Using AHP: The Case of Turkey

Aykut A Öncü; Yeditepe University, Turkey
Atilla M Öner; Yeditepe University, Turkey
Nuri Basoglu; Bogazici University, Turkey

This research discusses different choices for technology sourcing of countries following strategic "make or buy" analysis in private firms. It also develops a methodology for "local manufacture or import" decisions. All needs of countries should be investigated strategically in order to decide "to manufacture locally or to import." Because of its long-term effects on the industry, governments should examine carefully acquisition processes for the economical welfare of their countries. This approach strengthens the current "cost/effectiveness" based acquisition approach of Turkey by adding long term strategic factors that evaluate capabilities and competencies present in the national industrial base. The paper reports a multi-criteria decision model and its application in Turkey.

TD-07.3 [R] Fuzzy Multi-Criteria Decision-Making (FMCDM) for Evaluating IC Design House System on Chip Capability Strategy in Taiwan

Hong-Yuh Lee; ADMtek, Taiwan
Gwo-Hshiung Tzeng; National Chiao-Tung University, Taiwan
Hsiao-Cheng Yu; National Chiao Tung University, Taiwan

Taiwan's IC design industry revenue now ranks second in the world behind the United States. However, the "market follower" strategy and core competence of Taiwan's IC design houses may no longer be valid as technological development moves toward the SoC (System on Chip) design. The need for strengthening SoC design capability is crucial for the competitiveness of Taiwan's IC design houses. Only by choosing the right strategy toward SoC capability as an initial step forward, can Taiwan's IC design houses ride the next wave of SoC-oriented competition. A proposed SoC strategy is discussed and a hierarchical fuzzy multi-criteria decision-making (FMCDM) method for evaluating SoC capability strategies is proposed to evaluate the strategies from the perspectives of R&D, sales & marketing, government policy and industry clustering. In addition, this paper uses triangular fuzzy numbers to establish AHP weights to include the interaction between any two criteria within the same hierarchy. Finally, in order to show the practicability and usefulness of this method, an empirical study of Taiwan's IC design houses is used as an example. The results show that alliance and cooperation with system vendors or OEM and name brand players is the most important strategy for developing the SoC capability of IC design houses in Taiwan.

TD-08 Technology Assessment and Evaluation-1

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Council Suite

Chair: Udo-Ernst Haner; University of Stuttgart

TD-08.1 [R] Evaluation of Technological Innovation in the Cellular Phone Display

Jongsu Lee; Seoul National University, Korea, South
Sang-Kyu Byun; ETRI, Korea, South
Jeong-Dong Lee; Seoul National University, Korea, South
Tai-Yoo Kim; Seoul National University, Korea, South

The incredibly fast pace of technological development was up until recently the key growth factor in the mobile communications industry. Recently, however, as the market for the mobile communications equipment became saturated and competitive pressure intensified, the demand-side growth factors grew in importance. As a consequence, consumer preferences are likely to play the key role in determining the direction in which the mobile communications technology will develop. At present, multimedia services are the priority areas of the

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

mobile communications technological progress. The multimedia services such as VOD (Video On Demand), video telephony services using streaming video technology as well as technological fusion with the other digital appliances like PDAs (Personal Digital Assistant) and digital cameras, will attract more consumers' attention when the next generation of mobile communication services reaches the market. For example, color displays in cellular phones are one of the most important milestones in the path to the new paradigm of the multimedia technology. In this study, we analyzed consumers' valuation of color displays in cellular phones. At the time of the survey implementation, the market data was not available because it was a very early stage of adopting the color displays in cellular phones. Instead of adopting the revealed preference approach, a conjoint experiment was conducted where respondents were asked to rank cellular phone specification alternatives differing in the following attributes: the type of display (black and white or color display), brand, and price. The ordered logit model applied to the survey data allowed us to decompose the cellular phones' values by the attributes, additional profit due to color display and the brand value, among others. Using our empirical estimates we also derived several implications for the competition strategy in the cellular phone market.

TD-08.2 [A] An Application of Technology Assessment in the UK

Rebecca J De Coster; Brunel University, United Kingdom

The Department of Systems Engineering has been contributing to the assessment of business plans for technology start-ups. Over the last four years over 200 business plans have been assessed in terms of the business opportunity (e.g. industry lifecycle, novelty) and the enterprise itself (e.g. their people). This presentation looks at the role of the university "expert" against the principle characteristics of the technology start-ups assessed. The technology start-ups span various industry sectors and types of innovation (product, process and market) to different levels of innovation (incremental, radical or transformational). The main assessment methods are evaluated by consideration of "the 3 main thinking processes that underpin reflective practice: (1) Intuitive thinking that underlies action & rapid decision making (2) Analytical and objective thinking that allows professionals to plan for action (3) Reflective thinking that is crucial to monitoring and learning from experience" (Source: Atkinson, Terry & Claxton, Gary (2001) "The Intuitive Practitioner" Open University Press, p. 6). The key factors of technology assessment used in particular cases are then compared. These include factors identified in studies into new venture performance and Venture Capitalists (e.g. a conceptual model by Shepherd, Ettenson and Crouch, 2000).

TD-08.3 [R] Modularity and Real Options: Structuring and Valuing the Modularity of the QoS-Enabled Internet

Hak J Kim; University of Pittsburgh, United States

An emerging theme in the network industry is the modularity as a strategy for managing complexity of network services and processes efficiently. Since complete replacement of existing networks is not practical, and since it is costly for one operator to manage everything in a network, modularity in network design may be an efficient approach. This paper presents an overview of modularity concepts, motivation and considerations for the modularized Internet QoS network design to support multimedia applications in the end-to-end Internet service architecture. We investigate some examples of modularity in the networks concerning protocols, equipment, and network design. To value the potential of a modularity in network design, we apply a real options approach (ROA) to Internet QoS model design. The main components of this model are technical potential of the module (s), the expected value of mix-and-match experiments (Q(k)), and the costs of coordination (?). Finally, since the modularity in networks is still at the fledgling stage and the modularity will be a dominant network design rule within several years, the economics of modularity will emerge as a potential academic area.

TD-09 Supply Chain Management-4: SCM and related concepts

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Directors Suite

Chair: Bo Terje Kalsaas; Norwegian University of Science and Technology

TD-09.1 [A] Challenging the Traditional Product Life Cycle Model in Delivering Software Technology Solutions

Note: [R] = Research paper; [A] = Industry Application

David A Abercrombie; LSI Logic, United States

Manu Rehani; LSI Logic, United States

The traditional product life cycle approach to delivering software technology solutions is plagued by the challenges of adequate requirement definition, translation of requirements into product design, limited utility of effort during development, deployment of finished product into the user domain, and duplication of sustaining infrastructure across systems. This paper presents a summary of our experience at solving these problems within a semiconductor engineering environment by mixing the users and providers into one organization and redefining the metrics of product delivery. We combined members previously working in software development and semiconductor engineering into one group with four new functional roles: Applied Prototyping, Consulting, Robust System, and Sustaining Infrastructure. The Applied Prototyping and Consulting functions are best characterized as "living with the customer." The developers in these roles are typically from an engineering background. They solve the business issues by developing and implementing changes to the business process itself or providing software automation prototypes or both. This solves several typical life cycle issues: The business requirements get refined instead of just defining the software requirements, the users gets a short-term solution and the prototype becomes the software requirements documentation. The Robust Systems and Sustaining Infrastructure functions are best characterized as "protected from the customer." The developers in these functions are focused on reliability and maintainability without being tied to a specific software product. They are encouraged to always develop solutions across products and to reuse methods, code and hardware with the intent of maximizing the return on investment in the development effort. As the infrastructure matures it becomes the framework for future prototyping solutions. We redefined Sustaining Infrastructure as a development challenge in which elegant systems are deployed to automate managing the inherent "holes" in the "glamorous" business systems. These changes have solved several traditional issues: we no longer redevelop parallel solutions to similar problems across products, and system maintenance is no longer a demoralizing human chore.

TD-09.2 [R] Five Rules that Govern Supply Chain Performance and Their Implication for Integrated Chains

Gerry Frizelle; University of Cambridge, United Kingdom

There is evidence that closer integration of supply chains is regarded as wholly beneficial. This paper challenges that view. It suggests that at an operational level there are a number of drawbacks in having an integrated chain. It arrives at this conclusion first by describing five rules that appear to govern how supply chains work. These rules evolve from mathematical models of how complex systems are measured, using an information theoretic approach. Then the paper describes a three year study that took measurements on the three supply chains. The findings from the study support the rules. Finally applying the rules throws up concerns about integrated chains. Potential problems include having too rigid a structure, loss of autonomy for supply chain partners, having to share sensitive data and partners being forced to pursue goals that are not in shareholders interests.

TD-09.3 [R] Supplier Selection Using Analytic Hierarchy Process

Demet Bayraktar; Istanbul Technical University, Turkey

Ferhan Cebi; Istanbul Technical University, Turkey

In today's global economy, most of the companies have to cope with competition by means of reducing costs, improving quality, responding rapidly to the market demand, and customizing production. This forces companies to focus on supply chain management. Supplier selection process is an essential and important key issue for a successful and effective management of supply chain. A number of performance evaluation criteria, which are tangible, intangible and may also be conflicting, affect the supplier selection decision problem. These issues in supplier selection decisions have led purchasing managers to utilize a decision support system. The purpose of this study is to propose a decision support system to guide supplier selection decision-making process. The proposed decision support system includes the main criteria and sub-criteria, which influence the supplier selection decision. The model building and solution processes of the proposed system have been achieved by means of utilizing analytic hierarchy process. The application process, which was performed in a manufacturing firm

SESSIONS

producing household products, has been explained. Therefore, the application and the usefulness of the proposed model has been presented through an actual case study.

TD-10 Technology Transfer-3

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Studio Suite

Chair: Glenn Dietrich; University of Texas-San Antonio

TD-10.1 [R] A Stage-Gate Model for Guiding International Technology Transfer

Kalinga Jagoda; University of Western Sydney, Australia

Krishnamurthy Ramanathan; University of Western Sydney, Australia

In today's globalized business setting international technology transfer is seen as an important means for firms to profitably exploit their intellectual assets. However, evidence exists to show that international technology transfer projects are often confronted with many complexities and problems. Careful planning and good implementation of such projects are thus seen as important prerequisites. This paper outlines an integrated model for managing technology transfer based on a stage-gate approach for the planning and implementation of an international technology transfer project. At each stage, mandatory and prescribed activities are outlined and at each gate the deliverables needed to arrive at a decision are prescribed. It is envisaged that the adoption of the proposed model by transferees of technology will facilitate prudent management of the transfer process and lead to effective technology transfer. The model is then illustrated using two case studies from Europe. The analysis of the cases suggests that, in instances where problems were experienced, it is possible to trace their origins to the non-fulfillment of the procedures prescribed by the model.

TD-10.2 [R] The Transfer of Technology from R&D to the Manufacturing Environment During Innovation Projects: A Contingent Communication-Based Perspective

Corrado Lo Storto; University of Naples Federico II, Italy

This paper proposes a framework to investigate some organizational issues of intra-firm technology transfer in a contingent-behavioral research perspective. The framework adopts the Daft and Lengel conceptualization emphasizing the communication process occurring during the transfer of technology. Different characteristics of technology introduce specific requirements as regards the communication behavior. The framework is tested on a sample of 92 new product development processes. The data were collected retrospectively from privileged informers — project managers and supervisors — who were directly involved in the activities of innovation. The hierarchical moderated regression approach was implemented to test the framework hypotheses.

TD-10.3 [R] The Design of the Working Capabilities Program and National Norm for Laboral Competences in e-Commerce and e-Business

Victoria E Erosa; Mexican Association for E-Commerce, Mexico

Pilar E Arroyo; ITESM, Mexico

The e-commerce and e-business concepts are changing not only the way to compete in the business environment, but they are also creating new demands for the labor market. Workers should develop continuously technical and non-technical skills required to support the organization operations in this technology-driven era. Since many of these employees have completed formal education, the acquisition of the required capabilities came from training programs or expertise, being difficult to assess their qualification. This work describes how the Mexican Association for E-commerce Standards (AMECE) used information about e-business practices of Mexican firms to identify the labor market requirements for high skilled workers. After the definition of basic requirements, a detailed inventory of capabilities was developed. The capabilities were classified as operational and technical. Then each capability was related to specific job tasks that need to be performed in particular electronic operations. The resulting inventory was allowed to define the contents of the Technology Education Program for E-commerce and E-business and was taken as the base for the development of the Norm for Labor Competences in E-Commerce which defines the standard skills and basic knowledge required for official certification.

TD-11 SPECIAL SESSION: XML-TR: Steps Towards Defining a Language for Technology Roadmaps (Part 1)

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Executive Suite

Speakers: Carl Dietz; The Learning Trust

James A Houston; Lockheed Martin Aeronautics Company

Jonah Duckles; Purdue University

Sukhan Lee; Samsung

Irene J Petrick; Pennsylvania State University

Robert Phaal; University of Cambridge

Martin Rinne; Portland State University

Robert R Schaller; College of Southern Maryland

Technology roadmaps have become widely used for technology planning and coordination. They are difficult to maintain and cannot readily be exchanged, however, because they are constructed manually and lack standards. Standardization of technology roadmaps will encourage development of software to manipulate, maintain, and exchange technology roadmaps. XML has become the language of choice for such standards. Following the syntactical conventions of XML, XML-TR would standardize concepts that are specific to roadmaps, such as technologies, components, and products. Once defined, roadmap elements as well as entire roadmaps could be exchanged, merged, and compared as XML-TR documents, facilitating collaboration and improving roadmap maintainability. Standard technology roadmaps would become critical enablers of software ranging in functionality from integrating supply chains, to managing innovation, to virtual innovation. The goal of this workshop will be to assemble a diverse group of interested parties to take first steps towards defining an XML-TR standard by delineating the context of such an endeavor and chartering an organization to develop, publish, and maintain that standard.

TD-12 Telecommunications-1: Wireless

Tuesday, 7/22, 1:30 PM – 3:00 PM

Room: Senate Suite

Chair: Jee Hyung Lee; ETRI

TD-12.1 [A] Mobile Communications Development Strategy in Korea

Seok Ji Park; ETRI, Korea, South

We suggest technology policies and strategies to promote the national IT industry and wireless Internet services of Korea. Because the wireless Internet services are in their starting stage, it is very important to find the roles of the government and, moreover, to launch proper supporting policies of the mobile communications for wireless Internet users. At present, the mobile telephone subscribers are saturated, but the wireless Internet subscribers are increasing rapidly yet. The Korean government recognizes it is important for the IT industry and national economy to promote the wireless Internet services. We knew they were the most important factors of future mobile communications from past studies to get the appropriateness of usage fees and network speed. Further, future communications have directions of convergence, seamless, ubiquitous, integration, simple user interface, and RTT by technology innovation. The Korean government establishes new technology strategy and policy integrating the new communications vision with needs of mobile communications market for promoting the IT industry. She has launched the fourth generation mobile communications technology development plan. This plan has the technological goal to develop a new communication system with 100 Mbps in high tier access and 1Gbps in low tier access of wireless Internet on 2010 and also strategies of R&D, standardization, and spectrum allocation to deploy commercial product timely. Based on these results, we suggest the government's policies and strategies are important for the successful deployment of wireless Internet services in Korea.

TD-12.2 [R] Customer's Wireless Application Need Assessment in Technology Selection for a Service or Technology Firm

Petteri Laaksonen; Lappeenranta University of Technology, Finland

Hannu Kärrkkäinen; Lappeenranta University of Technology, Finland

Jouni Koivuniemi; Lappeenranta University of Technology, Finland

Markku Tuominen; Lappeenranta University of Technology, Finland

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

Due to the very initial state of the Mobile Internet market formation, there are many technological solutions available and still to come to markets. Firms are beginning to build new applications based on Wireless E-Business. Technology selection is crucial for the best return on investment as well as the manageability of the systems, including user support and security. Technology selection always contains a risk. In this paper we present results of the application of need assessment in technology selection in companies. By analyzing future application needs we have built a foresight to reduce risk in the technology selection for a firm. The data for our research was created in two separate innovation sessions with lead users in Group Decision Support Systems Laboratory (GDSS). In those sessions we generated ninety-seven Wireless E-Business applications, which will create benefits or open completely new business opportunities for the case firms' business. Based on the application requirements we specified the technologies satisfying them. Taking into account the fact that application implementation takes two to four years from innovation to start-up, it is possible to create a foresight of the future application requirements for technology and thus reduce firms' risks in technology selection.

TD-12.3 [R] The Origins of New Industries: The Case of the Mobile Internet

Jeffrey L Funk; Kobe University, Japan

This paper describes a model of new industry formation that is based on evolutionary theories of technical change. It represents the origins of new network industries as the interaction between multiple technological trajectories that are specific to a particular technology or broadly defined technological regime. The speed with which these multiple trajectories cause industry formation depends on their effective application to the most economical applications; this process occurs through the interaction between design hierarchies and market concepts. Growth in these initial applications causes sub-trajectories or sub-regimes, where competition in the new industry initially takes place, to emerge from the main trajectories. The model is applied to the mobile Internet, an industry that has just started to grow particularly in Japan and Korea.

TE-01 Technology Management Perspectives on Terrorism

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Pavilion East

Chair: Robert Dryden, Portland State University

TE-01.1 [A] Disrupting Patterns of Terror: Creating Technology Triggers for Pre-emptive Interdiction

John W Peterson; The Strategy Augmentation Group, United States

John Ruskin, the 19th-century poet, has provided an epigram that provides suitable context for the challenges posed by the asymmetry of terrorism. He talks about "seeing"—Hundreds of people can talk For One who can think But thousands can think For One who can see. To see clearly is Poetry, Prophecy, And Religion, All in One—In context of the shadow world of terror, providing necessary proof to 'see clearly' the meaning of multiple events on a national threat continuum becomes a critical priority. In a world of relatively easy access to weapons of mass destruction, individuals, loosely networked organizations, and governmental entities can all become sources of strategic threat. As a result, interdiction, including anticipatory pre-emption, becomes a viable policy option. Unfortunately, in the last five decades most policy decisions have been shaped by military threat and sustained by 'politics as usual.' Over time, this has undermined flexibility, capability and built-in national vulnerabilities. In context of weapons of mass destruction, even partial first event adversarial success creates excessive losses and increased strategic vulnerability. The traditional hierarchical response to simply 'shoot the messenger' and delay action until after the situation is 'further developed' has deadly consequences. BOOM! COUGH! WHEEZE! and GURGLE! One potential remedy can be found in a knowledge fusion network that uses data mining, bibliometric tagging, data foraging, and knowledge tunneling tools to accumulate relevant archived and real time information. Patterns of terror can be identified, and pre-emptive strategies gamed and tested using the tools of augmented reality.

TE-01.2 [A] Technology, Terrorism, and the Multiple Perspective Approach

Harold A Linstone; Portland State University, United States

The multiple perspective concept, developed in 1977, has proven very useful in bridging the gap between analysis or modeling on the one hand, and the real world on the other. By introducing two perspectives to augment the traditional science/engineering based "technical" (or T) perspective, it has been consistently found that each of the three yields insights on complex sociotechnical systems that cannot be obtained with the others. The two perspectives are the "organizational" (or O) perspective and the "personal" (or P) perspective. Applications have ranged from technology assessment to regional planning to the study of industrial catastrophes. The cross-cuing or integration of the three perspectives on a given system provides an enhanced basis for decision making. The recent concern with terrorism strongly suggests the value of adding a fourth perspective, one first briefly mentioned by the author in his 1999 book: the "religious/mythological" (or R) perspective. This paper focuses on the need to consider the R perspective in the context of 21st century conflict management.

TE-01.3 [R] Portland International Airport A/B/C/ Concourse Security Terminal Simulation Analysis

Hilary T Martin; Intel, United States

The challenge with any security system is to increase the level of throughput and efficiency while minimizing customer impact. This models the security terminal at the Portland International Airport (PDX) for A/B/C domestic concourses. The research was influenced by recent layout changes that consolidated two smaller checkpoint locations and implemented an express line. The ProModel 2002(c) model considers the flow of passengers and carry-on baggage through checkpoints. Objectives focused on express line wait time and revealed strong dependence on equipment availability to meet goals. Furthermore, it was discovered that additional passengers can qualify for express service before cycle-time is impacted.

TE-02 TUTORIAL: Earned Value Management Method

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Pavilion West

Speaker: Frank T Anbari; The George Washington University

The Earned Value Analysis Management Method (often referred to as EVM or EVA) integrates three critical elements of project management: scope, cost and time management. It requires the periodic monitoring of actual expenditures and physical scope accomplishments. EVM supports the periodic evaluation of project performance against the project's schedule and budget. It allows the calculation of cost and schedule variances, and performance indices, and allows forecasting of project cost and time at completion. This powerful method provides early indications of expected project results based on project performance and highlights the possible need for preventive and corrective action. Therefore, EVM allows the project manager and project team to adjust project strategy based on cost and schedule requirements, actual project performance and trends, as well as project objectives and the environment within which the project is being conducted. This tutorial/workshop presents the major aspects of EVM, using simplified terminology. It provides graphical tools, extensions, simplifications, and examples to enhance the effective application of this important method in project management. The tutorial/workshop provides for active audience participation to allow participants to gain usable skills in applying EVM to enhance the success of their projects.

TE-03 New Product Development-4

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Broadway-1

Chair: Sungjoo Lee; Seoul National University

TE-03.1 [A] Evolution of the PLC at Intel

Chris R Galluzzo; Intel, United States

Deanna B Bolton; Intel, United States

This paper examines diffusion of the Product Life Cycle (PLC) at Intel from 1994 to present time. The PLC evolution story is set against a central theme of change agency Change is possible when there is a sufficient amount of organization pain or discomfort with the status quo, when there is a pretty clear and easy to communicate picture of what the new status quo looks like, and when the next steps are defined. Change is possible if all three elements are in place, and greater than the cost of change. These elements are the enablers of change. A change agent knows how to act when these conditions exist and how to lay pipe to enable

SESSIONS

those conditions to exist. Since its conception, the PLC has strived to improve Time-to-Market (TTM) and development efficiency. In specific business units, the PLC has been successful. The initial effort was intended for the product development community, but expanding to groups outside of traditional product development organizations. The objectives of the PLC are to enable product development to be competitive, repeatable and continuously improving. This presentation tells the story of the evolution of the PLC from a single division to the entire product development community at Intel. It also tells the story of the maturation of the PLC from project level adoption, to the effective and efficient transformation of large programs, to the optimization of product development at the organizational level. This presentation tells the story of change agent's ability to exploit the opportunity when the elements of change are present, or to purposely put the elements of change in place to create a future opportunity.

TE-03.2 [R] A Methodology and Audit Tool for Dual-Use New Product Development

Baris Demirci; Yeditepe University, Turkey
Atilla M Öner; Yeditepe University, Turkey
Nuri Basoglu; Bogazici University, Turkey

New technologically related products must be developed to make attempts to enlarge the market base in the current competitive environment. Dual-use technology which enables the companies to use both military and commercial applications in the same product will provide such type of opportunity for the firms. This article will propose systematic approaches for dual-use product development and a methodology for that difficult integration process. In order to accomplish this purpose, new product development models and dual-use technology in literature are analyzed and an expanded dual-use new product development model which has five main phases according to Goal Project Directed Management rules. The paper represents performance and process audit for the model applied to eleven companies from Turkey with a questionnaire and results are evaluated according to model activities.

TE-03.3 [R] On the Development of a Supporting Tool for New Product Development (NPD) Process

Yongtae Park; Seoul National University, Korea, South
Sungjoo Lee; Seoul National University, Korea, South
Byungun Yoon; Seoul National University, Korea, South

Since New Product Development (NPD) is generally based on evolutionary process of existing products, several researchers have described it as a knowledge-intensive activity. Although knowledge sources of new product are ubiquitous, many firms keep a close eye on a precise record of patents that reflect the recent technology trend. This study presents the development of a supporting tool for NPD process by utilizing the technical knowledge included in patent documents. This tool consists of three modules- (1) Patent Map Development, (2) Patent Vacuum Identification, (3) Vacuum Validity Test. Patent map is created by mapping patents in two dimensions based on keywords extracted by text mining. Principle Component Analysis (PCA) is employed as a methodology developing patent map by reducing the voluminous dimension of keyword vectors in each patent. In this map, we identify some product vacuums. The vacuum is defined as the area where patents are sparse. Then, we screen meaningful vacuum(s) by conducting adjacency analysis, trend analysis, and market analysis. Namely, information in similar technology and market as well as pertinent technology is observed for searching significant opportunity of NPD.

TE-04 TUTORIAL: Value-Added PICMET: MOT Knowledge Mining

Tuesday, 7/22, 3:30 PM – 5:00 PM **Room: Broadway-2**

Speakers: Alan I Porter; Georgia Institute of Technology
Robert J Watts; TACOM

Conferences, such as PICMET, compile the knowledge of their field. However, that knowledge is horribly underutilized. In the past, attendees had no good way to capture this knowledge for ongoing personal use. Rarely did they share this knowledge effectively with their organizations. We can change this. The availability of conference CD's provides an information

resource that can be mined to track developments in the field and to access desired items when needed. We illustrate for MOT by spotlighting trends over the 1997, 1999, 2001, and 2003 PICMET CD's. We demonstrate how you can use text mining software to see the "big MOT picture" in various perspectives, as well as to zoom in on particular topics. For those who wish to try out these knowledge exploitation approaches, we provide a VantagePoint Reader software with which you can mine the combined PICMET CD content. We discuss ideas on how you can disseminate PICMET knowledge to your colleagues via your intranet sites.

TE-05 Science and Technology Policy-3

Tuesday, 7/22, 3:30 PM – 5:00 PM **Room: Broadway-3**
Chair: Alptekin Erkollar; University of Applied Sciences Wiener Neustadt

TE-05.1 [R] The Future Landscape of UK Engineering: Exploring the Paradoxes

Jean-Noel Ezingear; Henley Management College, United Kingdom
David W Birchall; Henley Management College, United Kingdom
Nigel Spinks; Henley Management College, United Kingdom

Those developing science and technology policy face an increasingly uncertain landscape. This paper reports the results of a research project undertaken to develop an understanding of some of the key issues which the UK engineering industry must confront in the future. Based on a series of in-depth interviews with industry leaders and experts, it proposes a framework of nine 'vectors of contention,' which highlight the tensions with which UK engineering is faced. It is proposed that this approach, emphasizing paradox rather than polarization, provides a basis for generating insights and fresh thinking about change. Moreover, the framework can serve to inform scenario generation as a planning and policy tool.

TE-05.2 [A] Fuzzy Integral MCDM Approach for Evaluating the Effects of Innovation Policies: An Empirical Study of IC Design Industry in Taiwan

Hsien-Che Lai; National Chiao-Tung University, Taiwan
Joseph Z Shyu; National Chiao-Tung University, Taiwan
Gwo-Hshiang Tzeng; National Chiao-Tung University, Taiwan

The objective of this paper is to develop a "national system of innovation" (NSI) based on framework for formulating and evaluating the effects of innovation policies. Policy makers usually face fuzzy decision scenarios. Traditional decision making methods fail to satisfy policy makers' needs in this regard. A hierarchical fuzzy integral multi-criteria decision-making (Fuzzy integral MCDM) approach for evaluating the effects of innovation policies is proposed in this paper. To show the practicality and usefulness of this approach, an empirical study on Taiwan's integrated circuit (IC) design industry is demonstrated. The results show that a "political" policy tool is the most effective one. This demonstration also shows that the proposed model is valid.

TE-05.3 [R] Opening Network Policy for Fair Competition in Mobile Internet

Jaehyun Yeo; ETRI, Korea, South
Hanjoo Kim; ETRI, Korea, South
Sangmu Lee; MIC, Korea, South

In Korea, an opening network policy in mobile internet has received much attention recently. By guaranteeing a fair competition, it is expected to generate abundant business opportunities and enable subscribers to enjoy a variety of services at low prices. In this paper, we introduce the concept of opening network and suggest desirable directions for the policy. And then we consider challenges that will have to be dealt with in order for opening network, which is at an infant stage at the moment, to successfully take root.

TE-06 Information Technology (IT) Management-4

Tuesday, 7/22, 3:30 PM – 5:00 PM **Room: Broadway-4**
Chair: Nicole Steckler; OGI School of Science and Engineering at OHSU

TE-06.1 [R] Challenges in the Implementation of Global Information Systems

Nazmun Nahar; University of Jyväskylä, Finland
Nitya L Karmakar; University of Western Sydney, Australia

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

Increasingly international and multinational companies are attempting to implement advanced global information systems (GISs) in order to provide support to their international business operations and to participate in intra- and inter-firm collaboration across borders. Companies encounter a great number of challenges in implementing their GISs and fail to achieve the expected benefits. This study examines the various categories of factors that cause challenges in implementing and utilizing GISs. This research has been carried out by: a) reviewing relevant literature in the field of GIS, b) analyzing a background theory, c) utilizing a qualitative case study method, and d) interviewing experts, practitioners, and researchers who are knowledgeable in the field of GIS implementation. By using the research results companies will be able to reduce the difficulties associated with GIS implementation and avoid very expensive and time consuming mistakes. This study also suggests the future research directions.

TE-06.2 [A] Implementing Knowledge Management Systems: Anticipating and Avoiding Common Pitfalls

Marianne Koch; OGI School of Science and Engineering at OHSU, United States

Nicole Steckler; OGI School of Science and Engineering at OHSU, United States

David Drake; Catalyst Communications, Inc., United States

Implementations of information management systems often go awry. Information systems turn out to have unanticipated and undesired consequences. Implementation efforts run into technical and political roadblocks that delay or even doom the success of the new system. Once implemented, information systems often underperform relative to the hopes and dreams of those who designed and funded them. This presentation offers a framework for understanding different groups' information needs, and shows how implementation pitfalls might be avoided. Specifically, three cultures within government agencies are identified and explored and they are used to develop propositions for anticipating and diminishing undesired consequences. We share a case of information-sharing efforts across three federal agencies and use the case to illustrate the propositions.

TE-06.3 [A] System Integration Process of Government Information Systems

Ahto Kalja; Tallinn Technical University, Estonia

Government Information Systems status and construction in Estonia have fully changed twice in the last ten years. The first period of change started at the beginning of the 90s when paper documents based folder and register systems came to an end and the DBMS-based development began. The second period of change began ten years later (and continues now) where most stand-alone databases are transformed into common data resources accessible over the Internet. This last change is described in this paper. The development of a distributed software environment, which can be used for solving data manipulation and query operations by using data from different databases and information systems, is discussed.

TE-07 Decision Making in Technology Management-4

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Forum Suite

Chair: Stacey E Ewton; Portland State University

TE-07.1 [A] An AHP-Based Approach for Maintenance Strategy Selection in a High Technology Facility

Shanmugam R; Indian Institute of Technology, India

L S Ganesh; Indian Institute of Technology, India

This paper describes an application of the Analytical Hierarchy Process (AHP) for selecting the best maintenance policy for a Heavy Water Plant. Presently only a preventive maintenance policy is applied to all machines. TPM (Total Productive Maintenance) is being planned to be implemented in the plant in stages. Three possible alternative maintenance strategies are considered. They are aggressive maintenance (TPM), predictive maintenance, and preventive maintenance. The best maintenance strategy must be selected for each machine in the plant. The various criteria used for maintenance policy selection are Safety to plant/personnel, Production loss, Importance of a machine to the process, Failure frequencies, Maintenance cost, and Power rating of the machines. Each criterion is expressed in terms of three degrees. With the AHP technique, the criteria, the maintenance strategy alternatives, and criterion-degrees are arranged in a hierarchic structure and evaluated using a series of

pair-wise judgments. The composite weights are worked out for various criteria-degree combinations. All the machines of the plant are evaluated using these weights and suitable maintenance strategy is chosen for each machine.

