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PICMET '15

PICMET

Dear PICMET Guests:

We are pleased to welcome you to the PICMET '15 Conference.

The Technology Age is upon us. It is a challenge to think of any activity in any part of our lives that is not affected or driven by technology. We are in the era of wearable technologies, self-driving cars, vehicle-to-vehicle communication, 3-D printing revolutionizing manufacturing and construction industries, liquid biopsy for fast DNA-sequencing machines leading to simple blood tests for cancer, megascale reverse-osmosis desalination plants, growing human brain cells to cure dementia, and genetic tools to boost crop yields and feed billions more people.

PICMET defines the primary role of Technology Management as the management of technologies to assure that they work for the betterment of humankind. Using this definition, technology management has a critical role to play in the proper utilization of technology to meet the world's needs.

This is a big challenge for the leaders and future leaders in the Technology Management field. Recognizing this challenge, the PICMET '15 Conference explores the role of technology management in the technology age.

PICMET '15 received 663 submissions. After a double-blind refereeing process, 273 papers were included in the conference. The referees were from around the world. The authors represent more than 200 academic institutions, industrial corporations and government agencies in 30 countries.

The PICMET '15 Conference has two outputs:

This ***Conference Bulletin*** includes an up to 200-word abstract of each paper to enable the participants to select the sessions to attend and the presentations to follow. The *Bulletin* is intended as a reference book for an overview of the field, in general, and the conference, in particular.

The ***Proceedings*** is a flash drive containing full-length presentations included in the conference. Its purpose is to give full access to the entire conference for many years after the conference is over. The *Proceedings* is divided into 43 sections, listed below, each containing several papers on the topic.

- **Technology Management Framework**
- **Strategic Management of Technology**
- **Science and Technology Policy**
- **Collaborations for Technology Management**
- **Competitiveness in Technology Management**
- **Science and Technology Communication**
- **Decision Making**
- **Emerging Technologies**
- **Disruptive Technologies**
- **Convergence of Technologies**
- **E-Business**
- **Innovation Management**
- **Commercialization of Technology**
- **Entrepreneurship/Intrapreneurship**
- **Intellectual Property**
- **Educational Issues**
- **Global Issues in Technology Management**
- **Cultural Issues**
- **Environmental Issues**
- **Information & Knowledge Management**
- **Productivity Management**
- **ICT Management**
- **Enterprise Management**
- **Product Development Management**
- **Project/Program Management**
- **R&D Management**
- **Supply Chain Management**
- **Manufacturing Management**
- **Resource Management**
- **Quality Management Sustainability**
- **Technological Changes**
- **Technology Assessment and Evaluation**
- **Technology Forecasting**
- **Technology Planning**
- **Technology Roadmapping**
- **Technology Acquisition**
- **Technology Adoption**
- **Technology Diffusion**
- **Technology Transfer**
- **Technology Management in the Service Sector**
- **Technology Management in Transportation**
- **Technology Management in the Energy Sector**

PICMET ’15

A large number of colleagues around the world contributed to the success of the PICMET ’15 Conference.

The PICMET Board of Directors set the strategic direction; the Advisory Council provided guidance for the implementation of the strategies for the conference.

Kenny Phan, as the Executive Director of PICMET, coordinated the overall planning for the conference; Liono Setiowijoso designed, maintained and managed the information systems, and formatted the papers for the *Proceedings*; Ann White, as the Executive Director Emeritus, edited the *Bulletin* and prepared the front end materials; Caroline Mudavadi, as the Executive Assistant, provided continuous support throughout the planning process. Tugrul Daim was the Director of Technical Activities, Kiyoshi Niwa and Dilek Cetindamar were the Co-Directors of International Activities, Antonie Jetter was the Director of Student Activities, and Charles Weber was the Director of Awards. Dongjoon Lim and Caroline Mudavadi managed the registration process; Songphon Munkongsujarit and Byung Sung Yoon coordinated the on-site activities; Inthrayuth Mahaphol managed the documentation together with Pei Zhang; and Jeff Birndorf developed graphic arts for the conference.

Timothy Anderson, Tugrul Daim, Kiyoshi Niwa, Dilek Cetindamar Kozanoglu and Gary Perman conducted the review process for the papers as the Associate Editors; 167 colleagues from around the world constituted the Panel of Reviewers. They each reviewed up to 10 papers submitted to PICMET ’15. Each paper was reviewed by two or more reviewers to assure high quality. Kenny Phan and Caroline Mudavadi did the scheduling of the accepted papers for presentation at the conference. Inthrayuth Mahaphol, Liliya Hogaboam, Shabnam Jahromi, Jiali Ju, Dongjoon Lim, Caroline Mudavadi, Byung Sung Yoon and Pei Zhang were the Editorial Assistants to check and verify that the finalized papers included all the revisions recommended by the reviewers.

Vince Reindl, Kai Oldenburg, and Rob Bossingham of Omnipress worked with PICMET from the beginning to the end of the conference planning effort. Their professionalism and superb expertise assured the high quality production of the PICMET *Proceedings* on schedule.

The Country Representatives, under the leadership of Kiyoshi Niwa and Dilek Cetindamar Kozanoglu, provided linkages between PICMET and the regions they represent.

The sponsors of PICMET ’15 made this conference possible. We extend special thanks to all of them: Portland State University Department of Engineering and Technology Management, Maseeh College of Engineering and Computer Science, Office of Information Technology Instructional Technology Services and Classroom Audio Visual Event Team, Panasonic System Communications Company of North America, and Travel Portland.

We believe the PICMET ’15 *Bulletin* and *Proceedings* contain some of the best knowledge available on Technology Management for addressing the challenges and opportunities in a world where services and infrastructure are being integrated. We hope they will contribute to the success of technology managers and emerging technology managers throughout the world.

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***Timothy R. Anderson**, Associate Editor, Portland*
***Tugrul U. Daim**, Associate Editor, Portland*
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DEDICATION

PICMET '15 is dedicated to all researchers, educators and practitioners of Technology Management who are contributing to the establishment and growth of this field throughout the world.

PICMET '15

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Dr. Oliver Yu, Executive in Residence, College of Business, San Jose State University, USA

PANEL OF REVIEWERS

Papers submitted to PICMET conferences are subjected to a double-blind review process. Each paper included in the PICMET '15 conference was reviewed by two or more members of the Panel of Reviewers to assure a very high quality. The panel had 167 members from around the world. They are listed below in alphabetical order by last name.

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Fatima Albar
Jose Albors-Garrigos
Joe Amadi-Echendu

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PICMET LEADERSHIP IN TECHNOLOGY MANAGEMENT (LTM) AWARD RECIPIENTS

The PICMET Leadership in Technology Management (LTM) Award recognizes and honors individuals who have provided leadership in managing technology by establishing a vision, providing a strategic direction, and facilitating the implementation strategies for that vision.

The Award was established in 1991. The recipients with their affiliations and positions at the time of the award are listed below.

1991
Dr. Andrew S. Grove, CEO of Intel, USA

1997
Mr. Norman Augustine, Chairman of Lockheed Martin, USA

1999
Mr. Jack Welch, CEO of General Electric, USA
Dr. Richard M. Cyert, President of Carnegie Mellon University, USA

2001
Dr. Modesto A. Maidique, President of Florida International University, USA
Ms. Carleton S. Fiorina, Chairman and CEO of Hewlett-Packard Co., USA
Ms. Donna Shirley, Manager of the Mars Exploration Program, USA

2003
Mr. Jong-Yong Yun, Vice Chairman and CEO of Samsung Electronics, Inc., Korea
Dr. Joseph Bordogna, Deputy Director of the National Science Foundation (NSF), USA
Dr. Chun-Yen Chang, President of National Chiao Tung University, Taiwan

2004
Dr. Kwan Rim, Chairman of Samsung Advanced Institute of Technology (SAIT), Korea
Dr. Gunnar Hambraeus, member of the Swedish Royal Academy of Science and former President and Chairman, Royal Swedish Academy of Engineering Sciences, Sweden

2005
Dr. Morris Chang, Founding Chairman, Taiwan Semiconductor Manufacturing Company Ltd. (TSMC), Taiwan
Dr. Pairash Thajchayapong, Permanent Secretary, Ministry of Science and Technology, Thailand
Dr. Eric von Hippel, Professor and Head of the Technological Innovation and Entrepreneurship Group, Sloan School of Management, Massachusetts Institute of Technology, USA
Prof. Dr.-Ing. Dr. Sc. h.c. Bacharuddin Jusuf Habibie, former President, Indonesia, and founder and chairman, The Habibie Center, Indonesia

2006
Dr. Youngrak Choi, Chairman, Korea Research Council of Public Science & Technology (KORP), Korea
Dr. Tsuneo Nakahara, Adviser to CEO (past Vice Chairman) of Sumitomo Electric Industries, Ltd., Japan
Dr. Mehmet Nimet Ozdas, Dept. of Mechanical and Control Engineering, Istanbul Technical University, Turkey
Dr. Edward B. Roberts, David Sarnoff Professor of the Management of Technology and Chair, Massachusetts Institute of Technology (MIT) Entrepreneurship Center, USA

2007
Dr. Harold A. Linstone, Editor-in-chief, Technological Forecasting and Social Change, University Professor Emeritus, Systems Science, Portland State University, USA
Dr. Yoshio Nishi, Director of Research of the Stanford

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Center for Integrated Systems, Director of the Stanford Nanofabrication Facility, and Research Professor in the Department of Electrical Engineering at Stanford University, USA

2008

Mr. William P. Venter, Chairman, Allied Electronics Corporation Limited, South Africa

Dr. Gideon de Wet, Professor Emeritus, University of Pretoria, South Africa

2009

Dr. Klaus Brockhoff, Professor, Otto Beisheim School of Management, Germany

Ms. Anne M. Mulcahy, Chairman and Former CEO, Xerox Corporation, USA

Prof. Muhammad Yunus, Managing Director, Grameen Bank, Bangladesh

2010

HRH Princess Maha Chakri Sirindhorn, Thailand

2011

Dr. David M. Steele, Dean, College of Business and Lucas Graduate School of Business, San Jose State University, USA

2012

Dr. Daniel Berg, Distinguished Research Professor of Engineering, the University of Miami, USA

Dr. Nam P. Suh, President, Korea Advanced Institute of Science and Technology (KAIST), Korea

2013

Dr. Robert JT Morris, VP Global Labs, IBM Research, USA

Dr. James M. Utterback, David J. McGrath jr (1959) Professor of Management and Innovation, MIT Sloan School of Management; and Professor of Engineering Systems, School of Engineering, Massachusetts Institute of Technology, USA

2014

Dr. Hans-Joerg Bullinger, Senator of the Fraunhofer-Gesellschaft, Germany

Mr. Michael Joseph, Director of Mobile Money, Vodafone Group Services Limited, UK; and Fellow, the World Bank

Dr. Thomas L. Magnanti, President, Singapore University of Technology and Design (SUTD), Singapore; and Institute Professor and former Dean of Engineering, Massachusetts Institute of Technology (MIT), USA

Mr. Takeshi Uchiyamada, Chairman of the Board, Toyota Motor Corporation, Japan

PICMET MEDAL OF EXCELLENCE AWARD RECIPIENTS

PICMET's "Medal of Excellence" recognizes extraordinary achievements of individuals in any discipline for their outstanding contributions to science, engineering and technology management.

The award was instituted in 2004. The recipients with their affiliations and positions at the time of the award are listed below.

2004

Dr. Daeje Chin, Minister of Information and Communications, Seoul, Korea

Dr. Kiyoshi Niwa, Professor in the Department of General Systems Studies at the University of Tokyo, Japan

Dr. Rosalie A. Zobel, Director of Components and Systems in the Information Society and Media Directorate-General of the European Commission

2005

Mr. Bob Colwell, President, R & E Colwell and Associates; and former Fellow, Intel Corporation

2006

Dr. Frederick Betz, Former Program Officer, NSF

Dr. Fariborz Maseeh, Founder and President, The Massiah Foundation
Dr. T. Nejat Veziroglu, Director, Clean Energy Research Institute, University of Miami

2007
Dr. Mihail C. Roco, National Science Foundation (NSF), National Nanotechnology Initiative (NNI), and International Risk Governance Council (IRGC), USA

2009
Dr. Albert H. Rubenstein, Founder and President, International Applied Science and Technology Associates (IASTA); and Professor Emeritus, Industrial Engineering and Management Sciences, Northwestern University

2010
Ms. Kiran Mazumdar-Shaw, Chairman and Managing Director, Biocon Limited, India
Prof. Dr. Nuket Yetis, President, Scientific and Technological Research Council of Turkey (TÜBITAK)

2011
Mr. Alejandro Cruz, Minister of Science and Technology, Costa Rica

2013
Dr. Eliezer Geisler, Distinguished Professor, Stuart School of Business, Illinois Institute of Technology, USA
Dr. Hans Georg Gemuenden, Professor, Berlin University of Technology, Germany

PICMET FELLOWS

The PICMET Fellow Award was established in 2011 to commemorate PICMET's 20th Anniversary. It is bestowed upon those who have excelled in the technology management field by making a significant impact in one or more of the following six areas:

1. **Technology Management Research** as demonstrated by technology management programs/courses developed, taught or managed, PhD students supervised, and new educational initiatives taken.

2. **Technology Management Education** as demonstrated by technology management programs/courses developed, taught or managed, PhD students supervised, and new educational initiatives taken.

3. **Technology Management Implementation** as demonstrated by management of technology-based projects, programs and organizations in industry or government.

4. **Technology Management Consulting** as demonstrated by consulting activities with high impact on the improvement of technology management practice.

5. **Technology Management Policy Making** as demonstrated by the role played in policy making levels for effective utilization of technology management concepts and processes.

6. **Technology Management Leadership** as demonstrated by the book(s) published, journal(s) edited, technology management organization(s) established or managed.

The PICMET Fellows with their affiliations and at the time of the award are listed below.