TE-07.2 [R] Strategic Decision: Process for Technology Selection in the Petrochemical Industry

Toryos Pandejpong; Mahidol University, Thailand

Dundar F Kocaoglu; Portland State University, United States

Process for technology selection in the petrochemical industry is presented. Based on technology selection by using multiple perspectives proposed by Linstone and Balachandra. The proposed model recognizes the technology selection as the systems and includes four perspectives that could help reduce the gap between the technical assessment model and the reality for decision-making. Four perspectives are technical perspective (technical and innovation aspects), organization perspective (strategic directions and cultural issues), personal perspective (collection and quantification of decision-makers' judgments), and external perspective (market competition, commercial profitability, political and economic condition). A specific case study was developed for the purpose of demonstrating the technology selection process.

TE-07.3 [R] Pairwise Decision Making Model for Deciding Best Team to Win 2003 NBA Finals

Jose R Gonzalez-Baird; Portland State University, United States

Sudha Krishna; Portland State University, United States

Proadpran Pringsulaka; Portland State University, Thailand

Panumas Siritanthong; Portland State University, Thailand

The NBA playoffs are an exciting sports event in which many fans participate; some even make wagers on their favorite teams or teams they believe are most likely to win. The amount of the gamble is usually determined by the likelihood of a particular team to win. There are several factors that may be used to determine which team is most likely to win, such as a team's past playoff experience, or their playoff seeding. However, it is often difficult to understand which factor or combination of factors most influence(s) the outcome of a particular team winning. This paper will address the need for a model that can accept user-defined input of the various criteria to determine the most likely outcome of the event. The NBA Playoff Decision Model will use input gathered from the user of the program as well as statistical data that will be compiled for each team. The data represents the information the model will use to compare each team. The decision criteria are as follows: (1) Playoff seeding; (2) Playoff experience; (3) No. 2003 reg. season all-stars; (4) Coach playoff win %; (5) Games missed to injury; (6) Total team efficiency. Once the user-defined priority weights are applied, the model will specify the team that is most likely to win. A revised decision tree will be constructed for which the user may analyze the possible actions along with the probability of their outcomes. The revised probabilities will be calculated by using various priority weights and past playoff data and matching the predicted winners with the actual winners. This function will increase the reliability of the model's predictions. The decision diagram will reflect three risk-taking strategies-risk-averse, risk-neutral, and risk-seeking. These strategies will be developed by assuming preference curves and utility functions for the risk-averse and risk-seeking personality.

TE-07.4 [R] The PD-Utility Function for Decision-Making in Risk Market

Ling Liang; Huazhong University of Science & Technology, China

Feng Dai; Zhengzhou Information Engineering University, China

Kewei Sun; Zhengzhou Information Engineering University, China

In this paper, we put forward a general PD-utility function in the traits of risk market based on the partial distribution. By using the utility function, one's risk preference in a market could be sufficiently reflected, and all the expected average income and the corresponding market risk could be estimated according to PD-utility. The methods of risk decision-making to market are given on PD-utility. Key Words: PD-utility function; partial distribution; risk market; risk decision-making.

SESSIONS

TE-08 Technology Assessment and Evaluation-2

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Council Suite

Chair: Rebecca J De Coster; Brunel University

TE-08.1 [R] Functionality as a Lever for Managing Technology: A Nomenclature

Udo-Ernst Haner; University of Stuttgart, Germany

For being able to describe and assess the value of a particular technology beyond its originating domain in an interdisciplinary context one has to look beyond any particular implementation. Also, restricting oneself to a technical specification not considering context and use of a technology is inappropriate. Therefore, it is necessary to distinguish between the “physical” aspect of technology — the technology elements — the functions which are performed by these technological elements considering their affordances, and the purposeful application of technology, i.e. constituting functionalities in certain contexts. It is actually these functionalities which are to be considered when selecting and introducing technology in organizational settings and when managing technology in interdisciplinary contexts. This paper establishes the respective nomenclature and explains its meaningful application.

TE-08.2 [R] Measuring Technology Performance: An Action Research Case

Hans-Helmuth Jung; Swiss Federal Institute of Technology Zurich, Switzerland

NebojĀa Atanasoski; Swiss Federal Institute of Technology Zurich, Switzerland

The increasing pace of technological change has made technology planning more important to enterprises. In addition to technology planning systems, the counterpart — management control systems that measure and control the planned technology strategy must also be considered. This paper proposes a novel concept for technology-based enterprises: a Technology Management Control System. The system’s main purpose is to provide relevant information about the current state of the implemented technology strategy and indicate deviations, caused by strategic uncertainties. The system can assist enterprises therefore in adapting their technology strategies. After a short introduction, the Technology Management Control System is designed and described in detail, and then illustrated by means of an action research project conducted at Infineon Technologies, a German semiconductor manufacturer.

TE-08.3 [R] Identification of Generic Technologies in Life Science Area: Evidence from an Institutional Level in South Korea

Yong-Gil Lee; Korea Institute of Science and Technology, Korea, South

Se-Jun Lee; Korea Institute of Science and Technology, Korea, South

Tai-Yoo Kim; Seoul National University, Korea, South

Generic technology is the technology base from which market applications are derived. Generic technology research enables the subsequent applied R&D that results in market-specific products, processes, and services. Generic technologies could be understood as fundamental technologies or key technologies. We need to identify the generic technologies in each technological field to enhance the efficiency of R&D and frame a good R&D policy. This study suggests the method identifying the generic technologies, and especially derived a few generic technologies in life science area in South Korea. In South Korea, life science is a science based research field and its basic research is closely related to applied research and development. Generic technology development such as recombinant RNA and protein synthesis is accented in current R&D of life science. In this paper, we would identify the generic technologies in life science and test the characteristics of those technologies. As a method of identifying the generic technologies, the proximity index between technologies would be suggested in use of Jaccard measure, and the summed-up figure of the index could derive the generic technologies. Also technology cluster analysis is suggested to group the near technologies.

TE-08.4 [R] Valuation of Technology: Exploring a Practical Hybrid Model

David R Probert; University of Cambridge, United Kingdom

Francis H Hunt; University of Cambridge, United Kingdom

J. C Wong ; University of Cambridge, United Kingdom

Robert Phaal; University of Cambridge, United Kingdom

How much is this technology worth? This is a question of great interest and importance in a wide variety of circumstances. These vary from companies considering investing in R&D projects, to venture capitalists funding start-up companies. However, such valuation is notoriously difficult to get right, and the cost of failure can be very high. Many techniques have been proposed to assist managers facing this issue, from traditional discounted cash flow analysis to more recent methods based on real options thinking. This paper discusses the practicality of the various methods available, and explores the application of a hybrid model, which aims to make these rather abstract ideas more accessible to practicing managers.

TE-09 Manufacturing Management-1

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Directors Suite

Chair: William T Flannery; University of Texas — San Antonio

TE-09.1 [R] Modeling the Dynamics of Manufacturing Flexibility in an Engineering Organization

O. P Sharma; Delhi College of Engineering, India

Sushil; Indian Institute of Technology, India

The electronics-enabled revolution has brought about rapid changes in the corporate and business world and has also resulted in changing the societal and cultural patterns throughout the world. The manufacturing industry, which has seen much advancement in the manufacturing technologies during the last few decades, is also an example of this paradigm shift. The advent of flexible manufacturing technology (FMT) is one such e-enabled revolution. Although the diffusion of FMT is fairly substantial in Japan and other developed nations (especially in the USA, U.K., Germany, Sweden, Italy, and France), in India, the technology is in a nascent stage of take off. Although much has been reported about the operating and managing aspects of FMT, not much attention has been paid to capturing the dynamics of interplay among its critical parameters and subsystems. This paper is an attempt in the direction, and using the system dynamics (SD) modeling methodology, develops a causal-relationships based long-term projected behavior of various parameters and subsystems of FMT in the context of an internationally renowned engineering company of India. The results have been found to be quite nearer to the actual reported growth trajectory of the elements investigated. The developed model, it is hoped, can be reengineered/modified for situations-specific adaptations by researchers, practitioners, and organizations. It is further believed that the model can provide a generic base for applications to other emerging areas such as business process reengineering (BPR), which of late has been found to be possessing much relevance to FMT.

TE-09.2 [R] Break-Even Analysis Based on Production Capacity

Fuchiao Chyr; National Kaohsiung University of Applied Science, Taiwan

This paper presents a new break-even analysis based on production capacity. The production capacity is decided by the factors of processing time, employees, equipments, and workdays. However, conventional break-even analysis does not consider the influences of these production factors. Considering production factors, we develop new formulas to decide break-even production volume in units. Using the new formulas, decision maker can decide the reasonable amount of employees, equipments, workdays, and processing time to achieve break-even production volume.

TE-09.3 [R] Multimodal Verification System Using Fingerprint and Speech Information

Karine Pellerin; Carleton University, Canada

The proliferation of computers has considerably increased the need for proper authentication. Widely used authentication methods include passwords, Personal Identity Number (PINs), identity cards and tokens. These methods provide proof of possession and not proof of identity. Recent research demonstrates the benefits of using multiple biometric identifiers to increase the accuracy of the authentication decision. Biometrics is answering many access management problems and is changing the way authentication is performed. In a rapidly changing world, the effective management of emerging technologies, like biometrics, is quite challenging and the misuse of such technology can lead to the violation of privacy prin-

SESSIONS

principles. The objective of this research paper is twofold: (1) to propose a multimodal system that uses fingerprint and speech information and (2) describe an experiment to test the performance of the multimodal system against its fingerprint and speech subsystems. The proposed system is robust, convenient, easy to use, and privacy-sympathetic. It offers to address the authentication needs of computer and telephone networks. The experiment tests whether or not the performance of the multimodal verification system is superior to its fingerprint and speech subsystems using a confidence level fusion strategy with different combinations of weights assigned to each expert.

TE-10 Technology Transfer-4

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Studio Suite

Chair: Arnold Reisman; Sabanci University

TE-10.1 [A] Business Value Analysis Based on Reusability of Core Technology and Its Application to Design Solution Business in Managing Technology Transfer from Mature Product Field to New Business Fields

Kaoru Suzuki; Hitachi, Ltd., Japan

This paper proposes a new method of product business value analysis called BIVALENCE (Business Value Analysis based on Evaluation of reusability of Core Technologies) aimed to improve accuracy in planning a product business strategy. BIVALENCE is the analysis method using the level of core technologies and their applicability to new business fields as key evaluation factors. The business value of developing supercomputers and mainframes is evaluated by BIVALENCE. Design solution business is presented as an effective business plan for continuation of mature product business, also contributing to standardization of product development technology levels across divisions among group companies. This evaluation result has been substantiated by analyzing actual design solution business cases of hardware development process solutions and consulting services proposed to 66 divisions of 41 companies for ten months from October 2001. Analysis of these business cases also highlights the human resource problems in Japanese companies and the trend of design solution business in the Japanese market encountered promoting the design solution business in Japan. These problems and trend suggest that the current strategy of design solution business should rather be focused on European, American and Southeast Asian markets.

TE-10.2 [A] PRISM: A Systematic Approach to Planning Technology Transfer Campaigns

*Brent A Capps; Oregon Master of Software Engineering Program, United States
Richard E Fairley; Oregon Health and Science University, United States*

This paper introduces PRISM, an approach for systematically planning software technology infusion campaigns. PRISM is particularly well-suited to centralized technology diffusion agencies operating within large software organizations. Applying the PRISM methodology results in the selection of an appropriate mix of engagement models, training modes, and success models.

TE-10.3 [A] Model Framework for Technology Transfer from R&D to Manufacturing: An Application Study in a High Tech Semiconductor Company

Francis Giang; IDT, United States

In the complex high-tech environment, driving an effective technology transfer from R&D to production is vital to successfully put newly transferred processes into manufacturing. The fast pace of transferring new technologies, the shorter cycle time for production ramp up, and the quality and yield required for the newly transferred products are the key challenges in technology transfer. Therefore, implementing adequate solutions is crucial for successful transfer projects. After conducting a literature research, we have collected internal feedback on past organizational practices, studied their metrics and context to define and narrow down the transfer concept alternatives that are relevant to the semiconductor manufacturing environment. The model that we developed for application purposes within the company is designed with 6 phases, starting from decision making, implementation to managing and sustaining the transfer as it unfolds and develops over time: (1) identify the users' needs

versus current gaps, (2) generate a model concept for technology transfer, (3) design the specifications and operation charts for the transfer process, (4) test and validate the transfer model, (5) implement the transfer process, and (6) set up a continuous improvement approach to monitor the transfer process. By utilizing the new process development approach and considering its diffusion and its integration within the company in a field study, this application paper proposes a framework model to facilitate improved performances and effectiveness in the practices of the transfer of complex technology in electronic manufacturing, while bringing solutions to the case of a hi-tech company.

TE-11 SPECIAL SESSION: XML-TR: Steps Towards Defining a Language for Technology Roadmaps (Part 2)

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Executive Suite

Speakers: Carl Dietz; The Learning Trust

James A Houston; Lockheed Martin Aeronautics Company

Jonah Duckles; Purdue University

Sukhan Lee; Samsung

Irene J Petrick; Pennsylvania State University

Robert Phaal; University of Cambridge

Martin Rinne; Portland State University

Robert R Schaller; College of Southern Maryland

Technology roadmaps have become widely used for technology planning and coordination. They are difficult to maintain and cannot readily be exchanged however, because they are constructed manually and lack standards. Standardization of technology roadmaps will encourage development of software to manipulate, maintain, and exchange technology roadmaps. XML has become the language of choice for such standards. Following the syntactical conventions of XML, XML-TR would standardize concepts that are specific to roadmaps, such as technologies, components, and products. Once defined, roadmap elements as well as entire roadmaps could be exchanged, merged, and compared as XML-TR documents, facilitating collaboration and improving roadmap maintainability. Standard technology roadmaps would become critical enablers of software ranging in functionality from integrating supply chains, to managing innovation, to virtual innovation. The goal of this workshop will be to assemble a diverse group of interested parties to take first steps towards defining an XML-TR standard by delineating the context of such an endeavor and chartering an organization to develop, publish, and maintain that standard.

TE-12 Telecommunications-2: Wired

Tuesday, 7/22, 3:30 PM – 5:00 PM

Room: Senate Suite

Chair: Jeffrey L Funk; Kobe University

TE-12.1 [A] Stimulating Local Competition: Perspectives and Alternatives of Global Telecommunications Deregulation

Joe Z. Cheng; Chiao-Tung University, Taiwan

Shih-Chi Chang; Ta Tung Junior Technological College of Commerce, Taiwan

Ko-Tsung Chu; Chiao-Tung University, Taiwan

Hsiao-Cheng Yu; Chiao-Tung University, Taiwan

Global telecom deregulation has sparked innovation while revolutionizing the telecom industry. Although competition for long distance, international, and cellular service is fierce, there remains a lack of competition in the local loop environment. This may be of particular concern in the Internet broadband service era due to the potential aggregation of service providers. In order to foster local loop competition, special government policy attention and regulation is required. The pros and cons of different policy approaches will be discussed in this paper. Several "complementary" issues need to be addressed before full competition can take place in the local loop. Alternatively, a radical local loop divestiture model is another potential option. Finally, in light of the recent telecom bubble and the emergence of cross-industry competitors, another viable option could come into play. If a majority of the CLECs are unable to effectively compete with incumbent carriers, then a CLEC consolidation — leading to a well-controlled monopoly — could be a solid option for future local loop networks.

SESSIONS

TE-12.2 [R] Comparison of Broadband Internet Pricing Systems

Jee Hyung Lee; ETRI, Korea, South

Jeong-Seok Park; ETRI, Korea, South

Recently, Edell and Vraiyi (1999) pointed out the waste of resource occurred by the flat rate tariff of broadband Internet service. They implicitly presupposed the additional investment on the ISP, when a subscriber to the flat rate, in the state of limited network resource, uses the service over the equilibrium point with the meter rate. This paper attempts to compare the two Internet pricing systems — the flat rate and usage-based pricing systems — in terms of their roles in the social welfare, by generalizing the theory advocated by the scholars. This study contributes not only to the systematic generalization of the theory but also to the examination of the waste of resource innate in the flat rate tariff. What is interesting in this study is that the superiority between the two charging systems with regard to the waste of resource is not decided by the generic features of the charging systems themselves but by the scarcity of network resource. In other words, the flat rate pricing is better when there is no limit in the supportable volume of network source. Otherwise, the usage-based pricing system is better in the respect of reducing the unnecessary waste of network resource.

TE-12.3 [R] Telcos' Access Network Migration Strategies for Post-ADSL and Its Prospects in Korea

Byung-sun Cho; ETRI, Korea, South

Hoyoung Hwang; ETRI, Korea, South

Myungjae Kwak; ETRI, Korea, South

As the broadband Internet service market has reached its peak in less than three years with its subscribers having attained a level of saturation, the pressing questions are what is the next stage of high-speed Internet and how development strategies of Telcos will evolve in preparation for the post-ADSL age. In this article, we will examine the VDSL as an alternative technology of ADSL and present an estimate of the number of subscribers to the post-ADSL Internet service, produced using the Bass model taking into account a substitution model.

WB-01 E-Business-1

Wednesday, 7/23, 10:00 AM – 11:30 AM

Room: Pavilion East

Chair: Anthony Narsing; Savannah State University

WB-01.1 [R] e-Government and Social Services

Dong-Hee Shin; Syracuse University, United States

Shafiz M Yusuf; Syracuse University, United States

Information and communication technology (ICT)-enabled community networks may provide a range of services to residents. In an evolutionary sense, it is possible to trace their beginning as free Internet-access providers to purveyors of local content to portals offering access to content and to interactive services — such as social services. This paper is focused on the last — interactive tele-services in the social sector. A community is geophysical entity where normal social life is possible. A community may come to mean many things to its residents. Fundamentally, it should meet the instrumental needs of residents — such as the need for transportation, jobs, safe and clean public places, and healthcare institutions. A community, in this sense, must offer a social and physical support infrastructure for need fulfillment. A utilitarian view of community argues an instrumental view of community network function. Community networks can extend the reach of the support infrastructure for need fulfillment; they can help adapt these structures of support to the needs of residents with impairments and disabilities. Community networks can help alter the social structure of choice and make it more convenient for the needy to avail of services. We collected data from two types of sources for our analysis (1) selected Internet-based municipal web sites in New York communities, and (2) field test of broadband application for health care benefits that was implemented in Syracuse. We draw on our case studies of these networks to suggest development trends. We analyzed the content (information and services offered) of a subset of these networks. We assess the networks in light of four normative frames. First, the NY State Lt. Governor's Task Force on Quality Communities' principles targeting community and economic development. Second, the League of Cities' program promoting e-government.

Third, social and economic priorities acknowledged by the urban planning and community development agencies in target communities. Fourth, project goals articulated by the municipal websites and the field test of the broadband application. Given these frames, what information and services do these networks currently offer residents? What is the legitimate role(s) of a network in the community it purports to serve? Our survey reveals a significant gap between the normative frames and network function. While Internet-based networks did offer information tailored to local needs, broadband networks did not. Neither type of network offered extensive social services that are possible with the current technology. Both the networks were minimally interactive (users could email the Webmaster). The broadband networks served narrow populations on a fee-for-service basis, and services were predominantly in distance learning/training. The Internet-based networks were broader in the populations they served. In conclusion, these networks were not viewed as policy tools by community development interests, with the result that such interests were not involved in network development process. Normative frames must be translated into social technology policy guidelines before the connection between the community network and the community's needs work at the practical level.

WB-01.2 [R] Performance of a Method for Performing Authentication to Obtain Access to Public Wireless LAN with a Cache Table

Hyun-woo Lee; ETRI, Korea, South

Jeong-hwan Kim; ETRI, Korea, South

Won Ryu; ETRI, Korea, South

Chong-ho Yoon; Hankuk Aviation University, Korea, South

Currently, Wireless LAN (WLAN) service is widely deployed to provide high speed wireless Internet access through the mobile stations such as notebook and PDA. To provide enhanced security and user access control in the public WLAN area, WLAN access points should have the capability of IEEE 802.1x-based user authentication and authorization functionality. In this paper, we provide a brief understanding of IEEE 802.1x standards and related protocols like EAPOL (Extended Authentication Protocol Over LAN), EAP, RADIUS and describe how the IEEE 802.1x is designed and implemented in our embedded linux-based WLAN AP which is named i-WING (Intelligent Wireless Internet Gateway). In this paper, we present an efficient authentication proxy for IEEE 802.1x systems based on the port-based access control mechanism. An IEEE 802.1x system consists of supplicants, an AP with authentication client functions, and an authentication server. For the network security and user authentication purposes, a supplicant who wants to access Internet should be authorized to access the AP port using the EAPOL. The AP then relays the frame of EAPOL to the authentication server. After several transactions between the supplicant and the server via the AP, the supplicant may be either authorized or not. Noting that the transactions between the relaying AP and the server will be increased as the number of supplicants grows in public networks, we propose a scheme for reducing the transactions by employing an authentication proxy function at the AP. The proxy is allowed to cache the supplicant's user ID and password during his first transaction with the server. For the next authentication procedure of the same supplicant, the proxy function of the AP handles the authentication transactions using its cache on behalf of the authentication server. Since the main authentication server handles only the first authentication transaction of each supplicant, the processing load of the server can be reduced. Also, the authentication transaction delay experienced by a supplicant can be decreased compared with the conventional 802.1x systems.

WB-01.3 [R] The Limits of Cooperation in e-World

Alptekin Erkollar; University of Applied Sciences Wiener Neustadt, Austria

Birgit J Oberer; University of Applied Sciences Wiener Neustadt, Austria

The success of Supply Chain Management (SCM) is dependent on the quality of planning. But the first step for the SCM is the decision of the choice of partner and strategically planning and cooperation. The limit values for the cooperation e.g. prices, order volumes, delivery times, and certainty of relations, which are very important player during the cooperation. The analysis of maximal limit and feasibility are strategically success factors for the SCM. After this step must be considered the optimal planning parameter and the synchronization of chain partner. Different factors influence the local planning and the production flow as well.

SESSIONS

Generally, these factors can be considered in different ways. Nevertheless, it is not possible to do a correct and complete planning and to consider all different alternatives. With the integration of different chain partners is the planning task more complex as local planning. Therefore, it will be the aim to analyze possible procedures during the planning, to evaluate possible measures and their results and to prepare optimal measures. When there should be considered that the task has to consider additional influence factors on the Supply Chain level the complexity of the task increases considerably. Today's planning systems are not fully prepared for these demands because of the relatively fixed nature of their planning data structures (local planning nets) that hardly may be integrated into an overall planning structure. Moreover, these systems rely upon deterministic input parameters and fixed work sequences, which does not correspond to the situation in dynamic environments. On the other hand supply chain management offers a large potential for the enterprises to reduce cost and improve customer service performance. Apart from the Supply Chain Management Concept, planning systems require much more than in the ERP approach; integration as well as adaptability of the planning systems, especially integration of internet and intranet and multiagent based distributed applications. Beside different technical difficulties for the online data update or the synchronization of planning, there are missing modeling approaches which can be integrated in practice. In this research paper we will analyze the possibilities in the area of combinatoric and distributed planning based on distributed databases for the support of the production planning from first step, choice of best partner through to best planning decision and parameter synchronization between partners. Further, we will introduce a new web based alternative for modeling, called NETSIM, and we will present its applicability by means of a Prototype. This NETSIM (Network Simulation) concept fits into the dynamic scenario of dynamic environments as well as it provides substantial enhancements to traditional planning (Deterministic or stochastic basis). A very important aspect for NETSIM is that all scenario parameter can be considered and if its needed can be changed. Additional will be analyzed apart from problems of combinatoric there the applicability of deterministic and stochastic planning. A very important aspect in this contribution is an universal interface description for using with all standard software systems, e.g. SAP, BAAN, Navision and Peoplesoft. Using this universal interface can be used the NETSIM concept with all state-of-the-art (ERP Enterprise Resource Planning)systems.

WB-01.4 [R] Strategic Challenges of Integrating Wireless Technology in Global e-Business Markets

Anthony Narsing; Savannah State University, United States

Michael Michalisin; Southern Illinois University, United States

John Whittaker; University of Alberta, Canada

Samuel Frimpong; University of Alberta, Canada

Wireless technology is providing an additional link for buyers and sellers to access the Internet and more importantly to participate in mobile commerce or m-commerce. Tremendous excitement surrounds the wireless Internet because it introduces yet another dimension to seamless transactions. In fact, it has been estimated that 150 to 330 million mobile units will be Internet ready by 2003. Unfortunately, unlike its wired counterpart, wireless technology has many issues to resolve before achieving comparable success in e-commerce. Firms using wireless technology as a sustainable competitive advantage in the 21st century face several challenges such as technological constraints, risks imposed by wireless technology on intangible resources, and diminished integrity of transmitted information due to turbulent environmental conditions. This paper examines threats to a firm's strategic competitive assets along with operational issues of interfacing wireless technology in competitive global e-commerce markets.

WB-02 TUTORIAL: Project Strategy: The Path to Achieving Competitive Advantage/Value

Wednesday, 7/23, 10:00 AM – 11:30 AM

Room: Pavilion West

Speaker: Michael Poli; Stevens Institute of Technology

Nike's "Just Do It!" is the prevailing attitude around projects. Schedule and budget domi-

nate. When projects are more than just tactical or operational, enormous opportunities become available. Building market share, extending product lines, increasing revenue, satisfying customers, and building for the future are more important success measures. It is through the project that the company implements its strategic intent. Project Strategy is essential to achieving better results and increasing the necessary value from the project. It is an overarching set of guidelines to be used by the project in making decisions and taking action. Project Strategy is in alignment with the business, marketing and operational strategies. It helps focus on the desired strategic results. Various frameworks are available to aid management: Michael Porter's generic strategies and value chain concept; Wheelwright and Clark's project portfolio framework; Shenhar's UCP (Uncertainty, Complexity and Pace) model; Roger's Technology Adoption Life Cycle; and Shenhar's Success Dimensions. This presentation shows how to use these frameworks to define a Project Strategy that will help you achieve your corporate strategic intent.

WB-04 Knowledge Management-1

Wednesday, 7/23, 10:00 AM – 11:30 AM

Room: Broadway-2

Chair: Timothy G Kotnour; University of Central Florida

WB-04.1 [R] Framework for Implementing Knowledge Management

James A Albers; Pacific Lutheran University, United States

Knowledge assets and intellectual capital are core competencies of organizations. Knowledge management leverages knowledge assets and knowledge processing which can result in improved operational effectiveness and competitive advantage. As the result of literature searches, talking with companies that have implemented knowledge management, and discussion with consultants in the field there does not seem to be a definitive framework, methodology, or roadmap for implementing knowledge management in organizations. This paper provides answers to key questions that need to be addressed for implementing knowledge management in organizations and discusses the application of the framework to technology management.

WB-04.2 [R] Themes and Challenges of Knowledge Management: A Technology Management Perspective

Kiyoshi Niwa; The University of Tokyo, Japan

A knowledge management movement began worldwide in the mid-1990s stimulated by the book "The knowledge creating company" (Nonaka & Takeuchi, 1995). However, there are few actual successful applications of its ideas. This paper presents a different approach to practical knowledge management by focusing on technology management areas. First, it reviews the past twenty years' papers in technology management areas and identifies fifty on various themes of knowledge management. Next, the characteristics of their approach (i.e., technology management approach) are examined in comparison with those of a knowledge engineering (or expert systems) approach and an organizational approach (Nonaka and Takeuchi, 1995; von Krogh, et al., 2000). Then this paper clarifies why and how the technology management approach to knowledge management has advantages over the other two approaches in terms of actual management applications. Finally, based on the past paper themes as well as discussions of the future trends of technology management, examples of the challenges of knowledge management are presented.

WB-04.3 [R] Leveraging Knowledge Assets: Combinative Capabilities — Theory and Practice

Stefan M Koruna; Swiss Federal Institute of Technology Zurich, Switzerland

Since the publication of Prahalad and Hamel's [62] seminal paper on core competencies, leveraging technological competencies has become a topic in the resource-based literature. This conceptual paper focuses on the creation of combinative capabilities and explains the logic of leveraging resources by combining them. Furthermore, the paper explains on which company levels combinations can be expected to occur and how firms can apply such combinations to commercial ends.

SESSIONS

WB-05 Entrepreneurship/Intrapreneurship-2**Wednesday, 7/23, 10:00 AM – 11:30 AM****Room: Broadway-3****Chair: Thomas G Lechler; Stevens Institute of Technology**

WB-05.1 [R] Modelling the Development of a Start-up Company*Dragana R Popovic; Swiss Federal Institute of Technology Zurich, Switzerland
Fritz Fahrni; Swiss Federal Institute of Technology Zurich, Switzerland*

Observations show that the growth of successful high-tech start-up companies can be described with an S-curve. To the best of our knowledge, there is no quantitative theory of this growth-process. In this paper we present, for the first time, a mathematical model to describe the first phase of the S-curve, the fast-increasing growth in sales of high-tech start-up companies. We concentrate in this study on the high-tech start-up companies, which are in the phase of self-financing. The necessary funds for the development are generated in a cash sales flow of R&D services and some already developed parts of the future product. By offering R&D services, the start-up company accumulates know-how in a strategically important area and so advances with the development of its own product. We find that the sales depend on the re-invested accumulated capital. We construct a differential equation relating the sales with the factors of the re-investing process. The solution of this equation shows that the company's sales increase exponentially with time. In a case study, we compare this solution with reality. We find that the initial part of the S-curve is composed of several exponential functions. By discussing the parameters of these functions we shall come to understand how management can influence the optimisation of start-up growth.

WB-05.2 [R] A Conceptual Framework for Technology and Innovation Management in New Technology-Based Firms (NTBF)*Martin Luggen; Swiss Federal Institute of Technology Zurich, Switzerland
Hugo Tschirky; Swiss Federal Institute of Technology Zurich, Switzerland*

To compete with larger firms, New Technology-Based Firms (NTBF) must develop advantages of flexibility and speed of response. Capitalizing on these advantages requires an integrated technology management approach. Therefore, it is of crucial importance to understand and classify the technology management activities of NTBF in regard to developing methods, processes and structures. This paper describes some of the key elements of strategic technology management found to apply in a wide range of companies and industrial sectors. These are: technology strategy, technology intelligence, technology management control and knowledge management. This paper is the result of a cooperative research study carried out with partners in Swiss industry.

WB-05.3 [R] Revenue Viability of Mobile Virtual Network Operators in Korea*Byung-Woon Kim; Electronics & Telecommunications Research Inst., Korea, South
Soo-Cheon Kwoen; Electronics & Telecommunications Research Inst., Korea, South*

Like other developed countries, South Korea ponders on the introduction of Mobile Virtual Network Operators (MVNO). This study attempts to estimate or forecast the possible net profit of MVNO, in the supposition of the possible discount rate of service charge, the market share and ARPU (Average Revenue Per User) of MVNO. The estimated net profit of MVNO is in inverse proportion to the discount rate of its service charge. That is, the higher the discount rate, the less the profit will be. On the other hand, increase in market share and ARPU is proven to contribute to the growth of annual net profit of MVNO. However, in case that the discount rate is over 40%, the increase of the market and ARPU cannot help the profit increase and so the annual profit is on the decrease. It seems because the increased access charge results from the increased number of subscribers, which is first triggered by the discount rate of service charge. This also means that the customers are not sensitive to the discount rate over a certain level. Meanwhile, MVNO has a great range of services and provides the service without fixed frequency. Due to versatility of MVNO, its introduction is expected to create many new service providers and allowing them to launch their businesses in mobile communication market. In the early stage of MVNO's introduction, serious service charge discount seems inevitable due to the severe competition of those new providers for market share. Therefore, new providers should take seriously account of their market-

ing abilities, customer's fidelity, other providers' charging systems, and brand power, as well as the possible profit when an organization decides to launch MVNO.