2011
Mr. Charles Allcock, PGE, USA
Dr. Daniel Berg, Rensselaer Polytechnic Institute (RPI), USA
Dr. Frederick Betz, Portland State University, USA
Dr. Joseph Bordogna, University of Pennsylvania, USA
Dr. Youngrak Choi, Korea University, Korea
Dr. Robert Colwell, DARPA, USA

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Dr. Joseph Cox, Distinguished Public Service Professor and Chancellor Emeritus, Oregon University System, USA
Ms. Charmagne Ehrenhaus, Portland Community College, USA
Mr. Les Fahey, Fahey Ventures, USA
Dr. Gunnar Hambraeus, Royal Swedish Academy of Engineering Sciences, Sweden
Dr. Dundar Kocaoglu, Portland State University, USA
Mr. Thomas Lipscomb, The Center for the Digital Future, USA
Dr. Tom Long, Tektronix Vice President, Retired, USA
Mr. John McDougall, Alberta Research Council, Canada
Dr. Graham Mitchell, University of Pennsylvania, USA
Dr. Kiyoshi Niwa, The University of Tokyo, Japan
Dr. Kwan Rim, Samsung Corporation, Korea
Dr. Frederick Rossini, George Mason University, USA
Mr. Terry Rost, The Franchise Group, USA
Dr. Nam Suh, KAIST, Korea
Dr. Nejat Veziroglu, University of Miami, USA
Dr. Eric von Hippel, MIT, USA
Dr. Seiichi Watanabe, Terumo Corporation, Japan
Dr. Rosalie Zobel, European Commission, Belgium

2013

Dr. Klaus Brockhoff, WHU – Otto Beisheim School of Management, Germany
Dr. Antonie de Klerk, University of Pretoria, South Africa
Dr. Norman G. Einspruch, University of Miami, USA
Dr. Joseph P. Martino, Yorktown University, USA
Mr. Terry Oliver, Bonneville Power Administration, USA
Dr. Alan L. Porter, Search Technology, Inc., USA
Dr. Albert H. Rubenstein, Northwestern University, USA
Dr. James C. Spohrer, IBM, USA
Dr. David M. Steele, San Jose State University, USA

2014

Dr. Timothy R. Anderson, Portland State University, USA
Dr. Tugrul U. Daim, Portland State University, USA
Dr. Fred Phillips, Stony Brook - State University of New York, USA
Dr. David Probert, University of Cambridge, UK

STUDENT PAPER AWARD

PICMET NAMES ITS OUTSTANDING STUDENT PAPER AWARD

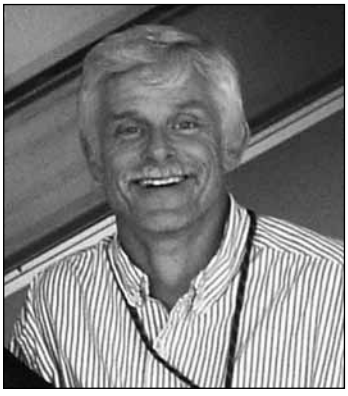
An endowment has been created to name the PICMET Outstanding Student Paper Award after **Brad W. Hosler**, who was a dedicated engineer and technology leader with 25 years of service at Intel, as well as a proud and loving family man. Brad Hosler lived by his motto: "Work hard, play hard."

AWARD CRITERIA

The Brad W. Hosler PICMET Outstanding Student Paper Award is bestowed upon a paper based on the student's research toward a graduate degree in the area of Engineering and Technology Management. Eligibility is restricted to currently enrolled students and those who have received their master's or doctorate degrees after July 31, 2014. The paper is nominated by the advising professor and selected by the Awards Committee. The award consists of $1,000, complimentary conference registration and a plaque for the student, as well as a plaque and complimentary registration for the nominating professor. The winner may not be nominated again for the same award in subsequent years.

ABOUT BRAD W. HOSLER

Brad Hosler passed away on August 31, 2007, at his home in Portland, Oregon, after several years of battling cancer. He received his undergraduate degree from Bucknell University and completed his graduate studies at Carnegie Mellon University. Brad joined Intel in 1980 to work on the architecture and implementation of the I/O subsystem and had key roles in the Plug & Play BIOS definition and its implementation on Intel's first PCI chipset, Saturn. He formed the Compliance Workgroup to establish the PC industry's first multi-vendor I/O compliance program. The innovative methods and practices that he architected and implemented have become the benchmark for the computer industry. Brad was among the pioneers recognized for his industry contributions at the 10-year anniversary of the PCI-SIG, which has a worldwide membership of about 900 companies.



Brad's signature accomplishments are associated with the Universal Serial Bus (USB) family of technologies. He received two Intel Achievement Awards, one in 2003 and another in 2006, for his outstanding work. The success of the USB interface and market of platforms and peripherals that sell in multiple billion units today is a measure of his impact.

Brad was promoted to Principal Engineer in 2006 and was vested with the informal authority of Chief Technical Officer for the USB Implementers Forum.

PICMET is proud to recognize Brad Hosler's accomplishments, as an engineer and a technology leader, by naming the Outstanding Student Paper Award after him.

STUDENT PAPER AWARD

BRAD W. HOSLER OUTSTANDING STUDENT PAPER AWARD

The number of students doing significant research in the area of Engineering and Technology Management was demonstrated by the number of nominations received. The selection of the award winner was difficult because of the excellent quality of all the submissions, but one paper stood out for its contribution to the field of Engineering and Technology Management.

AUTHOR
Sercan Özcan

ADVISOR & CO-AUTHOR
Dr. Nazrul Islam

UNIVERSITY
Bahcesehir University, Turkey

PAPER TITLE
"Industry-Academia Linkages in a High Tech Research Field"

ABSTRACT
Currently, academic researchers' focus started changing towards protecting IP rights and to transferring them into industrial actors. Accordingly, it is argued that academic's basic research focus started shifting towards applied research as it is essential for the radical inventions to be introduced in a competitive market. This research seeks to understand industry-academia linkages in a high tech field such as nano-crystals. In regards to supporting the technology transfer process within or cross country, this study illustrates the technology development trends and actors' engagement; nano-crystals technology and their interconnections; and maps the organizational (industry-academia) linkages that enhance the commercialization of radical inventions. The results show that the industry-academia linkages that appeared as decentralized structure are more stable compared to other linkage types. Korean and Japanese organizations present such stable linkages. The linkages are even stronger when they appear as a mono-linkage type. Chinese organizations show a great illustration of such an effective mono-linkage of co-inventorships in high tech research fields. The organizations in the US maintain international linkages.

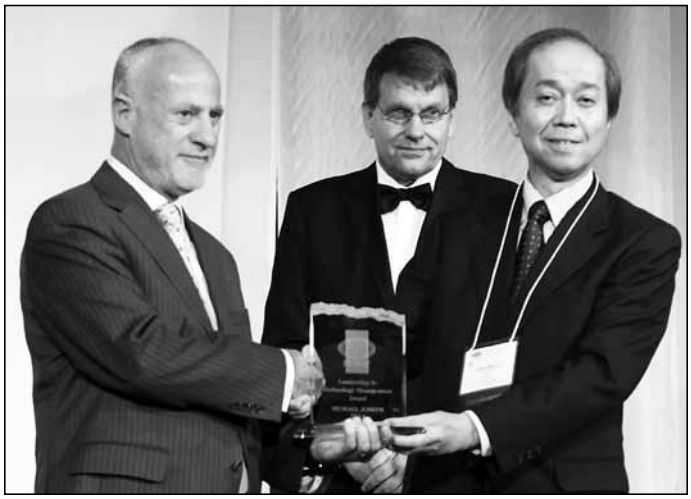
LTM Award

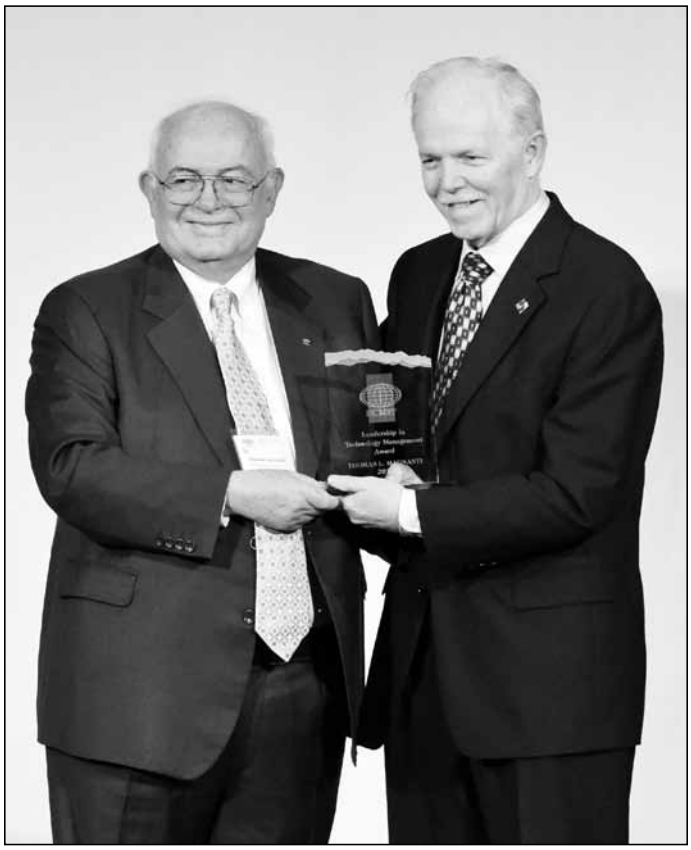
The PICMET Leadership in Technology Management (LTM) Award recognizes and honors individuals who have provided leadership in managing technology by establishing a vision, providing a strategic direction, and facilitating the implementation strategies for that vision.

PICMET '15 AWARDEE

Mr. John R. McDougall
President of National Research Council, Canada

Mr. John McDougall, born and raised in Edmonton, Canada, was appointed as NRC's President in April 2010 following 12 years as President and CEO of the Alberta Research Council when he also founded and chaired Innoventures Canada, bringing together Canada's leading research and technology organizations. His career began as a petroleum engineer, and then quickly evolved into the ownership and management of an international engineering consulting firm and subsequently a private merchant bank. From 1991 to 1997, he was the first Poole Chair in Management for Engineers, a leadership position within the University of Alberta. He has held leadership positions with some of Canada's most innovative research and manufacturing businesses, research consortia and not-for-profit organizations and with numerous professional and business organizations. He has served on advisory boards and committees at provincial, federal and international levels. Mr. McDougall has been recognized by organizations including the Canadian Academy of Engineers, Engineers Canada, Mexican College of Civil Engineers and PICMET. He has a B.Sc. in Civil Engineering from the University of Alberta, and completed several postgraduate courses in Environmental Engineering.





MEDAL OF EXCELLENCE

Initiated at PICMET '04 in Seoul, Korea, the Medal of Excellence award is given for extraordinary achievements of individuals in any discipline for their outstanding contributions to science, engineering and technology management.

PICMET '15 AWARDEES

Dr. Steven Eppinger
Professor of Management Science and Innovation, Massachusetts Institute of Technology, USA

Dr. Steven Eppinger is Professor of Management Science and Innovation at the Massachusetts Institute of Technology Sloan School of Management. He holds the General Motors Leaders for Global Operations Chair and a joint appointment in MIT's Engineering Systems Division. Professor Eppinger teaches interdisciplinary courses at both the master's and executive levels in product design and innovation, engineering project management, and digital product management. He has co-authored a leading textbook entitled *Product Design and Development* (McGraw-Hill). Currently in its sixth edition, the text has been translated into several languages and is used by hundreds of universities and more than a quarter million students. Dr. Eppinger's research is applied to improving complex technical projects in a wide range of industries and is the basis of the book titled Design Structure Matrix Methods and Applications (MIT Press). Professor Eppinger is the Co-Director of MIT's System Design and Management Program. He served as Deputy Dean of the MIT Sloan School of Management for five years. He received S.B., S.M., and Sc.D. degrees from MIT's Department of Mechanical Engineering.

Dr. Alan L. Porter
Professor Emeritus of Industrial & Systems Engineering, and of Public Policy, and Co-director of the Technology Policy and Assessment Center, Georgia Institute of Technology, USA; Director of R&D for Search Technology, Inc., Georgia, USA

Dr. Alan Porter is Professor Emeritus of Industrial & Systems Engineering, and of Public Policy, at Georgia Tech, where he is Co-director of the Technology Policy and Assessment Center. He is also Director of R&D for Search Technology, Inc., Norcross, Georgia (producers of VantagePoint and Thomson Data Analyzer software). He is author or co-author of some 230 articles and books, including *Tech Mining* (Wiley, 2005) and *Forecasting and Management of Technology* (Wiley, 2011). Current research emphasizes "forecasting innovation pathways" for newly emerging technologies. This entails text mining of science, technology & innovation information resources to generate Competitive Technical Intelligence. Dr. Porter received a B.S. in Chemical Engineering from Caltech (1967) and a Ph.D. in Engineering Psychology from UCLA (1972). He served on the University of Washington faculty through 1974, joining Georgia Tech in 1975.

Fellow Award

The PICMET Fellow award recognizes outstanding contributions to the development and growth of the Engineering and Technology Management discipline.

PICMET '15 AWARDEE

Dr. Oliver Yu
President and CEO, The STARS Group, Woodside, California, USA; Executive in Residence, Lucas College of Business, San Jose State University, California, USA

Dr. Oliver Yu, President and CEO of the STARS Group, a premier technology management strategy consulting firm spun off from SRI International (formerly Stanford Research Institute) in the year 2000, is an internationally recognized expert on technology and resource management strategy planning and analysis. He is also a Consulting Associate Professor of Management Science & Engineering at Stanford University and an Adjunct Full Professor on Technology Portfolio Planning for the MBA-MS Engineering Dual Degree Program, and since 2009 an Executive in Residence at the College of Business of San Jose State University (SJSU) in California. Dr. Yu holds a BSEE from Taiwan University, an MSEE from Georgia Institute of Technology, and an M.S. in Statistics and a Ph.D. in Operations Research from Stanford University. He has published over 80 technical papers and authored and co-authored five books on technology and resource strategy planning, including *Technology Portfolio Planning and Management* published by Springer in 2006, and *Technology Management and Forecasting* by Tsinghua University Press in China.

General Information

CONFERENCE FOCUS

The Technology Age is upon us. It is a challenge to think of any activity in any part of our lives that is not affected or driven by technology. We are in the era of wearable technologies, self-driving cars, vehicle-to-vehicle communication, 3-D printing revolutionizing manufacturing and construction industries, liquid biopsy for fast DNA-sequencing machines leading to simple blood tests for cancer, megascale reverse-osmosis desalination plants, growing human brain cells to cure dementia, and genetic tools to boost crop yields and feed billions more people.

It is the responsibility of the Technology Management community to guide technologies effectively for the betterment of humankind. This is a big responsibility for the leaders and emerging leaders in the Technology Management field, but it is critical that they accept the responsibility and meet the challenges head on. The focus of the PICMET '15 Conference is Management of the Technology Age. It is highlighted throughout the conference.

WHO SHOULD ATTEND

Following the PICMET tradition, this high-impact symposium will set the stage for innovation management for decades to come. The world's leading experts from academic institutions, industrial corporations and government agencies will participate in the discussions. PICMET '15 is essential for:

- Presidents and CEOs of technology-based corporations
- Vice presidents of engineering, R&D and technology in industrial organizations
- R&D managers
- Engineering, manufacturing, operations, quality and marketing managers in the technology-based organization
- Project and product managers
- Information systems managers in industrial and service organizations
- Technology management researchers
- Educators in engineering management, technology management, manufacturing management, technology marketing, software management, information systems management, project management, and technology-focused MBA programs
- Engineering and technology management program heads
- Students in engineering management, management of technology and related programs
- Government officials responsible for technology policy
- Government officials responsible for science and technology programs
- Engineers and scientists moving from technical specialty to management positions while maintaining their identity in technical fields

PROGRAM

The PICMET '15 program consists of

- Ph.D. Colloquium, "Getting Your PhD….and Beyond," Sunday, August 2, 13:00 - 17:00, Broadway-I/II (Plaza Level)
- Plenary sessions by global leaders from industrial corporations, academic institutions and government agencies in the Pavilion Room (Plaza Level).
- Two special meetings:
  1. Country Representatives Meeting for the current PICMET Country Representatives and those who are interested in becoming Country Representatives, Wednesday, August 5, 12:00-14:00, Skyline 3 (23rd Floor)
  2. PICMET '15 & '16 Planning Session for everybody who would like to discuss strategies for future PICMET conferences, Thursday, August 6, 14:00-15:30, Pavilion West (Plaza Level)
- Research papers by cutting-edge researchers
- Applications papers by researchers and practitioners working on industry applications
- Panel discussions with interactions between panelists and the audience
- Tutorials on select topics by authorities in the field

PUBLICATIONS

There will be two publications at PICMET '15:

- The "Bulletin" containing the conference schedule and abstracts of each presentation
- The "Proceedings" containing all of the papers on a USB drive.