WB-06 Information Technology (IT) Management-5**Wednesday, 7/23, 10:00 AM – 11:30 AM****Room: Broadway-4****Chair: Jungmann Lee; Electronics and Telecommunications Research Inst.**

WB-06.1 [A] Linking Information Across Industry Sectors to Jump Start Product and Process Innovation*Irene J Petrick; Pennsylvania State University, United States*

Technology developed in one industry sector often does not reach another sector where it might be successfully applied to a problem. One of the main reasons for this is that industry sectors use unique terms to describe what might be otherwise common situations or problems. A generalized ontology, particularly targeted to manufacturing, will improve cross-sectoral technology transfer by providing a common framework to which individual sectors can map their terminology. The generalized framework becomes the repository for sector-specific technologies and production/design methods that can then be searched without regard to specialized terms. An ontology and web-based software has been developed for the metal casting, forging and powder metals and materials to facilitate this type of technology transfer. Industry sector roadmaps developed by the U.S. Department of Energy as well as company specific comments are integrated into common locations where engineers and manufacturers might seek alternative solutions to common problems. This paper presents the rationale for a generalized manufacturing ontology, highlights specific entries for the powder metals and materials industry, and identifies the contribution to new product development and innovation that such an ontology makes possible.

WB-06.2 [R] Advanced Data Mining Developments: New Data Mining Technologies and Their Applications*Jeffrey Hsu; Fairleigh Dickinson University, United States*

Data mining is already being used widely for business intelligence and related purposes. Beyond traditional statistically-oriented data mining, a number of new technologies and techniques have come about. This paper discusses a number of technologies, approaches, and research areas which have been identified as having critical and future promise in the field of data mining. There is currently an explosion in the amount of information which we now produce and have access to, and much of this is in the form of text documents, both electronic and hard copy. Mining information from these text sources can uncover important information which had previously been buried in all of our reports, correspondence, memos, and other paperwork. The extensive use of handheld, wireless, and other ubiquitous devices is another developing area, since a lot of information being created and transmitted would be maintained and stored only on these kinds of devices. Among the other areas which are being developed, investigated, and applications identified for include hypertext and hypermedia data mining, phenomenal data mining, distributed/collective data mining, constraint-based data mining, and other related methods.

WB-06.3 [R] Realizing Digital Life in Korea: Core Technology and Promotion Policy*Jungmann Lee; Electronics and Telecommunications Research Inst., Korea, South
Kiyong Om; Electronics and Telecommunications Research Inst., Korea, South
Yeong-Wha Sawng; Electronics and Telecommunications Research Inst., Korea, South*

This paper first provides the definition of "digital life" and reasons for its introduction by the Korean government and then explains the procedure of selecting core technologies from the promising digital services that are essential to make digital life work. It also provides an illustrative example of selection process of core technologies from the field of wireless telecommunications in Korea. Finally, we examine several issues to be addressed for the successful deployment implementation of digital life and discuss expected impact of the realization of digital life on Korean economy and society.

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

WB-07 Decision Making in Technology Management-5

Wednesday, 7/23, 10:00 AM – 11:30 AM

Room: Forum Suite

Chair: Dundar F Kocaoglu; Portland State University

WB-07.1 [A] Portland General Broadband Vendor Evaluation Using Judgement Quantification

Roda Batarseh; Portland State University, United States

Wendy Christensen; Portland State University, United States

Diane Keil; Portland State University, United States

Khanh Nguyen; Portland State University, United States

This report discusses the vendor selection project completed by a team of students from Portland State University's Engineering Management Master's program. The team completed the project using tools and concepts gained in the Decision Making in Engineering and Technology Management course (EMGT 530) during the Spring 2002 Term. Working with Portland General Broadband (PGB), a potential telecommunications competitive local exchange company, the team gained knowledge of the telecommunications industry and the products of six vendors selected for evaluation by PGB. The six vendors for the evaluation are Cisco Systems, Nortel Networks, Extreme Networks, Foundry Networks, Sorrento Networks, and Turin Networks. The team researched each company's products for the relative information that would provide PGB with the most flexible, scalable, and reliable network possible. The team asked PGB to perform a pair wise comparison of the characteristics they had deemed important for their network. The comparison values were then entered into PCM software provided with the class materials to determine the relative weights for each of the characteristics. The PSU team, using the information gathered from the vendors, then performed a pair wise comparison of the 6 vendors based on the characteristics PGB provided. The comparisons were also entered in to the PCM software to find the combined weights for each vendor based on the characteristics. The weight values from these two pair wise comparisons were then combined to determine which vendor offered the optimal solution for PGB to use in their network. The results concluded that Cisco and Turin were the most viable, with Extreme a viable third option.

WB-07.2 [A] Use of Hierarchical Decision Modeling for Site Selection of a Major League Baseball Stadium in Portland

Priya Ajgaonkar; Portland State University, United States

Aroonrat Auysakul; Portland State University, United States

Ryan Jefferis; Portland State University, United States

Seiji Shinriki; Portland State University, United States

The paper proposes a hierarchical decision model to select a site from various potential sites for a major league baseball stadium in Portland, Oregon. A short background on MLB in Portland, with all the related factors, is provided. The various site selection methodologies are then explored. Next the paper describes Hierarchical Decision Modeling using pairwise comparisons and the process of using this as a decision making tool. A detailed description of the HDM developed is then provided. This model includes determination of the number of levels of the HDM and their relationship with each other. It describes all the elements of each level and the process of identifying and specifying them. The pairwise comparison method used to gather the experts' judgments is then described. Next it describes the analysis of the gathered data from which final priority weights are obtained for the various sites under consideration. The site selection decision would be based on these weights. Finally this paper discusses future work that would be required on this model to provide effective application to the site selection decision process.

WB-07.3 [R] A Decision Model for Stock Portfolio Development

Che-Min Cheng; Portland State University, United States

Julia Dietmeier; Portland State University, United States

Russell A Hensley; Portland State University, United States

Wajana Linhavess; Portland State University, United States

Margaret Wang; Portland State University, United States

This paper presents an investment decision-making model which can be used as a tool in

abetting an investor in selecting stocks for an individual portfolio. The investment model analyzes nine key financial criteria: analyst predictions, beta coefficient, debt-to-equity ratio, earnings per share, inventory turnover, price-to-book ratio, price-to-earnings ratio, return on asset, and return on equity. Using current values, each criterion is normalized on a 0 to 10 scale using utility curves. The criteria are then weighted using a pair-wise comparison technique and summed creating a ranked list of stocks. The second step in model is to distribute the cash assets among the individual stocks focusing on the highest ranked stocks from the performance analysis. This is done using several portfolio risk criteria that can be modulated to either increase or decrease risk in the overall portfolio. Five criteria are considered in the model — number of stocks in the portfolio, number of stocks held in one market sector, number of mid or small cap stocks held, and percent of assets allocated to an individual stock. A linear programming model is used to maximize the utility value of the portfolio while constraining it based upon the given criteria.

WB-08 International Issues in Technology Management-1

Wednesday, 7/23, 10:00 AM – 11:30 AM

Room: Council Suite

Chair: Tom Long; PriMotive Corporation

WB-08.1 [A] Outsourcing Manufacture to China: Technology SME Perspective

Ying Ki Kwong; PriMotive Corporation, United States

Tom Long; PriMotive Corporation, United States

Over the last two decades, China has emerged as an important low-cost manufacturing base for the global supply chains of different industries. Increasingly, firms in developed economies are manufacturing in or sourcing from China. Indeed, the literature contains many accounts of multinationals operating in China, as well as small and medium enterprises (SMEs) owned by Mainland Chinese, Hong Kong, and Taiwanese concerns that are responsible for much of the low-cost manufacturing capacities in China. This literature presently lacks the perspectives from SMEs in developed economies that must increasingly look to China for low-cost manufacturing to remain competitive. In this paper, we analyze factors that shape the "China strategy" in respect to manufacture outsourcing by SMEs working in technology or fragmented markets. By nature, such firms strive to innovate under significant constraints on capital and time-to-market but are crucially important to the commercialization of new technologies and new products and the development of new markets. Such firms must decide what level of manufacturing capabilities, if any, must be developed or maintained internally in order to achieve their niches in the marketplace. The decision to work with offshore manufacturers and Chinese manufacturers, in particular, entails evaluation of various issues and associated risks. Many of these issues are international trade related, though some are China specific. This paper presents a planning framework that should be useful to innovative SMEs in developed economies.

WB-08.2 [A] Techno-Economics: Can Thailand Find a New Technological and Sustainable Way to Competitively Reenter the Global Market?

Nathasit Gerd Sri; Portland State University, United States

Pisek Gerd Sri; Portland State University, United States

The Asian economic crisis in 1997 had severe impacts on Thailand economic, domestic social and political fundamentals. The consequences of this undesirable event led to dramatic changes across the country. Since then, Thai people admitted what they had been denying for quite some time about the diminishing of their competitive advantage on low-labor cost incentive built since the 1980s. As a result, there have been great efforts initiated by the government and policy makers on trying to redesign the national strategic position and finding sustainable ways to exploit the uses of today's technologies for reinforcing the new strategies. This presentation describes where Thailand stands today in the global techno-economics picture five years after the crises. The relevant issues discussed from both economic and technological standpoints and the potential strategic opportunities and challenges for Thailand are addressed for the near and long-term future.

SESSIONS

WB-08.3 [R] Efficiency in the Telecommunications Industry: An International Comparison using DEA

Supachart lamratanakul; Portland State University, Thailand

We examined the efficiency of the telecommunications industry in 26 different nations. Data Envelopment Analysis (DEA) has been applied to evaluate the performance of investment parameters using information gathered from various national telecommunications industries. The particular DEA models and approaches were tested with data that was consistently collected from multiple countries over a period of 5 years from 1995-1999. The results of the data tested in the model were used to conduct the analysis. In addition, we analyzed the simulated numerical results of models to compare the efficiency of these countries and to express the projection of the factors in the telecommunications industry that need to improve in order to achieve one hundred percent efficiency. The relative efficiency change between 1995 and 1999 is also introduced by using the Malmquist output-based productivity index. The results of the research imply these countries can increase their competitiveness in the telecommunications industry.

WB-09 Semiconductor Industry-1

Wednesday, 7/23, 10:00 AM – 11:30 AM

Room: Directors Suite

Chair: David W Moore; Colorado School of Mines

WB-09.1 [R] A Study on the Globalization Strategies for Taiwanese Semiconductor Foundry

Benjamin Yuan; National Chiao-Tung University, Taiwan

Mei-Chen Lo; National Chiao-Tung University, Taiwan

Semiconductor industry has been a crucial and strategic industry in Taiwan given the structure of Taiwanese electronic industries since the 1980s and has played an important role on global IC manufacturing. However, not until 2001 the issue of its spread investment into Mainland China becomes hot and critical given the trend of globalization and magnetic attractiveness of the modernizing Chinese economy. IC enterprises' setting up their investments across the straits can not only bring up positive linkage effect but also form complete supply-chain of the industry. Besides, some multiple-extended markets would be developed to create great niche for the future development of the entire IC industry. This paper concerns about how Taiwanese firms formulate their investment positions within the competitive environments and how to strategically manage their available resources to maintain and enhance their competitiveness. Taiwanese semiconductor industry has been focused on IC manufacturing for quite a long period. The industrial value exceeds 60% of the entire semiconductor industry on the island. The ratio of Memory chip and wafer OEM of the IC manufacturing is also high up to 90% of the industrial value. This paper focuses on those enterprises intending to reposition their investment and those who are capable of influencing the direction of future development of the semiconductor industry in international market. The main viewpoint is to identify those factors and conditions influencing managerial strategies of the investment formulation, based on the strategies of globalization and localization.

WB-09.2 [R] Competition Analysis in the Semiconductor Foundry Industry

Jonathan C Ho; Portland State University, United States

This paper analyzes the competition of semiconductor foundry industry. The analysis applies the theories of competition, technology strategy and cost structure to develop the framework. Identification of critical managerial areas to the competition in the industry is the objective of this study. Top companies in the semiconductor foundry industry are compared side by side using benchmark method. Results show that technology leadership, market share and factory utilization are the major areas that contribute to competitiveness in the industry. Further research on manufacturing capacity planning for better factory utilization and assessment of market demand on advance technologies to reduce investment uncertainty are recommended.

WB-09.3 [R] Yield Learning and the Sources of Profitability in High Technology Manufacturing and Process Development

Charles M Weber; Portland State University, United States

A numerical model that identifies the high-leverage variables associated with profitability in

high technology manufacturing is presented. Varying the parameters of the model demonstrates that a rapid yield-learning rate determines profitability more than any other factor does. Factors such as ramping up to volume production early, adding factory capacity, maximizing quality, and increasing the robustness of product designs all yield diminishing returns. The model also suggests that preparations in the early stages of process development are the key to successful yield learning.

WB-09.4 [A] Headcount Requirement Forecast Model of Wafer Fab Operation

Mei-Chen Lo; National Chiao-Tung University, Taiwan

Chun-Yen Chang; National Chiao-Tung University, Taiwan

Gwo-Hshiung Tzeng; National Chiao-Tung University, Taiwan

As semiconductor manufacturing technology has entered the 8-inch wafer era, the complexity of fab operations increases as the wafer size increases. The wafer handling method has evolved from manual mode in a 6-inch wafer fab to semi-automated or fully automated factory for 8-inch and 12-inch wafer fab. The distribution of manpower requirements in each specialty varies as the trend of fab operations goes for downsizing manpower with automation and outsourcing maintenance work. This paper studies the specialty distribution of manpower from the requirement in a typical 6", 8" to 12" wafer fab. The human resource planning in today's fab operation shall consider many factors which include the stability of technical talents. The turnover ratio of employees is relatively high as the industry migration to Asia in recent years has impacted the long-term competitive advantage of the company due to the difficulty in knowledge management. This study discusses the optimization of manpower structure for a modern fab by considering the automation, maintenance outsourcing, redundancy of key technology talents, etc. The model can be used to forecast the future manpower requirement of each specialty for the strategic planning of human resources to serve the development of the industry.

WB-10 Technology Marketing-1

Wednesday, 7/23, 10:00 AM – 11:30 AM

Room: Studio Suite

Chair: Robert Harmon; Portland State University

WB-10.1 [A] Strategic Analysis Tools for High Tech Marketing

Carmo A D'Cruz; Florida Institute of Technology, United States

Ken Ports; Florida Institute of Technology, United States

High Tech Marketing is characterized by high levels of technical, market and financial uncertainties, rapidly declining prices, collapsing markets and shortening product life cycles. Conventional strategic analysis tools are inadequate for effective analysis in developing high tech marketing strategy. This paper reviews a portfolio of contemporary strategic analysis tools that have been used effectively in developing high tech marketing strategies and case analyses. These include the Boston Consulting Group's (BCG) Portfolio Matrix, The Technology Adoption Life Cycle, The Whole Product Concept, and Disruptive Technologies Mapping. Some of these tools have been effective in alleviating the Engineering — Marketing interface issues in high tech companies. The implicit relationships between these tools are also explored.

WB-10.2 [R] Will Koreans Flock to the new Smart Apartment Complexes?

Yeong Wha Sawng; ETRI, Korea, South

Inkap Yeo; ETRI, Korea, South

Jung Mann Lee; ETRI, Korea, South

This research will analyze the concept, the structure and the importance of the smart apartment, as well as the current developments by Korean companies involved in the smart apartment. The objective of this research is to provide an overview regarding of living trends in the era of information technology and develop marketing strategies based on the customers' perspectives in Korea.

WB-10.3 [R] The Relationship of Customer Satisfaction and Switching Barrier on Customer Loyalty in the Korean Mobile Telecommunications Service

Moon-Koo Kim; ETRI, Korea, South

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

*Myeong-Cheol Park; School of Business, Info. and Comm. Univ., Korea, South
MinYoung Kim; ICU, Korea, South*

Faced with a new transition period brought by the market's reaching its maturity phase, the launching of IMT-2000 service, and the scheduled introduction of mobile number portability, the Korean mobile telecommunication services industry is shifting its strategic focus away from attracting new customers and towards retaining existing customers through promoting customer loyalty. This paper investigates how customer satisfaction and the switching barrier influence customer loyalty. The SEM (Structural Equation Model) is used to determine the casual relationship of customer loyalty. And the adjustment effect between customer satisfaction and customer loyalty, produced by switching barrier, is also analyzed.

WB-10.4 [R] Location-Based Services: Models for Strategy Development in M-Commerce

*Ramaprasad Unni; Portland State University, United States
Robert Harmon; Portland State University, United States*

There is wide appreciation of the integral role location-based services would play in the mobile-commerce arena. The early-stage infrastructure for enabling these services is just now reaching the commercialization stage. Strategic thinking in this domain is rudimentary — there is not a clear understanding of issues associated with location data such as ownership and management of location-specific data, and consumer privacy. This paper provides an overview of location-based mobile-wireless services and related technologies, an evaluation of potential business models, and strategic implications for key entities in the value chain.

WB-11 PANEL: New Directions in Technology Forecasting and Assessment **Wednesday, 7/23, 10:00 AM – 12:30 PM** **Room: Executive Suite**

*Panelists: Joseph F Coates; J.F. Coates, Inc.
Theodore J Gordon ; United Nations University
Guenter Clar; European Commission, Belgium
Harold A Linstone; Portland State University
Darrell Mann; CREAM
Gerhard Mensch; International Institute of Innovation
Fred Phillips; Oregon Health and Science University
Alan L. Porter; Georgia Institute of Technology*

A distinguished panel will address the outlook for new approaches to technological forecasting and assessment in the 21st century. Among the subjects to be discussed: • the systematic prediction of trends of technological evolution and nonlinear technological disruptions based on the analysis of patents and scientific advances • forecasting models using cellular automata and agents • a multifractal approach to examine moving technological frontiers • the increasingly rapid conversion of science into technology • the expansion of technology into new domains such as biological and social systems • the new uses of data mining and bibliometric analysis in forecasting • technology roadmapping • the interaction between technology forecasting and foresight • technology foresight as policy and management tool This will be an extended panel session continuing until 12:30 PM.

WD-01 Innovation Management-4 **Wednesday, 7/23, 1:30 PM – 3:00 PM** **Room: Pavilion East** **Chair: James Koch; Santa Clara University**

WD-01.1 [R] Opportunities, Innovation, and Value Creation: The Trend Micro Case

*Shih-Chang Hung; National Tsing Hua University, Taiwan
Tzu-Hsin Liu; National Tsing Hua University, Taiwan
Yee-Yeen Chu; National Tsing Hua University, Taiwan*

The purpose of this paper is to examine how an entrepreneurial software firm exploits opportunities to pursue innovations that in turn create organizational values. Value creation has been an important issue for entrepreneurship, and most researchers agree that its sources are numerous. In this paper focusing on the case study of Trend Micro, we discuss oppor-

tunity identification and exploitation as a source of organizational innovation and performance. Our methodology is that of a case study, centered on a dynamic, historical process. Implications for research and practices are drawn out.

WD-01.2 [A] Implementing a Balanced Innovation Management Concept to Work

*Vicente F Raurich; Swiss Federal Institute of Technology Zurich, Switzerland
Christian Marxt; Swiss Federal Institute of Technology Zurich, Switzerland
Fritz Fahmi; Swiss Federal Institute of Technology Zurich, Switzerland
Christopher Speirs; Philips Semiconductors, Zurich, Switzerland
Patrick Nolan; Philips Semiconductors, Zurich, Switzerland*

In order to cope with the challenges of rapidly changing markets and technologies, a comprehensive and balanced business process should integrate technological aspects and handle them in an equal manner with all other management issues. The integration of market feedback into strategic technology planning and its linking with the strategy deployment are issues of paramount importance to innovation management. This is the key for comprehensive management, leading to lean and appropriate, as well as timely New Product Development (NPD). Innovation management is seen as closely related to successful NPD. Being aware of this, Philips Semiconductors Ltd. and the ETH-Chair: for Technology Management and Entrepreneurship started a cooperation in order to implement a balanced framework for innovation management, which was presented as a result of earlier studies. The semiconductor industry being a very dynamic and complex industry, has proven as a fruitful testbed for the selected framework. This paper discusses the framework including its elements and how it was put to work in the situation found at Philips Semiconductors Ltd.

WD-01.3 [R] Restrictive Factors in the Regional Technological Innovation Ecosystem and the Strategies for Adaptation

*Lucheng Huang; Beijing University of Technology, China
Luo Yafei; Beijing University of Technology, China*

This paper, combining the theories of ecology and the regional technological innovation system (RTIS), first advances a new concept: the regional technological innovation ecosystem (RTIE), which consists of the composite organizations and the organizations with a composite environment for regional technological innovation. RTIS with characteristics and regularities of the ecosystem has provided us with a new thought for the study of RTIE. The discussion will only focus on the restrictive factors of various kinds in RTIE, i.e. the technological factors, the market factors, ecological environment factors as well as system and policy factors, and how composite organizations cope with the changes of restrictive factors in the system along with the strategies that they should take for adaptation to these changes.

WD-02 Project/Program Management-5 **Wednesday, 7/23, 1:30 PM – 3:00 PM** **Room: Pavilion West** **Chair: John Whittaker; University of Alberta**

WD-02.1 [R] Whole System Resource Scheduling in Multi-Project Environments

Philip J Viljoen; University of Pretoria, South Africa

Resources in multi-project environments are utilised in all stages of the project flow process, from initiation to closure as well as on essential non-project work. The resultant workload is typically managed through multi-tasking that causes the lead-time of projects to be increased excessively. Treating the project flow process as a production process, defining workload early, scheduling for a heavily loaded resource across projects, subordinating to this schedule and designing buffers and protective capacity into the rest of the system, can provide effective resource scheduling for the entire system. This approach could effectively deal with the conflicting demands on resources from production and project tasks. Improved reliability and shorter project lead-times at lower costs can be delivered. The application of this approach is demonstrated by a short case study.

SESSIONS

WD-02.2 [R] Assigning Projects to Project Managers in a Multiple-Project Management Environment: A Pilot Study of a Decision Support Model

Peerasit Patanakul; Portland State University, United States

Dragan Milosevic; Portland State University, United States

Timothy Anderson; Portland State University, United States

Project assignment is considered one of the critical project decisions since it influences the performance of projects, and eventually the performance of the organization. Despite its importance, the literature reveals two major gaps on project assignment criteria and methodology. To close these gaps, this study proposes an additional set of project assignment criteria and a systematic methodology for project assignments, so called, a decision support model for project assignments (DSM). By using the concepts of case study research combined with a literature review, the important potential criteria for project assignments are identified. These criteria are used in conjunction with the concepts of the analytic hierarchy process (AHP) and the integer programming (IP) to develop a DSM for one company. The DSM is executed and validated with the company's information. As a part of this research project, this paper illustrates the results of the pilot study developed for the feasibility study of the DSM development.

WD-02.3 [R] Capacity Management for Multiple Project Environments

Supachart lamratanakul; Portland State University, Thailand

This paper discusses the capacity management in multiple project environments. We studied the capacity problems of projects, the context of multiple project management, and we summarized the definition of capacity and capacity planning. Moreover, we have explored the components of capacity and the processes of managing capacity as well as the composition of a project manager's capacity. The capacity management model has been proposed in this paper to provide a means to study its system and provide familiarity with how it behaves. As a result, the study will acquire the comprehension of capacity management in multiple project management.

WD-03 TUTORIAL: New Product Development Using Adaptive Product Management

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Broadway-1

Speaker: Vince Socci; On Target Technology Development

New product development engineers promote adaptive prototyping as a method to manage unpredictable engineering development. However, project managers reject the business challenges, risks and uncertainties of the adaptive development environment. Adaptive Product Management (APM) bridges the gap between unpredictable, adaptive technology development and predictive, practical product management techniques. The technical merits and management challenges of using adaptive development in today's customer-centric business environment are discussed. APM forces a product development paradigm shift from execution of known constraints to learning of unknown product potential. A "pull" development strategy creates a lean, value-add product development cycle. APM uses time-phased product demands to map development. APM implementation strategies, best practices and performance control warnings are outlined. Participants will learn how to effectively deploy APM in their organizations and new technology development applications.

WD-04 Knowledge Management-2

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Broadway-2

Chair: Charles M Weber; Portland State University

WD-04.1 [R] The Fit between Problem and Organization Infrastructure as a Determinant of the Generation of Routine Knowledge in Technical Problem-Solving: Findings from the Food-Equipment Manufacturers in Southern

Corrado Lo Storto; University of Naples Federico II, Italy

This paper reports the findings of an empirical study aimed at identifying the attributes of the organization infrastructure supporting the generation of procedural (routine) knowledge in small manufacturing firms. The following assumptions were determinant in the research

framework design: a) organizations act as cognitive systems that process information and knowledge; b) knowledge in small manufacturing firms is many times a by-product of technical problem-solving; c) product innovation can be regarded as a stream of random or planned problem-solving; d) many attributes of the organization infrastructure that support innovation also foster knowledge generation during technical problem-solving. Empirical results show that learning is affected by three dimensions of the organization infrastructure: openness, innovativeness, and leadership. These attributes allow to identify two different typologies of organization infrastructures, the first one presenting higher values for all three dimensions than the second. Differences exist in the generation of procedural knowledge across these typologies during technical problem-solving, the first showing an activation effect when the cognitive state of problem-solvers, determined by how problem is perceived, is characterized by high ambiguity, uncertainty and complexity. Ninety-one cases of technical problem-solving occurred in 35 small firms in the food-equipment manufacturing industry in Southern Italy were considered in the study.

WD-04.2 [R] Developing Knowledge Preservation Strategies in Situations of Personnel Turnover: A Conceptual Paper

Stefan M Koruna; Swiss Federal Institute of Technology Zurich, Switzerland

The firms' ever increasing need to differentiate themselves from their competitors has made knowledge the most important asset for firms. As most parts of this knowledge are not available in an explicit form but bound to employees, firms have become increasingly dependent on a small yet increasing number of employees. This conceptual paper addresses the need to develop knowledge preservation strategies for situations of personnel turnover and illustrates the advantages and disadvantages of the various strategies available.

WD-04.3 [R] Identifying Push-Pull Approaches for Managing Knowledge Across Projects

Timothy G Kotnour; University of Central Florida, United States

Rafael E Landaeta; University of Central Florida, United States

This article identifies push-pull approaches for managing knowledge across projects. Knowledge management can be broadly defined as the set of processes, tools, and techniques for the most effective and efficient use of knowledge. Knowledge management across projects (KMAP) offers an opportunity for multi-project organizations to improve, maintain, and create organizational capabilities to generate sustained competitive advantage. The push-pull approaches were identified through the literature and by our experience as applied researchers. This investigation serves as foundation for further research and development in the effort to define the appropriate set of managerial actions required for successful knowledge management in multi-project environments.

WD-05 Entrepreneurship/Intrapreneurship-3

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Broadway-3

Chair: Fred Y Phillips; Oregon Health and Science University

WD-05.1 [R] Early Sales of New Technology Products: A Framework for Comparing the Sales Cycle of Competing Start-up and Large Supplier Firms

Josee M Loudiadis; Carleton University, Canada

The objective of this paper is to examine the theory and describe a methodology to compare the early sales of innovative technology products made by two samples: technology-based start-ups and large companies. The categories examined for the samples' comparison include target buyer characteristics (size, type of business, distance from buyer and years in operation), first meeting with the buyer firm (method of introduction, department and power level of initiator), the buyer's perspective of the product offer (importance and value), the buyer's involvement in product development, the relationship strength developed between the buyer and the seller firms, the buyer's purchase decision-making process and the resulting degree of buyer loyalty. Based on these factors, the author proposes hypotheses to reduce the early sales cycle duration and increase the buyer's loyalty. The intent is to offer a method for providing insights into the early buyer's view of the new product's sales cycle. Sellers currently facing the task of developing early sales for their new product could then adjust their

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

investing, partnering, hiring, outsourcing and designing policies based on the results gathered from successful predecessors.

WD-05.2 [R] Growth in the Early Development Stages of Technology-Driven New Ventures

Timothy C Koeller; Stevens Institute of Technology, United States

Thomas G Lechler; Stevens Institute of Technology, United States

The research explaining the growth and development of new ventures did not yet result in a substantial consensus. One reason is the complexity of the topic itself but also because of the lack of theoretical foundation. The goal of this study is to overcome this theoretical gap by explaining empirically the growth of new ventures in the early development stages based on the model of firm growth suggested by Marris (1964). The analysis of 157 technology driven ventures validates the basic theoretical model structure. The derived model explains 32% of the variance of new venture growth. The major driver for firm growth in the early stages are owned patents of the firms. Limiting growth factors are the focus on a small number of customers. On the other hand is the outsourcing of distribution channels offered by customers or other larger organizations strongly related to the firm growth. Internal managerial processes especially the organization of information processes are significantly fostering the growth of new ventures. The present results underline the need for extension of existing economic growth models of the component of managerial processes. The results underline the need for further model development on the base of an integration between microeconomics and management to cope theoretically with the dynamics of the early development stages of technology driven firms.

WD-05.3 [R] The Driver of Corporate Entrepreneurship: Opportunity or Resources?

Cheng-An P Tsai; National Chengchi University, Taiwan

Su-Lee Tsai; Fu Jen Catholic University, Taiwan

Corporate entrepreneurship (CE) has been an effective means for a firm's growth. It involves extending the company's domain of competence and corresponding opportunity set through internally generated new resource combination. This paper used 23 new ventures from LiteOn group on their new venture formation process. We examined whether it is opportunity-driven or resources-driven and whether it will be affected by firm's development stage. This exploratory study found that a firm in forming new ventures would pursue different opportunities and apply different resources utilization orientations at different stages of its life cycle. Empirical result supports that a firm pursuing opportunity would tend to seek external resources, the relatedness of new ventures may affect the entrepreneurial orientation, and different types of resources may influence a firm's tendency to chose opportunity pursuit or resources utilization. The findings of this empirical study indicate that strategic focus and intention of a firm may affect the directions of resources accumulation. Corporate entrepreneurship in new ventures formation cannot be separated completely from the strategic management theory.

WD-06 Technology Management Framework-1

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Broadway-4

Chair: Terry Bristol; Inst. for Science, Engineering and Public Policy

WD-06.1 [R] Connecting the Dots: Problems and Proposed Solutions

Charles W Thompson; Northwestern University, United States

The recent focus on asymmetric warfare and turf battles within the intelligence community highlights the critical function of communication in identifying problems and developing solutions. Technology management provides a number of enduring examples. Communication provides a framework for examining these problems and both available and proposed solutions.

WD-06.2 [R] The Power of Stories (I): A Discussion of Why Stories are Powerful

Loïck Roche; Groupe ESC Grenoble, France

John Sadowsky; Groupe ESC Grenoble, France

In the past decade, much has been written about how the advent of the 'information age' has changed corporations and management. Organizations are decentralizing, delaying and destroying bureaucracy in order to unleash the talent of the individual. Digitization is making individuals and corporations more productive than ever, allowing teams to be increasingly dispersed and still stay in contact. Workers have become 'free agents'—no longer dependent on a corporation for lifelong employment, they are independent purveyors of expertise and service in a rapidly evolving global marketplace. This environment of decentralization, digitization, dispersion and free agency poses interesting challenges for leaders. Foremost among these challenges is that of engendering loyalty and commitment. Winning the allegiance and focus of the modern-day, independent knowledge worker means providing inspiration through a sense of shared purpose. In this paper, the authors discuss the premise—found in works by Gardner, Tichy and Denning, among others—that storytelling is among the leader's most effective tools for inspiring an organization's human capital. The basic question of the author's research: Why is storytelling so powerful as a motivator? Where, exactly, does the power of stories come from? Among the conclusions: —Stories are powerful because they are universal—fascinating to everyone—crossing boundaries of language, culture and age. —Stories are powerful because they mirror human thought. They are the way individuals learn and remember. Evidence from the fields of neurology and psychology shows that humans think in narrative structures. Therefore, concepts conveyed in story form—more than ideas explained purely with logic and analysis—insert themselves naturally into human minds. —Stories are powerful because they build and preserve a group's sense of community. Stories motivate by portraying the world in vivid terms that build an emotional connection with workers, giving them a sense of participating in something larger than their day-to-day tasks. The authors discuss these and other conclusions, giving examples from their experience and research.

WD-06.3 [R] Cosmology from an Engineering Perspective

Terry Bristol; Inst. for Science, Engineering and Public Policy, United States

William Wulf, President of the National Academy of Engineering, recently called for a radical revision of engineering education. I doubt this effort will succeed — until there is a radical revision of our understanding of the place of the engineer and the engineering enterprise in the universe. The Scientific Cosmology has always had a problem making sense of engineering as real and meaningful. By contrasting the scientific and engineering traditions in a number of ways, I begin to construct an Engineering Cosmology that is formally complementary to the Scientific Cosmology. A rigorous examination of scientific idealizations — such as perfect repeatability — reveals aspects of the limits and incompleteness of the scientific model. An understanding of Popper's Question, together with an examination of the classical idealizations of motion (viz. frictionless; three-body indeterminacy), point to a fundamentally thermodynamic Engineering Cosmology. Popper's demarcation entails that the symmetric Scientific Cosmology is incommensurable with this thermodynamic Engineering Cosmology. Additional methodological and historical arguments strongly support the thesis that Scientific and Engineering Cosmologies are formally complementary. These conclusions demand a radical revision of engineering education and a fundamentally new conceptual framework for management of engineering and technology for reshaping the world.

WD-06.4 [R] The Fifth School of Management of Technology

Mohammad R Arasti; Sharif University of Technology, Iran

Hamid Mazloomi Khamseh; University of Tehran, Iran

This paper concerns a new approach to MOT, called process-based approach. Historical development of Management of Technology (MOT) is reviewed based on the four schools of MOT suggested by Drejer: R&D Management, Innovation Management, Technology planning and Strategic Management of Technology. Then Drejer's classification is completed by introducing the fifth school- Strategic Management of Technology (Process-based Approach). For this purpose, the concept of process is described and the advantages of process view of an organization are explored. The need of process view on MOT is also argued. Finally, two different aspects of process-based approach to MOT are developed and discussed, which are MOT by processes and MOT through processes. The first one concerns different processes related to the MOT, such as technology transfer process, technology strategy elaboration

SESSIONS

process, etc. The second aspect deals with identification, selection and acquisition of appropriate technologies and their effective implementation in organization processes.

WD-07 Collaborations in Technology Management-2

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Forum Suite

Chair: Michael D Santoro; Lehigh University

WD-07.1 [A] Why do Mergers and Acquisitions Thwart Innovation, Creativity and Diversity in the Service Sector?

Harsha Savani; Indepth Consulting Group, United Kingdom
Khalid Hafeez; Sheffield Hallam University, United Kingdom

This paper explores issues which have an impact on organisational culture, innovation, diversity and creativity when mergers and acquisitions take place. It reviews relationships between diversity, creativity, innovation, knowledge sharing and e-strategies. A field study was conducted to evaluate and match the current practice against the academic theories. Results are from a sample of 20 managers representing the two UK based global banks which were merging. Our analyses suggest that on average 75% of the respondents said that mergers and acquisitions are like successful marriages; 60% of the survey participants also agreed that effective management of diversity and creativity leads to organisational competitiveness and enhanced learning. Environmental analysis results reveal that top-down communication strategy is a major barrier in implementing an organisation's wide diversity agenda because maintaining creativity and innovation during the merger process. This is probably the most complex and critical task an executive team will face. When organisations are going through rapid change during mergers and acquisitions, information technology tools are identified to improve communication and collaborations among diverse teams. The managers interviewed from both the banks identified issues such as the changing workforce, shifting employee values, new emerging markets, impact of new technology, new policy development, e-learning, increasing awareness of strategic plans for successful mergers. We argue that understanding the dynamics of organisational culture, e-learning and retaining the best talent pool are most important for the merging organisations.

WD-07.2 [R] A Design of Collaborative Commerce Service System — Taiwan Machine Tool Industries as an Example

Chyuan Perng; Tunghai University, Taiwan
Jenteng Tsai; Tunghai University, Taiwan
Shui-Shun Lin; National Chinyi Institute of Technology, Taiwan

Taiwan Industry today face intense pressure of the global competition and information technology change. The major pressure comes from the broad delivery of information to everyone who impacts business processes — at a rapid time-to-market with a low cost-of-ownership. To meet this challenge, Taiwan Industry need business intelligence (BI), not for a select few, but for everyone — employees, managers, partners, suppliers, customers, and constituents. Increases in demand and hands-on users are making the traditional model of BI applications, developed within departments and disconnected from the enterprise, inefficient and ineffective. Collaborative commerce technologies are expected to change this paradigm, adding information-rich interactive capabilities to the e-business environment. Collaborative technologies also help complete the online commerce ecosystem, driving transactions and inter-enterprise process execution to the Internet automatically. In this research, we try to build a collaborative commerce service system for machine tool industry which can provide a complete service to their customer stand at the point of products' life cycle. This collaborative commerce service system will have different program of services to fit the different stages of customer's needs from the first step to the final end of a products' life cycle. For external, we will integrate the inner products instant service to provide to our customers. For internal, we will integrate the outer customers' opinions and information. In this system besides using Internet being the tool for the basic selling, we also integrate the designing, producing, and selling three steps to fit the needs of traditional manufacturing industry in Taiwan. It will truly achieve the goal to provide the customers instant service by collaborative commerce.

WD-07.3 [A] Partnering: Elements of a Good Partnering Agreement

Barbara Williams; Private Company, United States
William T Flannery; University of Texas — San Antonio, United States

Current literature presents change as a series of techniques and strategies that, carefully planned, implemented, and managed, will lead to success. However, those who have undergone such experiences know that with any planned change it is necessary to work with those soon-to-be-affected to obtain their understanding and commitment prior to implementing the change. This paper will look at the social context of change as it relates to partnering agreements and relate it to the experiences of one of the authors as a project manager for a joint venture between two small business entities.

WD-08 Technology Management Education-3

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Council Suite

Chair: Devorah Lieberman; Portland State University

WD-08.1 [A] A Critical Review of Engineering and Technology Management Programs and Some Suggestions for Improvement

Kudret Yurtseven; Dogus University, Turkey
Berrin Agaran; Dogus University, Turkey
Walter W Buchanan; Northeastern University, United States

In this article, characteristics that are common to most technology management or engineering and technology management programs are reviewed. It was observed that, in almost all of these programs, the following aspects were either missing or were not given sufficient importance: (1) coverage of social, economic, and cultural aspects of engineering and technology management, (2) coverage of the whole subject matter from a systems point of view. In the article, the authors argue why these aspects are so vital in such interdisciplinary studies, which will help broaden the outlook of the students and provide some depth in their understanding of societal impacts of engineering and technology management. The Engineering and Technology Management program established at Dogus University is given as an example to support the discussion provided in the article.

WD-08.2 [R] MOT Programs in Different National Contexts: A Preliminary Comparative Study

Meng Li; Japan Advanced Institute of Science and Technology, Japan
Akio Kameoka; Japan Advanced Institute of Science and Technology, Japan

The paper reviews the rapid growth of management of technology (MOT) education in Japan and China, and preliminarily compares the similarities and differences of management of technology education program in the two countries as well as their difference with original U.S. systems. The findings suggest that the US-originated programs draw lots of attentions from the countries but the main difference lies at the difference of socioeconomic environments. Beside, in late developing countries, such as China, MOT programs relate to more complex factors due to the variety of diverse demands, technological level, and industrial experiences. These programs in new contexts have to be tailored to local conditions when strong government pushes fade away.

WD-08.3 [R] Educational Trends in Engineering and Technology Management (ETM)

Dundar F Kocaoglu; Portland State University, United States
Halime Incelcer Sarihan; Portland State University, United States
Iwan Sudrajat; Portland State University, United States
Ivan Patricio Hernandez; Portland State University, United States

As the Engineering and Technology Management (ETM) field continues to grow, Portland State University's Department of Engineering and Technology Management is conducting a worldwide research study on education and research in this field. It is a follow-up to previous studies in 1977, 1981 and 1984, 1990 and 1994 [1] [2] [3]. The objective is to develop a resource guide for ETM by analyzing growth patterns in ETM education, and determining the characteristics and strategic directions of the educational and research components of the field. Approximately 3500 individuals have been contacted in more than 1200 academic insti-

SESSIONS

tutions, and responses have been received from 148 academic institutions up to now. An additional 121 ETM programs have also been identified, but their responses have not been received yet. This paper presents a summary of the findings of the study.

WD-09 Competitiveness in Technology Management-1

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Directors Suite

Chair: Tony J Bailetti; Carleton University

WD-09.1 [R] Protecting Technology Companies from Unexpected Competitive Attacks

Tony J Bailetti; Carleton University, Canada

Chrystal Y Liu; Carleton University, Canada

Terence Y Zhang; Carleton University, Canada

Carlos A Yepes; Carleton University, Canada

The conceptualization of what is a competitive attack is a central construct of the Austrian school's view of competitive dynamics. According to this view, an aggressive competitive attack is one where the duration of the attack is long, and the attack's volume, complexity, and unpredictability are high. In this paper, we examine unexpected competitive attacks, a type of aggressive competitive attack. Unlike the Austrian view of what constitutes a highly aggressive attack, an unexpected attack has a short duration, and the attack's volume, complexity and unpredictability are low. It is very difficult and costly for a company to successfully respond to an aggressive rival's unexpected attacks. We first identify the salient features of unexpected competitive attacks and then use a non-business analogy to make specific recommendations on how senior managers can protect their technology companies from unexpected competitive attacks.

WD-09.2 [R] Competitive Actions that Affect the Performance of Telecommunication Equipment Suppliers During Periods of Industry Meltdown

Tony Bailetti; Carleton University, Canada

Yanxia Hao; Carleton University, Canada

We use Dubin's theory building framework to propose a theory of competitive actions for periods of industry meltdown (i.e., prolonged period of economic decline). We identify the building blocks of the theory by identifying the elements considered important in the literature on growth and competitive strategy and in news releases and financial reports issued by eight of the world's largest telecommunications equipment suppliers. Our theory conceives competitive attacks comprised of product trials, price discounts, R&D dedicated to customers of core businesses, and vendor financing as positively contributing to company performance during periods of industry meltdown. The theoretical model identifies seven antecedents of the aggressiveness of a company's competitive attacks: asset divestment and headcount reduction, top management team diversity, liquidity, special R&D and supplier relationships, past spending, company's capital expenditures relative to its rivals,' and changes in the stock market index.

WD-09.3 [A] Business Competitive Advantage Through Advanced Planning Simulator

Pichit Saengpongpaew; AMD (Thailand) LTD., Thailand

Darin Smitasiri; AMD (Thailand) LTD., Thailand

In today's agile technology, the changing in innovation is extremely fast as well as the significant dynamic changing in customer demand. The traditional solutions are often not robust enough to provide the optimum solution for the complex IC business environment. Advanced Production Simulator (APS) is the new solution for today's IC manufacturing. With the integration of enterprise's global forecast and demand, manufacturing process explosion, real-time shop floor responsiveness, inventory adjustment system, online plant capacity and expert modules, APS can generate a very flexible and realistic plan with the optimum output on profit margins, revenue growth, customer satisfaction and plant resource performance under feasible constraints. APS synchronizes material flow with dynamic bottleneck, helps planners make the decisions needed to meet the demand for finished products, and

drives the lean manufacturing principle in order to gain the business competitive advantages. Of particular innovative and complicated technology changes in IC industry, APS considers the mix change on customer demand, problem solving learning curve on product life cycle, especially new product launching, and resource availability and limitation. Simultaneously, it provides the superb business solution through business rules and priorities by the operation research (OR) mechanism and supply chain management, which obviously brings the key success to the high business competition.

WD-10 Technology Commercialization-1

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Studio Suite

Chair: Kenneth Keys; Cleveland State University

WD-10.1 [R] Acquisition of Resources for Commercializing Emerging Technologies: Comparing Large Firms with Startups

Lois Peters; Rensselaer Polytechnic Institute, United States

Malavika Sundararajan; Rensselaer Polytechnic Institute, United States

Radical innovation programs designed for commercializing emerging technologies are compared to emerging technology startup firms in terms of the research work, risk, uncertainty and acquisition of resources and capabilities. Current literature shows that companies with potentially disruptive technologies are focusing initially on simple applications in industries with short product development cycles. A continuing question is how initial resources and resource acquisition strategies associated with disruptive technology commercialization are translated to positions of sustainable competitive advantage. Drawing on the resource-based view of the firm, transaction costs theory and the dynamic organization capability perspective, we characterize the chief resources being used by large firms and startups. We further analyze the ways in which these resources are acquired and categorize them under four distinct groups: Internal and external resources, internal and external collaboration. The study shows how the risk, uncertainty, and flexibility associated with each of these resource groups affects the product development cycles. A comparative analysis is then undertaken to understand the role of the "acquisition of resources" process in commercialization of emerging technologies. The paper compares small and large firms in three "hot" areas of emerging technologies, biotechnology, photonics and nanotechnology. Drawing on this examination and a review of the literature we offer a schematic of how large and small firms differ in their approaches to commercialization of emerging technologies. Based on several propositions derived from our investigation, we provide conjectures about what large and startup firms can learn from each other regarding commercializing emerging technologies.

WD-10.2 [R] Technology Commercialisation: Patent Portfolio Alignment and the Fuel Cell

Alan Pilkington; University of London, United Kingdom

The limits and potential of patents as a source of information in plotting technological development and competitive insight are gradually being explored. The value of patents as commercialisation and technology emergence predictors is an area where tools have yet to be fully developed. In this paper a statistically driven patent-based method that identifies the technological portfolios in industry players is introduced. The approach is explored through the case of fuel cell technology development, a technology with a succession of failed predictions which appears to be nearing commercial introduction. The paper identifies the close alignment between the technology portfolios of the firms developing fuel cell technology and this is seen as a precursor and indicator of commercialisation.

WD-10.3 [A] T-CAT — A Technology Commercialization Assessment Tool

Simon Brightman; University of Ottawa, Canada

David Large; University of Ottawa, Canada

Managers of publicly funded labs routinely attempt to assess which of their technologies have genuine commercial potential, and then to assess which commercialization mechanism (e.g., license versus spinout) might be optimal. Many tools do exist to assist these assessments, but spotty commercialization results suggest that there is room for improvement. T-CAT© is a new spreadsheet-based software tool designed to improve the reliability of the commer-

SESSIONS

cial potential assessment, and, unlike other tools, the reliability of the commercialization mechanism assessment. It has been derived from a rigorous literature review, and several in-depth interviews with senior managers from leading North American labs. It features: • Dual stage analysis: an initial AlphaScreen 20-factor assessment of commercial potential; and a subsequent BetaScreen 46-factor re-assessment, including a directional indication of the optimal commercialization mechanism; • Assessment factors in five categories: Technology; Market; Technology Champion; Management; and Financials; and • User interfaces that are: quantitative, qualitative and/or graphical; interactive; easy to use; and customizable. The disciplined use of T-CAT© may help managers of publicly funded labs to: standardize their assessment processes; identify the most critical determinants of commercialization success; and elevate the consistency and degree of commercialization success.

WD-11 Technology Planning and Forecasting-1

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Executive Suite

Chair: Ranjit Singh; Engineering College, Bikaner, Rajasthan

WD-11.1 [R] Forecasting Analysis for the Fuel Cell Technology in the Automotive Industry using Bibliometrics Analysis and System Dynamics Models

Guillermo Rueda; Portland State University, United States

Bassam Abu-Khater; Portland State University, United States

Turki Alsudiri; Portland State University, United States

Farooq Chandiwalla; Portland State University, United States

Samir Said; Portland State University, United States

This presentation will project the future of fuel cell technology as one of the most promising oil source/solution for the automotive industry. Bibliometrics and system dynamics are the tools used in this research to forecast the fuel cell technology for the next 20 years. Bibliometric analysis defines the maturity level inside the model, more articles published in peer review journals and conferences means less maturity level while system dynamic model allow us to incorporate feedback structures adding non-linear behaviors in the model This research considered different scenarios associated with economy levels, government considerations related with management time response and environmental concerns. Scenario results are then validated with expert panels from international organizations. The model is elaborated in Stella software and has a user interface with different switches and gauges that allow non-expert users in system dynamics to manipulate a set of variables and run the model very easily.

WD-11.2 [A] Prediction Analysis of the Components Industry Based on Fuzzy Theory and the Grey Model

Chao-Hung Wang; Ling Tung College, Taiwan

Li-Chang Hsu; Ling Tung College, Taiwan

Well-designed prediction models can still make poor forecasts when they are given poor quality data. Common problems include sample groups that are too large to handle, historical data covering long time periods, differences among the attributes of industries, and so on. The production value of the computer components industries has the following features: short product life cycle, uncertainty regarding factors influences on the market, and rapid progress of production technology. These features obstruct forecasts relating to the Taiwanese computer components industry. Particularly, the data are always obsolete, making it difficult to gather the large amounts of high-quality data required for constructing satisfactory conventional statistical models. Artificial intelligence methodologies can overcome the above constraints. This investigation describes an effective methodology, which combines characteristics of the grey forecasting model and fuzzy time series to made forecasts regarding the computer components industry. These methods can replace the traditional statistical approach, which is extremely inefficient, time consuming and impractical as a method of obtaining accurate predictions.

WD-11.3 [A] Application of Artificial Intelligence to Forecast the Tourist Arrivals to Taiwan

Li-Chang Hsu; Ling Tung College, Taiwan

Forecasting tourism demand in the capacity constrained service industry has been a major theme in this field. The work presents two models that can be used to predict which tourism demands are vulnerable to wide fluctuations. Both of two models are based on artificial intelligent (AI) applied to enormous fields other than service marketing. Neural network was first applied to tourism demand forecasting in 2000 and empirically tested using the raw data of tourist's arrival Hong Kong. This work provides empirical evidence using grey theory and fuzzy time series, which do not need huge sample data and long past time data. These AI models are estimated for tourist arrivals to Taiwan from Hong Kong, the United States, and Germany during the period of 1989 to 2000. GM(1,1) model achieves accurate forecasting when the sample data stably increases trend. Nevertheless, the Markov modification model can efficiently improve the GM(1,1) model when the sample data has significant fluctuation.

WD-11.4 [A] The Comparison of Hybrid Grey Predicting Model with Conventional Time Series

Chao-Hung Wang; Ling Tung College, Taiwan

The orientation of Grey prediction model has been successfully applied to several research fields. Most of this research focuses on engineering, electronic power systems, and business, etc. However, the shifting high-technology Integrated Circuit (IC) industry is not widely explored. The authors applied and compared the different models to forecast the demand and supply of the global IC industry. Two evaluation standards, i.e., the relative percentage error (RPE) and the root mean sequence error (RMSE), are used to test the accuracy of the forecast models. The time series data (from 1994 to 1997) of the demand and sale of global IC industry are used as test data sets. The Grey model becomes the short-term prediction rather than mid-term and long-term prediction, Meanwhile, the Markov-chain residual modification model has reliable and precise results.

WD-12 TUTORIAL: Strategic Implementation of Six Sigma and Project Management

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Senate Suite

Speaker: Frank T Anbari; The George Washington University

Organizational strategy includes (1) improvement of current technologies, which can be pursued through Six Sigma initiatives, and (2) introduction of new technologies, which can be carried out as coordinated projects and programs. Successful implementation and growing organizational interest in the Six Sigma management method have been exploding in recent years. It is rapidly becoming a major force driving the strategy of numerous successful organizations. Involvement in Six Sigma projects is becoming an important career path requirement in many organizations. Understanding the main concepts of the Six Sigma method provides important opportunities in Six Sigma project leadership, coaching, mentoring, and training. This tutorial/workshop provides a clear understanding of the Six Sigma management method, the roles of various organizational participants in achieving the objectives of Six Sigma projects, and the integration of project management and Six Sigma strategies. It helps the participants identify and define appropriate Six Sigma projects, and the main elements of managing them successfully. It ensures participants understand the roles of Green Belts, Black Belts, Master Black Belts, Champions and other participants in managing Six Sigma projects. The tutorial/workshop provides for active audience participation to allow participants to fully capture the essence of Six Sigma project management.

WD-13 Software Process Management-1

Wednesday, 7/23, 1:30 PM – 3:00 PM

Room: Cabinet Suite

Chair: Hannu Jaakkola, Tampere University of Technology

WD-13.1 [R] Evaluating the Effects of User Interface on Performance: User Interface Modes and Web Coding Performance and Satisfaction

Jeffrey Hsu; Fairleigh Dickinson University, United States

The role of the user interface is of key importance, since the mode of interaction can have an impact on both performance and satisfaction with regards to using a programming language. A well-designed user interface can improve performance and satisfaction, while a poorly designed one can reduce levels of these. While markup languages are now widely used

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

for web page and site design, and electronic publishing applications, they have not been studied adequately compared with other kinds of languages. The impact of interaction mode, in this case command-based coding, versus using a form-fill-in wizard, is examined, with respect to performance and satisfaction while performing a survey-oriented task. Skill level, which classified users as being either a novice or experienced, was another factor which was taken into account in this study. The results showed that the use of wizards brought about better performance than using the command language, and the difference between modes was far greater for novices rather than experienced users. In addition, using the wizard tended to equalize performance across skill levels. With regards to system satisfaction, there were significant differences between interaction modes, however no differences were reported between skill levels. These differences in performance and satisfaction should be noted and considered when designing interactive systems for programming-related applications.

WD-13.2 [R] Incorporating Price Sensitivity Measurement Into the Software Engineering Process

Robert Harmon; Portland State University, United States
David Raffo; Portland State University, United States
Stuart Faulk; University of Oregon, United States

Software developers typically make critical design decisions without understanding how the market will value the final product in terms of the price that customers are willing to pay. Market research techniques that rely on simulated purchase situations, laboratory experiments, and actual purchase behavior are often dismissed as too expensive, too time consuming, or too impractical. What is needed is a quick and cost-effective method for assessing customers' price expectations that can be utilized at key points in the software development process where design decisions are at stake. Price sensitivity measurement (PSM) research provides product developers with the capability to quickly assess the range of acceptable prices, indifference points, and optimum pricing points for any given software configuration.

WE-01 Innovation Management-5

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Pavilion East

Chair: Marthinus W Pretorius; University of Pretoria

WE-01.1 [R] Innovation Management: Achieving Multiple Objectives

David W Birchall; Henley Management College, United Kingdom
Malcolm S Armstrong; Henley Management College, United Kingdom

In order to become more competitive many businesses could improve the effectiveness of their innovation process and as a result of this strategy improve the deployment of scarce resources in an effort to provide greater customer satisfaction. The connection between innovation and the broader strategic issues associated with resources and customer satisfaction intimates that innovation success should not be based solely on the output from the innovation process in the form of new or improved products, processes or services. Strategic innovation is acknowledged as a causal factor in an organisation's development of new business models that establish a clear competitive edge by disrupting existing markets. Further, academic and practical opinion seem to accept that benefits relating to continuous improvement and increased capability through organisational learning are also outputs from the adoption of an innovative stance. Research in the fields of project management and strategic planning have contributed to a prescriptive approach to the management of the innovation process, and yet, it is unclear to many decision makers just how they might prioritise actions to achieve desired goals. In circumstances where multiple goals are being sort managers experience difficulties prioritising their decisions. In order to function in such a complex environment it is assumed that the underpinning given by a sound model is of considerable benefit. Within the body of this paper a model is proposed that has been derived from both the prevailing literature and the analysis of the project data, which it is hoped, will give such benefits. The research reported here is based on a study of 240 businesses in 7 European countries. It explores factors reported in literature as being important for success in innovation and identifies relationships that strengthen an organisation's ability to achieve successful innovative outcomes. It is based on an earlier study by the first author, in which a preliminary survey instrument was used. The development of the instrument is explained along with the analysis of data using principal com-

ponents analysis, linear regression and canonical correlations. The results help clarify factors related to successful innovation along a number of different dimensions offering the possibility of making strategic decisions on where to concentrate effort. The research illustrates how one might better understand the relationships between Innovation Critical Success Factors (ICSF's) and multiple Innovation Success Criteria (ISC).

WE-01.2 [R] Knowledge Intensive Service Activities in Korea's Innovation System

Kongrae Lee; STEPI, Korea, South

This study aims to explore and understand the knowledge intensive service activities in the innovation system of Korea. It analyzes external and internal services, and public and private service inputs to user firms for specific cases of Korean knowledge intensive services. The contribution of KISs to the innovation of both service suppliers and user firms was analyzed by using survey questionnaire. The results of the analysis revealed that the contribution of public services to the innovation of KIS suppliers was indirect and done mainly through education and public R&D activities. Direct input, such as public software service, was not utilized as much in service suppliers. The major reason is that public KISs may not be relevant to their actual needs. The results of analyses on user firms of KISs revealed that they could function as a launch pad for user firms' diversification into other knowledge intensive service sectors. KISs become integrated to or loosely coupled with manufacturing firms. User firms have implemented both tighter integration of familiar KISs and loosely coupled collaboration of unfamiliar KISs. According to our survey, large user firms that have internal capability to build a service division are also active in using external KISs. It was confirmed that the contribution of KISs to the innovation capability of user firms is significant. The user firms that utilized KISs intensively proved to be more innovative than those did not. Heavy KISs users also entertained benefits of capability enhancement as they improved monitoring and achieved efficient application of knowledge asset into product and process innovation.

WE-01.3 [R] Enhancing the Effectiveness of eCommerce in East Asia: A Cultural Perspective

Jeffrey Hsu; Fairleigh Dickinson University, United States

The potential for the Internet and E-Commerce in China and Chinese-speaking nations (including Hong Kong, Taiwan and Singapore) is huge. Many experts believe that China will have the second largest population of web surfers, after the US, by the year 2005, and currently, the Internet population in China is doubling every six months [6]. There are many issues relating to the cultural aspects of Chinese culture and society which can impact the design and content of web sites which are directed towards Chinese audiences. Some of these issues include the basic differences between Chinese and American/Western cultures, family and collective orientations, religion and faith, color, symbolism, ordering and risk/uncertainty. Attention is given to the differences between the cultures of China, Hong Kong, Taiwan, and Singapore, as well as addressing issues brought up by related theories and frameworks. A discussion of important considerations which relate to using Chinese language on the World Wide Web (WWW) is also included. Finally, insights are gained by examining web sites produced in China and Chinese-speaking countries. This paper will focus on many of these issues and provide practical guidelines and advice for those who want to reach out to Chinese audiences, whether for e-commerce, education, or other needs.

WE-02 Project/Program Management-6

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Pavilion West

Chair: Peter Flynn; University of Alberta

WE-02.1 [R] Introduction of Web-based Collaborative Project Management in Alaska

Thomas F Krause; University of Alaska at Fairbanks, United States
Robert A Perkins; University of Alaska at Fairbanks, United States

In 2002 we reviewed the state of the art of electronic collaborative project management nationwide and investigated via survey its then-current use in construction project management. We noted that it was not in use in Alaska, at all. We concluded that it was applicable

SESSIONS

but it would take a large project or two for it to become accepted. Concurrently a large (\$179 million) construction project, the Bassett Army Community Hospital at Fort Wainwright (Fairbanks), started, and the contractor introduced the use of collaborative project management software for the construction phase. We now report on the implementation of this management method in a new environment and the reactions of the users, and we compare these results with our earlier nationwide survey. We found the system is working successfully, but there are gaps — not all entities use the system fully and effectively, and some are reluctant to give up the conventional paper based system. This results in doubling efforts and requires other entities to reprocess the data, thus impacting overall efficiency. We make some suggestions for improvement on future projects.

WE-02.2 [A] New Project Management System at ABC Company

*Sarka Dluhosova; Portland State University, United States
Bob Black; Welch Allyn Protocol, United States*

The Customer Care department of ABC company simultaneously runs many projects of implementing patient monitoring systems in health care organizations. As a result of very little process in place, sudden change in technology and other aspects, they were facing several critical issues such as insufficient customer focus, communication issues within their teams, long project life cycle, confusion about customer requirements and significant number of errors. They specified several goals to achieve more efficient and customer oriented results. The presentation concentrates on one part of the solution, which is a design and implementation of a new project management system. The main objective is to describe the PM system design, its basics, phases, milestones and template documentation used. It explains the steps of the PM system implementation and considerable results, which have been achieved since then. It also outlines the next steps, which the Customer Care department plans to take. It concludes with lessons learned during the whole process. Keywords: Project management system, system phases, milestones, sign-offs, managerial deliverables, technical deliverables, templates, customer focus

WE-02.3 [A] Project Management of Development, Production and Delivery of Trams for the City of Portland

*Zdenek Vostracky; the University of West Bohemia, Czech Republic
Michal Korecky; SKODA HOLDING a.s., Czech Republic
Jan Cerny; University of West Bohemia, Czech Republic*

The building of a tram system in Portland, the historical US comeback to this means of transport, got together companies and organizations both from the United States and Europe. Beside the others let us mention the city of Portland — the investor, engineering company LTK, INEKON Group — the seller and SKODA DOPRAVNI TECHNIKA s.r.o. (SKODA TRANSPORT SYSTEMS Ltd.) — the producer. Use of project management for planning and realization of the project was one of the logical requests of the investor before signing the contract. SKODA already had some experience with project management because they used a method of parallel directing of development programmes for diversification of their product portfolio in the middle of the 90's, when the Eastern market had collapsed. Specialists from the University of West Bohemia helped SKODA to start using project management. For the project, "trams — PORTLAND," SKODA used the matrix organization structure and created a team organized both in line (functional) and project structure. At the beginning of the creation of the planning documents it was obvious that it would be very difficult to fulfill the deadlines, define important milestones, and plan fixed costs considering the complexity of relationships between all subjects involved in the project. It was necessary to utilize all possibilities of actualization of the Gantt's diagrams of the project. There were quite a lot of conflicts typical for matrix organizing. It was difficult to fulfill single stages and organize optimal ways of progress cooperating with all supervising organizations (the seller, consulting firm and investor). Thanks to well-prepared project management documents, it was also possible to control the cash flow from the financing bank. The result was the delivery of the SKODA INEKON trams to the United States, where they serve the citizens of the city of Portland.