The publications will be available to PICMET '15 attendees at the registration desk.

REGISTRATION POLICY

All PICMET attendees, including speakers and session chairs, must register and pay the registration fee to have access to sessions and other events. The registration fee allows admittance to all technical session and social events.*

Name badges must be worn to all PICMET sessions, functions and events. If you attend tours, site visits, or other events not covered by the registration fee, you will be required to pay an additional fee.

General Information

**The one-day registration fee and the student registration fee do not include the evening social events. The PhD Colloquium and site visits are not included in the registration fee. Tickets for these events may be purchased at the registration desk.*

SESSION AND PAPER DESIGNATIONS

The sessions are identified by a four-digit code as follows:

First digit shows the day	M: Monday T: Tuesday W: Wednesday H: Thursday
Second digit shows the time	A: 08:30-10:00 B: 10:30-12:00 C: 12:00-14:00 D: 14:00-15:30 E: 16:00-17:30
Third and fourth digits show the room	00: Pavilion 01: Pavilion-East 02: Pavilion-West 03: Broadway-I 04: Broadway-II 05: Broadway-III 06: Broadway-IV 07: Studio Suite 08: Directors Suite 09: Council Suite 10: Forum Suite 11: Executive

Presentations in each session are given consecutive numbers following the session number. For example, paper TD-05.2 is the second paper on Tuesday at 14:00-15:30 in Broadway-III.

PRESENTATION GUIDELINES

SESSION GUIDELINES

The sessions are 90 minutes long and include two, three, or four papers. Depending on the number of papers in the session, the time should be divided equally for each presentation, allowing about five minutes after each one for questions.

SESSION CHAIR GUIDELINES

If you are chairing a session, please follow the guidelines below:

- Contact the speaker before your session starts.
- Check the equipment in the room. If something does not work or if anything else is needed, contact the PICMET volunteer responsible for your room.
- Introduce each speaker.
- Coordinate the time allocated to each speaker so that each has about equal time, allowing about five minutes for questions from the audience.
- Fill out the Session Summary Form and leave it on the table in the room. The form will be given to the session chair by the PICMET volunteer at the beginning of the session.

SPEAKER GUIDELINES

If you are presenting a paper, please follow the guidelines below:

- Introduce yourself to your session chair, and provide him/her with a brief background statement that he/she can use in introducing you to the audience.
- Divide the 90 minutes by the number of papers in your session so that every speaker in the session has approximately the same length of time.
- Allow about five minutes for questions from the audience after your presentation.

AUDIO/VISUAL EQUIPMENT

The Cabinet Suite on the 3rd floor of the hotel is designated as the Authors' Room. The authors can work there with their laptops anytime they wish to do so.

Each session is equipped with an LCD projector, a Windows 7 Laptop and screen. The laptops have VGA ports and are connected to the projectors. If you prefer to use your own devices, such as Macbook or iPad Ultrabooks that only have HDMI/Mini-HDMI connections for the presentations, please bring your own adapters to transfer your connection form into VGA connections.

If you need information about anything else concerning the conference, volunteers in the registration area will try to help you.

WIRELESS ACCESS

Wireless access will be available in a designated area on the Plaza Level.

PICMET VOLUNTEERS

PICMET Volunteers wearing white polo shirts with the PICMET logo will assist the participants throughout the conference. If you need help in locating the room where your session will be held or if there are equipment problems, for example, you can contact the PICMET Volunteers. If you need information about anything concerning the conference, a volunteer in the registration area will try to help you.

CITY OF ROSES

GETTING AROUND PORTLAND

Portland's public transportation system includes MAX (Metropolitan Area Express) light rail, Tri-Met buses, and the Portland Streetcar. Tickets are interchangeable among the three and can be purchased aboard buses or from ticket machines along the MAX or Streetcar lines. Fares are $2.50, less for seniors ("honored citizens"), the disabled and youths.

Complete information about Portland's public transportation system is available at http://trimet.org.

AIRPORT TRANSPORTATION

The pickup area for taxis and town cars is located in the center section of the airport terminal's lower roadway on the baggage claim and departure level. Most transportation providers serve downtown Portland, which is approximately 20-40 minutes from Portland International Airport, depending on traffic.

If you are traveling light and do not mind walking two blocks, you can board the MAX (Metropolitan Area Express, http://trimet.org) Red Line on the baggage claim level of the Portland International Airport (follow the signs to MAX Light Rail). Get off the train at the Pioneer Square stop (between 6th Ave. and Broadway) in downtown Portland and walk two blocks south on 6th Avenue to the **Hilton Portland and Executive Tower (921 SW 6th Ave., Portland, Oregon)**. Tickets are $2.50 and can be purchased at the ticket machine inside the airport close to the MAX line.

CLIMATE

The temperature in Portland generally varies between 56^{o}F (13^{o} C) in the evening to 80^{o} F (27^{o} C) during the day in July/August in Portland. The low humidity makes summer months very pleasant and comfortable. You may need a sweater or light jacket in the evening.

GRATUITIES

Informally known as tipping, in the United States gratuities are voluntary. Tips are rewarded for services performed (gratitude) and are a supplement to an employee's income.

Following are recommended gratuities:

- For your hotel stay: housekeeping, $2.00 per day; bellman, $1.00 per bag; and discretionary for above and beyond services provided for you.
- For a taxi ride: 10 – 15 percent of the fare.
- For restaurant service: 15 – 20 percent of your total bill.

TRAVEL OREGON

Portland, otherwise known as "The City of Roses," is a robust and vibrant city with endless things to see and do. Music, food and art festivals abound throughout the city during the summer months. Museums, art galleries, unique retail shops, and restaurants of all varieties are within walking distance of the Hilton.

The State of Oregon is famous for its award winning wineries and golf courses, as well as its breathtaking coastline, rivers and mountains. We hope you will venture out and experience Portland and the surrounding countryside while you are in Oregon.

Following is a sampling of events and destinations while you are visiting. For a complete list, visit www.travelportland.com.

PORTLAND EVENTS

The Bite of Oregon

The Bite of Oregon is a stunning celebration of Oregon, its food, its people and its extraordinary quality of life. Come join the fun at the best summer party on the Portland waterfront and discover Oregon's Bounty! (Tom McCall Waterfront Park, SW Naito Parkway., August 7-9; for schedule and ticket prices, visit http://www.biteoforegon.com/)

Downtown Portland and the Willamette River

First Thursday Gallery Walk

"First Thursday" is an after-hours evening gallery walk that takes place on the first Thursday of each month. On Thursday, August 6, galleries and shops in Old Town, the Pearl District and downtown will stay open late, inviting the

public to mingle with the artists and explore new exhibits. The streets buzz with performers, sidewalk artists and enthusiastic crowds, and many galleries offer free appetizers and wine.

Flicks on the Bricks
On five Friday evenings in July and August, Pioneer Courthouse Square will be transformed into an outdoor movie theater for the entire community to enjoy. Each Flicks on the Bricks event will kick off at 7 pm with live entertainment provided by KINK.FM followed by movies which will begin at dusk. Admission is free and attendees are encouraged to bring low back chairs, pillows, cushions or bean bags to truly make the Square their "living room." Food and beverages will be available for purchase on-site. *(Pioneer Courthouse Square, 701 SW 6th St.; free)*

First Thursday Gallery Walk

Noon Tunes Summer Concert Series
Since 2002, Pioneer Courthouse Square has celebrated summer with a free lunchtime concert every Tuesday in July and August. The popular Noon Tunes Concert Series showcases the best in regional and local musical talent. *(Tuesdays, July & August; Pioneer Courthouse Square, 701 SW 6th Ave.; 12:00-13:00; free)*

Oregon Brewers Festival
The 28th Annual Oregon Brewers Festival, July 22-26, is one of the nation's longest running and best loved craft beer festivals. Situated on the west bank of the Willamette River, with towering Mt. Hood as a backdrop, it is the ideal venue for anyone who loves craft beer. With a laid back attitude and scores of award-winning beers, the festival reflects the essence of the city of Portland. The Oregon Brewers Festival exists to provide an opportunity to sample and learn about a variety of craft beer styles from across the country. Eighty-four craft breweries from all parts of the nation offer more than 30 styles of handcrafted brews to nearly 80,000 beer lovers during the four-day event. A Buzz Tent offers another 50+ rare and specialty beers.

The festival's focus is craft beer, but there's more than sampling involved. The event features live music all four days, beer-related vendors, beer memorabilia displays, beer writers and publishers, home brewing demonstrations, and an assortment of foods from a variety of regions. *(Tom McCall Waterfront Park; Main entrance at S.W. Oak Street and Naito Parkway; www.oregonbrewfest.com)*

Oregon Zoo Summer Concerts
It wouldn't be summer in Oregon without an evening of great music at the zoo's annual summer series. On Friday, July 31, Emmylou Harris and Rodney Crowell will perform. *(Oregon Zoo, 4001 SW Canyon Rd.; for schedule and ticket prices visit www.zooconcerts.com)*

Portland Saturday Market

Portland Saturday Market
Stroll down row upon row of local handcrafted items and homemade foods. The Portland Saturday Market—open Sundays too—is the nation's largest open-air craft market. Talk directly to the artists and learn about their creative styles and products. *(Waterfront Park and Ankeny Plaza in Historic Old Town Chinatown; Saturdays 10:00-17:00; Sundays 11:00-16:30; www.portlandsaturdaymarket.com)*

City of Roses

Portland Timbers Soccer
Major League Soccer team the Portland Timbers will host the Chicago Fire on August 7th at Providence Park. *(Providence Park, 1844 SW Morrison; for schedule and ticket information visit www.portlandtimbers.com)*

Portland Timbers Soccer

Saturday Portland Farmers Market
This market, located at Portland State University, attracts a large crowd of people seeking the finest and freshest produce from local farmers as well as breads, cheese, flowers and more. *(South Park Blocks between SW Harrison & SW Montgomery; 08:30 - 14:00; Saturdays only)*

Portland Farmers Market at the Square
Every Monday, from June 15th through September 28th, shoppers can grab fresh produce and lunch while listening to a variety of live market music. More than 30 farmers and food artisans will call Portland's Living Room home each Monday selling the freshest summer fruits, vegetables, flowers and hot food items. *((Mondays, July & August, 10:00-14:00; Pioneer Courthouse Square, 701 SW 6th Ave.)*

PORTLAND ATTRACTIONS

Art Galleries
The Pearl District, loosely bordered by W. Burnside and NW Hoyt, and NW 13th and NW Park, represents a good share of the gallery arena. Galleries can also be found in fairly concentrated numbers in the Skidmore District (roughly between Front and Fourth Aves. from SW Oak to NW Glisan St.) and the city's downtown core.

Oregon Historical Society
In the heart of Portland's Cultural District, the Oregon Historical Society houses treasures of the Northwest, a priceless collection that tells the story of Oregon from its earliest people to the present day. Exhibits are designed for visitors of all ages, with artwork, artifacts, photographs, audio/visual presentations and hands-on displays for children. The Oregon Historical Society Museum Store is Portland's premier spot for distinctive Northwest gifts, including jewelry, artwork, books and games. *(1200 S.W. Park Avenue, Portland, Oregon 97205; Museum Store: S.W. Broadway at Madison; for hours and admission charge visit www.ohs.org)*

Oregon Museum of Science and Industry (OMSI)
Imagine a place where you can journey to the outer reaches of the galaxy, feel the power of an earthquake, climb aboard a real submarine, uncover a fossil, enter the world of virtual reality, or travel the globe in a five-story high IMAX® domed theater. With more than 200 interactive exhibits and labs, there is something for everyone in the family. Touch, explore, question and discover at the Oregon Museum of Science and Industry (OMSI), located on Portland's waterfront. Open year-round; hours vary. *(1945 S.E. Water Avenue, Portland, Oregon; www.omsi.edu)*

Pittock Mansion
Experience the charm of a lost era as you learn about Henry and Georgiana Pittock and the beautiful estate that symbolizes the growth of Portland. Admire remarkable antique furnishings and fine arts set in a 1914 National Historic Register property. Pack a picnic basket and enjoy a sweeping view of mountains, rivers and the city. *(3229 N.W. Pittock Drive, Portland, Oregon 97210; for hours and admission charge visit www.pittockmansion.org)*

Portland Art Museum
Find out why the oldest museum in the Northwest, the Portland Art Museum, is internationally renowned for exciting art experiences. Located in the heart of downtown's cultural district, the Museum's campus includes an outdoor sculpture court and historical interiors. Tour the world and travel through history in magnificent permanent collection galleries, six stories of modern art and special exhibitions. *(1219 S.W. Park Avenue, Portland, Oregon, 97205; phone: 503 226-2811; for hours and admission charge visit www.portlandartmuseum.org)*

Portland Classical Chinese Garden
Located in Portland's historic Old Town Chinatown, Lan Su ("Garden of Awakening Orchids") Chinese Garden is one of Portland's greatest treasures and most interesting sites to see while visiting Portland. A result of a collabora-

City of Roses

tion between the cities of Portland and Suzhou, our sister city in China's Jiangsu province that is famous for its beautiful Ming Dynasty gardens, Lan Su was built by Chinese artisans from Suzhou and is the most authentic Chinese garden outside of China. Much more than just a beautiful botanical garden, Lan Su is a creative wonder - a powerfully inspiring experience based on a 2,000-year-old Chinese tradition that melds art, architecture, design and nature in perfect harmony. Once inside the garden's walls, you will feel as if you have traveled through time to another era in a faraway world. Lan Su is a window into Chinese culture, history and way of thinking. Ever changing, Lan Su always

Classical Chinese Garden

has something new to offer - by the minute, by the hour, and with the seasons *(Northwest 3rd Ave. at Everett Street; hours: 10:00—18:00; admission, $9.50; www.portlandchinesegarden.org)*

Portland Spirit
The Portland Spirit welcomes you aboard the Northwest's premier dining ship. Daily lunch and dinner cruises on the Willamette River offer a perfect opportunity to surround yourself with unmatched views of the Portland skyline. Freshly prepared cuisine, full-service bars and live entertainment complete a river experience unlike any other. *(www.portlandspirit.com)*

Portland Walking Tours
Portland Walking Tours is the #1 ranked attraction and tour in Portland. These fun and award-winning tours explore the excitement, history, food, architecture, neighborhoods, bridges, parks, fountains, artwork, and just plain weird places in Portland, Oregon.