WE-03 New Product Development-5

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Broadway-1

Chair: William T Flannery; University of Texas — San Antonio

WE-03.1 [R] Schedule Delays in New Product Development: A Life-Cycle Perspective

*Kevin P Grant; University of Texas — San Antonio, United States
William M Cashman; United States Air Force, United States
Ayman A Omar; University of Texas — San Antonio, United States*

Successful technology management in the contemporary business environment requires the ability to rapidly translate new ideas into viable commercial products that serve the needs of the market place. Delays experienced during the development of new products only impede the rate of progress that is so critical to the success of the technology-intensive firm. This study identifies the most common causes of schedule delays based on a detailed examination of 451 delays experienced in 22 major weapon system development programs. This study employs a life cycle framework to examine delays associated with the stages of the new product development process. Technical difficulties experienced in the performance of key stage activities were the most often cited category of delays. Changes to the design were also a frequently reported cause of delay. Finally, late delivery of critical inputs such as technical data and information, as well as parts, material, equipment and tooling are also prominent reasons for delay. This study concludes with actions that technology managers can take to reduce the incidence of delay as they strive to reshape the world through the introduction of new technologies and products.

WE-03.2 [R] Flexibility, Stability and Profitability: Exploring the Effects of Using Leased Employees in a Manufacturing Environment

*William T Holland; Sony Electronics, United States
William T Flannery; University of Texas — San Antonio, United States*

The ever-increasing use of leased employees, particularly in the manufacturing environment, has created a new set of rules which govern the employee-employer relationship. Employees are faced with a job status that allows them much greater freedom of movement while, at the same time, exposes them to the possibility of unexplained unemployment on very short notice. Employers have the benefit of reduced administrative responsibilities but must deal with situations over which they have less supervisory control. In this study, personal interviews provided information on the various elements of leased employment from several viewpoints: the leased employee, regular employees, management, and human resources. The knowledge gained from the literature review and interview results, when evaluated together, suggest a condition that has significant positive potential for both labor and management, but also points to several areas that must be addressed and reconciled before the employer and employee can experience the full benefit of the arrangement.

WE-03.3 [R] Determinants of Cross-Functional Integration and Speed-To-Market in New Product Development Teams

*Patricia J Holahan; Stevens Institute of Technology, United States
Gary S Lynn; Stevens Institute of Technology, United States
Ali E Akgün; Gebze Institute of Technology, Turkey*

This paper tests a theoretical model of the determinants of cross-functional integration and cross functional project team performance (speed-to-market) in a sample of 156 new product development teams. Cross-functional integration is hypothesized to mediate the relationship between several team and organization level variables and speed-to-market. Technological uncertainty is hypothesized to moderate the effect of cross-function integration on speed-to-market. Support is found for team structure, team process, and management support as determinants of cross-functional integration. Cross-functional integration, team composition and technological uncertainty are found to have direct effects on speed-to-market.

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

WE-04 Knowledge Management-3**Wednesday, 7/23, 3:30 PM – 5:00 PM****Room: Broadway-2****Chair: David W Moore; Colorado School of Mines**

WE-04.1 [A] A Case Study: Assessment of Knowledge Management Practices in a Company*Melda Polat; Arcelik A.S., Turkey**Sertac Koksaldi; Arcelik A.S., Turkey**Iffet Iyigun; Arcelik A.S., Turkey*

Knowledge Management is one of the critical issues in recent years for many organizations. The related literature and real life practices are being discussed in different platforms widely. Knowledge Management comprises hard elements like databases, infrastructure, workflow management, document management systems and soft elements like cultural and behavioural aspects. A successful application of Knowledge Management in a company should handle both elements and their interactions. In order to provide this, the company should assess the Knowledge Management practices. In this study, development and implementation of an assessment model for Knowledge Management maturity level in Arcelik is discussed. Improvement areas in Knowledge Management practices are identified.

WE-04.2 [R] Organizational Learning as Catalyst to Technological Innovation*Azim Ozturk; Cukurova University, Turkey**Jongbae Kim; Silla University, Korea, South**David Wilemon; Syracuse University, United States*

With rapid change and intensive competition in the emerging global economy, an organization's capability to develop, capture, absorb, transfer, and use new knowledge is a key success factor. Through effective learning, companies are more likely to develop the speed, innovation, quality, and customer responsiveness essential to meet the growing expectations of customers and the threats of competitors. We first examine the strategic role of technological innovation and then address the importance of organizational learning in creating and managing technology-based innovation. We then identify several factors which can influence the rate and effectiveness of organizational learning. Finally, we advance several managerial implications and propositions for future research.

WE-04.3 [R] Entrepreneurial Innovations by Managing the Knowledge: Cases from Formal and Informal Sectors*Kavita Mehra; NISTADS, India*

The paper focuses on three issues: a) innovations are knowledge based resulting from the synthesis and application of the tacit and the coded knowledge; b) the role of entrepreneur (as knowledge manager) is important for exploiting the tacit knowledge and making use of the coded knowledge; and c) for the diffusion of innovations, variety of actors (as individuals or institutions) participate, which leads to the formation of innovation networks. An attempt has been made to elaborate upon the above issues through two case studies from diverse sectors — formal and informal. One case study is related to the diffusion of new technology (plant biotechnology) at the field level. The process from technological innovation to diffusion level involved interaction amongst public and private institutions. The change was mainly based on the coded knowledge (the adoption of new technology) and in the process of change, the tacit knowledge played substantial role (in how to make use of the new technology) in accomplishing the technical change. In the second case of informal sector (the adoption of floriculture by traditional crop growing farmers), entrepreneurs' tacit knowledge initiated the change process. Tacit knowledge was used to fulfill customers needs and thus was used to capture the market. The new knowledge was created by combining the tacit one with the explicit and then applied meaningfully by the entrepreneurs so as to reap the economic benefits. The participation of different institutions in the later case was not so much differentiated and direct as it was in the first case. The role of the government, influenced by the circumstances, for the sustenance of the technical change was apparent.

WE-05 Entrepreneurship/Intrapreneurship-4**Wednesday, 7/23, 3:30 PM – 5:00 PM****Room: Broadway-3****Chair: Josee M Loudiadis; Carleton University**

WE-05.1 [R] New Ventures in New Technology-Based Industries: An Industry Evolution Approach*Elizabeth W Garnsey; University of Cambridge, United Kingdom**Tim Minshall; University of Cambridge, United Kingdom*

Industry level and firm level studies have traditionally been assigned to different categories of academic study. However entrepreneurs and managers have to handle concurrent pressures of growth and change within their business and in the wider industry. This report presents initial findings from research on the development of new ventures and business units seeking to enter new industry sectors characterised by fast evolving technologies. The growth of the firm itself as it matures, the technology that underpins the service or product offering of the firm, and the industry within which the firm operates are evolving concurrently. This paper focuses specifically on the last of these evolutionary processes, reviewing and synthesising the literature. The case study industries selected are the formative years of the handheld computer, industrial inkjet printing and geographic information system industries. The analysis of these cases is then used to present an initial comparison of the advantage and disadvantages of being an early entrant into a new industry. These initial findings then feed into the wider discussion of the ways in which consideration of the evolutionary processes affecting the firm, technology and industry can be linked to provide lessons for practitioners by drawing insight from common patterns and experiences.

WE-05.2 [A] Technology Management in the Network Age: A Report from the Field Based on a Cross-Regional Comparison of Technology-Intensive Entrepreneurial Firms*George Tovstiga; Arthur D. Little, Switzerland**Len Korot; Institute for Global Management, United States**Leo-Paul Dana; University of Canterbury, New Zealand*

Essential to the creation and development of innovative, high-technology, knowledge-driven organizations is a tight symbiosis between regional culture and infrastructure. Although this symbiosis is often recognized anecdotally, there is virtually no systematic research testing whether regional cultures are a driving factor in the creation of successful technology ventures. In this paper, the authors compare four geographic regions using a diagnostic research tool specifically developed for profiling knowledge management practices in high-technology firms. As an outcome of their previous research, the authors have been able to identify those key practices that distinguish firms that we characterize as "leading-edge." In an analysis of high-technology centers around the globe, WIRED magazine rated 46 regions from 1 (low) to 4 (high) on each of four factors (Hillner, 2000): (1) the ability of area universities and research facilities to develop new technologies and to provide skilled knowledge professionals (2) the presence of established companies and multinationals to provide expertise and economic stability (3) the population's entrepreneurial drive to start new ventures and (4) the availability of venture capital to ensure that ideas make it to market. Of the four regions included in this study, two — Silicon Valley and Israel — were rated highest on the four factors. Two regions, Singapore and the Netherlands, are rated lower. Therefore, if regional infrastructure and culture are key drivers for high technology innovation, we hypothesized that the highest performing organizations, as based on the results of the survey of knowledge management practices, will be found in the Silicon Valley and in Israel, with lower performing organizations found in the Netherlands and Singapore. No significant differences were found between Silicon Valley/Israel vs. Singapore/the Netherlands. However, key practices that were found to be common to leading-edge firms in all regions included: (1) a propensity for experimentation; (2) collective sharing of knowledge, and (3) collective decision-making. Overall, this paper (a) describes the research in terms of a cross-cultural comparison of the four regions, (b) derives key determinants of competitiveness, (c) profiles regional characteristics which enhance innovation and entrepreneurship and (d) closes with a discussion on the implications of the research outcomes for entrepreneurial firms seeking to build a global presence.

SESSIONS

WE-05.3 [R] Technology Management in Chinese Township and Village Enterprises: A Case-Study Approach

Gloria L Ge; Griffith University, Australia

Daniel Z Ding; City University of Hong Kong, Hong Kong

Malcolm Warner; University of Cambridge, United Kingdom

This study examines technology management in China's non-state sector: township and village enterprises (TVEs). TVEs in China have played an increasingly important role in the Chinese economy, employing over 120 million workers and contributing about one third of China's GDP. Based on in-depth case-studies of twenty selected TVEs located in Southern China, this paper explores technology management issues in TVEs, including the acquisition of technology, technology transfer and diffusion, innovation and new technology development, strategic technology alliances, and the recruitment, training, reward and retention of technical personnel. The results of our investigation reveal that proper management of technology has a strong impact on the success of TVEs.

WE-06 Historical Perspectives-1

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Broadway-4

Chair: Joseph Cox; Oregon University System

WE-06.1 [R] The Start-Up as Illustration of Nietzsche's "Will to Power"

Loïck Roche; Groupe ESC Grenoble, France

John Sadowsky; Groupe ESC Grenoble, France

A fundamental question for Nietzsche: what he considers to be the Will to Power. For Nietzsche, the Will to Power is life itself. For example, in the notes published after his death: "Life is not the adjustment of internal conditions to external ones, but it is the Will to Power which, internally, yields to external factors and integrates them." (Wotling, 1998, 9-20). Life for Nietzsche is endless and fertile. Therefore everything that sustains life is good, is moral, even "religious." Where there is life, there is desire and therefore there are opposing forces. Life is the desire to develop and create, precisely because nothing can live or survive without desire. "Where I found life, I also found the Will to Power. Not wanting to be alive but wanting the Will to Power" (Müller-Lauter, 1998, 38). All forms of life come back to a basic tendency that is the Will to Power. Nietzsche sees examples of the Will to Power everywhere. "Man doesn't seek to preserve himself but to surpass himself." The Will to Power, according to Schopenhauer, is conservation; it is therefore permanent and thus applies to "ordinary" companies. Nietzsche on the contrary argues that the Will to Power represents greater achievement — this is the philosophy for a start-up.

WE-06.2 [R] Recoupling our Millennial Society with Quantum Science & Technology

Jerome H Selman; q-ERA, Inc., United States

Victor N Selman; The American University, United States

Physicists argue that the 19th Century was known for the development of machines, the 20th Century for the Information technologies, the 21st Century would be characterized by quantum technologies. Like Quantum Logic or Quantum Physics or Quantum Games, quantum thinking is an insightful, body/mind/spirit approach, attempting to connect our classical world-where objects or things have definite identities-with our new quantum world-where things take on multiple realities simultaneously. The concept of mind, limiting our perceptual abilities is no longer confined to the brain or even the body—all organs are, in some ways, thinking organs, permitting restructuring of our cognitive cultural commitment toward infinite choice and diversity. Quantum thinking changes all our current paradigms—exploding all our artificial limits of big and little. On the quantum level matter can be transported a la Star Trek's Transporter on the original Enterprise. "Beam me up, Scotty —There's no intelligent life on this stellar body!" The phenomenon of "entanglement" allows particles to be in two places at the same time. Quantum Mechanics allows the electron to be placed in a "superposition" of the two states, in which the two states both exist and are, in a sense, sort of stacked up upon one another. Until the particle is disturbed by an outside agent—a quantum tweak—there is equal probability that it is in either state, and thus, it is considered to be in both states.

WE-06.3 [R] Raising Social Capital by Adopting QS9000: A Case of a Korean Company

Suck-Chul Yoon; Seoul National University, Korea, South

This paper will show that manufacturing (or construction) companies can raise the quality of their engineering products by adopting the recording culture of Joseon Dynasty that existed in Korean Peninsula from 1392 through 1910. The term recording culture as used in this paper refers to the practice of recording all the major decision-making processes in the organization. Throughout the Joseon Dynasty two scribes were always present where the king and his ministers were discussing the matters of the state, one recording their words, the other their actions. The complete annals of the reign of all the kings of the Dynasty is referred to as Sillok, and the Sillok was added to UNESCO's World Heritage List in 1997. The objective of this paper is to develop a how-to-do model to update the recording culture of Joseon Dynasty to fit the needs of today's manufacturing companies and analyze a case to that effect. The case will show how Korea Electric Power Corporation (KEPCO) developed their unique recording culture to successfully construct Korea Standard Nuclear Power Plant. This paper concludes that if we introduce a proper system of recording culture to a manufacturing company, its technological capabilities along with its product quality would be increased.

WE-06.4 [R] A Perspective on Management of Technology in Japan

Hiroyuki Yamasaki; Mitsubishi Electric Corporation, Japan

Ikuo Yamada; Mitsubishi Research Institute, Japan

Jun'ichi Baba; Mitsubishi Electric Corporation, Japan

Based upon an analysis of Japan's defeat in World War II, it is believed that Japan lacks effective management of technology (MOT), and that in order to strengthen itself in this area the country must "establish MOT policies," "research MOT theory and practical uses" and "fully educate concerned parties on MOT." It is especially important for Japan's industrial sectors to understand the basic policies of "open MOT." Towards this end, in this paper the authors introduce the latest activities in Japan, and discuss the importance of metaphysical knowledge as being near essence of MOT.

WE-07 Collaborations in Technology Management-3

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Forum Suite

Chair: Thorsten T Teichert; Institute for Innovation Management

WE-07.1 [R] Reshaping Our World Through Virtual Collaboration

Grace M Bochenek; U.S. Army, United States

Kenneth J Ciarelli; U.S. Army, United States

James M Ragusa; University of Central Florida, United States

To shrink the protracted length of total system and product development life cycles (DLCs), public and private sector organizations and their cross-functional Integrated Product Teams (IPTs) have moved away from serial to concurrent collaboration to reshape organizational and stakeholder worlds. More recently, some organizations are now using real-time, on-demand, 3D life size fully- and semi-immersive virtual collaborative environments (VCEs) for DLC applications. To transform the U.S. military to meet future needs, the U.S. Department of Defense (DoD) and the U.S. Army have implemented visionary, strategic, and technology-enabling initiatives called Simulation Based Acquisition (SBA) and Simulation and Modeling for Acquisition, Requirements and Training (SMART), respectively. Transformation-enabling technologies making SBA and SMART realities are: modeling and simulation (M&S), virtual reality (VR), and advanced collaborative environments (ACEs). Results have included the significant reduction in the use of traditional hardware prototypes and demonstration models, DLC times, and program costs. This case study focuses on the theories and foundations that led to the development of an ACE "toolset," empirical testing and results, and the identification of advantages and applications of its use by operational collaborative IPTs. In spite of the success of this early ACE development, additional research and operational issues, empirical testing, and economic analysis remains.

SESSIONS

WE-07.2 [R] Developing a Distributed Knowledge Model for Knowledge Management in Collaborative Development and Implementation of an Enterprise System

Yuh-Min Chen; National Cheng Kung University, Taiwan

Ching-Bin Wang; Nan-Hua University, Taiwan

Yuh-Jen Chen; National Cheng Kung University, Taiwan

Recently, enterprise systems have been extensively adopted to boost enterprise competitiveness. The development and implementation of enterprise systems is a knowledge intensive procedure, being related to enterprise processes and involving information, system and software engineering technologies. Consequently, knowledge management is required to enhance the effectiveness of enterprise system development and implementation, thus helping to increase industrial competitiveness. This study aims to develop a distributed knowledge model for knowledge management, capable of supporting the collaborative development and implementation of enterprise systems. This objective can be obtained by performing the following tasks: (1) modeling and characterization of the collaborative development and implementation process, (2) identification, analysis and modeling of involved knowledge, and (3) development of a distributed knowledge model for knowledge management related to the collaborative development and implementation of enterprise systems.

WE-07.3 [R] The Process of Collaborative Innovation: A Guide to Successful Projects

Christian Marxt; Swiss Federal Institute of Technology Zurich, Switzerland

The capability to innovate is considered as the most critical success factor for business performance both for big and small companies. Increasing technological complexity and specialization on the one hand meet with decreasing budgets for R&D and the high pressure of a fast and successful market entrance on the other hand. Collaborative ventures can be an adequate answer to this challenge. Various (core) competencies and different knowledge of markets and technologies can be combined thereby developing new successful and innovative products. This paper presents results of a project on "Collaborative Innovation," which was conducted with several academic and industrial partners in Switzerland.

WE-08 Technology Management Education-4

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Council Suite

Chair: Diane Ferington; Energy Trust of Oregon

WE-08.1 [R] Development of an e-Learning System for Product Development

Masatake Saito; Aoyama Gakuin University, Japan

Masashige Tsuji; Aoyama Gakuin University, Japan

The aim of this paper is to develop an E-learning system for product development as a part of the MOT programs at universities. To complete the E-learning system there are 4 things to achieve in this study: (1) To build an educational program where learners study the strategies, managements, methodologies and operations for product development. (2) To produce a sample solution for product planning on each market position in order to be explained by educators. (3) To develop a Web-based system including decision support tools for product development. (4) To discuss the effectiveness of the educational program and the usability of this system for learners. The target process for this educational program is based on the former processes of product development, which are significant but also difficult to decide. Concretely, the market analysis, product concept design, product specification design, cost analysis and design review are the target for our education. The program consists of 9 steps to learn through experience in order to develop a new PC (Personal Computer). The system is developed to be an active, practical and collaborative study for learners. Through demonstrations by students and professors, a developed system is available. The Web-based E-learning system that has been developed is a great stride taken in the expansion of product development education in future.

Note: [R] = Research paper; [A] = Industry Application

WE-08.2 [A] Project Management Education Online Using a Structured and Layered Approach

William Leban; DeVry University, United States

In today's transient and technology-based environment, students now have another learning option for project management education. Advances in technology and use of the Internet now provide an alternative for learning project management concepts. Instructional design techniques and course assignments are used to provide a structured and layered approach to covering course subject areas. A unique combination of online activities and off-line study, allowing the student to address subject areas from a number of perspectives, are discussed. The role and responsibilities of the student and faculty are also addressed. Finally, the paper provides comments from students and the author's perspective on the future of online education.

WE-08.3 [A] The Studio Classroom Model: Rethinking Management of Technology Education in the Connected Era

John A Bers; Vanderbilt University, United States

If you were given the assignment to forget everything you ever learned about how to teach management of technology and to build a new MOT course around all the tools and resources of the connected era, what would it look like? This application paper describes the philosophy, development, and implementation of a pilot introductory course in MOT that overturns most assumptions about how MOT education is delivered. At the core is the studio classroom model, which puts students in charge of their learning and places the instructor in the role of mentor and facilitator. Benefits include a learning experience that more closely approximates the real world, an opportunity for students to learn from a far wider range of resources than lectures and assigned readings, and the development of a closer, more collaborative relationship between instructor and students.

WE-09 Competitiveness in Technology Management-2

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Directors Suite

Chair: Al Herman; Quantric Corporation

WE-09.1 [R] The Impact of Acquisitions on Technology Based Competitive Advantage: Don't Underestimate It — Manage It!

Valerie Bannert; Swiss Federal Institute of Technology, ETH Zurich, Switzerland

Hugo Tschirky; Swiss Federal Institute of Technology, ETH Zurich, Switzerland

Several scholars have proven that in technology intensive industries competitive advantage is based on technological capabilities and management's ability to reconfigure them according to fast changes within these industries. This technology-based competitive advantage has not been considered sufficiently during acquisition management in the past, which has led to disastrous results. This paper describes the technology-based synergies and risks associated with an acquisition and proposes a conceptual framework to achieve technology-based synergy realization and thus acquisition success in technology intensive acquisitions.

WE-09.2 [R] The Emergence and Competitiveness of VIA Technologies Taiwan

Gin-Yuan Lee; National Chiao Tung University, Taiwan

Min-Jen Tsai; National Chiao-Tung University, Taiwan

Jung-Jung Chang; National Chiao-Tung University, Taiwan

Intel is the pioneer and dominant provider of PCs' microprocessors with AMD as the only significant follower. However, VIA Technologies, Inc., a relatively young semiconductor design house in Taiwan, should have the courage to challenge the unshakeable position of the CPU giant, Intel. The purpose of this paper is to explain and analyze the key factors of why VIA can become a serious player in the PC chipset microprocessor market. This paper highlights the major characteristics of VIA, including its emergence, its R&D, its market strategy, its intellectual property litigations with Intel, its major decisions in business direction changes, and, above all, its competitive strengths. The clustering effect of strong PC industry and IC foundry industry in Taiwan provides an important supporting foundation to the growth of VIA.

SESSIONS

WE-09.3 [R] Analysis of the Competition Dynamics in the Infrared Mobile Payment Market in Korea

Jung Ji Bum; ETRI, Korea, South

Yeo Jaehyun; ETRI, Korea, South

Kim Hanjoo; ETRI, Korea, South

Recently a payment settlement service using a mobile phone based on infrared communications has been at the center of attention and major parties have been in conflict wrangling over the market share. Not only mobile service providers but also the cooperation of the banking industry and solution providers is necessary for the introduction of the new technology. Against this paper analyzes a competition dynamics of mobile service providers and the domestic market environment to facilitate the mobile payment service using infrared capabilities.

WE-10 Technology Commercialization-2

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Studio Suite

Chair: John P Dismukes; The University of Toledo

WE-10.1 [R] Value Costing: The Development of a Post-Manufacturing Product Cost Analysis Model

Shibiao Chen; Euclid-Hitachi Technical Center, United States

L. Kenneth Keys; Cleveland State University, United States

Among the five essential factors about a product — function, cost, quality, reliability, and maintainability — the total product life cycle cost has its unique importance for both manufacturers and customers, and it can be deployed as an integrated standard for measuring the improvement of the other four factors. However, the different stake holder's utilization cost views/ scopes can lead to quite different expectations and conclusions of product performance. The difference in this point-of-cost view may cause numerous problems between manufacturers and customers and eventually be harmful for the manufacturers. Starting from the conventional manufacturers' cost view, this paper first presents the necessity and the importance of expanding the manufacturers cost scope to the post-manufacturing customer stage of their products. Then based on the philosophy of the system life cycle cost, this paper distinguishes the cost responsibilities between manufactures and consumers during the different stages of a product's life. Finally, this paper establishes a general Post-Manufacturing Product Cost (PMPC) analysis model and expresses it in a corresponding general mathematics model. This paper reinforces the philosophy of the system life cycle cost by focusing on analyzing the total product cost for customers. The PMPC model provides the more accurate utilization cost view for both manufacturers and consumers. Hence, a major emphasis of PMPC model is placed on the strategy of manufacturers' cost management and the strategy of consumers' purchasing management as related to their intention of the product utilization pattern. This general cost model can be applied to a large number of product areas and was developed as part of Euclid-Hitachi competitiveness improvement process. FootNote: The research presented in this paper is drawn from the 2002 doctoral thesis of Dr. Shibiao Chen, completed as part of the requirement for his doctoral degree in the Fenn College of Engineering at Cleveland State University, and was supported by Euclid-Hitachi Heavy Equipment, Ltd., Cleveland, Ohio.

WE-10.2 [R] Stage-Gate Modeling and Metrics for Software Commercialization

Yogesh C Shiralkar; The University of Toledo, United States

Lawrence K Miller; The University of Toledo, United States

John P Dismukes; The University of Toledo, United States

Rahul Mittal; The University of Toledo, United States

Samuel H Huang; The University of Cincinnati, United States

George C Daley; Effective Metrix, Inc., United States

The software industry suffers from almost unmanageable complexity both in the products it produces and in the process of engineering and commercialization. Almost all of the currently developed life cycle software engineering models are inflexible and monolithic. During commercial software development, customer requirements change over time, and existing software life cycle models are not flexible enough to handle these changes. This

lack of a reliable modeling capability for prediction and analysis continues to plague new software development and commercialization projects. The goal of this research is to develop and demonstrate a flexible Stage-Gate style framework to support the software life cycle and to allow quantitative modeling and estimation of the costs and time of software development and commercialization. In the 1960's, large-scale system development projects (e.g. NASA) faced very similar problems because of their structure and management as phased engineering developments. The introduction and full deployment over the last 30 years of concurrent engineering and innovation management techniques, such as the Stage-Gate System, has contributed order, reduced the cycle time, and improved the success rate of development and commercialization of process, product and service innovations. The software industry is very young, its pace of change is rapid, and every piece of end-user software goes through different phases of development and testing. However, at the core, software development is similar to tangible product development, because it basically involves individual blocks of code, which have been put together or assembled to form one major block. Hence, clearly the experience and results of managing other system innovations can be related to software. An extensive literature search showed that existing software engineering techniques are compatible with a comprehensive stage-gate system approach, but did not reveal research studies in this area. In this paper we propose and develop a methodology whereby software engineering can benefit from and be accelerated in its development by adapting a stage-gate framework to model the software development and commercialization life cycle. The framework of this new approach is flexible enough to incorporate the benefits of conventional software engineering models, and it further facilitates the application of mathematical models for quantitative estimation and tracking of time and costs of an iterative software development and commercialization process. The feasibility of the framework and mathematical model are demonstrated by an initial case study of its application to the web-based MERITM software productivity tool commercialized by Effective Metrix, Inc. based on research conducted at The University of Toledo.

WE-10.3 [R] Commercialization of MEMS Technologies: What Seems to Work?

Bruce A Kirchoff; New Jersey Institute of Technology, United States

Scott L Newbert; Rutgers University, United States

Steve T Walsh; University of New Mexico, United States

Commercialization is the successful marketing of innovative products. We are interested in knowing how firms in the MEMS industry carry out this commercialization and whether their technology affects their marketing strategies. To gather information on this, we surveyed top managers of all firms attending the COMS 2001 conference in Santa Fe, New Mexico. We asked these managers to describe their first product's technology focus and market strategies. Of the 104 who received questionnaires, 74 provided complete and usable responses. This paper presents the results of that survey. We find that these managers report that technology does affect choice of marketing strategy. Large firms tend to develop technologies that evolve from their technological competences developed over a period of time. Furthermore, they tend to sell these MEMS products to their existing customers as replacements substitutes for their current products. Small firms tend to prefer new technologies for their first product more so than large firms. However, smaller firms market strategies are evenly split between offering replacement or substitute products for customers and initiating totally new products unknown in the targeted industry. Theory suggests that these findings are correct. Large firms will use their technological competencies to develop new products and sell these to existing customers. Small firms typically are entrepreneurial startups and have no existing customers. Their new technology is based upon recent R&D. But, they often launch their first product as a replacement or substitute for existing products currently in use by potential customers. This market strategy produces more revenue in a shorter period of time so as to supply operating capital on which the firm can survive. The managers also reported the time required to move from research to first sale of a product. Smaller firms required about one half the time than that required by large firms. Perhaps timing is the principal advantage that smaller firms have over large firms in the market for new products.

SESSIONS

WE-11 Technology Planning and Forecasting-2

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Executive Suite

Chair: Charles M Weber; Portland State University

WE-11.1 [A] A Pilot Foresight Study in Turkey on the Use of Advanced Materials in Automotive Industry

Ünal Elbeyli; Bogazici University, Turkey

Atilla M Öner; Yeditepe University, Turkey

The need for advanced materials in automotive industry as replacement for conventional materials is identified. Advanced materials foresight activities in other countries, their outcomes and implications in industry together with policy suggestions stated by governments and research centers are assessed. A foresight of critical sub-sectors in advanced materials is defined for Turkey to allocate her resources for future development in the technological advancement route. The Delphi questionnaire constitutes the means to conduct foresight and reach experts in industry, universities and other research organizations to define the sectors and corresponding sub-topics in advanced materials technologies that are critical for Turkey. Group-wide and individual electronic mail options are used. Results of the Turkish foresight on advanced materials were then compared to those of the UK foresight study for eleven topic statements common in both studies.

WE-11.3 [R] The Real Business Cycle Theory, Innovations, and Technology Management

Ayse Y Evrensel; Portland State University, United States

This paper provides a discussion regarding the treatment of innovations in Economics. Even though economists such as Marx and Schumpeter emphasized the importance of innovations, the Real Business Cycle (RBC) theory in which technology plays an important role was formally established in the early 1980s. The RBC theory explains the short-run fluctuations in a country's output based on the shocks to the production function. Among other things, this theory has been criticized for its weak connection between innovations and the downturns in the economy. Although the RBC theory has not yet addressed this issue, some firm-level empirical research has provided insights into the adoption process of new technologies, which may provide clues as to how innovations affect short-run fluctuations in national output. The paper shows that the way in which innovations are considered in Economics is not very different than their consideration in Technology Management. While the technology manager decides about the time and the extent of the use of a particular technology, the economist may be observing his decisions and deducing clues regarding the economy's output.

WE-12 Strategic Management of Technology-1

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Senate Suite

Chair: Phillip T Meade; Xodus Business & Technology Solutions, Inc.

WE-12.1 [A] Measuring Impact of Investments: University Investments as Part of a Technology Company's Growth Strategy

Deborah Stokes; Nortel Networks, United States

Jay Byrne; Sprint, TP&I, United States

As technology companies must grow to create value for shareholders, customers and employees, corporate investments in external research with universities must demonstrate growth initiatives in the H3-H2 (Baghai, Coley and White, 2000; Balleit, 2002) space — transforming results obtained on one horizon (long term) into a new initiative in a horizon with a shorter time to payoff (mid term). This paper will address the evolution of a strategic investment program into a “venture capital operational mode,” and how it was reshaped to meet corporate and customer requirements for sustaining impacts of investments. Three areas will be documented: (1) Active customer engagement in external research investments with specific case model example (2) “Community of Interest” across range of internal and external partners as a method for ensuring Iol, and (3) Metrics to capture “impact of investment,” not just “return on investment” as benefits to this evolutionary approach.

Note: [R] = Research paper; [A] = Industry Application

Additional areas for future evaluation will be explored: tracking projects transformed from seeding options into “new” business opportunities as part of “core” business units, and Intellectual Property Rights issues and challenges.

WE-12.2 [R] Development of a Framework for Managing the Technology Adoption Life Cycle Using Chaos and Complexity Theories

Phillip T Meade; Xodus Business & Technology Solutions, Inc., United States

Luis C Rabelo; University of Central Florida, United States

Unlike more stable industries, high-tech firms must constantly be in a strategy development phase. These companies are in desperate need of assistance in strategy formulation. Chaos and Complexity theories can provide a powerful approach to support the development of business strategies to deal with these fast-moving environments. This paper analyzes the different schemes provided by Chaos and Complexity theories and their possible applications to study cycles of products, processes, and organizational innovations in the high-tech industries. This analysis includes the definitions and previous work accomplished in similar areas. In addition, a case study is selected (the disk drive industry) and preliminary work using attractors, phase diagrams and neural networks is discussed.

WE-12.3 [A] Strategic Positioning of Taiwan in the Global Biotechnology Value Chain

Yu-Shan Su; International Business/ National Taiwan University, Taiwan

The biotechnology industry has emerged rapidly in recent years, especially after the completion of the human genome project. In the post-genome era, much more innovations and applications have been created in the biotechnology industry than any other industries. The USA has not only led this industry, but also built extensive collaborative networks to profit from such innovation. We would like to discuss the strategic positioning of Taiwan in the global biotechnology value chain. Biotechnology firms in Taiwan could be categorized into peripheral and core industries, respectively. The peripheral part of the industry includes the firms stemming from the diagnosis reagents and medical devices. They found niche points to enter this new industry and generated profitable returns. The core part of the industry referred to the firms with the capabilities of developing new drugs. These start-up companies will be important global partners and Asian hub in the global biotechnology value chain.

WE-13 Software Process Management-2

Wednesday, 7/23, 3:30 PM – 5:00 PM

Room: Cabinet Suite

Chair: Brent A Capps; Oregon Master of Software Engineering Program

WE-13.1 [R] An Exploratory Study of Software Review in Practice

Zoe Y Wong; University of Technology, Sydney, Australia

The aim of this paper is to identify the key software review inputs that significantly affect review performance in practice. Five in-depth semi-structured interviews were conducted with different I.T. organizations. From the interviews' results, the typical issues for conducting software review include (1) selecting the right reviewers to perform a defect detection task, (2) the limitation of time and resources for organizing and conducting software review (3) no standards and specific guidelines to measure an effective review for different types of software artefacts (i.e. requirement, design, code and test cases). Thus the results show that the experience (i.e. knowledge and skills) of reviewers is the most significant input influencing software review performance.

WE-13.2 [R] Comparing Software Development Processes Using Information Theory

Tony J Balleit; Carleton University, Canada

Jingdong Liu; Lead to Win, Canada

Information theory is used to identify the criteria for comparing software development processes. We then use the criteria identified to make assertions about the Capability Maturity Model (CMM) developed by the Software Engineering Institute at Carnegie Mellon University vis-à-vis the eXtreme Programming (XP) process developed by Kent Beck.

SESSIONS

WE-13.3 [R] Models for Improving Software Development and Assessing Organisational Capability

Noordin Than Myint Hlaing Shehabuddeen; *University of Cambridge, United Kingdom*
Francis Hunt; *University of Cambridge, United Kingdom*
David Probert; *University of Cambridge, United Kingdom*

Software development is a disciplined process that is inherently complex with several uncertainties in terms of potential risks and predicted outcome. Knowledge intensive, competence dependent, and intangible nature of software development means that traditional project management approaches cannot be solely relied upon. The processual steps are often less clearly separable and tend to overlap with the presence of iterative loops. The process of software creation may best be described as an organised chaotic activity. Several development process models have been developed and applied, to add stability, controllability, and predictability to the development lifecycle. These models vary in terms of their focus and application environment, each having a specific emphasis, e.g. for risk mitigation, reducing time to market, etc. Some of these models are discussed and compared in this paper. A number of internationally accepted models for assessing the capability of software organisations is also explored. These models focus on the management processes within an organisation, as opposed to specific processes for developing software. Many organisations have used these as a means to improve and demonstrate their level of maturity and quality, and assess the potential of their suppliers to meet contractual obligations. This paper is motivated by an ongoing research project aimed at developing a process for making embedded software sourcing decisions (i.e. for software present in manufactured products). Therefore, an aspect of the discussions concerns the relevance of 'generic' software models to outsourcing and embedded software.

HB-01 Innovation Management-6

Thursday, 7/24, 10:00 AM – 11:30 AM

Room: Pavilion East

Chair: David W Birchall; Henley Management College

HB-01.1 [R] Collaborative Management Models in the National Innovation System of China

Ji-zhong Zhou; *Chinese Academy of Sciences, China*
Xiong Wei; *Chinese Academy of Sciences, China*
Chao-ying Tang; *Chinese Academy of Sciences, China*

The linkage and efficiency among subsystems or models in the National Innovation of System (NIS) concern competitive power of both S&T and economy of the country. There are three subsystems or models which play important roles in the NIS. This article analyses factors of the subsystems or models, such as the model of Government-Enterprise-Research (GER), the model of Finance-Enterprise-Research (FER) and the model of Enterprise-Research-University (ERU).

HB-01.2 [R] Total Innovation Management: Reinventing and Revitalizing the Corporation for the 21st Century

Qingrui Xu; *Zhejiang University, China*
Jingjiang Liu; *Zhejiang University, China*
Shouqin Shen; *Zhejiang University, China*

Thriving in an age of mass innovation change is more and more difficult. It requires perpetual and pervasive innovation at all levels of organization. Therefore, managing innovation is increasingly challenging, especially for Chinese companies after joining in WTO. A theoretical framework of competence-based total innovation management is put forward in this paper. This framework mainly draws on three distinct areas of recent research: the innovation theory of the firm, the resource-based view (RBV) and competence theory of the firm, and the complexity theory. Total innovation management is the set of reinvention and management of innovation value network that dynamically integrates conception, strategy, technology (including IT), structure, process, culture and people at all the levels of organization in order to enhance innovation competence of company, create value for stakeholders and sustain competitive advantage. It is a journey heightening competence of company, not a destination of company. It is concluded that it is only through total innovation management that Chinese com-

panies can hope to create sustainable business success through successive rainstorm of creative destruction in a turbulent and changing world.

HB-01.3 [R] Innovation Process Analysis of Entertainment Robots Market: Case Studies of The Dog Shaped "AIBO" and Cat Shaped "BN-1"

Osamu Horiuchi; *Japan Advanced Institute of Science and Technology, Japan*
Akio Kameoka; *Japan Advanced Institute of Science and Technology, Japan*

The robot boom has emerged in Japan since Sony started selling the entertainment robot "AIBO" in 1999. The expositions of various robots, for example, educational, care, security and hobby typed robot were held in various places in Japan, and several types of entertainment robots were put on the market. Although "Entertainment robots" attracts attention, the development possibility of "Entertainment robots" market isn't investigated. This paper reviewed the recent commercializing process of entertainment robots by focusing on the market scale, the development process of individual products and modification after the commercialization. The results revealed the following factors in the market formation process for "entertainment robot." (1) The entertainment robot was started with developing product that is not essential for every day life. (2) The new products were experimentally introduced into the unknown markets. (3) Selling through the Internet by subscription reduced the risk and the circulation of market was accelerated. (4) Autonomous entertainment robots communities have emerged and they promoted communication between the manufacturers and customers as well as among customers.

HB-02 Project/Program Management-7

Thursday, 7/24, 10:00 AM – 11:30 AM

Room: Pavilion West

Chair: Dragan Z Milosevic; Portland State University

HB-02.1 [A] Six Sigma Method, Project Management, and Strategic Management of Technology

Frank T Anbari; *The George Washington University, United States*

This paper provides an overview of the Six Sigma management method and the integration of project management and Six Sigma in the development and implementation of strategic management of technology. This important topic has not yet received the attention it deserves in engineering and technology management conferences and publications. The paper presents the main elements of strategic selection and effective management of Six Sigma projects, aimed at business systems improvement. It clarifies the roles of various participants in achieving engineering, technical, financial and customer satisfaction objectives of each Six Sigma project, and the importance of evaluating the success of these projects. The paper also presents applications of the Six Sigma method in managing strategic projects in organizations. It suggests that projects are conducted under the quadruple constraints of scope, time, cost, and quality, and shows the implications of applying the Six Sigma method in each of these four areas. Successful implementation and growing organizational interest in the Six Sigma method have been exploding in recent years. It is rapidly becoming a major force driving the strategy of numerous successful organizations. Involvement in Six Sigma projects is becoming an important career path requirement in many organizations. Understanding the main concepts of the Six Sigma method provides important opportunities to engineering, technology, and project professionals to lead Six Sigma projects, and allows them to better support their organizations' strategic direction, and increasing needs for coaching, mentoring, and training.

HB-02.3 [A] Technological Project Management at Research and Development (R&D) Organization in Cooperation with the University: RoboTurb/RoboFurnas Project — A Case Study

Carlos E Sato; *LACTEC — Instituto de Tecnologia para o Desenvolvi, Brazil*
Dario E Dergint; *CEFET-PR — Centro Federal de Educação Tecnológica, Brazil*
Kazuo Hatakeyama; *CEFET-PR — Centro Federal de Educação Tecnológica, Brazil*

This paper discusses the implementation of project management methodology, using project office concepts, at a Research and Development (R&D) Organization, particular-

SESSIONS

ly in the software development of a robot, involving multidisciplinary teams, high technology, innovation and the cooperation between a private R&D company and a University in Brazil. It discusses the difficulties and specific challenges of implementing project management in this R&D environment and what actions were taken to minimize the risks of this type of project. It concludes with some lessons learned and the conclusions obtained so far as the implementation of the project management methodology and project office is taking place.

HB-03 New Product Development-6

Thursday, 7/24, 10:00 AM – 11:30 AM

Room: Broadway-1

Chair: Kathryn Stecke; University of Texas at Dallas

HB-03.1 [R] Interface Decision in NPD Management

Kuo-Min Chen; Tunghai University, Taiwan

Ren-Jye Liu; Tunghai University, Korea, South

New product development (NPD) management is a key issue for product innovative firms. To decide on the interfaces and the functional module deploy is the first stage of design procedures. This study focuses on the decisive model of interfaces of a product from the perspective of modular architecture. We try to build a basic theory for understanding the interface essence in product innovation through a literature review and to identify the key elements, including internal and external interfaces and functional modules. Based on a two-level product architecture hierarchy, we construct a decision-making model for interfaces in modular product design processes. We also discuss the managerial meaning of this model and the implication in design management. This study suggests that the existing external interface standards impose limits on product innovation; and the practical innovative efforts tend to focus on the internal interfaces. An iterative decision-making approach is identified in design processes accompanied with the choice between the existing and the new, standard and non-standard interfaces. In most cases, external interfaces are decided on earlier than internal ones. We expect that such a discussion provides the impetus for structural changes in product innovation.

HB-03.2 [R] Broker Design Skills as a Key Driver in the Formation of New Product Development Networks: A Detailed Case Study

Darragh Murphy; University of Wales Institute Cardiff, United Kingdom

Alan Lewis; University of Wales Institute Cardiff, United Kingdom

Robert Brown; University of Wales Institute Cardiff, United Kingdom

This paper reports some preliminary observations of the operation of a collaborative product development network of manufacturing Small Medium Enterprises (SMEs) centred in industrial South Wales through a European Regional Development Fund Grant. The paper describes the formation and initial operation of the network and draws parallels between its process of brokering the network and product design process itself.

HB-03.3 [R] A Preliminary Research on a Roadmap of the Concept Development for Complex Products

Delin Yang; Tsinghua University, China

Yi Zou; Tsinghua University, China

Yaogang Chen; Tsinghua University, China

High system interaction and high technological novelty of complex products give intense resonance to complex product concept development, and have a large bearing on the nature and management of the new product development project. Based on several case studies, a model of concept development activities, especially focusing on complex product development, is proposed in this paper with a collection of various knowledge and distinct activities. This model can describe the characteristics of complex product concept development and offer a roadmap which help managers to debunk the fuzziness of the front end and integrate methods and tools used in the concept development into their practices.

HB-05 Resource Management-1

Thursday, 7/24, 10:00 AM – 11:30 AM

Room: Broadway-3

Chair: Gerald H Williams; Portland State University

HB-05.1 [A] Transformation of High Tech Engineering Companies for Sustained Value Creation

Dietmar H Winzker; RAU University, South Africa

Leon Pretorius; Rand Afrikaans University, South Africa

An urgent need is perceived that high-technology companies require a value-creating business leadership and management model which demands a completely holistic approach to achieve sustained growth in the contemporary, turbulent and high risk post-millennium business environment and where the company and its complete business environment is seen as an open system. Key strategic and operational challenges, which are subject to continuous change, as well as important stakeholders, must be satisfied holistically and simultaneously. The expression "holistic" here implies a truly wide range of issues, aspects, factors and disciplines as well as their causalities and interdependencies, all bundled together in a rather messy, inconsistent and fluid framework. In a technical environment, this is usually handled by introducing additional structures or re-engineering and through more efficient processes, which often fail to achieve greater effectiveness nor higher levels of competitiveness. This paper presents and discusses an effective approach to transform high tech engineering companies for sustained value creation and global competitiveness, which operates within a framework of paradox, extreme turbulence and continuous paradigm shifts on the basis of a management model, which has considerable practical application but which represents an oxymoron itself.

HB-05.2 [A] An Application of MRP to EVMS in Korean Construction

Soo-Yong Kim; Pukyong National University, Korea, South

Young-Dai Lee; Pukyong National University, Korea, South

"Earned value" is a project management technique that is emerging as a valuable tool in the management of all projects, including and in particular software projects. It is based on C/SCSC that has been released by the U.S. Department of Defense (DOD) in 1967. Several researches have been conducted to apply the earned value concept as a project management tool for construction projects. Material Requirement Planning (MRP) is also known as a planning tool in the manufacturing industry. The purpose of this study is the effective employment of Earned Value Management to manage the construction projects by utilizing MRP based on project management software programs and Work Packaging model.

HB-05.3 [R] The Average Annual Work Value as a Criterion for Contracting System

Jamal M Assbeihat; Balqa University, Jordan

Many classification types are used as criteria for contractors' identification. No one of these types could give variable indications according to which the variety of contractors' needs in terms of technology and human resources could be defined. These classification types couldn't be enough to be used as an instrument to determine the actual adequate level of the contractor at the time of project implementation, his ability when the project is awarded, or his actual contribution to the contracting sector. The contractor's average annual work value (AAWW) has been proposed and established as a criterion for the contracting sector. It is expected to be a suitable one as an accreditation parameter for purposes of meeting these needs. It may be used even for the purposes of registration and classification. It might be stated as a weight or a level, according to which the contractor's participation in the contracting sector and the national economy, in general, could be determined. Further studies should be conducted in order to apply and support the idea of including this criterion in the contracting system of Jordan, as well as that of other developing countries.

HB-05.4 [R] The Role of Ergonomics as an Instrument to Identify and Correct Changes in Industrial Environments

Luiz B Silva; Federal University of Pará, Brazil

Márcio Botelho da Fonseca Lima; Federal University of Pará, Brazil

Germana Costa Rocha; Federal University of Pará, Brazil

SESSIONS

The objective of this paper is to approach the role of the Ergonomics as instrument to identify, to correct and to consider changes in industrialist environments, emphasizing the linking between the comfort and the quality of the services generated in such environments. It was based on national and foreign authors concerning the evolution of the Communication and Information Technologies (CITs), the conformity of the man-machine system and the existing relation between environment of work, health and project performance. It is concluded that Ergonomics can play a basic role in establishing comfort, motivation and satisfaction to the workers who use the CITs. Besides it improves their services.

HB-06 Healthcare Industry-1

Thursday, 7/24, 10:00 AM – 11:30 AM

Room: Broadway-4

Chair: Arnold Reisman; Sabanci University

HB-06.1 [R] Customer Relationship Management in High Tech: A Perspective from an Academic Healthcare Institution

Bridget J Haggerty; Oregon Health and Science University, United States

Businesses everywhere are seeking ways to improve customer service. In addition, improved customer service needs to be obtained at a minimal cost. Current economic conditions, and the fiercely competitive nature of the information technology (IT) industry are demanding top rate service, delivered with a minimum impact on the bottom line. In order for these two objectives to come together amicably it is critical that organizations actively manage their service levels, customer satisfaction ratings, customer relationships and customer expectations. Ontario Health & Science University (OHSU) is an academic health care institution with over 12,000 employees and a firm dedication to improving human health. Supporting this objective, as well as the diverse missions of OHSU is a top-notch Information Technology Group (ITG). ITG's mission is to develop, implement and maintain technology-based services and solutions enabling OHSU to effectively manage information to accomplish its missions. The Customer Relationship Management (CRM) Division has oversight over the major customer service operations within the department. This division handles approximately 90% of the customer interaction that occurs between ITG and OHSU technology users. This report reviews the typical definition of Customer Relationship Management (CRM), the products available to support CRM, as well as common metrics and benchmarking standards. OHSU is then analyzed by its ability to meet the highest level of customer satisfaction standards reasonable in an economically stretched environment. Finally, recommendations are provided for OHSU to reduce costs, restructure departments and employee strategies, partner with vendors and colleagues, as well as a definitions of roles and responsibilities between the to be named CRM Division Director and the Sr. Managers within the Division.

HB-06.2 [R] Modeling Healthcare Clinic Operations as a Discrete System Simulation

William Eisenhauer; Portland State University, United States

Alain Brûlé; Portland State University, United States

A ProModel discrete system simulation (DSS) model was developed to simulate a gastroenterology clinic operation and then analyze a planned move to a new and larger facility. Results include preliminary indications that the planned resources at the new facility will be adequate. The model of the current operation also serves as detailed documentation that clinic administrators can use in the future to discuss and plan for other operational changes. The value of using throw away models and graphical representations to facilitate communication amongst modelers and between the modelers and the clients is also discussed. The limitations and capabilities of ProModel versus other DSS packages are discussed as well.

HB-06.3 [R] Service Performance Measurement: A Case of Intensive Care Unit of Hospital

Prasanta Kumar Dey; University of West Indies, Barbados

S. Hariharan; Queen Elizabeth Hospital, Barbados

Intensive care unit (ICU) being one of those vital areas of a hospital providing clinical care, the quality of service rendered must be monitored and measured quantitatively. It is therefore essential to know the performance of an ICU, in order to identify any deficits and enable

the service providers to improve the quality of the service. Although there have been many attempts to do this with the help of illness severity scoring systems, the relative lack of success using these methods has led to the search for a form of measurement which would encompass all the different aspects of an ICU in a holistic manner. Analytic Hierarchy Process (AHP), a multiple attribute decision-making technique, is utilized in this study to evolve a system to reliably measure the performance of ICU services. This tool has been applied to a surgical ICU in Barbados and we recommend AHP as a valuable tool to quantify the performance of an ICU.

HB-07 Technological Changes-2

Thursday, 7/24, 10:00 AM – 11:30 AM

Room: Forum Suite

Chair: Janice L Forrester; NIKE

HB-07.1 [R] Understanding System Behavior: A Prerequisite for Technological and Process Improvements

Warren K Vaneman; Virginia Tech/ System Performance Lab, United States

Konstantinos Triantis; Virginia Tech/ System Performance Lab, United States

Organizational change is the only constant in the workplace of today's fast paced world of technological evolution. However, many organizations fail to master the change process by relying on flawed, or outdated, mental models to make their key policy decisions. Organizational policy decisions are often based on what are believed to be linear relationships that are linked closely together in space and time. As a result the outcome of these decisions are often sub-optimized because the non-linear relationships among variables, causal relationships, and feedback mechanisms are ignored. One approach to minimizing the unintended consequences of organizational change is to mimic the system's behavior through modeling and simulation. Our recent research using system dynamics (SD) models linked the dynamic production axioms to the basic behaviors associated with system dynamics structures to glean a better understanding of the system/process being improved. This paper addresses the concepts of the dynamic production axioms, and links those axioms to system behaviors to better define the production assumptions that must be addressed during a change implementation.

HB-07.2 [R] Innovation and Adoption as Main Mechanisms for Economic Growth in a Knowledge-Based Economy

Sang-choon Kim; ETRI, Korea, South

Kwang-sun Lim; ETRI, Korea, South

Young-shin Yu; ETRI, Korea, South

Being considered the importance of technological change gets more attention as the knowledge-based economy evolved, understandings of the mechanisms for long-run economic performance seem necessary to have better insight for the evolution of the current world economy. As an attempt for this, this paper reviews some selected studies on the model of endogenous innovation and adoption, the two mechanisms regarded as most crucial for economic growth in a knowledge-based economy. We find that economic factors such as market structure, size or population of a country, preference and so on are more crucial for economic performance in the model of innovation, but in the model of adoption less or non-economic factors such as national politics and institution are more crucial.

HB-07.3 [R] Holonic Architecture for a Legacy Robot Assembly Cell

Carlos N Vetorazzi Jr; UDESC, Brazil

Geraldo N Telles; UNICAMP, Brazil

The holonic approach proposes to divide a system in several elements called holons, which interact by means of a structure called holarchy, to execute its tasks and achieve common goals. Among several aspects that can result from this approach, we can highlight the stability and agility to deal with unexpected changes or disturbances, both in internal and external environment. This is due to the features that are present in holonic systems: autonomy, cooperation and evolution. Here, we make a proposal for an approach for the implementation of these concepts in a robotic cell, used to assembly printed circuit boards (PCBs). The elements of the process) are represented by software components as autonomous entities

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

(holons), interacting and negotiating to perform the required operations. The system also has to deal with changes in products, process and the system itself. Another important issue is that the implementation relative to the robot is done by a software "layer" over the robot control, adding the required features of holonics, without hardware changes in the legacy robot control. For sure there will be hardware with "native" holonic attributes in the future, but the approach presented here can help to upgrade the large base of current technology machines to get into holonic manufacturing.

HB-08 TUTORIAL: T-CAT — A Technology Commercialization Assessment Tool
Thursday, 7/24, 10:00 AM – 11:30 AM **Room:**

Speakers: Simon Brightman, University of Ottawa, Canada
David Large, University of Ottawa, Canada

Managers of publicly funded labs routinely attempt to assess which of their technologies have genuine commercial potential, and then to assess which commercialization mechanism (e.g., license versus spinout) might be optimal. Many tools do exist to assist these assessments, but spotty commercialization results suggest that there is room for improvement. T-CAT© is a new spreadsheet-based software tool designed to improve the reliability of the commercial potential assessment, and, unlike other tools, the reliability of the commercialization mechanism assessment. It has been derived from a rigorous literature review, and several in-depth interviews with senior managers from leading North American labs. It features: • Dual stage analysis: an initial AlphaScreen 20-factor assessment of commercial potential; and a subsequent BetaScreen 46-factor re-assessment, including a directional indication of the optimal commercialization mechanism; • Assessment factors in five categories: Technology; Market; Technology Champion; Management; and Financials; and • User interfaces that are: quantitative, qualitative and/or graphical; interactive; easy to use; and customizable. The disciplined use of T-CAT© may help managers of publicly funded labs to: standardize their assessment processes; identify the most critical determinants of commercialization success; and elevate the consistency and degree of commercialization success.

HB-09 Manufacturing Management-2
Thursday, 7/24, 10:00 AM – 11:30 AM **Room: Directors Suite**
Chair: Kiyoshi Niwa; The University of Tokyo**HB-09.1 [A] Successful IT Applications to Manufacturing Management and Engineering**

Takehisa Seino; Toshiba Corporation / The University of Tokyo, Japan
Kiyoshi Niwa; The University of Tokyo, Japan

Japanese electronics makers have been accelerating the introduction of Information Technology (IT) infrastructure and tools in manufacturing fields, which includes product development and production, since the late 1990s. However, in spite of huge IT investment, the anticipated effects are not always obtained. In this paper, successful applications of IT to manufacturing management and engineering at Toshiba are described. These are actual cases carried out by adopting three approaches: clarifying the goal of IT introduction (speed up of product development and quality control in production), converting tacit knowledge into explicit knowledge, and evaluating IT employment levels.

HB-09.2 [R] Information Systems for Production Management: Does the Educational System Meet the Changing Requirements of the Yugoslav Industry?

Zoran T Lovrekovic; University of Novi Sad, Yugoslavia (Srbija)
Milan Djurica; University of Novi Sad, Yugoslavia (Srbija)

Information technologies enable a new way of production and lead to an entirely new production philosophy and relationship with customers. In advanced economies rigidity is no longer acceptable. The products need to be made in accordance with a customer's demands, wishes and needs. Time elapsed from the moment of order to the moment of delivery must be short enough in order to a product could be treated as an instant one. Yugoslav companies neither have capabilities demanded by such a new way of production nor awareness of inevitability of business change. The only way for success is a training of management for

reengineering and informatization of business processes through reengineering. CIM is not only technological but also a cultural concept. It is of vital importance for CIM to be successful that appropriate education of employees is provided. By surveying professors and students of higher education has been displayed that students are not being taught enough how to use a computer in their future work places. Both professors and students are unsatisfied with the education and utilization of new information technologies. A graduate student does not feel that they are capable of improving business processes in their future company.

HB-09.3 [A] Operations Transference General Model

Juan Acosta; Universidad de Monterrey, Mexico
Martin Bacopulos; Universidad de Monterrey, Mexico
Roberto Carvajal; Kemet, Mexico
María Posada; Kemet, Mexico
Diana Velázquez; Whirlpool, Mexico

CEO's clearly see their job as creating value for shareholders. An extreme action they take when pursuing this aim is to transfer manufacturing plants to a different country. This is a very demanding decision for the whole organization. Both transfer operation and business improvement must be achieved simultaneously. It is likely that transferring manufacturing plants from developed to developing countries will continue in the near future. These countries offer large markets and low labor costs among other advantages for original manufacturers. This paper describes a method to manage the transfer process. It provides a disciplined framework with cross-functional participation and activities to be performed clearly stated. It helps to create a plan and to track progress. It is instrumented with a TQM approach using the plan-do-check-act cycle and a number of quality tools. Application of the method in the transfer of an electronics components' plant from the US into Mexico is described in the paper. In this case, in addition to a specific cost reduction objective, the quality of product was to be maintained and the quality of the process was to be improved right from the first quarter of operations in Mexico. This means reducing the number of rejected parts per million, improving the yield and reducing the scrap in relation with performance of the plant in the US.

HB-09.4 [R] Technology Management in Blue Pottery Industry of Jaipur Region of Rajasthan State in India

Ranjit Singh; Engineering College, Bikaner, Rajasthan, India
Awadhesh Bhardwaj; Malviya National Institute of Technology, India

Blue pottery units in Jaipur region of Rajasthan state of India are export oriented small scale industry. Items like ash trays, flower vases, jars, bear mugs, dinner sets, door handles, surahi, tiles, lota candle stand etc. are exported from here to Japan, Germany, U.S.A., Taiwan, Newziland, Netherlands and other parts of the world. Total turnover is more than \$ 2 million per year. To be more competitive, the industry has resorted to deploy various technologies / techniques at design, manufacturing and marketing stages to improve productivity. The various technologies / techniques used by the industry for productivity improvement, productivity improvement coefficients due to application of each technology were found out. Regression was used to develop a model to find out technologies/techniques mix for the given conditions of the industry. Thus the present paper presents an analytical model for technology management for productivity improvement in blue pottery industry in Jaipur region of Rajasthan state of India.

HB-11 Technology Roadmapping-1
Thursday, 7/24, 10:00 AM – 11:30 AM **Room: Executive Suite**
Chair: Hugo Tschirky; Swiss Federal Institute of Technology Zurich**HB-11.1 [R] An Analytical Approach to Building a Technology Development Envelope (TDE) for Roadmapping of Emerging Technologies: A Case Study of Emerging Electronic Cooling Technologies for Computer Servers**

Nathasit Gerdarsi; Portland State University, United States
Dundar Kocaoglu; Portland State University, United States

This paper proposes a systematic approach to help technology managers to strategically identify and select emerging technologies in which to invest in order to achieve technologi-

SESSIONS

cal competitiveness in their new product development. The combination of Delphi method and hierarchical decision model is used in building a technology development envelope (TDE) — a curve representing a series of technologies with maximum impact on company's competitiveness over time. The result of TDE can be used as strategic inputs in the company's technology roadmapping process. A specific case study of emerging electronic cooling technologies for computer servers is introduced for demonstrating the model development processes in this paper.

HB-11.2 [R] Linking Roadmapping and Scenarios for Planning the Development and Deployment of Technologies and Applications Towards Shared Visions

Fernando Lizaso; Institute for Innovation and Internationalisation, Germany
Guido Reger; Institute for Innovation and Internationalisation, Germany

Great efforts have to be devoted to create shared visions. Visions are desirable end states, objectives which guide organisations in making decisions; however, the paths and conditions to get them are still a matter of discussion. This paper aims at developing a new methodology that links both roadmapping and scenario technique in order to plan the development and deployment of new and existing technologies and applications. It involves the identification, analysis, assessment and projection of both technologies and applications necessary to meet market needs under different future circumstances. It is supposed to help to avoid isolated and linear thinking and vagueness, as well as improve creativity, communication, collaboration and integration in coordinated science and technology planning, while giving people at organisations not only room to create the future by themselves, but also to remain flexible against uncertainty. Not only does it foster vision creation, but it also improves flexibility to refine and adjust plans and strategies "in route." The concept is based on a deep analysis of the literature and an example illustrates how the method works.

HB-11.3 [A] Strategic Program Planning Lessons Learned in Developing the Long-Term Stewardship Science and Technology Roadmap

Brent Dixon; Idaho National Engineering and Environmental Lab., United States
Duane Hanson; Idaho National Engineering and Environmental Lab., United States
Gretchen E Matthern; Idaho National Engineering and Environmental Lab., United States

Technology roadmapping is a strategic planning method used by companies to identify and plan the development of technologies necessary for new products. The U.S. Department of Energy's Office of Environmental Management has used this same method to refine requirements and identify knowledge and tools needed for completion of defined missions. This paper describes the process of applying roadmapping to clarify mission requirements and identify enhancing technologies for the Long-Term Stewardship (LTS) of polluted sites after site cleanup has been completed. The nature of some contamination problems is such that full cleanup is not achievable with current technologies and some residual hazards remain. LTS maintains engineered contaminant barriers and land use restriction controls, and monitors residual contaminants until they no longer pose a risk to the public or the environment. Roadmapping was used to clarify the breadth of the LTS mission, to identify capability enhancements needed to improve mission effectiveness and efficiency, and to chart out the research and development efforts to provide those enhancements. This paper is a case study of the application of roadmapping for program planning and technical risk management. Differences between the planned and actual application of the roadmapping process are presented along with lessons learned. Both the process used and lessons learned should be of interest for anyone contemplating a similar technology based planning effort.

HB-11.4 [R] Technology Roadmapping of Wireless Local Area Networks Using Graphical Modelling System

Seda Güler; Marmara University, Turkey
Atilla M Öner; Yeditepe University, Turkey

This paper describes a Technology Roadmap of Wireless Local Area Network (WLAN) technology, which makes use of Graphical Modelling System (GMS). Wireless networks and mobile computing are experiencing an explosive growth, with millions of users in the past few years.

With current demands, WLANs are being developed to provide better quality and higher bandwidth to users in a limited geographical area. The objective of building a roadmap for WLANs is to stimulate timely and effective development of the infrastructure required to be successful in deploying WLAN technology. The role of the roadmap in achieving this goal is to develop and document a view of the technical capabilities required to successfully use WLANs in critical applications. The use of GMS will assist in capturing, visualizing, manipulating and managing the information contained in technology.