The Best of Portland and Underground Portland tours are available seven days a week; and the Flavor Street, Chocolate Decadence and Beyond Bizarre tours run every weekend year-round. Join the award-winning, leisurely walks with no hills and discover what guests and the media are talking about. *(www.portlandwalkingtours.com)*

Powell's City of Books
More than just a bookstore, Powell's is a Portland institution. The largest independently owned bookstore in the country, Powell's has more than one million volumes of new, used, rare and out of print books and covers a city block. Powell's map helps guide browsers from one room to the next. *(1005 W. Burnside; www.powells.com/locations/powells-city-of-books)*

Tom McCall Waterfront Park
It is hard to believe that this stretch along the Willamette River was once a busy expressway. Rather than impatient motorists, the park is now occupied with new types of movers—joggers, bikers and rollerbladers, as well as pedestrians in the mood for nothing more energetic than a stroll. Waterfront Park is taken up during the warmer months with cultural and musical events, as well as overheated folks hoping to cool off in the Salmon Street Springs Fountain at the east end of S.W. Salmon St. *(Naito Parkway between S.W. Harrison St. and N.W. Glisan St.)*

Tom McCall Waterfront Park

Washington Park
Washington Park is not only one of Portland's most beautiful sights, it also contains many of the city's favorite haunts. Lying within the park's expansive boundaries are not only the requisite children's play area, tennis courts and picnic areas, but also wonderful surprises such as the Oregon Zoo, Japanese Garden, World Forestry Center, Hoyt Arboretum and the International Rose Test Gardens.

City of Roses

Washington Park has its own MAX (Metropolitan Area Express) stop, which lets you off right at the zoo entrance (at the Pioneer Square stop, take the west-bound Red Line or Blue Line trains marked "Beaverton" or "Hillsboro"). Read on for more information about these attractions. *(www.washingtonparkpdx.org)*

Oregon Zoo
Trek through the tropics amid the sounds of birds, monkeys and other creatures. You're not in West Africa; you're in Portland at the zoo's African Rain Forest exhibit. After you've survived the steamy tropics, dry off in the savanna, where giraffes, rhinos and hippos graze. From the tundras of Alaska to the coastal waters of Peru, travel around the world in an afternoon. Five minutes from downtown on Hwy. 26 West, or take MAX light rail. *(Washington Park, 4001 S.W. Canyon Road; for hours and admission price visit www.oregonzoo.org)*

Japanese Garden

Japanese Garden
Nestled in the scenic west hills of Portland, the Japanese Garden is a haven of tranquil beauty which has been proclaimed one of the most authentic Japanese gardens outside of Japan. Encompassing five and one-half acres and offering five separate garden styles, the Garden includes an authentic Japanese Tea House, meandering streams, intimate walkways, and an unsurpassed view of Mt. Hood. *(Washington Park; for hours and admission price visit www.japanesegarden.com)*

World Forestry Center
All new hands-on, interactive exhibits that are fun for the whole family are waiting to be explored at the Discovery Museum. You can get harnessed in and hoisted up 45 feet to see a bird's-eye-view of the forest, or take a wet-free raft ride in Class IV rapids. Climb underneath the forest to see the life below, or try your smoke jumping skills! Round out your adventure with video journeys to Siberia, China, South Africa and Brazil to learn about trees of the world. Come explore, discover and grow at the Discovery Museum! Five minutes from downtown Portland via Hwy. 26 or MAX light rail. *(Washington Park, 4033 S.W. Canyon Road; for hours and admission price, visit www.worldforestry.org)*

Hoyt Arboretum
Hoyt Arboretum is a much beloved Portland open space, covering 185 ridge top acres about two miles west of downtown. It is home to a collection of trees representing more than 1,100 species gathered from around the world. Twelve miles of trails wind through this living exhibit. The Visitor Center, at the heart of the Arboretum, offers maps, trail guides, and information. Spiraling up the southwest corner of the arboretum is the Vietnam Veterans' Living Memorial, which honors Oregonians who died or are still missing from that conflict. *(Washington Park, 4000 SW Fairview Blvd.)*

International Rose Test Garden

International Rose Test Garden
Whether you want to take in spectacular scenery or the luscious smell of fragrant roses, the International Rose Test Garden offers both. Approximately 10,000 plants, among which are more than 400 varieties of roses, flourish high above a breathtaking city view. Established in 1917, the International Rose Test Garden is the oldest

operating test garden in the country. Admission is free year-round. *(Washington Park, 400 SW Kingston Ave.)*

Willamette Jetboat Excursions
See Portland's waterfront and more aboard the Willamette Jetboats. Enjoy the area's sights, history and scenic beauty while experiencing the fun and excitement found only in a jet boat. See giant ships, bridges, elegant riverfront homes, historic Oregon City and the majestic Willamette Falls. Reservations are highly recommended. *(1945 S.E. Water Avenue, OMSI Submarine Dock; www.willamettejet.com)*

SHOPPING

From shop-lined streets to expansive malls, you'll find great spots for tax-free shopping all around town.

Pioneer Place

Downtown Portland
In the heart of downtown, you will find Pioneer Place – four city blocks filled with shopping, dining and entertainment. *(700 SW Fifth Ave.; www.pioneerplace.com)*

Nordstrom and Macy's department stores are adjacent to Pioneer Square, and specialty shops are scattered throughout downtown Portland.

Northwest/Nob Hill
This district's main streets (Northwest 23rd and 21st Avenues) are packed with boutiques selling Portland-designed clothing and housewares.

Pearl District
You can sample haute couture and hot cuisine in Portland's Pearl District, which has quickly become the place to see and be seen. The Pearl is composed of 50 city blocks of industrial warehouses turned into sleek loft apartments, cutting-edge art galleries and vibrant international restaurants.

Though the neighborhood features outstanding brewpubs, delicious international cuisine and the world's largest independent bookstore, the soul of the Pearl is in its galleries. Check them out on the first Thursday of every month, when most galleries stay open late to showcase the talents of new and established artists. *(www.explorethepearl.com/)*

Portland's Mall Scene
Bridgeport Village offers an exclusive mix of local, regional and national shops unlike any other shopping experience in Oregon. *(7455 SW Bridgeport Rd., Tigard, Oregon; www.bridgeport-village.com)*

Columbia Gorge Premium Outlets has your favorite brands at significant savings. The center's 45 stores include Adidas, Carter's, Eddie Bauer, G.H. Bass & Co. - Footwear, Gap Outlet, Jones New York, OshKosh B'gosh, Tommy Hilfiger, Van Heusen and more. Columbia Gorge Premium Outlets is located just 15 minutes east of downtown Portland. *(Take I-84 east to Exit 17; 450 N.W. 257th Way, Troutdale, Oregon; www.premiumoutlets.com/outlets/outlet.asp?id=28)*

The nation's first major mall, Lloyd Center offers some 200 specialty shops in addition to familiar anchors. An ice rink offers entertainment. *(bordered by Multnomah and Broadway, 9th and 15th Streets; www.lloydcenter.com)*

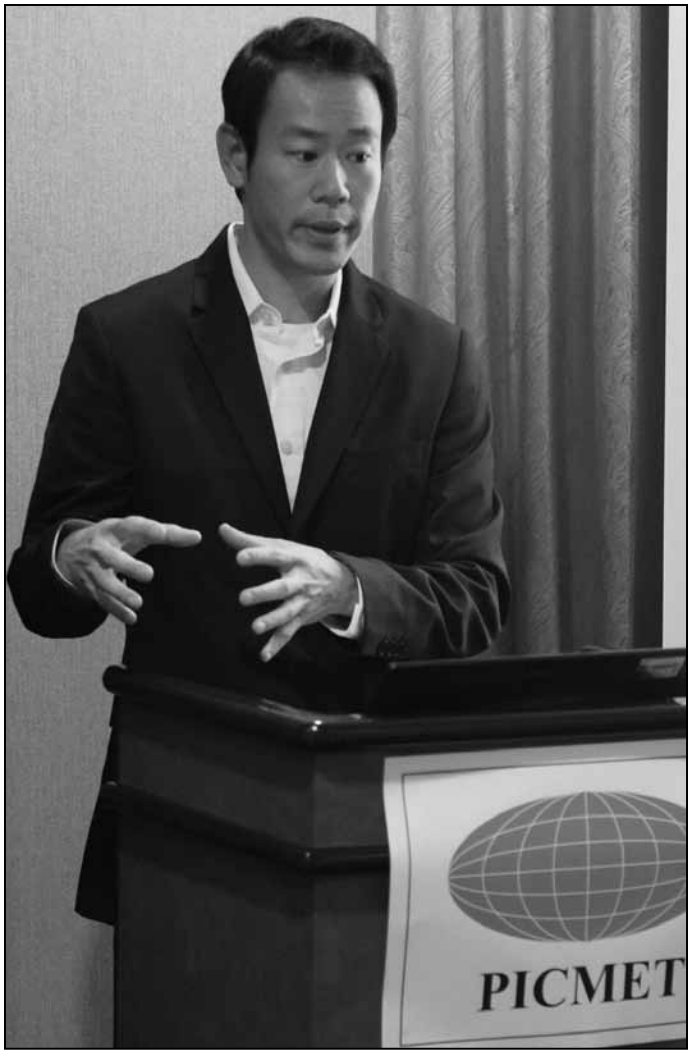
Washington Square pulls shoppers into its many specialty shops with the help of several popular anchor stores. *(9585 SW Washington Square Rd.; www.shopwashingtonsquare.com)*

Woodburn Company Stores, Oregon's largest outlet center, features over 100 shops including Adidas, Banana Republic Factory Store, Calvin Klein, Eddie Bauer, Nautica, and Polo Ralph Lauren Factory Store to name a few. *(I-5 South at the Woodburn exit; www.woodburncompanystores.com)*

IEEE TEMS Reception

IEEE – TECHNOLOGY ENGINEERING MANAGEMENT SOCIETY RECEPTION

DATE: WEDNESDAY, AUGUST 5
TIME: 17:30 - 19:00
LOCATION: PAVILION-EAST (PLAZA LEVEL)
SPEAKER: MR. SOREN ANDERSON, SUPPLY CHAIN STRATEGIC PLANNER, INTEL CORP., USA



"The Digitalization of Intel's Supply Chain"

Eighty six percent of businesses will be digital businesses in five years. Intel is a leading high tech manufacturer with a world leading supply chain (#4 Gartner 2015). On this supply chain foundation, Intel's journey to digitalization includes adoption of emerging technologies such as Internet of Things (IoT) and analytics. Industry adoption will approach 30 billion devices by 2020. The connection of these devices and exploiting the data they generate will provide significant advantages and value. We will look at examples which highlight Intel's supply chain expertise and how it is extending its capabilities via new approaches and technologies to realize value and remain a supply chain leader.

Mr. Soren Andersen is the Supply Chain Strategic Planner in Intel's Supply Chain IT. He has been with Intel for 17 years where he has held roles in people management, Portfolio/Program Management, Service Ownership, and Enterprise Systems Operations in Finance, Technology Manufacturing Group, eBusiness Group, and Information Technology.

He has delivered impactful supply chain programs such as Customer Planning Re-engineering, Outsource e-Solutions, SAP (Supply Chain, Finance, Direct and Indirect Materials), Digital Supply Chain, and Systems Manufacturing. He also supported Intel Software enabling common software development tools for Intel's Android OS.

Mr. Soren has degrees in Industrial Engineering and Business Administration from Oregon State University. Prior to Intel he was a Manager at Electronic Data Systems (now HP) and a Director of Supply Chain at Claremont Technology Group.

There is no fee for this event.

SOCIAL EVENTS

To facilitate the informal interaction of the participants, several social events have been scheduled during PICMET '15.

RECEPTION/BUFFET

DATE: SUNDAY, AUGUST 2
TIME: 19:00—22:00
LOCATION: HILTON PAVILION
DRESS: INFORMAL

Meet other conference attendees, renew old acquaintances, and begin new friendships and collaborations at this opening reception/buffet in the Hilton's Pavilion room on the Plaza Level. Included in the regular registration fee.*

DINNER AT THE WORLD TRADE CENTER

DATE: MONDAY, AUGUST 3
TIME: 19:00-22:00
LOCATION: WORLD TRADE CENTER, OUTDOOR PLAZA, 121 SW SALMON ST.
DRESS: INFORMAL

Enjoy a savory buffet of local and international dishes while you mingle and network with colleagues. A local band, The BeckerHeads, will perform. Included in the regular registration fee.*

AWARDS BANQUET

DATE: TUESDAY, AUGUST 4
CASH BAR: 18:30—19:00 (IN THE PLAZA FOYER)
BANQUET: 19:00—22:00
LOCATION: HILTON PAVILION
DRESS: BUSINESS ATTIRE

This is the premier social event of the conference. The PICMET '15 Leadership in Technology Management, Medal of Excellence, Outstanding Student Paper, and PICMET Fellow awards will be presented at the banquet. Included in the registration fee.*

The one-day registration fee and the student fee do not include the Sunday, Monday, and Tuesday evening social events. Tickets for these events may be purchased at the registration desk.

SITE VISITS

Site visits to the following companies are offered during PICMET '15. Seating is limited, so sign up early. The registration fee is $60 for each site visit.

The times below include travel time. Return times are approximate and will depend on traffic.

Site visit attendees will meet in the Hilton Lobby by the 6th Avenue entrance, where a PICMET volunteer will guide you to the bus.

3D SYSTEMS

MONDAY, AUGUST 3, 12:00-16:00

The 3D Systems Wilsonville, Oregon, site comprises a team of printer development and systems engineers, materials scientists and chemists who were formerly Xerox's respected solid ink engineering and development teams. Joining 3D Systems in 2014, they immediately added significant state-of-the-art development and testing labs to 3D Systems as well as over 100 engineers and technical support staff to work on the next generation of inkjet-

based 3D printers. On this tour you will see work areas along with the above noted labs and prototype build facilities. Also, you will observe the continuous high speed customized manufacturing process being developed in Wilsonville.

WESTERN STAR TRUCK PLANT TOUR

TUESDAY, AUGUST 4, 12:15-17:00

Western Star Trucks is one of several commercial vehicle brands of Daimler Trucks North America LLC (a Daimler company), which is headquartered in Portland, Oregon.

With its roots in logging camps in the Canadian wilderness, Western Star has earned a worldwide reputation for building trucks that do jobs no other trucks can tackle. All over the world, customers turn to Western Star Trucks when they want a traditional truck that combines unmatched durability and the highest level of quality, comfort and craftsmanship.

Built in 1969, the Portland Truck Plant has seen many changes and upgrades, and today it builds the tough and premium Western Star class 6, 7 & 8 heavy duty commercial trucks. On this tour you will see how a truck is built from start to finish.

The plant tour will include the following:
- Building the chassis frame assembly
- Assembling the cab-in-white
- Trimming out the cab
- Building up the engine assembly
- Engine drop into the chassis
- Cab drop onto the chassis
- Final truck trim
- Final truck systems and dyno test

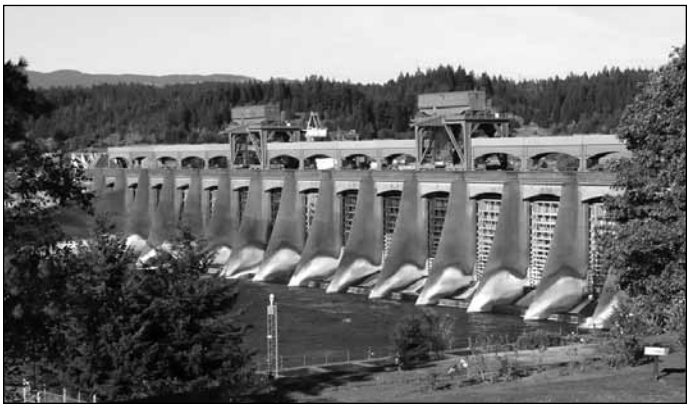
SITE VISITS

BONNEVILLE LOCK AND DAM

WEDNESDAY, AUGUST 5, 12:00-17:00

Located in Oregon's Columba River Gorge National Scenic Area 40 miles east of Portland, Bonneville Lock and Dam spans the Columbia River and is designated as a National Historic Landmark.

President Franklin D. Roosevelt dedicated Bonneville Lock and Dam in 1937. The U.S. Army Corps of Engineers built this "public works project" during the Great Depression of the 1930s to put people back to work, generate power, and improve navigation on the Columbia River. Soon after, more generators were added to provide energy for building ships and aircraft during World War II.



In later years, the addition of a second powerhouse doubled electrical output. Bonneville can provide the power needs for 500,000 Northwest homes. A second lock replaced the original lock in 1993. Bonneville is part of a series of locks on the Columbia-Snake waterway allowing vessels to transport people and valuable commodities 465 miles (748 km) from the Pacific Ocean to Lewiston, Idaho.

On both sides of the dam you may view the inside of a massive powerhouse. During spring, summer, and fall, view migrating salmon as they swim past windows in the fish ladder. Visitor centers include films and displays about salmon, hydropower, and river navigation.

This site visit includes a guided tour (approximately one hour) providing a full overview of dam operations, including the fish ladders and a walk through of the entire dam.

After the tour, attendees will be taken to the Bonneville Fish Hatchery for a self-guided tour (approximately 45 minutes). Bonneville Hatchery was first named "Central Hatchery" and was built in 1909. The hatchery raises 6.6 million fall Chinook, 900,000 spring Chinook, 750,000 Coho, 250,000 summer Steelhead and 60,000 winter Steelhead salmon. Adult salmon begin arriving at the hatchery in September and are then sorted through before spawning begins. Spawning begins during the last week in October and continues until the beginning of December. As part of their natural life cycle, all Pacific Northwest Salmon die after spawning. There are also at least 40 different species of birds to view at Bonneville Fish Hatchery.

It is recommended that you wear comfortable walking shoes for this tour. Purses are permitted during your visit to the dam; however, backpacks must be left on the bus.

For more information about Bonneville Lock and Dam, please visit: http://www.nwp.usace.army.mil/Locations/ColumbiaRiver/Bonneville.aspx

For more information about Bonneville Hatchery, please visit: http://www.dfw.state.or.us/resources/visitors/bonneville_hatchery_more.asp

TECHNICAL PROGRAM

PROGRAM OVERVIEW

The PICMET '15 technical program consists of 99 sessions including 4 plenaries, 2 special sessions, 2 tutorials, 2 panel discussions, and 89 paper sessions.

The plenaries are scheduled from 08:30 to 10:00 every morning, Monday, August 3, through Thursday, August 6, in the Pavilion Room on the Plaza Level. They are described in the "Plenaries" section of this Bulletin.

The Tutorials are offered by experts in specific areas of technology management. They are scheduled among the regular paper sessions.

THE PAPERS

Research papers and applications-oriented papers are explicitly identified in this conference. Separate evaluation criteria were used, and different referees were selected for each category to make sure that appropriate papers were included in the conference for the "Research" and "Application" categories. We emphasized research methodology, the use of the research literature, the theory behind the paper, the sample size, and the impact on the research community for the "Research Papers." The important evaluation criteria for "Industry Applications" were the usefulness of the application, the importance of the case being discussed, the generalizability of the concepts presented, and the impact of the paper on the users of technology management. The "Research Papers" included in PICMET '15 are listed with an [R] in front of their titles on the following pages; and the "Industry Applications" papers are shown with an [A] in front of their titles. Roughly 83 percent are in the [R] category, and the rest are in the [A] category.

The Research Papers and Industry Applications are mixed in the sessions. This was done intentionally to assure effective exchange of ideas among those presenting research papers and those presenting applications-oriented papers.

THE SCHEDULE

The plenary is the only session in the 08:30-10:00 time slot. After that, there are up to 11 break-out sessions throughout the day, Monday through Thursday.

In order to make the sessions easy to see, we have prepared the schedule listings in three different formats for you.

First, you will find a pictorial display of the sessions for each day. The four pages (one for each day) should help you visualize what session is scheduled in what time slot and in which room each day.

In the second set of schedules, the sessions are listed in chronological in order to give you a breakdown of the sessions by time of day.

The third set contains the same information as the second set, but the sessions are ordered by room. This set is intended to give you a good picture of all the tracks in which the sessions are scheduled. The sessions in a track are kept in the same room as much as possible. By looking at the sessions in each room, you should easily be able to select the tracks which you would like to follow.

Finally, you will find a "Personal Schedule" following the schedule listings. It is a chart for you to make your own schedule. Only the common events are marked up on the personal schedule. You can fill it out as a daily calendar for the sessions you would like to follow, events to attend, and people to meet with.

We hope these will help you to take full advantage of the richness of the technical program at PICMET '15.

DAILY SCHEDULE

MONDAY, AUGUST 3, 2015

	01 Pavilion East	02 Pavilion West	03 Broadway-I	04 Broadway-II	05 Broadway-III	06 Broadway-IV	07 Studio Suite	08 Directors Suite	09 Council Suite	10 Forum Suite	11 Executive Suite
MA 08:30-10:00	Plenary - 1										
MB 10:30-12:00	Innovation Management-1	Supply Chain Management 1	NPD 1	Project Mgmt 1	Intellectual Property 1	Knowledge Management - 1	Technology Diffusion	TM in Service 1	Collaborations for TM 1	Sustainability 1	ICT Mgmt 1
MC 12:00-14:00	**LUNCH**										
MD 14:00-15:30	Innovation Management 2	Al's View: Disagree But Not Be Disagreeable	NPD 2	Project Mgmt 2	Intellectual Property 2	Knowledge Management 2	Technology Adoption 1	TM in Service 2	Collaborations for TM 2	Sustainability 2	ICT Mgmt 2
ME 16:00-17:30	Innovation Management-3	Resource Management	NPD 3	Decision Making 1	Intellectual Property 3	Knowledge Management 3	Technology Adoption 2	TM in Energy 1	Collaborations for TM 3	Enterprise Management	ICT Mgmt 3

DAILY SCHEDULE

TUESDAY, AUGUST 4, 2015

	01 Pavilion East	02 Pavilion West	03 Broadway-I	04 Broadway-II	05 Broadway-III	06 Broadway-IV	07 Studio Suite	08 Directors Suite	09 Council Suite	10 Forum Suite	11 Executive Suite
TA 08:30-10:00	Plenary - 2										
TB 10:30-12:00	Innovation Management-4	Technological Changes	NPD 4	Decision Making 2	Emerging Technologies	Global Issues 1	Tech Assessment & Evaluation	TM in Energy	Collaborations for TM 4	Educational Issues 1	Environmental Issues
TC 12:00-14:00	**LUNCH**										
TD 14:00-15:30	Innovation Management 5	Commercialization of Tech 1	NPD 5	Decision Making 3	Emerging Technologies 2		Tech Assessment & Evaluation 2	Technology Planning	TM Framework	Educational Issues 2	Entrepreneurship 1
TE 16:00-17:30	Innovation Management-6	Meet the Editors	S&T Communication		Disruptive Technologies	Global Issues 2	Technology Acquisition	Quality Management	Technology Transfer	Educational Issues 3	Entrepreneurship 2

Daily Schedule

WEDNESDAY, AUGUST 5, 2015

	01 Pavilion East	02 Pavilion West	03 Broadway-I	04 Broadway-II	05 Broadway-III	06 Broadway-IV	07 Studio Suite	08 Directors Suite	09 Council Suite	10 Forum Suite	11 Executive Suite
WA 08:30-10:00	Plenary - 3										
WB 10:30-12:00	Innovation Management-2	Commercialization of Tech 2	R&D Management 1	S&T Policy 1	Managing Technology Push Through Marketing Testbeds		Technology Roadmapping 1	E-Business	Strategic Mgmt of Tech 1		Entrepreneurship 3
WC 12:00-14:00	**LUNCH**										
WD 14:00-15:30	Innovation Management 8	Technology Forecasting 1	R&D Management 2	S&T Policy 2	Scalable Strategic Planning	Tech Mining 1	Competitiveness in TM 1		Strategic Mgmt of Tech 2		
WE 16:00-17:30	Innovation Management-9		R&D Management 3	S&T Policy 3	Technology Scorecarding	Tech Mining 2	Competitiveness in TM 2	Convergence of Tech	Strategic Mgmt of Tech 3		

Daily Schedule

THURSDAY, AUGUST 6, 2015

	01 Pavilion East	02 Pavilion West	03 Broadway-I	04 Broadway-II	05 Broadway-III	06 Broadway-IV
HA 08:30-10:00	Plenary - 4					
HB 10:30-12:00	Manufacturing Management 1	Technology Forecasting 2	Productivity Mgmt 2			Cultural Issues 1
HC 12:00-14:00	**LUNCH**					
HD 14:00-15:30		PICMET 2016 Planning Session	Productivity Mgmt 1			
HE 16:00-17:30						

SCHEDULE OF SESSIONS

SCHEDULE OF SESSIONS BY DATE

MONDAY, AUGUST 3, 2015

Session	Number	Day	Time	Room	Session Title
MA	00	Monday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 1”
MB	01	Monday	10:30 - 12:00	Pavilion East	“Innovation Management 1”
MB	02	Monday	10:30 - 12:00	Pavilion West	“Supply Chain Management 1”
MB	03	Monday	10:30 - 12:00	Broadway-1	“NPD 1”
MB	04	Monday	10:30 - 12:00	Broadway-2	“Project Mgmt 1”
MB	05	Monday	10:30 - 12:00	Broadway-3	“Intellectual Property 1”
MB	06	Monday	10:30 - 12:00	Broadway-4	“Knowledge Management 1”
MB	07	Monday	10:30 - 12:00	Studio Suite	“Technology Diffusion”
MB	08	Monday	10:30 - 12:00	Directors Suite	“TM in Service 1”
MB	09	Monday	10:30 - 12:00	Council Suite	“Collaborations for TM 1”
MB	10	Monday	10:30 - 12:00	Forum Suite	“Sustainability 1”
MB	11	Monday	10:30 - 12:00	Executive Suite	“ICT Mgmt 1”
MD	01	Monday	14:00 - 15:30	Pavilion East	“Innovation Management 2”
MD	02	Monday	14:00 - 15:30	Pavilion West	PANEL: “Al’s View: Disagree But Not Be Disagreeable”
MD	03	Monday	14:00 - 15:30	Broadway-1	“NPD 2”
MD	04	Monday	14:00 - 15:30	Broadway-2	“Project Mgmt 2”
MD	05	Monday	14:00 - 15:30	Broadway-3	“Intellectual Property 2”
MD	06	Monday	14:00 - 15:30	Broadway-4	“Knowledge Management 2”
MD	07	Monday	14:00 - 15:30	Studio Suite	“Technology Adoption 1”
MD	08	Monday	14:00 - 15:30	Directors Suite	“TM in Service 2”
MD	09	Monday	14:00 - 15:30	Council Suite	“Collaborations for TM 2”
MD	10	Monday	14:00 - 15:30	Forum Suite	“Sustainability 2”
MD	11	Monday	14:00 - 15:30	Executive Suite	“ICT Mgmt 2”
ME	01	Monday	16:00 - 17:30	Pavilion East	“Innovation Management 3”
ME	02	Monday	16:00 - 17:30	Pavilion West	“Resource Management”
ME	03	Monday	16:00 - 17:30	Broadway-1	“NPD 3”
ME	04	Monday	16:00 - 17:30	Broadway-2	“Decision Making 1”
ME	05	Monday	16:00 - 17:30	Broadway-3	“Intellectual Property 3”
ME	06	Monday	16:00 - 17:30	Broadway-4	“Knowledge Management 3”
ME	07	Monday	16:00 - 17:30	Studio Suite	“Technology Adoption 2”
ME	08	Monday	16:00 - 17:30	Directors Suite	“TM in Energy 1”
ME	09	Monday	16:00 - 17:30	Council Suite	“Collaborations for TM 3”

Schedule of Sessions

ME	10	Monday	16:00 - 17:30	Forum Suite	“Enterprise Management”
ME	11	Monday	16:00 - 17:30	Executive Suite	“ICT Mgmt 3”

TUESDAY, AUGUST 4, 2015

TA	00	Tuesday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 2”
TB	01	Tuesday	10:30 - 12:00	Pavilion East	“Innovation Management 4”
TB	02	Tuesday	10:30 - 12:00	Pavilion West	“Technological Changes”
TB	03	Tuesday	10:30 - 12:00	Broadway-1	“NPD 4”
TB	04	Tuesday	10:30 - 12:00	Broadway-2	“Decision Making 2”
TB	05	Tuesday	10:30 - 12:00	Broadway-3	“Emerging Technologies 1”
TB	06	Tuesday	10:30 - 12:00	Broadway-4	“Global Issues 1”
TB	07	Tuesday	10:30 - 12:00	Studio Suite	“Tech Assessment & Evaluation 1”
TB	08	Tuesday	10:30 - 12:00	Directors Suite	“TM in Energy 2”
TB	09	Tuesday	10:30 - 12:00	Council Suite	“Collaborations for TM 4”
TB	10	Tuesday	10:30 - 12:00	Forum Suite	“Educational Issues 1”
TB	11	Tuesday	10:30 - 12:00	Executive Suite	“Environmental Issues”
TD	01	Tuesday	14:00 - 15:30	Pavilion East	“Innovation Management 5”
TD	02	Tuesday	14:00 - 15:30	Pavilion West	“Commercialization of Tech 1”
TD	03	Tuesday	14:00 - 15:30	Broadway-1	“NPD 5”
TD	04	Tuesday	14:00 - 15:30	Broadway-2	“Decision Making 3”
TD	05	Tuesday	14:00 - 15:30	Broadway-3	“Emerging Technologies 2”
TD	07	Tuesday	14:00 - 15:30	Studio Suite	“Tech Assessment & Evaluation 2”
TD	08	Tuesday	14:00 - 15:30	Directors Suite	“Technology Planning”
TD	09	Tuesday	14:00 - 15:30	Council Suite	“TM Framework”
TD	10	Tuesday	14:00 - 15:30	Forum Suite	“Educational Issues 2”
TD	11	Tuesday	14:00 - 15:30	Executive Suite	“Entrepreneurship 1”
TE	01	Tuesday	16:00 - 17:30	Pavilion East	“Innovation Management 6”
TE	02	Tuesday	16:00 - 17:30	Pavilion West	PANEL: “Meet the Editors”
TE	03	Tuesday	16:00 - 17:30	Broadway-1	“S&T Communication”
TE	05	Tuesday	16:00 - 17:30	Broadway-3	“Disruptive Technologies”
TE	06	Tuesday	16:00 - 17:30	Broadway-4	“Global Issues 2”
TE	07	Tuesday	16:00 - 17:30	Studio Suite	“Technology Acquisition”
TE	08	Tuesday	16:00 - 17:30	Directors Suite	“Quality Management”
TE	09	Tuesday	16:00 - 17:30	Council Suite	“Technology Transfer “
TE	10	Tuesday	16:00 - 17:30	Forum Suite	“Educational Issues 3”
TE	11	Tuesday	16:00 - 17:30	Executive Suite	“Entrepreneurship 2”