HB-12 Strategic Management of Technology-2

Thursday, 7/24, 10:00 AM – 11:30 AM

Room: Senate Suite

Chair: Stefan M Koruna; Swiss Federal Institute of Technology Zurich

HB-12.1 [R] The Convergence of Total Quality Management and Strategic Management: Past, Present, and the Future

Mahour Mellat Parast; University of Nebraska — Lincoln, United States

Strategic Management and Total Quality Management (TQM) are two management approaches that have been extensively discussed, both in practice and in the literature. While strategic management and TQM may appear as different approaches toward business excellence, it seems that they share common viewpoints in terms of the way they look toward many organizational processes. This paper investigates the relationship between strategic management and TQM, and determines their similarities and differences. Furthermore, the concept of strategic total quality management (STQM) referring to the integration of strategy and quality will be discussed. The paper concludes that while TQM and strategic management address different environments for the organization, they can be integrated. However, their successful integration (successful TQM implementation) is related to balance of power in the organization, which is referred to it as organizational politics. Also, achieving successful competitive advantage may require that firms understand their political environment and try to affect the political forces, along with the traditional industrial forces.

HB-12.2 [A] A Model of Strategic Management for High Tech Firms — Integrating Academic Research for the Industry

Denis Couillard; Harris Corporation, Canada
Jozée Lapierre; École Polytechnique de Montréal, Canada
Bernard Sinclair-Desgagné; École des Hautes Études Commerciales de Montréal, Canada

Technology management study programs are typically comprised of various scientific disciplines: management, economics, marketing, engineering, innovation management and social sciences. The practicing manager who wants to improve the chances of success of his organization is faced with a large body of disconnected scientific knowledge he must somehow collect and integrate. This work, based on existing literature and industry examples, offers two simple models to understand the various inter-relationships between the technology management concepts underlying the management of a high-tech organization. The Corporate Ship analogy illustrates the dynamic nature of strategy making and the need to reconcile the pursuit of short-term opportunity with long-term objectives in turbulent high-technology environments. The Corporate Diamond model uncovers the strong inter-relationships between key concepts in technology management: leadership, learning, managing resources and developing successful new products and services.

HB-12.4 [R] Can Core Competences Be Planned? A Theoretical Model for Core Competence Planning

Stefan M Koruna; Swiss Federal Institute of Technology Zurich, Switzerland
Martin Luggen; Swiss Federal Institute of Technology Zurich, Switzerland

This paper is a conceptual paper which aims at developing a framework for the development of (technological) core competencies. Based on the view of the process school of the resource-based view, this paper derives a framework for the process of building core competencies from the Canon personal copier case study. This framework is further on refined and extended to support application also to the situation of small and resource-poor start-up companies.

Note: [R] = Research paper; [A] = Industry Application

SESSIONS

HD-01 Innovation Management-7: Best Practices at HP

Thursday, 7/24, 1:30 PM – 3:00 PM

Room: Pavilion East

**Chairs: Joni T Ohta; Hewlett-Packard
Michael Menke; HP**

HD-01.1 [A] Product Generation at the Edge of Chaos

Paul Henderson; HP, United States

Joyce Hougren; HP, United States

Joni T Ohta; Hewlett-Packard, United States

Product Generation in highly innovative, fast-paced businesses, benefit from less structure to enhance innovation and ability to respond to shifting business environments. The Edge of Chaos, for complex adaptive systems, is the point that maximizes innovation and ability to evolve, yet holds the system together and prevents it from flying out of control. This has been a difficult balance to achieve. Many systems are over constrained and others are not scalable, transferable, nor are very long lived — too chaotic. We present learnings from successful, innovative, product generation organizations within HP that have, over time, demonstrated their ability to successfully live at the Edge of Chaos.

HD-01.2 [A] A Systematic Process for Developing Product Family Architecture

Stephen Bear; Hewlett-Packard Company, United Kingdom

The architecture of a product concerns the large scale structure of the product and its subsystems. At the beginning of a product program there are basic architectural choices with many degrees of freedom. These choices are very important — they can affect many aspects of current and future products. For example the R&D effort required; the function, performance and quality that can be achieved; overall profitability; and customer's total experience of the product. However product level architectural choices are often not addressed explicitly nor explored in any depth. The traditional development approach has been to immediately partition the product into subsystems, defining interfaces and coordinating as necessary. If one discipline starts first then the others follow the leader. As a result, product architecture becomes an emergent property of more detailed design. Good implicit architectures do emerge, but they rely on intuitive judgements of program leaders and are not easy to communicate. There is academic research and a number of text books that propose interesting tools and guidelines [see for example Ulrich, Mayer, Martin]. These have been applied to a small number of projects within HP [for example Peat, Raptor]. The results have been promising but the work is not easily accessible to development teams and does not address the full scope of industrial product development. A practical industrial strength process must have the following characteristics: Systematic: The process must be easy to communicate, well defined and systematic Early: The process must allow architectural issues to be addressed early, when information about product value propositions, functional and quality requirements is incomplete. Ideally, the process should allow the product definition and product architecture to be co-developed Cross-functional: The process must address issues involving marketing, r&d, manufacturing, and supply chains Cross discipline: The process must identify and explore options in mechanical, electrical, firmware, software and service subsystems Product family: The process must explore address issues of sometimes loosely defined product families In this paper we describe a revised product architecture process that makes several steps towards achieving true industrial strength.

HD-01.3 [A] Total Innovation Management at Hewlett-Packard

Michael M Menke; Hewlett-Packard, United States

Quingrui XU; Research Center for Innovation & Development, China

Prof. Quingrui XU and his colleagues have articulated a framework and system of Total Innovation Management (TIM) and illustrated it with the case of Haier, one of the most successful Chinese technology companies. TIM stresses innovation in every aspect of the organization, with technological innovation as the core and portfolio innovation as the approach. The other key areas of innovation stressed by TIM are strategy, organization, culture, institution, market and management. TIM also stresses that innovation must be pervasive-happening everywhere in the organization (all people, all functions) and perpetual-happening all the time. Measured against this framework, Hewlett-Packard has exhibited virtually all the

characteristics of TIM over its 60+ year history. HP's long tradition of technological and product innovation is well documented, providing a solid core for HP's TIM. The culture established by the founders called The HP Way is legendary and has been credited for much of the success not only of HP but also of HP's many spin-off companies throughout Silicon Valley. The HP way embodies not only an enduring core set of values and beliefs, but also many institutional and organizational innovations that have been copied by many others. These include things like open door policy, management by walking around, deep respect for the individual and unquestioned integrity. Building on its many technological and product innovation, HP has created whole new innovative and useful markets in instruments, measurement systems, calculating, computing, imaging and printing. HP has long stressed innovation in all parts of the business and was early to introduce many business process innovations such as formal product development processes, quality management and team-based management. In 1999 our new CEO launched a sweeping "re-invention" effort affecting all aspects of HP's business. This led to strategy and organizational innovations to drive focus and growth to deal with the issues arising from size and sluggish technology markets. To achieve clearer strategic focus, HP spun off the test and measurement businesses into Agilent Technologies in 2000, retaining computing, imaging and printing and services as its core businesses. In order to achieve world-class scale, cost structure and competitiveness in these businesses, HP merged with Compaq Computer Corporation in 2002. Early indications are that the new HP is on track to achieve the intended results from these big strategic shifts. To increase our focus on customers and improve Total Customer Experience (TCE), we have been experimenting with new organizational models, going from a large number of independent SBUs to a front-back model and now to a four business-sector model with the sectors hosting the various sales channels. We also introduced a measurement system and metrics for TCE and made the TCE metric a part of senior management's balanced scorecard and compensation determination. Recent major innovations in management and business process involve extensive reliance on outsourced manufacturing and even product development, as well as growing use of partners for collaborative development and to provide total solutions for customers. This paper documents how HP embodies the substance and spirit of TIM.

HD-02 Project/Program Management-8

Thursday, 7/24, 1:30 PM – 3:00 PM

Room: Pavilion West

Chair: Antonie de Klerk; University of Pretoria

HD-02.1 [A] Justice on the Critical Path.

Jean Côté; Alberta Court of Appeal, Canada

Lisa Prescott; University of Alberta, Canada

John Whittaker; University of Alberta, Canada

Delays and time lags at a typical Canadian Court of Appeal were analyzed using project management (PM) techniques. The project demonstrated how PM could offer new insights on how to deal with the backlog of cases. The study used CPM to map and analyses the process, treated judges, lawyers and clerks as resources, investigated the consequences of interrupting and partitioning activities, and the interaction between delay and outcome. The result was a book containing three critical path diagrams, and eighty-one recommendations for improving the efficiency of the court. This paper summarizes the techniques and insights for researchers interested in extending the boundaries of PM into non-traditional fields.

HD-02.2 [R] Current State of Russian Far East Project Management

Oliver Hedgepeth; University of Alaska Anchorage, United States

Morgan E Henrie; MH Consulting, Inc., United States

The Russia Far East and Alaska share many common features. Each is remotely isolate from the main political, social and cultural national centers. Each region is rich with many natural resources and low in population densities. Each region also suffers extensive logistic challenges and minimal local support structures. This paper discusses results derived from on going Russian Far East project management application comparison research efforts. The paper highlights the challenges and issues associated with expansion of project management skills and applications within the Russian Far East.

SESSIONS

HD-03 New Product Development-7**Thursday, 7/24, 1:30 PM – 3:00 PM****Room: Broadway-1****Chair: David Wilemon; Syracuse University**

HD-03.1 [R] The Other Side of Externalization: A Study of the Product Development Firms*Stefano Ferrari; Politecnico di Milano, Italy**Raffaella Manzini; University Cattaneo — LIUC, Italy**Emanuele Pizzurno; University Cattaneo — LIUC, Italy*

In the last few years, it has been observed that a large number of companies have been created, that provide the innovators with technical and scientific services such as contract R&D, laboratory testing services, technology consulting, industrial design, engineering and so forth. This is a consequence of an observed trend towards the externalisation of (part of) the firm's R&D activities. This is a subject that several authors have widely discussed and the reasons why. The outsourcing of these activities has been largely explored, but the state of the art of the literature is less complete by the side of the firms that can be considered as addressees of this outsourcing process. The paper has the aim to provide, first, an "exploratory map" of these firms, analysing their location and distribution worldwide and the level of competencies these firms are able to provide to their clients. To reach this objective, an empirical study, consisting in an extensive analysis, has been conducted; many information have been collected (for about two hundred of companies) about size, location and type of services offered. Second, an intensive analysis, consisting in a deep case study concerning a company providing the complete range of product development services, from conceptualisation to industrialization has been developed. Finally, some conclusions have been drawn about the characteristics of the market of product development and the management and organisation of companies offering services for new product development and some new research guidelines have been traced out.

HD-03.2 [R] Multiproduct Development: The Key to Efficient Management of Industrial Product Development*Knut E Aasland; SINTEF Industrial Management, Norway*

Traditional product development methodology has focused on one single product at a time. The objective of efficiency and quality has been met for the product, but companies with a complex portfolio of products, models and variants still find themselves burdened with ever more complex internal processes as markets get ever more demanding. The only way to meet this challenge, is by developing the entire product portfolio as a program with the desired internal and external effects. This is what we call multiproduct development. A method is suggested, and a selection of tools will be proposed. A case story is also presented.

HD-03.3 [R] Product Development Strategy for Growth Products*Masaru Ishioka; Ishinomaki Senshu University, Japan**Kazuhiko Yasuda; Tohoku University, Japan**Kouichi Iwata; Ishinomaki Senshu University, Japan*

During the growth stage of the product life cycle model, the target customer changes to innovators, early adopters, and early majority with time progress. The change speed of market condition related with customers and competitors is faster, and the range of the customer's product preferences becomes wider than the case of the maturity stage. Under these rapid changing market characteristics, organizations must continue to introduce new products to the market strategically, in order to follow these changes. In this research, strategic market positioning is defined by the observations of major competitive factors such as recognition of customers' product preference changes and the organization's market entry time. The factors are logically analyzed and the results are reexamined. After the analysis, four types of product development strategies for the growth market condition are suggested. More specifically, two analytical factors, product variety and product similarity, are designed to develop the strategy. The strategies are classified by the level of each factor of each company in the sample growth market. The proposed four strategies are leader strategy, proactive challenger strategy, reactive challenger strategy, and follower strategy. The developed strategies are designed to produce new products fitting changeable customer needs in the growth stage.

HD-03.4 [R] Analysis of Sustaining Growth in the Modern Enterprise Using System Dynamics*Luis C Rabelo; University of Central Florida, United States**Thomas Speller; Gemcor Corporation, United States**Chris Burns; Delphi Corporation, United States**Phillip Meade; Xodus Corporation, United States*

This paper describes a model developed to demonstrate the constancy of and virtual need for change in a sustaining organization. Much has been written about the accelerating rate of change related to technological change, but the results of the model developed shows that change is inherent in a sustaining growth corporation regardless of technological change. Several executives from different organizations were interviewed in order to capture the dynamics structure. Essential variables were listed and causal modeling was used to obtain important relationships. Equations of interrelationships among the variables were developed using stock and flows diagrams. Validation of the model was performed at two levels: (1) validation of the structure as suggested by the causal modeling process using a new methodology based on eigenvalue analysis and their elasticities, and (2) validation of the emergent behavior by using case studies of industries which have different time rates of evolution.

HD-05 Management of Technical Workforce-2**Thursday, 7/24, 1:30 PM – 3:00 PM****Room: Broadway-3****Chair: James Koch; Santa Clara University**

HD-05.1 [R] The Great Divide: A Case Study of Supervisors' and Employees' Views of Performance Management*Allan Ng; Honeywell Canada, Canada**Peter Flynn; University of Alberta, Canada*

A study at Spar Aerospace, an Edmonton based firm specializing in aircraft repair and overhaul, probed at employee and supervisory attitudes towards performance management. The survey found that employees had a high degree of acceptance of their performance rating (>65%), but experienced some discomfort in receiving a "meets standard" rating of 3. Supervisors showed a low awareness of employee discomfort with a 3 rating. Employees indicated a strong desire to discuss coaching, goal setting, career management and training outside of the performance evaluation setting; this occurs far less than desired. Supervisors claim to discuss these items, both inside and outside of the performance appraisal interview, far more than employees claim to receive it. Supervisors claim low levels of discomfort with "below standard" performance ratings of 1 or 2, but in fact rarely give these ratings. The gap between supervisors thinking that they are giving coaching and employees believing they do not receive is a source of concern, and can be addressed by company action.

HD-05.2 [A] Relevance of Performance Appraisal System in a Dynamic Organizational Environment*Mohana Bharat; Amdocs, Cyprus**Poonam Sabharwal; Amdocs, Cyprus*

This article aims at pointing out the complexities of performance appraisal system in a dynamic organizational environment of an information technology industry. Performance appraisal being an integral part of the organization's strategic management plays a very important role. Hence both the management and the employees should accept its reliability and efficacy. The persistent criticisms about the performance appraisal by employees point otherwise. The factors owing to this criticism can be numerous owing to the method and frequency of the performance appraisal system used, the perceptions held by the appraisees and appraisers and also the dynamic nature of the industry. We would here present our concerns regarding the performance evaluation system used and its efficacy in the high tech industry.

HD-05.3 [R] Benchmarking Employee Performance in Administrative Applications for Oregon Health and Sciences University: A Report Using DEA*Bridget Haggerty; Oregon Health and Sciences University, United States**Khoi Le; Portland State University, United States*

SESSIONS

Farolan A Mulla; Portland State University, United States
Liono Setiowijoso; Portland State University, United States

Evaluation of Information Technology Teams performance is extremely important in the currently difficult economic times. Now, more than ever before, expenditures for new projects, as well as analysis of current production support costs, are being carefully considered before technology projects are implemented. Our project deals with benchmarking and evaluating employee performance in the Oracle Administrative Applications Team at Oregon Health & Science University. We utilized Data Envelopment Analysis (DEA) with CCR/CRS model in order to measure the performance of each employee. The report provides a description of application team, the purpose of analysis, a description of DEA model and the specific model we used, and data collection methods. The objective of this project is to analyze individual employee performance thereby enabling the organization to improve its performance.

HD-07 TUTORIAL: TECHNO-ECONOMICS: Technological Evolution, The Laws of Techno-Economics, and Analytical Concepts, Tools and Techniques for Strategic and Operational Management of Techno-Businesses
Thursday, 7/24, 1:30 PM – 3:00 PM **Room: Forum Suite**

Speaker: Peter J Rafferty; TECHEX Management

Techno-economics characterises the technological and economic phenomenology of technological evolution. It is a comprehensive, quantitative and qualitative discipline for analysing and integrating numerous technological, competitiveness, market and economic factors in a wide range of techno-business analysis and decision-making. Systematic characterisation of technological evolution demonstrates that, for all techno-businesses, explicit, generic, quantifiable relationships exist between the key factors of production (time, technology, productivity, capacity, capital, energy, labour, and raw materials or components), and their competitiveness, market presence and economic results. Techno-economics was formulated as a generic discipline as a result of the author's extensive experience in techno-economic analyses associated with managing numerous technology research and development programs, in commercialising innovative new technologies, in designing and launching new plants, and in trouble-shooting and turning around ageing plants, during a time of dynamic technological and market evolution in environmental techno-businesses. The discipline was also partly inspired by the works of Professor Robert Solow ("Technology is the dominant engine of economic growth, with human capital investment in second place") and Professor Wickham Skinner ("The roots of major industrial change lie in economics and technology"). Tutorial handout based on the book "Techno-Economics" (360 pages, 15 chapters, 60 diagrams and exhibits, including Teach-Yourself-Techno-Economics Software; pre-publication copies available at the Conference).

HD-09 Manufacturing Management-3
Thursday, 7/24, 1:30 PM – 3:00 PM **Room: Directors Suite**
Chair: Kathryn Stecke; University of Texas at Dallas

HD-09.1 [A] Using Discrete Event Simulation to Measure Impact of Changing from Traditional Manufacturing to Cell Manufacturing in a Value-added Wood Processing Facility

James E Reeb; Oregon State University, United States
Eric S Baker; Oregon State University, United States
William F Reiter; Oregon State University, United States

Discrete event simulation was used to assess the impact of switching from traditional manufacturing to cell manufacturing in a value-added wood products firm. The firm currently uses traditional manufacturing practices to produce high value pianos and organs. ProModel, PROMODEL Corporation, Orem, Utah was used to model the current factory layout and the proposed new layout. Traditional manufacturing systems segregate different functional operations from each other. Cell manufacturing systems group these functional operations together. This reduces non-value-added activities such as batching and moving parts from one operation to the next. Cell manufacturing usually reduces lead time, work in process, and

enhances communication. A manufacturing cell has been defined as a production facility designed to completely manufacture a product or a group of similar products along a balanced, unidirectional flow path. The first step for modeling the cell manufacturing system is to arrange parts that flow through the process into part families. Cell manufacturing requires part families, since the goal of cell manufacturing is to have all the machines and people required to process parts in a small area. Batch size, part travel time, and the ratio between value-added and non-value-added time were assessed during the study.

HD-09.2 [R] Critical Analysis of the Management of FMT in India: A Case Study of an Automobile Giant in the Private Sector

O. P Sharma; Delhi College of Engineering, India

The electronics-enabled revolution has brought about rapid changes not only in the corporate and business world but has also resulted in changing the social and cultural patterns globally. The manufacturing industry is no exception and has seen much advancement in manufacturing technologies during the last few decades. The advent of flexible manufacturing technology (FMT) is one such revolution. Although the diffusion of FMT is fairly substantial in Japan and other developed nations (especially in the USA, U.K., Germany, Sweden, Italy, and France), in India, the technology is in an early stage of take off. The paper presents, in a case study framework, an in-depth analysis of the modes of managing FMT by one of the largest heavy automobile and engineering companies in the private sector in India, the Tata Engineering and Locomotive Company Limited (TELCO). This study is a part of an exhaustive survey, conducted over a time of three years, covering aspects related to the current and likely future state of adoption, operation and management of FMT in the Indian context. The case study was conducted by actually observing the operations, interviewing the concerned persons at all levels, and by administering a semi-structured questionnaire. Various aspects covered include the company profile, its FMT environment, the strategic factors contributing to the decision to adopt FMT, the choice of FMT equipment, impacts of FMT on the technical and organizational systems of the company, and so on. A situation?actor?process (SAP) analysis is carried out leading to the identification of learning issues, and conclusions.

HD-11 Technology Roadmapping-2
Thursday, 7/24, 1:30 PM – 3:00 PM **Room: Executive Suite**
Chair: Fernando Lizaso; Institute for Innovation and Internationalisation

HD-11.1 [R] Integrated Strategy Development: An Integrated Roadmapping Approach

Akio Kameoka; Japan Advanced Institute of Science and Technology, Japan
Terutaka Kuwahara; Science and Technology Foresight Center, Japan
Meng Li; Japan Advanced Institute of Science and Technology, Japan

This paper revisits two cases of new technology and product foresight and assessment in Japanese companies and industries. The case studies show that technology forecasting or roadmapping that integrates corporate strategy and technology strategy plays an important role in economic success. Integrated technology roadmapping provides a practical instrument for developing long-range technology and strategy by aligning internal resources and social marketing factors.

HD-11.2 [R] Technology Roadmaps: Unlocking the Potential of a Field

Martin Rinne; Portland State University, United States
Nathasit Gedsri; Portland State University, United States

The value of technology roadmaps for technology planning, technology selection, and technological innovation has become widely recognized. That value is often diminished by the lack of basic capabilities to manipulate and maintain these roadmaps. In this paper we return to the vision of technology roadmaps as inventories of the possibilities for an entire technology field. That vision implies a catalogue of capabilities. Based on a review of some key functions of technology roadmaps, we build a list of attributes to characterize truly capable technology roadmaps. We discuss how some of these capabilities can be implemented through

SESSIONS

object technology and how forecast metrics and patterns of technological innovation can be operationalized in these roadmaps. We conclude with a brief vision of how a truly capable technology roadmap might deliver the inventory of possibilities of a technological field.

HD-11.3 [R] Bringing Technology Management into the Academic Science & Engineering Laboratory: Through the Fusion of Soft Systems Methodology and Technology Road Mapping

Shoko Okutsu; ETH/JAIST, Switzerland

Kyoichi Kijima; Tokyo Institute of Technology, Japan

Hugo Tschirky; Swiss Federal Institute of Technology Zurich, Switzerland

The purpose of this paper is to develop a technology management methodology for Academic Science & Engineering Laboratories through the fusion of Technology Road Mapping and Soft Systems Methodology (SSM). The methodology aims at supporting academic researcher(s) by making full use of academic research qualities in order to generate emerging technology and creative invention as a basis for technological innovation. The fusion of Technology Road Mapping and SSM provides the methodology for researcher(s) by means of an Academic Technology Road Map, resulting in a customized Technology Road Map for Academic Science & Engineering Laboratories. The methodology also provides researcher(s) and stakeholders with the opportunity to communicate more openly as a result of the introduction of SSM as a guidance tool of Technology Road Mapping. The Academic Technology Road Map is the specialized application for Academic Science & Engineering Laboratories. Its use is important for communicating a 'Shared Vision' between researcher(s) and stakeholders and this application works a guide for fruitful discussions and a common understanding of the research. The methodology and the Academic Technology Road Map are validated through action research that was conducted at an artificial Intelligence Laboratory as an example of an Academic Science & Engineering Laboratory. Enterprise Science is a method of bringing all knowledge related to technology and management from academic to industry. When this concept is enhanced with the application of the Academic Technology Road Map, academic research results can be more effectively utilized.

HD-12 Strategic Management of Technology-3

Thursday, 7/24, 1:30 PM – 3:00 PM

Room: Senate Suite

Chair: Michael E Richerson; Boeing

HD-12.1 [R] Technology Strategy in the Large Commercial Aircraft Industry: Freedom of Choice?

Harm-Jan Steenhuis; Eastern Washington University, United States

Erik J de Bruijn; Technology and Development Group, Netherlands

Many companies experience extremely difficult situations as a result of their selected strategy, sometimes to such an extent that this may even threaten their survival. Strategic management theories implicitly assume that companies have a free choice in setting their actions, and consequently their strategy. Hence, when companies experience difficult situations this is because of management inadequacy. It is questionable whether companies always have a free choice. This research examines this issue. It focuses on the aircraft industry and analyses technology strategies by examining the new product strategies of the two main competitors: Boeing and Airbus. The development of the A380 aircraft was selected to determine to what extent the companies had a choice in setting their product development strategies. The conclusion is that neither has the alleged freedom for setting its strategy. Implications of this finding are that the strategy theory needs to be adjusted for this choice issue, and that management should not always be held fully responsible for the developing events. This phenomenon can be observed to a greater or lesser extent in other industrial sectors, e.g. the photocopy, automobile and the photo processing industry. For a general treatment of the issue, further in depth industry studies will be required.

HD-12.2 [R] How Can Enterprises Diagnostically and Interactively Control Their Technology-Based Strategies? An Action Research Case

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Technology strategy formulation and planning have become common business practices today. Nevertheless, successful implementation and measurement of the results is still quite difficult. The management control system of this paper shows how enterprises can best implement their technology strategies. Based on a case study of BMW's IT strategy, the paper describes different measurement and control processes that have led to BMW successfully realizing its IT strategy. Both control processes — the interactive and diagnostic control processes, designed within the scope of an action research project, are integrated into a balanced scorecard that provides BMW's IT management to measure and control IT technological innovations.

HD-12.3 [A] Internal Product Management of Services in Large Corporations

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In large corporations, internal services often need to be packaged, managed and delivered like a product. Large corporations have product management functions for external sales and project management functions for both internal and external activities. There is also a need to product manage major internal services, whether those services are provided by in-house organizations or external suppliers. Packaging an internal service as a product and managing it as a product is more than just service delivery management. In a large corporation, the customer base for the service is generally spread over many different organizations. The service may even be provided by multiple organizations or even some combination of internal organizations and external suppliers. The service delivery may even be managed by the service providing organizations. The product manager must orchestrate the service delivery with customer requirements, process changes, demand vs. affordability, the role of the service within the corporation, decisions on internal vs. external supplier and planning. There are both similarities and differences between product management and project management. Both organize and coordinate a multitude of activities. Both are concerned with cost and schedule. Both involve deliveries to a customer. On the other hand, a project has a specific beginning and end. A service is provided for an indefinite time period. Project management is capable of dealing with change, and change may or may not benefit the project. An ongoing service product will change with technology, economy of scale, organizational structure, customer "appetite," and benefit of the service.

AUTHOR INDEX

A

Aasland, Knut E.; HD-03.2
Abercrombie, David A.; TD-09.1
Abu-Khater, Bassam; WD-11.1
Acheson, Helena; TB-11
Acosta, Juan; HB-09.3
Agaran, Berrin; WD-08.1
Aje, John O.; TB-04
Ajgaonkar, Priya; WB-07.2
Akella, Ram; ME-03.3
Akgün, Ali E.; WE-03.3
Alam, Richard; TD-03.3
Albers, James A.; WB-04.1; MD-08.1
Alsudiri, Turki; WD-11.1
Ames, V. A.; TD-01.1
Anbari, Frank T.; HB-02.1; WD-12; TE-02
Anderson, Timothy R.; TB-08.2; WD-02.2; TB-08
Arai, Seiko; TB-10.3; TB-10
Arasti, Mohammad R.; WD-06.4
Armstrong, Malcolm S.; WE-01.1
Aronson, Zvi; TB-02.1
Arroyo, Pilar E.; TD-10.3; MD-09.3
Assbeihat, Jamal M.; HB-05.3
Atanasoski, Nebojá; TE-08.2
Auh, Yun-Bong; TB-04.4
Auysakul, Aroonrat; WB-07.2
Awazu, Yukika; MB-06.3
Ayberk, S.; TB-12.2

B

Baba, Jun'ichi; WE-06.4
Bacopulos, Martin; HB-09.3
Bailetti, Tony; WD-09.2; WE-13.2; TD-03.3; WD-09.1; ME-03; WD-09
Baker, Eric S.; HD-09.1
Bannert, Valerie; WE-09.1
Barclay, Ian; TB-06.2
Barczak, Gloria; TD-03.1; TB-03
Basoglu, Nuri; TE-03.2; TD-07.2; MB-11.4; MD-04.2; TD-07; TB-06.1
Batarseh, Roda; WB-07.1
Bayraktar, Demet; TD-09.3
Bear, Stephen; HD-01.2
Berg, Pekka; TB-04.2
Bernstine, Daniel O.; TA-01
Bers, John A.; WE-08.3
Betts, Stephen C.; MB-07.2
Bhaduri nee Chakraborty, Nilanjana; MB-13.1

Bharat, Mohana; HD-05.2
Bhardwaj, Awadhesh; HB-09.4
Birchall, David W.; TE-05.1; MB-07.1; TD-05; HB-01; WE-01.1
Black, Bob; WE-02.2
Bochenek, Grace M.; WE-07.1
Bolton, Deanna B.; TE-03.1
Boonserm, Kittinan; ME-12.1
Bras, Jos; TB-04.3
Bray, Olin H.; MD-11
Bressan, Mariana A.; ME-01.3
Brightman, Simon; WD-10.3; HB-08
Bristol, Terry; WD-06.3; WD-06
Brown, Robert; TB-03.4
Brûlé, Alain; HB-06.2
Buchanan, Walter W.; WD-08.1
Burns, Chris; HB-03.2
Byrne, Jay; WE-12.1
Byun, Sang-Kyu; TD-08.1

C

Çagan, Tayfun; MB-11.4
Capps, Brent A.; TE-10.2; WE-13
Carvajal, Roberto; HB-09.3
Cashman, William M.; WE-03.1
Cassingena Harper, Jennifer; TB-11
Ceausoglu, Dana E.; MB-06.1
Cebi, Ferhan; TD-09.3; TB-08.3; MB-06.2
Çelikyürek, Timur O.; ME-10.2
Cerny, Jan; WE-02.3
Chacko, George K.; HA-01
Chandiwalla, Farooq; WD-11.1
Chandrasekhar, Mahesh; MB-11.3
Chang, Chun-Yen; WB-09.4
Chang, Jung-Jung; WE-09.2
Chang, Shih-Chi; TE-12.1
Chen, Jin; MB-04.3; MB-04.4
Chen, Jiyao; TD-03.2
Chen, Kuo-Min; HB-03.1
Chen, Lien; TD-03.3
Chen, Peng-Ting; TB-09.3
Chen, Shibiao; WE-10.1
Chen, Yaogang; HB-03.3
Chen, Yuh-Jen; WE-07.2
Chen, Yuh-Min; WE-07.2
Cheng, Che-Min; WB-07.3
Cheng, James; ME-12.1
Cheng, Joe Z.; TE-12.1
Cheng, Wen-Lung; ME-11.3

Cho, Byung-sun; TE-12.3
Cho, Hwang hee; ME-05.4
Cho, Sang Sup; TD-05.1
Choi, Jong-in; ME-01.2; TB-05
Choi, Youngrak; WA-01
Christensen, Wendy; WB-07.1
Chu, Ko-Tsung; TE-12.1
Chu, Peter; ME-02.2
Chu, Yee-Yeen; WD-01.1; ME-11.3
Chung, Sunyang; MD-04.1
Chyr, Fuchiao; TE-09.2
Ciarelli, Kenneth J.; WE-07.1
Clar, Guenter; WB-11; TB-11
Coates, Joseph F.; WB-11
Côté, Jean; HD-02.1
Couillard, Denis; HB-12.2
Cox, Joseph; WE-06; TA-01