Schedule of Sessions

WEDNESDAY, AUGUST 5, 2015

WA	00	Wednesday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 3”
WB	01	Wednesday	10:30 - 12:00	Pavilion East	“Innovation Management 7”
WB	02	Wednesday	10:30 - 12:00	Pavilion West	“Commercialization of Tech 2”
WB	03	Wednesday	10:30 - 12:00	Broadway-1	“R&D Management 1”
WB	04	Wednesday	10:30 - 12:00	Broadway-2	“S&T Policy 1”
WB	05	Wednesday	10:30 - 12:00	Broadway-3	TUTORIAL: “Managing Technology Push Through Marketing Testbeds”
WB	07	Wednesday	10:30 - 12:00	Studio Suite	“Technology Roadmapping 1”
WB	08	Wednesday	10:30 - 12:00	Directors Suite	“E-Business”
WB	09	Wednesday	10:30 - 12:00	Council Suite	“Strategic Mgmt of Tech 1”
WB	11	Wednesday	10:30 - 12:00	Executive Suite	“Entrepreneurship 3”
WD	01	Wednesday	14:00 - 15:30	Pavilion East	“Innovation Management 8”
WD	02	Wednesday	14:00 - 15:30	Pavilion West	“Technology Forecasting 1”
WD	03	Wednesday	14:00 - 15:30	Broadway-1	“R&D Management 2”
WD	04	Wednesday	14:00 - 15:30	Broadway-2	“S&T Policy 2”
WD	05	Wednesday	14:00 - 15:30	Broadway-3	TUTORIAL: “Scalable Strategic Planning”
WD	06	Wednesday	14:00 - 15:30	Broadway-4	“Tech Mining 1”
WD	07	Wednesday	14:00 - 15:30	Studio Suite	“Competitiveness in TM 1”
WD	09	Wednesday	14:00 - 15:30	Council Suite	“Strategic Mgmt of Tech 2”
WE	01	Wednesday	16:00 - 17:30	Pavilion East	“Innovation Management 9”
WE	03	Wednesday	16:00 - 17:30	Broadway-1	“R&D Management 3”
WE	04	Wednesday	16:00 - 17:30	Broadway-2	“S&T Policy 3”
WE	05	Wednesday	16:00 - 17:30	Broadway-3	TUTORIAL: “Technology Scorecarding”
WE	06	Wednesday	16:00 - 17:30	Broadway-4	“Tech Mining 2”
WE	07	Wednesday	16:00 - 17:30	Studio Suite	“Competitiveness in TM 2”
WE	08	Wednesday	16:00 - 17:30	Directors Suite	“Convergence of Tech “
WE	09	Wednesday	16:00 - 17:30	Council Suite	“Strategic Mgmt of Tech 3”

THURSDAY, AUGUST 6, 2015

HA	00	Thursday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 4”
HB	01	Thursday	10:30 - 12:00	Pavilion East	“Manufacturing Management 1”
HB	02	Thursday	10:30 - 12:00	Pavilion West	“Technology Forecasting 2”
HB	03	Thursday	10:30 - 12:00	Broadway-1	“Productivity Mgmt 2”
HB	06	Thursday	10:30 - 12:00	Broadway-4	“Cultural Issues 1”
HD	02	Thursday	14:00 - 15:30	Pavilion West	PANEL: “PICMET 2016 Planning Session”
HD	03	Thursday	14:00 - 15:30	Broadway-1	“Productivity Mgmt 1”

SCHEDULE OF SESSIONS

SCHEDULE OF SESSIONS BY ROOM

Session	Number	Day	Time	Room	Session Title
MA	00	Monday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 1”
TA	00	Tuesday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 2”
WA	00	Wednesday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 3”
HA	00	Thursday	08:30 - 10:00	Pavilion	PLENARY: “Plenary - 4”
MB	01	Monday	10:30 - 12:00	Pavilion East	“Innovation Management 1”
MD	01	Monday	14:00 - 15:30	Pavilion East	“Innovation Management 2”
ME	01	Monday	16:00 - 17:30	Pavilion East	“Innovation Management 3”
TB	01	Tuesday	10:30 - 12:00	Pavilion East	“Innovation Management 4”
TD	01	Tuesday	14:00 - 15:30	Pavilion East	“Innovation Management 5”
TE	01	Tuesday	16:00 - 17:30	Pavilion East	“Innovation Management 6”
WB	01	Wednesday	10:30 - 12:00	Pavilion East	“Innovation Management 7”
WD	01	Wednesday	14:00 - 15:30	Pavilion East	“Innovation Management 8”
WE	01	Wednesday	16:00 - 17:30	Pavilion East	“Innovation Management 9”
HB	01	Thursday	10:30 - 12:00	Pavilion East	“Manufacturing Management 1”
MB	02	Monday	10:30 - 12:00	Pavilion West	“Supply Chain Management 1”
MD	02	Monday	14:00 - 15:30	Pavilion West	PANEL: “Al’s View: Disagree But Not Be Disagreeable”
ME	02	Monday	16:00 - 17:30	Pavilion West	“Resource Management”
TB	02	Tuesday	10:30 - 12:00	Pavilion West	“Technological Changes”
TD	02	Tuesday	14:00 - 15:30	Pavilion West	“Commercialization of Tech 1”
TE	02	Tuesday	16:00 - 17:30	Pavilion West	PANEL: “Meet the Editors”
WB	02	Wednesday	10:30 - 12:00	Pavilion West	“Commercialization of Tech 2”
WD	02	Wednesday	14:00 - 15:30	Pavilion West	“Technology Forecasting 1”
HB	02	Thursday	10:30 - 12:00	Pavilion West	“Technology Forecasting 2”
HD	02	Thursday	14:00 - 15:30	Pavilion West	PANEL: “PICMET 2016 Planning Session”
MB	03	Monday	10:30 - 12:00	Broadway-1	“NPD 1”
MD	03	Monday	14:00 - 15:30	Broadway-1	“NPD 2”
ME	03	Monday	16:00 - 17:30	Broadway-1	“NPD 3”
TB	03	Tuesday	10:30 - 12:00	Broadway-1	“NPD 4”
TD	03	Tuesday	14:00 - 15:30	Broadway-1	“NPD 5”
TE	03	Tuesday	16:00 - 17:30	Broadway-1	“S&T Communication”
WB	03	Wednesday	10:30 - 12:00	Broadway-1	“R&D Management 1”
WD	03	Wednesday	14:00 - 15:30	Broadway-1	“R&D Management 2”
WE	03	Wednesday	16:00 - 17:30	Broadway-1	“R&D Management 3”
HB	03	Thursday	10:30 - 12:00	Broadway-1	“Productivity Mgmt 2”
HD	03	Thursday	14:00 - 15:30	Broadway-1	“Productivity Mgmt 1”

Schedule of Sessions

MB	04	Monday	10:30 - 12:00	Broadway-2	“Project Mgmt 1”
MD	04	Monday	14:00 - 15:30	Broadway-2	“Project Mgmt 2”
ME	04	Monday	16:00 - 17:30	Broadway-2	“Decision Making 1”
TB	04	Tuesday	10:30 - 12:00	Broadway-2	“Decision Making 2”
TD	04	Tuesday	14:00 - 15:30	Broadway-2	“Decision Making 3”
WB	04	Wednesday	10:30 - 12:00	Broadway-2	“S&T Policy 1”
WD	04	Wednesday	14:00 - 15:30	Broadway-2	“S&T Policy 2”
WE	04	Wednesday	16:00 - 17:30	Broadway-2	“S&T Policy 3”
MB	05	Monday	10:30 - 12:00	Broadway-3	“Intellectual Property 1”
MD	05	Monday	14:00 - 15:30	Broadway-3	“Intellectual Property 2”
ME	05	Monday	16:00 - 17:30	Broadway-3	“Intellectual Property 3”
TB	05	Tuesday	10:30 - 12:00	Broadway-3	“Emerging Technologies 1”
TD	05	Tuesday	14:00 - 15:30	Broadway-3	“Emerging Technologies 2”
TE	05	Tuesday	16:00 - 17:30	Broadway-3	“Disruptive Technologies”
WB	05	Wednesday	10:30 - 12:00	Broadway-3	TUTORIAL: “Managing Technology Push Through Marketing Testbeds”
WD	05	Wednesday	14:00 - 15:30	Broadway-3	TUTORIAL: “Scalable Strategic Planning”
WE	05	Wednesday	16:00 - 17:30	Broadway-3	TUTORIAL: “Technology Scorecarding”
MB	06	Monday	10:30 - 12:00	Broadway-4	“Knowledge Management 1”
MD	06	Monday	14:00 - 15:30	Broadway-4	“Knowledge Management 2”
ME	06	Monday	16:00 - 17:30	Broadway-4	“Knowledge Management 3”
TB	06	Tuesday	10:30 - 12:00	Broadway-4	“Global Issues 1”
TE	06	Tuesday	16:00 - 17:30	Broadway-4	“Global Issues 2”
WD	06	Wednesday	14:00 - 15:30	Broadway-4	“Tech Mining 1”
WE	06	Wednesday	16:00 - 17:30	Broadway-4	“Tech Mining 2”
HB	06	Thursday	10:30 - 12:00	Broadway-4	“Cultural Issues 1”
MB	07	Monday	10:30 - 12:00	Studio Suite	“Technology Diffusion”
MD	07	Monday	14:00 - 15:30	Studio Suite	“Technology Adoption 1”
ME	07	Monday	16:00 - 17:30	Studio Suite	“Technology Adoption 2”
TB	07	Tuesday	10:30 - 12:00	Studio Suite	“Tech Assessment & Evaluation 1”
TD	07	Tuesday	14:00 - 15:30	Studio Suite	“Tech Assessment & Evaluation 2”
TE	07	Tuesday	16:00 - 17:30	Studio Suite	“Technology Acquisition”
WB	07	Wednesday	10:30 - 12:00	Studio Suite	“Technology Roadmapping 1”
WD	07	Wednesday	14:00 - 15:30	Studio Suite	“Competitiveness in TM 1”
WE	07	Wednesday	16:00 - 17:30	Studio Suite	“Competitiveness in TM 2”
MB	08	Monday	10:30 - 12:00	Directors Suite	“TM in Service 1”
MD	08	Monday	14:00 - 15:30	Directors Suite	“TM in Service 2”
ME	08	Monday	16:00 - 17:30	Directors Suite	“TM in Energy 1”

Schedule of Sessions

TB	08	Tuesday	10:30 - 12:00	Directors Suite	“TM in Energy 2”
TD	08	Tuesday	14:00 - 15:30	Directors Suite	“Technology Planning”
TE	08	Tuesday	16:00 - 17:30	Directors Suite	“Quality Management”
WB	08	Wednesday	10:30 - 12:00	Directors Suite	“E-Business”
WE	08	Wednesday	16:00 - 17:30	Directors Suite	“Convergence of Tech “
MB	09	Monday	10:30 - 12:00	Council Suite	“Collaborations for TM 1”
MD	09	Monday	14:00 - 15:30	Council Suite	“Collaborations for TM 2”
ME	09	Monday	16:00 - 17:30	Council Suite	“Collaborations for TM 3”
TB	09	Tuesday	10:30 - 12:00	Council Suite	“Collaborations for TM 4”
TD	09	Tuesday	14:00 - 15:30	Council Suite	“TM Framework”
TE	09	Tuesday	16:00 - 17:30	Council Suite	“Technology Transfer “
WB	09	Wednesday	10:30 - 12:00	Council Suite	“Strategic Mgmt of Tech 1”
WD	09	Wednesday	14:00 - 15:30	Council Suite	“Strategic Mgmt of Tech 2”
WE	09	Wednesday	16:00 - 17:30	Council Suite	“Strategic Mgmt of Tech 3”
MB	10	Monday	10:30 - 12:00	Forum Suite	“Sustainability 1”
MD	10	Monday	14:00 - 15:30	Forum Suite	“Sustainability 2”
ME	10	Monday	16:00 - 17:30	Forum Suite	“Enterprise Management”
TB	10	Tuesday	10:30 - 12:00	Forum Suite	“Educational Issues 1”
TD	10	Tuesday	14:00 - 15:30	Forum Suite	“Educational Issues 2”
TE	10	Tuesday	16:00 - 17:30	Forum Suite	“Educational Issues 3”
MB	11	Monday	10:30 - 12:00	Executive Suite	“ICT Mgmt 1”
MD	11	Monday	14:00 - 15:30	Executive Suite	“ICT Mgmt 2”
ME	11	Monday	16:00 - 17:30	Executive Suite	“ICT Mgmt 3”
TB	11	Tuesday	10:30 - 12:00	Executive Suite	“Environmental Issues”
TD	11	Tuesday	14:00 - 15:30	Executive Suite	“Entrepreneurship 1”
TE	11	Tuesday	16:00 - 17:30	Executive Suite	“Entrepreneurship 2”
WB	11	Wednesday	10:30 - 12:00	Executive Suite	“Entrepreneurship 3”

Personal Schedule

	Sunday August 2, 2015	Monday August 3, 2015	Tuesday August 4, 2015	Wednesday August 5 2015	Thursday August 6, 2015
08:00 – 08:30 Bright Start (Breakfast)					
08:30 – 10:00 (A)		Plenary - 1 (Pavilion)	Plenary - 2 (Pavilion)	Plenary - 3 (Pavilion)	Plenary - 4 (Pavilion)
10:00 – 10:30 Coffee Break					
10:30 – 12:00 (B)					
12:00 – 14:00 Lunch Break					
14:00 – 15:30 (D)					PICMET '16 Planning Session (Pavilion West)
15:30 – 16:00 Coffee Break					
16:00 – 17:30 (E)					
19:00 – 22:00	Welcome Reception (Pavilion)	Monday Dinner (World Trade Center)	Awards Banquet (Pavilion)		

SPECIAL SESSIONS

SPECIAL SESSION - 1

DATE: WEDNESDAY, AUGUST 5
TIME: 12:00-14:00
ROOM: SKYLINE 3 (23RD FLOOR)

PICMET has 135 Country Representatives in 59 countries. They provide the linkage between PICMET Headquarters and the different parts of the world by disseminating PICMET information in their regions, proposing locations for future PICMET conferences, and starting PICMET chapters in their countries. Three such chapters, PICMET – Japan, PICMET – Korea, and PICMET – Turkey, are already in operation.

PICMET's co-Director of International Activities, Dr. Kiyoshi Niwa, Professor Emeritus, The University of Tokyo, invites the Country Representatives and those who are interested in becoming Country Representatives to a meeting to discuss the roles of the Country Representatives, the procedure to start and organize PICMET Chapters, and the requirements for holding future PICMET conferences in their countries.

Lunch will be provided.

PICMET '16 AND '17 PLANNING SESSION

DATE: THURSDAY, AUGUST 6
TIME: 14:00-15:30
ROOM: PAVILION-WEST

This session will provide an opportunity to give feedback on PICMET '15 and to get involved in the planning for PICMET '16 and '17 conferences. PICMET '16 will be held September 4-8, 2016, at the Waikiki Beach Marriott Resort & Spa, Hawaii, USA.

PLENARIES

PLENARY SESSION—1

DATE: MONDAY, AUGUST 3
TIME: 08:30-10:00
ROOM: PAVILION ROOM, PLAZA LEVEL

Session Chair: Dr. Tugrul U. Daim, Portland State University, USA

KEYNOTE-1

Dr. Françoise Roure, the French National Advisory Board for Economy, Industry, Energy and Technologies, France

"Addressing Technology Transfers in the Climate and Energy Global Agendas"

In their paths and transitions towards a bio-based economy, the Global Agendas on Climate and Energy will rely on large-scale technology transfers for meeting their sustainable development goals. This presentation will focus on technology transfers in their "Impact Investments" dimension, i.e., investments intended to create positive impact beyond financial return. The discussion could inspire and infuse novel solutions in time for the 2015 ongoing international negotiations at the UN level.

Dr. Françoise Roure chairs the "Security, Safety and Risk" Committee in the French National Advisory Board for Economy, Industry, Energy and Technologies. She has two Ph.D. degrees in Economics (industrial and international) from the University Paris 1 Pantheon-Sorbonne. She is a member of the World Economic Forum Meta-Council on Emerging Technologies, and of the OECD's newly created Working Party on Biotechnology, Nanotechnology and Converging Technologies. She has been an advisor to the European Commission for more than 10 years on foresight and strategy issues in the fields of Advanced Technologies as well as Ethical Frameworks for Responsible Research, Innovation and Industry.

KEYNOTE-2

Dr. Oliver Yu, President and CEO, The STARS Group, Woodside, California, USA; Executive in Residence, Lucas College of Business, San Jose State University, California, USA

"Technology Portfolio Planning: A Systems Approach with Case Applications"

There have been rapid advances and expanding proliferation of technologies with vast and far-reaching impacts on economic production, social interactions, environmental changes, and political movements. As a result, effective investment in new technology development and acquisition is critically important not only to business enterprises and government agencies, but also to educational establishments, research institutions, non-government organizations, and even individuals. This presentation discusses the use of a systems approach that combines the principles of decision analysis, scenario forecasting, and modern portfolio theory to develop a systematic methodology for analyzing and optimizing the technology investment decision process. The methodology is further demonstrated through successful case applications to the technology investment decisions of a large U.S. public power administration and an Asian government agency.

Dr. Oliver Yu, President and CEO of the STARS Group, a premier technology management strategy consulting firm spun off from SRI International (formerly Stanford Research Institute) in the year 2000, is an internationally recognized expert on technology and resource management strategy planning and analysis. He is also a Consulting Associate Professor of Management Science & Engineering at Stanford University and an Adjunct Full Professor on Technology Portfolio Planning for the MBA-MS Engineering Dual Degree Program and since 2009 an Executive in Residence at the College of Business of San Jose State University (SJSU) in California. Dr. Yu is an honorary professor at National Dong-Hwa University in Taiwan and taught special courses on Innovation Management for MBA programs at Zhejiang University and Dalian University of Technology in China and EMBA programs at National Chung-Hsin University and National Chi-Nan University in Taiwan. Between November 28, 2013, and February 28, 2014, he has been invited to be a Visiting Professor on Asian Business Innovation Strategy at Kyushu University in Japan. He was invited twice to be a keynote speaker at the Asia-Pacific Technology Foresight Conference, once with Joe Martino and Alan Porter. Prior to founding the STARS Group, Dr. Yu was Director of Energy and Technology Strategies at SRI from 1989 to 2000, responsible for over 100 major projects on technology and resource management strategies throughout the world. Before that, Dr. Yu was for 15 years the Manager of Planning Analysis at the Electric Power Research Institute (EPRI), responsible for energy industry analysis and EPRI-

PLENARIES

wide research planning. Dr. Yu holds a BSEE from Taiwan University, an MSEE from Georgia Institute of Technology, and an M.S. in Statistics and a Ph.D. in Operations Research from Stanford. He was a Fulbright Fellow, and an officer as well as the 1984 General Chair of the national meeting and the 1995 General Chair of the first international meeting of the Institute for Operations Research and Management Science (INFORMS). He has published over 80 technical papers and authored and co-authored five books on technology and resource strategy planning, including Technology Portfolio Planning and Management published by Springer in 2006, and Technology Management and Forecasting by Tsinghua University Press in China. He was the co-organizer of the Global Innovation Forum: Silicon Valley, jointly sponsored by SRI, IBM, and SJSU and held at SRI in 2010, and is the Executive Director of the Global Access Innovation Network (GAIN), for promoting global cooperation in innovation management. He also serves as Board Member and Director of Smart Grid Task Force of the US-China Green Energy Council, Managing Editor of the IEEE annual series on Advances in Innovation and Technology Management, Chapter Vice Chair of the IEEE Technology Management Council, and Ambassador of the International Society of Service Innovation Professionals (ISSIP).

PLENARY SESSION—2

DATE: TUESDAY, AUGUST 4
TIME: 08:30-10:00
ROOM: PAVILION ROOM, PLAZA LEVEL

Session Chair: Dr. Kiyoshi Niwa, Professor Emeritus, The University of Tokyo, Japan

KEYNOTE-1

Mr. Shinjiro Iwata, Representative Executive Officer, Executive Vice President and Executive Officer, Hitachi, Ltd., Japan

"Social Innovation for the Future: New Collaborative Creation for Growth"

Even in the face of a number of social issues, the global economy's borders are vanishing and continue to grow. The Hitachi Group is committed to the social innovation business and believes that innovation holds the key to solving the issues that face society and to further growth. The Hitachi Group will work to solve the social and administrative issues for our customers. To do this, we will establish a broad partnership that is beyond industry and more into society which will promote a long-term collaborative creation of value. These efforts will help create a better society on a global scale by revolutionizing the services and social infrastructure that support our lives and businesses.

Mr. Shinjiro Iwata is the Representative Executive Officer, Executive Vice President and Executive Officer of Hitachi, Ltd.; and President and CEO of the Information & Telecommunication Systems Group.

Mr. Iwata began his career with Hitachi, Ltd., in 1972 in the Overseas Business Department. After holding positions of increasing responsibility, Mr. Iwata became Manager of the Business Planning Department for the Information Systems Group in 1996.

In 1997, Mr. Iwata joined Hitachi Data Systems (HDS), where he served as Executive Vice President. In 2000, Mr. Iwata returned to Hitachi, Ltd., and served as Deputy General Manager of the International Business Promotion Division. He was promoted to General Manager of the Global Business Development Division in 2001. Later that year, he returned to HDS as CEO. After leading HDS for almost five years, he returned to Hitachi, Ltd., to serve as Chief Marketing Officer (CMO) of the company's Information & Telecommunication Systems Group.

In 2006, Mr. Iwata joined Hitachi Global Storage Technologies (HGST) in San Jose, California, where he served as CMO. He was also a member of HGST's Board of Directors.

In 2009, Mr. Iwata returned to Hitachi, Ltd., as Vice President and Executive Officer, CEO of Service & Global Business, Information & Telecommunication Systems, Hitachi, Ltd. As CEO of Information & Telecommunication Systems, Mr. Iwata is credited with turning the company around and initiating a period of rapid growth and profitability.

KEYNOTE-2

Dr. Alan L. Porter, Professor Emeritus of Industrial & Systems Engineering, and of Public Policy, and Co-director of the Technology Policy and Assessment Center, Georgia Institute of Technology, USA; Director of R&D for Search Technology, Inc., Georgia, USA

"Forecasting Innovation Pathways: The Case of Big Data"

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PICMET's primary mission is to advance analyses of changing technologies to inform technology management. That reflects balancing expert and empirical components to provide effective intelligence. Are managers ready for that? Doubts remain.

I'd like to share an example of our group's efforts to "Forecast Innovation Pathways" (FIP) for the case of "Big Data." In tackling such a challenge, we strive to understand the target technology and its attendant "Technology Delivery System" (i.e., contextual factors affecting development of novel applications). We then perform "tech mining" – text analyses of research publication, patent, and contextual abstract records on the topic, retrieved from databases. One aspect of special interest is detecting "emergence."

Our process engages various experts and stakeholders to interpret the story of technology development to date. We then work to anticipate promising paths to diverse applications, and attendant issues, potential impacts, and policy/management leverage points.

"Big Data" offers an intriguing case. The explosive growth in R&D, business, and diverse popular interests, concurrently, fuels generation of challenging scenarios for technology managers.

Dr. Alan Porter is Professor Emeritus of Industrial & Systems Engineering, and of Public Policy, at Georgia Tech, where he is Co-director of the Technology Policy and Assessment Center. He is also Director of R&D for Search Technology, Inc., Norcross, Georgia (producers of VantagePoint and Thomson Data Analyzer software). He is author or co-author of some 230 articles and books, including Tech Mining (Wiley, 2005) and Forecasting and Management of Technology (Wiley, 2011). Current research emphasizes "forecasting innovation pathways" for newly emerging technologies. This entails text mining of science, technology & innovation information resources to generate Competitive Technical Intelligence. Many publications are available at: http://www.researchgate.net/profile/Alan_Porter4.

PLENARY SESSION—3

DATE: WEDNESDAY, AUGUST 5
TIME: 08:30—10:00
ROOM: PAVILION ROOM, PLAZA LEVEL

Session Chair: Dr. Robert Harmon, Portland State University, USA

KEYNOTE-1

Dr. Youngrak Choi, Advisor, Ministry of Science and Technology, Ethiopia

"Straying Slowly: STI in Developing Economies"

Over the last 50 years, numerous research projects and policy recommendations have been made for science, technology, and innovation (STI) in developing economies. However, only a few countries have emerged as achieving sufficiently capable status until now. Why do such gaps happen between discourse and reality? This presentation aims to examine this question with a brief review of predominant perspectives on STI such as Big Push, Import Substitution Industrialization, Appropriate Technology, Manufacturing Capabilities, Post East Asian Model, and Resource-led Development. Then, major features of STI in developing economies will be discussed: largely untapped latent potential; lagged behind and stagnant; no benefit and useful solution for society; neglected and isolated island from the world community. These may be caused by neglecting concerns of the gaps and also looking in wrong places in their quest of scholars across the globe. After that, constraints and bottlenecks hindering STI progress are examined to suggest a new framework; low equilibrium trap, no strong enterprise and no supportive university, limited investment capital, difficulty in priority setting and resource concentration, poor policy execution capability, risk-aversion attitude, inability to adapt technologies to raise productivity, and so on. Finally, some mandatory policy recommendations for global joint initiatives are addressed. Undoubtedly, STI can play an essential role as a critical growth engine of wealth creation for improvements of welfare and for progression of social systems in these economies.

Dr. Youngrak Choi is currently serving as the advisor for the Ministry of Science and Technology in Ethiopia (since 2013) and a PICMET Fellow (since 2011). He has extensive work experience in the field of Science and Technology (S&T) Policy, including serving as the Chairman of Korea Research Council of Public Science and Technology, a member of the Presidential Advisory Council for Science and Technology, a member of the Presidential Commission on Policy Planning, the President of Science & Technology Policy Institute, the President of

the Korean Society for Technology Management & Economics, and a full member of the National Academy of Engineering of Korea. Also, Dr. Choi served as a professor of the Graduate School of Management of Technology, Korea University, from 2009 to 2012. He holds a Ph.D. in Technological Innovation from Roskilde University in Denmark. Dr. Choi's research mainly focuses on the Korean innovation model, science and technology policy, and technology and development. Through his extensive research on the Long-term National S&T Development Plan, he has been instrumental in enhancing the effectiveness of Korean S&T policy over the past 30 years. Based on his outstanding contribution to the field of S&T policy, he received a LTM Award in Government from PICMET in 2006 and also an Iljin Award from NAEK in 2010.

KEYNOTE-2

Mr. Hamid Reza Amirinia, Head of INOTEX and Former Advisor to the Vice-President for Science and Technology, Iran

"Governance of Emerging Technologies in Developing Countries"

Emerging technologies have become the greatest agent of change in the modern world and perhaps in shaping the future. Positive technological breakthroughs from emerging technologies promise innovative solutions to the most pressing global challenges of our time, from resource scarcity to global environmental change. They are currently associated with high economic expectations and major opportunities for public welfare. However, in developing countries, due to a lack of appropriate investment, outdated regulatory frameworks and gaps in public awareness and legitimization process, many of these promising technologies are constrained from achieving their potential. Governments should deal with these technologies in an active way, intervene to develop them toward sustainability and to provide a competitive environment for their diffusion. For this intervention, governments should choose suitable frameworks to govern the technology development process compatible with societal circumstances.

Iran's growth in the field of nanotechnology has been remarkable. In 2000 Iran was ranked as the world's 59th country in terms of science generation, for which an important index is the number of ISI papers published in various well known international peer-reviewed journals. However, it only took a decade for Iran's nanotechnology to achieve 8th rank in 2013. Since 2004 Iran has had the highest rate of growth among leading countries of the world in this field. Upon realizing the significant influence of nanotechnology on Iran's future economy, extensive activities were initiated in 2000. This presentation will explain Iran's policies and strategies in dealing with nanotechnology over the last 15 years in the context of the Technological Innovation System approach.

Mr. Hamid Reza Amirinia is the Head of the International Innovation and Technology Exhibition (INOTEX). He is also an invited member of the steering headquarters for the implementation of the national science master plan map. Up to Jan 2015 he was advisor to the Vice-President for Science and Technology, Iran, and before that he was advisor to the Presidency and Head of the Presidential Center for Innovation & Technology Cooperation, 2008-2014. He was the Iran Embassy's Science – Industrial Attaché in Moscow from 2005 to 2008, and Head of the Engineering Department Technology Cooperation office, Presidency, 2003-2005. From 1998 to 2001 he was Vice-Chairman of the Technology Cooperation office, Presidency.

Mr. Amirinia was head of the Engineering Department, Technology Cooperation Office, Presidency, 1998-2004, and head of the Engineering Department of the Office of Science and Industrial Studies of the Prime Minister's Office, 1989-1997. He was a member of Iranian National Science and Technology Policy Committees for Nanotechnology, Biotechnology, Renewable Energy, Herbal Drugs, etc., between 2008- 2015.

Mr. Amirinia received a B.A. in Electronics Engineering from Amir Kabir University in 1988, and an M.A. in Industrial Management (Science and Research Policy) with distinction degree from Strathclyde University in Scotland in 2003. He is a Ph.D. researcher at The Iranian National Research Institute for Science Policy affiliated with the Ministry of Science, Research and Technology.

PLENARY SESSION—4

DATE: THURSDAY, AUGUST 6
TIME: 08:30-10:00
ROOM: PAVILION ROOM, PLAZA LEVEL

Session Chair: Dr. Timothy R. Anderson, Portland State University, USA

PLENARIES

KEYNOTE-1

Mr. John R. McDougall, President of National Research Council, Canada

"Innovation in Canada"

Historically, research and the arts were often viewed from a similar perspective – as "things advanced economies did," and there was minimal accountability from investments in research. Following massive global investments in research, expectations for impacts are rising around the world and people are beginning to question the appropriate shape of public investment across the entire ST&I horizon.