D

D'Cruz, Carmo A; MD-05.1; TB-05; WB-10.1; MD-05.2
da Fonseca Lima, Márcio Botelho; HB-05.4
Dai, Feng; TE-07.4
Daley, George C.; WE-10.2
Damiani, Jose Henrique S.; ME-01.3
Damianova, Zoya; TB-11
Dana, Leo-Paul; WE-05.2
de Bruijn, Erik J.; HD-12.1
De Coster, Rebecca J.; TD-08.2; TE-08
de Klerk, Antonie; HD-02; ME-07
deKorvin, Andre; ME-07.1
Demirci, Baris; TE-03.2
Deo, P. S.; MB-11.1
Deonísio, Cibele A. C.; ME-01.3
Dergint, Dario E.; HB-02.3
Desouza, Kevin C.; MB-06.3
Dey, Prasanta Kumar; HB-06.3
Dickerson, Bradley; ME-08.3
Dietlmeier, Julia; WB-07.3
Dietrich, Elton; ME-01.3
Dietrich, Glenn; TD-10
Dietz, Carl; TD-11; TE-11
Ding, Daniel Z.; WE-05.3
Dismukes, John P.; TD-01.1; WE-10.2; WE-10
Dixon, Brent; HB-11.3
Djurica, Milan; HB-09.2
Dluhosova, Sarka; WE-02.2
Dolgin, Benjamin; TB-07.2
Dominick, Peter; TB-02.1

AUTHOR INDEX

Drake, David; TE-06.2

Dryden, Robert D.; WA-01; TE-01

Duckles, Jonah; TD-11; TE-11

E

Eder, Robert W.; MB-05.3; MB-05

Eisenhauer, William; HB-06.2

Elbeyli, Ünal; WE-11.1

Elmore, Jack; HD-04

Emerick, Ronaldo; ME-01.3

Erkollar, Alptekin; WB-01.3; MD-09.2; TE-05

Ernst, Holger; TD-04.3

Erosa, Victoria E.; ME-07.2; TD-10.3; MD-09.3

Evrensel, Ayse Y.; WE-11.3

Ewton, Stacey E.; TB-07.1; TE-07

Ezingeard, Jean-Noel; TE-05.1

F

Fahrni, Fritz; WB-05.1; WD-01.2

Fairley, Richard E.; TE-10.2

Farris, George; MD-03

Farrukh, Clare; MD-01.3; MD-01.4

Faulk, Stuart; WD-13.2

Fernandes, Daniéla C.; ME-01.3

Ferington, Diane; WE-08

Ferrari, Stefano; HD-03.1

Flannery, William T.; TB-09.2; WD-07.3;
WE-03.2; TE-09; WE-03; MB-07

Flores, Marcos R.; ME-01.3

Flynn, Peter; HD-05.1; MB-06; WE-02

Forrester, Janice L.; ME-09.3; HB-07; MD-09

Fortuin, Frances T.J.M.; TB-04.3

Franza, Richard M.; ME-10.1

Frimpong, Samuel; WB-01.4

Frizelle, Gerry; TD-09.2; TB-02.3

Funk, Jeffrey L.; TD-12.3; TE-12

G

Galluzzo, Chris R.; TE-03.1

Ganesh, L S.; TE-07.1

Garcia, Jose Ivan; ME-01.3

Garg, T. K.; MD-05.3

Garnsey, Elizabeth W.; WE-05.1

Ge, Gloria L.; WE-05.3

Geisler, Eliezer; TB-06.3; MB-01; TB-06

Georghiou, Luke; TB-11

Gerd Sri, Nathasit; HD-11.2; HB-11.1; WB-08.2

Gerd Sri, Pisek; WB-08.2; ME-12.1

Ghosh, Sadhana; MD-08.2; ME-06.3

Giang, Francis; TE-10.3

Gonzalez-Baird, Jose R.; TE-07.3

Gordon, Theodore J.; WB-11

Gozlu, Sitki; TB-08.3; MB-06.2

Grant, Kevin P.; WE-03.1

Griffin, Abbie; MD-03

Güler, Seda; HB-11.4

Gunes, Fuat; TB-06.1

H

Hafeez, Khalid; WD-07.1

Haggerty, Bridget J.; HB-06.1; HD-05.3

Hambraeus, Gunnar; MA-01

Haner, Udo-Ernst; TB-04.2; TE-08.1; TD-08

Hanjoo, Kim; WE-09.3

Hanson, Duane; HB-11.3

Hao, Yanxia; WD-09.2

Hariharan, S.; HB-06.3

Harmon, Robert; WD-13.2; WB-10.4; WB-10

Hatakeyama, Kazuo; HB-02.3

Hedgepeth, Oliver; HD-02.2

Henderson, Paul; HD-01.1

Hendricks, Stephen D.; MB-13.2; MB-13

Henrie, Morgan E.; HD-02.2

Hensgen, Tobin; MB-06.3

Hensley, Russell A.; WB-07.3

Herman, Al; TD-01.2; WE-09; TD-01

Hernandez, Ivan Patricio; WD-08.3

Hirasaka, Masao; TB-07.3

Ho, Jonathan C.; WB-09.2

Ho, S. Michael; ME-09.2

Ho, Ying-Tz; ME-12.1; TD-07.1

Holahan, Patricia J.; TB-02.2; WE-03.3

Holland, William T.; HD-09.2

Hong, Wonsoon; ME-11.2

Horiuchi, Osamu; HB-01.3

Hougen, Joyce; HD-01.1

Houston, James A.; TD-11; TE-11

Hsu, Jeffrey; WB-06.2; WE-01.3; WD-13.1

Hsu, Li-Chang; WD-11.2; WD-11.3

Huang, Lucheng; WD-01.3

Huang, Samuel H.; TD-01.1; WE-10.2

Huda, Najmul; MB-11.1

Hung, Shih-Chang; WD-01.1

Hunt, Francis; WE-13.3; TE-08.4

Hwang, Hoyoung; TE-12.3

I

Iamratanakul, Supachart; WD-02.3; WB-08.3

Ishiguro, Shu; TD-04.1

Ishioka, Masaru; HD-03.3

Itakura, Hiroaki; ME-06.1

Iwata, Kouichi; HD-03.3

Iyigun, Iffet; WE-04.1

J

Jaakkola, Hannu; MD-08.3; ME-11.1; MD-08;
WD-13

Jaehyun, Yeo; WE-09.3

Jagoda, Kalinga; TD-10.1

Jain, Sushim; ME-06.3

Jefferis, Ryan; WB-07.2

Jetter, Antonie J.; TB-03.1

Ji bum, Jung; WE-09.3

Jing, Jingsong; MB-04.3; MB-04.4

Johnson, Madeline; ME-07.1

Johnson, Spencer; MB-02

Jung, Hans-Helmuth; TE-08.2; HD-12.2;
MD-01.2

K

Kalja, Ahto; TE-06.3

Kalsaas, Bo Terje; TD-09

Kameoka, Akio; HD-11.1; HB-01.3; WD-08.2;
MB-03

Karin, Igal; ME-12.2; ME-12

Kärkkäinen, Hannu; TD-12.2

Karmakar, Nitya L.; TE-06.1

Katz, Vera; WA-01

Kaya, İlhan; MD-04.2

Kaykusuz, Hamdi; ME-10.2

Keil, Diane; WB-07.1

Kemerdere, Nese; TB-12.2

Keys, Kenneth; WD-10

Keys, L. Kenneth; WE-10.1

Kiekel, Darren; TB-12.1

Kijima, Kyoichi; HD-11.3

Kim, Byung-Woon; WB-05.3

Kim, Hak J.; TD-08.3

Kim, Hanjoo; TE-05.3

Kim, Ho; ME-11.2; MB-11

Kim, Jeong-hwan; WB-01.2

Kim, Jinho; ME-09.1

Kim, Jongbae; WE-04.2; ME-03.2

Kim, MinYoung; WB-10.3

Kim, Moon-Koo; WB-10.3

Kim, Sang-choon; HB-07.2

AUTHOR INDEX

- Kim, Soo-Yong; HB-05.2
Kim, Tai-Yoo; TB-10.1; TE-08.3; TD-08.1
Kimiloglu, Hande; TB-06.1
Kirchhoff, Bruce A.; WE-10.3
Kishore, Rajiv; ME-03.3
Kitano, Hiroaki; TD-04.1
Klein, Richard S.; TD-07.1
Klusacek, Karel; TB-11
Kocaoglu, Dundar; HB-11.1; WD-08.3;
MB-06.2; WB-07; TE-07.2; MA-01
Koch, James; HD-05; WD-01
Koch, Marianne; TE-06.2
Koeller, Timothy C.; WD-05.2
Koivuniemi, Jouni; TD-12.2
Koksaldi, Sertac; WE-04.1
Komonchaisek, Phasin; TD-07.1
Korecky, Michal; WE-02.3
Korot, Len; WE-05.2
Koruna, Stefan M.; HB-12.4; WD-04.2;
WB-04.3; HB-12
Kotnour, Timothy G.; WD-04.3; WB-04;
MD-03
Krabbendam, Koos; MB-04.2
Krause, Thomas F.; WE-02.1
Krishna, Sudha; TE-07.3
Kumar, Yashwant; ME-06.3
Kuo, L. F.; TB-09.3
Kusaka, Yasuo; TB-07.3
Kuwahara, Terutaka; HD-11.1
Kwak, Myungjae; TE-12.3
Kwoen, Soo-Cheon; WB-05.3
Kwon, Kum-Ju; TB-04.4
Kwong, Ying Ki; WB-08.1
- L**
Laaksonen, Petteri; TD-12.2
Lai, Hsien-Che; TE-05.2
Landaeta, Rafael E.; WD-04.3
Lapierre, Jozée; HB-12.2
Large, David; WD-10.3; HB-08
Le, Khoi; HD-05.3
Leban, William; WE-08.2
Lechler, Thomas G.; TB-02.1; WD-05.2;
ME-02; WB-05
Lee, Byoung N.; TB-04.1
Lee, Gin-Yuan; WE-09.2
Lee, Hong-Yuh; TD-07.3
Lee, Hyun-woo; WB-01.2
Lee, Jee Hyung; TE-12.2; TD-12
- Lee, Jeong-Dong; TB-10.1; TD-08.1
Lee, Jong Yong; ME-05.3
Lee, Jongsu; TD-08.1
Lee, Jung Mann; WB-10.2
Lee, Jungmann; WB-06.3; WB-06
Lee, Kongrae; WE-01.2
Lee, Sangmu; TE-05.3
Lee, Se-Jun; TE-08.3
Lee, Suhwe; TD-02.1
Lee, Sukhan; TD-11; TE-11
Lee, Sungjoo; TD-05.2; TE-03.3; TE-03
Lee, Yong-Gil; TE-08.3
Lee, Young-Dai; HB-05.2
Lee, Zon-Yau; TB-09.3
Leem, Byunghak; MD-09.1
Lewis, Alan; TB-03.4
Li, Meng; WD-08.2; HD-11.1
Liang, Ling; TE-07.4
Liang, Shing-Ko; ME-02.2
Liberatore, Matthew J.; ME-02.1; MD-02
Lieberman, Devorah; WD-08
Lim, Kwang-sun; HB-07.2
Lin, Shui-Shun; WD-07.2
Linhavess, Watjana; WB-07.3
Linstone, Harold; TB-11; TE-01.2; WB-11;
MD-03
Lipscomb, Thomas H.; TA-01
Lister, Gordon; MD-10
Liu, Chrystal Y.; WD-09.1
Liu, Jihong; MB-04.2
Liu, Jingdong; WE-13.2
Liu, Jingjiang; HB-01.2
Liu, Ren-Jye; MB-05.1; HB-03.1
Liu, Tzu-Hsin; WD-01.1
Lizaso, Fernando; HB-11.2; HD-11
Lo, Mei-Chen; WB-09.4; WB-09.1
Lo Storto, Corrado; WD-04.1; ME-10; TD-10.2
Long, Tom; WB-08.1; TD-03; WB-08
Loudiadis, Josee M.; WD-05.1; WE-05
Lovrekovic, Zoran T.; HB-09.2
Luggen, Martin; WB-05.2; HB-12.4
Lukas, Ladislav; MB-11.2
Lynn, Gary S.; WE-03.3; TD-03.2
Lyth, David M.; MB-12.1; MB-12.2
- M**
Mäkinen, Jukka; ME-11.1
Mallak, Larry A.; MB-12.2; MB-12.1
Mann, Darrell; WB-11; ME-12.4
- Manzini, Raffaella; HD-03.1
Markkula, Markku; TB-11
Martin, Hilary T.; TE-01.3
Martin, R. Keith; TB-01.2
Marxt, Christian; WD-01.2; WE-07.3
Mathew, Mary; MB-13.1
Matthern, Gretchen E.; HB-11.3
Mayer, Heike; TB-05
Mazloomi Khamseh, Hamid; WD-06.4
McCarthy, Ian P.; TB-03.2
McDonough III, Edward F.; TD-03.1
McDougall, John; HA-01
Meade, Phillip; HB-03.2; WE-12.2; WE-12
Mehra, Kavita; WE-04.3
Mellat Parast, Mahour; HB-12.1
Menke, Michael; HD-01; HD-01.3
Mensch, Gerhard; WB-11
Michalisin, Michael; WB-01.4
Migliore, Herman; ME-08
Miller, Lawrence K.; TD-01.1; WE-10.2
Miller, Ruth; TD-01.1
Mills, John; MD-01.4
Milosevic, Dragan Z.; TD-02.2; WD-02.2;
HB-02; MB-12
Minshall, Tim; WE-05.1
Mittal, Rahul; WE-10.2
Miyazaki, Kumiko; ME-08.1
Monplaisir, Leslie; TB-03.3
Mooney, Ann C.; TB-02.2
Moore, David W.; WB-09; WE-04
Muir Bodensteiner, Nan; TB-12.1
Mulia, Farolan A.; HD-05.3
Munson, J. M.; TB-09.2
Murphy, Darragh; TB-03.4
- N**
Nahar, Kamrun; MB-11.1
Nahar, Nazmun; TE-06.1; MB-11.1
Nair, S. K.; MD-08.2
Narsing, Anthony; WB-01.4; WB-01
Nayar, Madhavan; TB-06.3
Nemiro, Jill E.; MB-07.3
Nepal, Bimal P.; TB-03.3
Newbert, Scott L.; WE-10.3
Ng, Allan; HD-05.1
Nguyen, Khanh; WB-07.1
Niwa, Fujio; ME-05.1
Niwa, Kiyoshi; WB-04.2; HB-09.1; TD-04.1;
HB-09, TD-04

AUTHOR INDEX

Nolan, Patrick; WD-01.2
Nuci, Elaine; ME-01.3
Nummi, Juha; TB-04.2
Nunez, German; MD-12

O

Oberer, Birgit J.; WB-01.3; MD-09.2
Ohta, Joni T.; HD-01.1; HD-01
Okutsu, Shoko; HD-11.3
Olson, Suzan D.; MB-12.1
Om, Kiyong; WB-06.3
Omar, Ayman A.; WE-03.1
Omta, Onno; TB-04.3
Öncü, Aykut A.; TD-07.2
O'Neal, Tom; MD-05.1; TB-05
Öner, Atilla M.; TE-03.2; WE-11.1; ME-10.2;
TD-07.2; HB-11.4; MB-11.4; MD-04.2
Ozbay, And; TD-02.2
Ozturk, Azim; WE-04.2

P

Pandejpong, Toryos; TE-07.2
Park, Gwangman; TD-05.2
Park, Jeong-Seok; TE-12.2
Park, Jong-Bok; TB-10.1
Park, Myeong-Cheol; WB-10.3
Park, Seok Ji; TD-12.1
Park, Yongtae; TD-05.2; TE-03.3
Patanakul, Peerasit; WD-02.2
Patton, Angela; ME-06.2
Patton, John R.; MB-02
Pellerin, Karine; TE-09.3
Perkins, Robert A.; WE-02.1
Perng, Chyuan; WD-07.2
Perry, Nolan; MB-02
Persaud, Ajax; ME-03.1
Peters, Lois; WD-10.1
Peterson, John W.; TE-01.1
Petrick, Irene J.; WB-06.1; TD-11; TE-11
Phaal, Robert; MD-01.3; MD-01.4; TD-11;
TE-11; TE-08.4
Phelan, Timothy M.; ME-02.3
Phillips, Fred; WB-11; TB-05; WD-05
Pihlajamaa, Jussi; TB-04.2
Pilkington, Alan; WD-10.2
Pivetta, Carlos S.; ME-01.3
Pizzurno, Emanuele; HD-03.1
Polat, Melda; WE-04.1
Poli, Michael; MD-02.3; WB-02

Pollack-Johnson, Bruce; ME-02.1
Popovic, Dragana R.; WB-05.1
Porter, Alan L.; WB-11; TE-04
Porter, Keith J.; TB-06.2
Ports, Ken; WB-10.1; MD-05.2
Posada, María; HB-09.3
Prabhaker, Paul; TB-06.3
Pratt, Catherine; MD-08.1
Prescott, Lisa; HD-02.1
Pretorius, Leon; HB-05.1
Pretorius, Marthinus W.; TB-01.3; MB-03;
WE-01
Pringsulaka, Proadpran; TE-07.3
Probert, David; WE-13.3; TE-08.4; MD-01.1;
MD-01.3; MD-01.4; MD-01

R

R, Shanmugam; TE-07.1
Rabelo, Luis C.; WE-12.2; HB-03.2
Rafferty, Peter J.; HD-07
Raffo, David; WD-13.2
Ragusa, James M.; WE-07.1; MB-08
Ramanathan, Krishnamurthy; TD-10.1; TB-
05; MB-10
Ramesh, R.; ME-03.3
Raurich, Vicente F.; WD-01.2
Reeb, James E.; HD-09.1
Reed, Julie L.; MD-13
Reger, Guido; HB-11.2
Reginato, Justin M.; MD-02.1
Rehani, Manu; TD-09.1
Reich, Blaize; MD-06
Reilly, Richard R.; ME-02.3; TD-03.2
Reisman, Arnold; TE-10; HB-06; TB-10.2
Reiter, William F.; HD-09.1
Ren, Liqin; MB-04.2
Richerson, Michael E.; HD-12.3; HD-12
Rim, Myung-Hwan; TD-05.1
Rinne, Martin; TD-11; TE-11; HD-11.2
Rocha, Germana Costa; HB-05.4
Roche, Loïck; WE-06.1; WD-06.2
Roelofse, Andrie J.; TB-01.3
Rogers, Jamie; ME-09.1; MD-09.1
Roh, Ilsue; TB-04.4
Rozenes, Shai; TD-02.3
Rubenstein, Al H.; MD-04.3; MD-04
Rueda, Guillermo; WD-11.1
Ryser, Peter; MB-06.1

Ryu, Tae-Kyu; TB-10.1
Ryu, Won; WB-01.2

S

Saberian, Amy; TB-12
Sabharwal, Poonam; HD-05.2
Sadowsky, John; WE-06.1; WD-06.2
Saengpongpaew, Pichit; WD-09.3
Said, Samir; WD-11.1
Saito, Masatake; WE-08.1
Sajjad, Aamer; TD-03.3
Salami, Reza; TD-05.3
Santanen, Mikko; MD-08.3
Santoro, Michael D.; MB-07.2; WD-07
Sardone, Frank J.; MB-12.1
Sarihan, Halime Inceler; WD-08.3
Sato, Carlos E.; HB-02.3
Savani, Harsha; WD-07.1
Savioz, Pascal; HD-12.2
Sawng, Yeong Wha; WB-10.2
Sawng, Yeong-Wha; WB-06.3
Schalick, Judith A.; ME-08.2
Schaller, Robert R.; TD-11; TE-11
Seino, Takehisa; HB-09.1
Selman, Jerome H.; WE-06.2
Selman, Victor N.; WE-06.2
Seppälä, Juuso; TB-04.2
Setiowijoso, Liono; HD-05.3
Shaikh, Muzaffar; MD-05.2
Sharma, O. P.; TE-09.1; HD-09.2
Sharma, S. K.; MD-05.3
Shehabuddeen, Noordin Than Myint Hlaing;
WE-13.3
Shen, Shouqin; HB-01.2
Shenhar, Aaron J.; MD-02.3; ME-02.3; TD-02;
MD-02.2
Shin, Dong-Hee; WB-01.1
Shin, Juneseuk; TD-05.2
Shinriki, Seiji; WB-07.2; ME-12.1
Shipley, Margaret F.; ME-07.1; TB-02
Shiralkar, Yogesh C.; TD-01.1; WE-10.2
Shumar, Debra; ME-09.2
Shyu, Joseph Z.; TE-05.2
Silva, Luiz B.; HB-05.4
Simons, Gene R.; TB-09.1
Sinclair-Desgagné, Bernard; HB-12.2
Singam, Stephen; ME-09
Singh, Nanua; TB-03.3
Singh, Ranjit; HB-09.4; WD-11

AUTHOR INDEX

Siritianthong, Panumas; TE-07.3

Smitasiri, Darin; WD-09.3

Smith, Sen. Gordon; MA-01

Smith, Jeffrey H.; TB-07.2; TB-07

Socci, Vince; WD-03

Soll, Jan Henrik; TD-04.3

Song, In young; ME-05.4

Song, Wook Jin; ME-05.4

Spanovich, Gary A.;

Specht, Pamela; ME-06.2; ME-06

Speirs, Christopher; WD-01.2

Speller, Thomas; HB-03.2

Spinks, Nigel; TE-05.1

Spivey, W. A.; TB-09.2

Spraggett, Stuart; TD-02.3

Spruce, Philip; TB-06.2

Stecke, Kathryn; HD-09; HB-03; TB-09;
MD-03

Steckler, Nicole; TE-06.2; TE-06

Steenhuis, Harm-Jan; HD-12.1

Stokes, Deborah; WE-12.1

Su, Chao-Chi; ME-11.3

Su, Yu-Shan; WE-12.3; TB-05

Sudrajat, Iwan; WD-08.3

Sun, Kewei; TE-07.4

Sundararajan, Malavika; WD-10.1

Sushil.; TE-09.1

Suzuki, Kaoru; TE-10.1

T

Tang, Chao-ying; HB-01.1

Teichert, Thorsten T.; MB-07.4; WE-07

Telles, Geraldo N.; HB-07.3

Teng, S. Gary; ME-09.2

Tepandi, Jaak; MB-11.1

Tetreault, Mary Kay; HA-01

Thachenkary, Cherian S.; MB-11.3; ME-11

Thamhain, Hans J.; TB-01.1

Thompson, Joyce A.; MB-05.2

Thompson, Charles W.; WD-06.1

Tongia, Rahul; MB-06.4

Tovstiga, George; MB-07.1; WE-05.2

Trachtenberg, Robert; TB-09.1

Triantis, Konstantinos; HB-07.1; TB-08.1

Tsai, Cheng-An P.; WD-05.3

Tsai, Fu-Sen; TB-09.2

Tsai, Jenteng; WD-07.2

Tsai, M. J.; TB-09.3

Tsai, Min-Jen; WE-09.2

Tsai, Su-Lee; WD-05.3

Tschirky, Hugo; WE-09.1; WB-05.2; HD-11.3;
MD-01.1; MD-01; MB-03; MD-01.2; HB-11

Tseng, Hsing Chau; ME-12.3

Tsinopoulos, Christos D.; TB-03.2

Tsuji, Masashige; WE-08.1

Tsujimoto, Masaharu; ME-05.2

Tuominen, Markku; TD-12.2

Tzeng, Gwo-Hshiung; WB-09.4; TE-05.2;
TD-07.3

U

Ulshafer, Susan M.; MB-12.1

Unni, Ramaprasad; WB-10.4

Uribe-Iniesta, Estela; ME-07.2

V

van der Merwe, Erik; TB-02.3

van Wyk, Rias J.; MB-03

Vaneman, Warren K.; HB-07.1; TB-08.1

Velázquez, Diana; HB-09.3

Vetorazzi Jr, Carlos N.; HB-07.3

Viljoen, Philip J.; WD-02.1

Vitner, Gad; TD-02.3

Voit, John R.; ME-03.3

von Zedtwitz, Max; MB-04.1; TD-04.2;
MB-04

Vostracky, Zdenek; WE-02.3

W

Wahlberg-Eklund, Paula; MD-08.3

Wakeland, Wayne; ME-09.3

Walsh, Steve T.; WE-10.3

Wang, Chao-Hung; WD-11.4; WD-11.2

Wang, Ching-Bin; WE-07.2

Wang, Margaret; WB-07.3

Wani, Vijay P.; MD-05.3

Warner, Malcolm; WE-05.3

Watts, Robert J.; TE-04

Weber, Charles M.; WB-09.3; WE-11; MD-05;
WD-04

Wei, Xiong; HB-01.1

Weisbin, Charles R.; TB-07.2

White, Donald E.; MB-02

Whittaker, John; HD-02.1; WD-02; WB-01.4

Wilemon, David; TD-01.3; HD-03; TB-01;
WE-04.2; ME-03.2

Williams, Barbara; WD-07.3

Williams, Gerald H.; TB-08.2; HB-05

Winzker, Dietmar H.; HB-05.1

Wong, J. C.; TE-08.4

Wong, Meiling; MB-05.1

Wong, Zoe Y.; WE-13.1

Wongsuebchart, Tassawan; TD-07.1

Wood, Colin S.; TB-06.2

X

Xie, Guangya; MB-04.2

Xijin, Tang; ME-07.3

Xu, Erming; TB-09.4

Xu, Qingrui; HB-01.2; HD-01.3

Xu, Yuehong; TB-09.4

Y

Yafei, Luo; WD-01.3

Yamada, Ikuo; WE-06.4

Yamasaki, Hiroyuki; WE-06.4

Yang, Delin; HB-03.3

Yang, Jianmei; ME-07.3

Yang, Kuo-Lung; ME-02.2

Yasuda, Kazuhiko; HD-03.3

Yeo, Inkap; WB-10.2

Yeo, Jaehyun; TE-05.3

Yepez, Carlos A.; WD-09.1

Yim, Deok S.; ME-05.4; ME-05

Yoo, Youngsang; ME-05.3

Yoon, Byungun; TE-03.3

Yoon, Chong-ho; WB-01.2

Yoon, Suck-Chul; WE-06.3

Young, Rochelle; ME-08.3

Yu, Hsiao-Cheng; TB-09.3; TE-12.1; TD-07.3

Yu, Young-shin; HB-07.2

Yuan, Benjamin; WB-09.1

Yurtseven, Kudret; WD-08.1

Yusof, Shafiz M.; WB-01.1

Z

Zhang, Hongxia; ME-11.4

Zhang, Terence Y.; WD-09.1

Zheng, He; ME-07.3

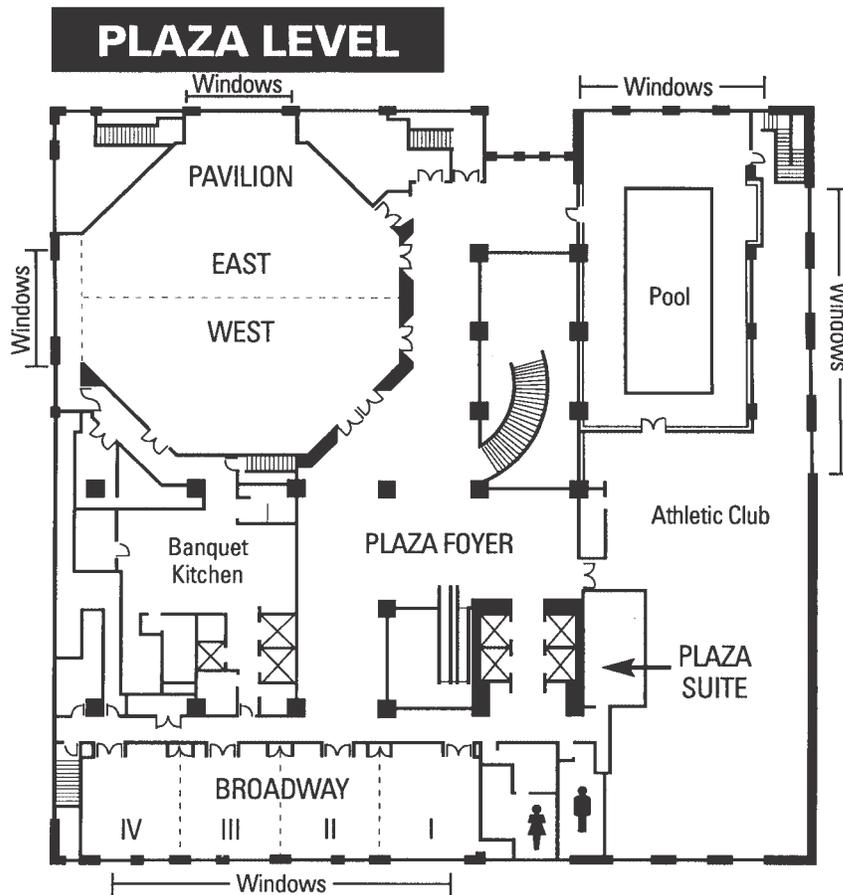
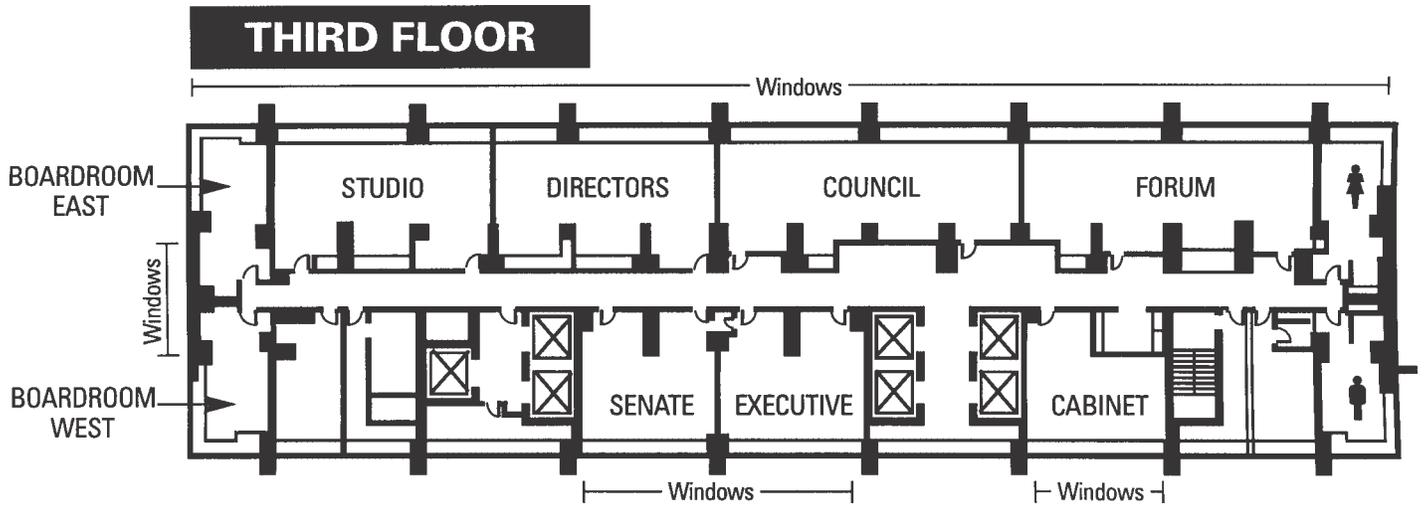
Zhou, Ji-zhong; HB-01.1

Ziv, Nina; ME-01.1; ME-01

Zobel, Rosalie; MA-01

Zou, Yi; HB-03.3

HILTON FLOOR LAYOUT



Room Code Key

01:	Pavilion East
02:	Pavilion West
03:	Broadway I
04:	Broadway II
05:	Broadway III
06:	Broadway IV
07:	Forum
08:	Council
09:	Directors
10:	Studio
11:	Executive
12:	Senate
13:	Cabinet