Canada too has made major investments in knowledge generation and, as a result, punches above its weight in publications and citations. However, raw knowledge is a tradable good, and like any other resource, in the absence of value added through innovation, is a relatively low value commodity and thus, is not sufficient to create a competitive economy. Monetizing knowledge through innovation underpins globally competitive economies – by contributing to productivity through development and commercial application of technologies, products and services.

Canadian business expenditures in research and development (R&D) lag behind many countries. Furthermore, Canada faces chronic challenges in effectively moving knowledge developed in higher education institutions to companies that have the ability to absorb it and translate it into commercially viable products. This presentation will outline the actions being taken to improve Canada's innovation performance.

Mr. John McDougall, born and raised in Edmonton, Canada, was appointed as NRC's President in April 2010 following 12 years as President and CEO of the Alberta Research Council when he also founded and chaired Innoventures Canada, bringing together Canada's leading research and technology organizations. His career began as a petroleum engineer, and then quickly evolved into the ownership and management of an international engineering consulting firm and subsequently a private merchant bank. From 1991 to 1997, he was the first Poole Chair in Management for Engineers, a leadership position within the University of Alberta. He has held leadership positions with some of Canada's most innovative research and manufacturing businesses, research consortia and not-for-profit organizations and with numerous professional and business organizations. He has served on advisory boards and committees at provincial, federal and international levels. Mr. McDougall has been recognized by organizations including the Canadian Academy of Engineers, Engineers Canada, Mexican College of Civil Engineers and PICMET. He has a B.Sc. in Civil Engineering from the University of Alberta, and completed several postgraduate courses in Environmental Engineering.

KEYNOTE-2

Dr. Steven Eppinger, Professor of Management Science and Innovation at the Massachusetts Institute of Technology, USA

"The Architecture of Engineering"

Our work with the design structure matrix (DSM) started by using the method as a research tool to model the performance of engineering projects. However, we immediately recognized DSM to be a powerful method to explore and explain the deep structure of complex technical projects across a range of industries. Today, we can use DSM to represent the architecture of complex engineering systems, the architecture of large engineering processes, and the architecture of networked engineering organizations. In this keynote presentation, I will review some of the key DSM research results and the ways in which the method is used today to manage complex technical projects. I will also offer thoughts on the frontiers in engineering management that may be addressed using DSM modeling and some reflections on why it takes more than 20 years to bring a practical new method into common practice.

Dr. Steven Eppinger is Professor of Management Science and Innovation at the Massachusetts Institute of Technology Sloan School of Management. He holds the General Motors Leaders for Global Operations Chair and a joint appointment in MIT's Engineering Systems Division. Professor Eppinger teaches interdisciplinary courses at both the master's and executive levels in product design and innovation, engineering project management, and digital product management. He has co-authored a leading textbook entitled Product Design and Development (McGraw-Hill). Currently in its sixth edition, the text has been translated into several lan-

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guages and is used by hundreds of universities and more than a quarter million students. Dr. Eppinger's research is applied to improving complex technical projects in a wide range of industries and is the basis of the book titled Design Structure Matrix Methods and Applications (MIT Press). Professor Eppinger is the Co-Director of MIT's System Design and Management Program. He served as Deputy Dean of the MIT Sloan School of Management for five years. He received S.B., S.M., and Sc.D. degrees from MIT's Department of Mechanical Engineering.

PhD Colloquium

GETTING YOUR PHD.… AND BEYOND

Critical Stages and Career Paths for the PhD Student

DATE: SUNDAY, AUGUST 2
TIME: 13:00—17:00
LOCATION: BROADWAY-I/II
REGIST: $35

Through guest lectures and a workshop, we will share experiences in the following areas:

- The Ph.D. process and career paths in different countries.
- Critical stages in the Ph.D. process and how to successfully master them.
- Coping with possible personal problems while pursuing a Ph.D. (lack of time or motivation, problems with advisers, insufficient time for family and friends, etc.).
- What's next - academia or industry?
- Entering the academic job market as future junior faculty versus landing your first industry job.

GUEST SPEAKERS:

Professor Gloria Barczak, Northeastern University, USA; Editor-in-Chief, *Journal of Product Innovation Management*

Professor Hongyi Chen, University of Minnesota Duluth, USA

Guest lectures will provide a starting point for workshop discussions. Workshops will tackle topics the participants are most interested in. They provide a unique opportunity to meet colleagues, share experiences and ideas, and network with students and faculty from different countries and university systems.

We encourage students in all stages of the Ph.D. process, as well as recent graduates, to join us.

Please contact Professor Antonie Jetter at ajetter@pdx.edu if you have any questions about the Colloquium.

TUTORIALS

MANAGING TECHNOLOGY PUSH THROUGH MARKETING TESTBEDS

DATE: WEDNESDAY, AUGUST 5
TIME: 10:30-12:00
LOCATION: BROADWAY-III

SPEAKERS: Hon. Prof. Dkfm. Dr. Rainer Hasenauer, Vienna University of Economics and Business (WU Vienna); Dr. Charles M. Weber, Portland State University, USA

This tutorial aims for a deeper understanding of:

- How technology readiness level (TRL) / market readiness level (MRL) are put into practice
- The relationship between TRL/MRL and the technology acceptance model (TAM)
- The relationship between TAM and marketability criteria

Questions to be discussed are:

- How to specify TRL and its sub-models (Integration Readiness, Manufacturing Readiness, IPR Readiness) for specific innovative products' TRL
- How to specify MRL and its sub-models (Supply Readiness, Demand Readiness, Customer Readiness, Product Readiness) to determine the market readiness for specific innovative products' MRL
- Discussion by selected examples of high tech innovative products.

Hon. Prof. Dkfm. Dr. Rainer Hasenauer is Honorary Professor of Marketing and Lecturer in Marketing of High-Tech Innovation and Technology Marketing at the Institute for Marketing Management, Vienna University of Economics and Business (WU Vienna). He is an entrepreneur who has long been involved with high-tech companies as a co-founder and a business angel. He is also a business developer focusing on innovative technologies. He initiated and co-founded the HiTec Marketing Research Association in Vienna (www.hitec.at). He also initiated the Cross Border HiTec Center (www.hitechcentrum.eu), where he serves as senior advisor.

His primary teaching and research interests lie in market entry of high-tech innovation in B2B markets, and in measuring innovation half-life and technology acceptance in B2B markets. He teaches at the WU Vienna, the Vienna University of Technology, and the Campus02 University of Applied Sciences in Graz. He has held guest lectureships at the Institute for Advanced Studies in Vienna, the University of St. Gallen, the University of Klagenfurt, and the University of Economics in Bratislava.

His research work is predominantly project-driven for B2B markets and comprises community-based innovation, marketing testbeds for market entry, and multi-disciplinary communication in high-tech innovation. Applications include satellite navigation and remote sensing, robotics, sensors, functional materials, flow batteries and remote power supply, threat analysis for safety and security systems of complex products and systems such as road tunnel ventilation and power plants, and applied operations research with a focus on multi-criteria decision models.

He serves on the advisory boards of high-tech investment groups, on an expert board for high-tech start-up incubators, and on the supervisory board of a global market leader in the field of safety-critical real-time communication systems.

Dr. Charles Weber holds (among other degrees) a B.S. degree in Engineering Physics from the University of Colorado, Boulder; an M.S. degree in Electrical Engineering from the University of California, Davis; and a Ph.D. in Management from MIT's Sloan School of Management. He joined Hewlett-Packard Company as a process engineer in an IC manufacturing facility. He subsequently transferred to HP's IC process development center, working in electron beam lithography, parametric testing, microelectronic test structures, clean room layout, and yield management. From 1996 to 1998, Dr. Weber managed the defect detection project at SEMATECH as an HP assignee. In December 2002, he joined the faculty of Portland State University, where he is as an associate professor of Engineering and Technology Management. Dr. Weber's research interests are in organizational learning, problem solving, knowledge management, innovation and entrepreneurship. In fall 2013, Charles held the Fulbright/Hall distinguished chair in entrepreneurship at the Vienna University of Economics and Business in Austria.

TUTORIALS

SCALABLE STRATEGIC PLANNING

DATE: WEDNESDAY, AUGUST 5
TIME: 14:00-15:30
LOCATION: BROADWAY-III

SPEAKER: Mr. Paul Menig, Tech-I-M LLC, USA

Based on personal experience doing strategic planning at multinational companies (General Electric, Eaton and Daimler), combined with mentoring of entrepreneurs through SCORE and Oregon Entrepreneurs Network, businesses large and small, regardless of funding source, fail. While there are many reasons, they can be traced to poor planning. The business or strategic plan serves multiple purposes and should be geared to multiple audiences of investors, customers, suppliers, and employees. Data needs to be gathered, turned into information and used to make decisions about the future of the business. These areas are sales and marketing channels, supply chain and outsourcing, competition, risk of disruption, market constraints and government, technology and internal initiatives. These seven forces prevent acceleration of the business. The business planning effort needs to be scaled to the size of the company and its growth or lifestyle objectives. There are common elements of plans regardless of size. As the company grows, additional steps or greater detail are needed. Small companies are focused on growth, while large, public companies deal more with risk. Differences in the approaches for the different forces are outlined for five different sizes of companies. Navigate your way on the road to success.

Mr. Paul Menig has spent his entire career leading teams to create, develop and support high-tech products for military, aerospace, industrial automation, medical, and automotive industries. He was an *in*-trapreneur at Daimler, Eaton and General Electric. He has been employee number 1 in a new business unit and one of the leaders in a company of 275,000. His teams have worked on breast scanners, cardiac monitors, self-guided bombs, nuclear reactors, programmable logic controllers, sensors, semiconductor processing equipment, radar systems, engines, transmissions, brakes, telematics and human interface devices. Mr. Menig has made sure they were designed right from the start; helped the factory produce and program the products correctly; been in the field to obtain customer orders; and suffered complaints of customers when things broke. Through experience, he has come to appreciate that Savvy Technology—the right technology, at the right time, applied properly—creates Powerful Results. Mr. Menig graduated from MIT with a bachelor's degree in electrical engineering and did post-graduate work at Syracuse University and Marquette University. He is a lifetime learner and has participated in numerous training programs such as Total Quality Management, Software Development, Strategic Planning, Finance for the Non-Financial Manager, ISO 9000, and Vehicle Dynamics.

PANELS

AL'S VIEW: DISAGREE BUT NOT BE DISAGREEABLE

DATE: MONDAY, AUGUST 3
TIME: 14:00-15:30
LOCATION: PAVILION-WEST

PANELISTS: Eliezer Geisler, Illinois Institute of Technology; Donald Kennedy, Wilbros Canada Inc.; Simon Philbin, Imperial College London; Charles W.N. Thompson, Northwestern University

Al Rubenstein knew all the founders; he respected (and often disagreed with) them. Most of the founders from Charnes and Morse to Shapero and Allen had mixed feelings about those at the other end of the dimension(s) they shared, but they were civil and open to conversation. My concern is that many of us may not realize that we are all in the same boat, that that problem we push aside because our "methods" don't work might be solved by another with a different tool – think spoon vs. fork. PICMET brings all of us together, face-to-face, face-to-face with our agreements and disagreements. What better place to examine, to share, to realize that we are all on the same side.

Dr. Eliezer Geisler is a Distinguished Professor at Illinois Institute of Technology, Stuart School of Business, and a leading scholar in the areas of technology management and knowledge management. His research, published in 10 books and over 80 scholarly articles, has contributed fundamental and innovative ideas that have significantly influenced the study of many areas, including industry-university-government alliances, entrepreneurship, and technology transfer and commercialization. He also conducted pioneering research in the field of management of healthcare technologies and co-founded the *International Journal of Healthcare Technology and Management*.

Dr. Donald Kennedy, Ph.D., P.Eng., attended his first PICMET in 2004. He has spent most of his time involved at the ground level of the execution of mega projects with budgets often exceeding $10 billion USD. He has spent time as a lecturer at Canadian Universities. He currently works in Project Controls for an industrial construction company. He has written two books on the need for improved management of technical people.

Dr. Simon Philbin is Director of Programme Management at Imperial College London, where he leads the Programme Management Office (PMO) focused on supporting a range of research programs and projects across the university. This portfolio includes strategic international research programs, EU collaborative research projects and commercial projects. Dr. Philbin joined Imperial in 2003, and previous roles include Associate Director of Enterprise Projects and Programme Director of the Institute of Shock Physics. Prior to Imperial he worked in scientific and managerial positions for QinetiQ Plc. and DERA (Defence Evaluation and Research Agency, Ministry of Defence) for nine years. He holds a B.Sc. (University of Birmingham) and Ph.D. (Brunel University), both in chemistry, as well as an MBA with distinction from the Open University Business School. In 2009 Dr. Philbin was elected a Fellow of the Royal Society of Chemistry (FRSC).

Dr. Charles W.N. Thompson is a respected engineer/attorney/consultant whose career spans nearly seven decades. His resume documents a diverse education – law degree from Harvard University, MBA from Ohio State University, and Ph.D. from Northwestern University – and a varied career, from Air Force engineer to business consultant to a 40-plus-year professorship at McCormick's Department of Industrial Engineering and Management Sciences, Northwestern University.

MEET THE EDITORS

DATE: TUESDAY, AUGUST 4
TIME: 16:00-17:30
LOCATION: PAVILION-WEST

PANELISTS: Gloria Barczak, Northeastern University; Dilek Cetindamar, Sabanci University; Scott Cunningham, Delft University of Technology; Tugrul Daim, Portland State University; Toni Doolen, Oregon State University; Charla Griffy-Brown, Pepperdine University; Robert Harmon, Portland State University; Nazrul Islam, University of Abertay Dundee; Harm-Jan Steenhuis, Eastern Washington University

Meet the editors of the Technology Management related journals. The editors will be discussing the philosophies, criteria, and submission processes of their journals and answer questions from prospective authors.

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SESSIONS

MA-00 PLENARY - 1

DATE: MONDAY, 8/3/2015
TIME: 08:30 - 10:00
ROOM: PAVILION
CHAIR(S): TUGRUL U DAIM; PORTLAND STATE UNIVERSITY

MA-00.1 [K] Addressing Technology Transfers in the Climate and Energy Global Agendas

Francoise Roure; French National Advisory Board, France

In their paths and transitions towards a bio-based economy, the Global Agendas on Climate and Energy will rely on large-scale technology transfers for meeting their sustainable development goals. This presentation will focus on technology transfers in their "Impact Investments" dimension, i.e., investments intended to create positive impact beyond financial return. The discussion could inspire and infuse novel solutions in time for the 2015 ongoing international negotiations at the UN level.

MA-00.2 [K] Technology Portfolio Planning: A Systems Approach with Case Applications

Oliver Yu; San Jose State University, United States

There have been rapid advances and expanding proliferation of technologies with vast and far-reaching impacts on economic production, social interactions, environmental changes, and political movements. As a result, effective investment in new technology development and acquisition is critically important not only to business enterprises and government agencies, but also to educational establishments, research institutions, non-government organizations, and even individuals. This presentation discusses the use of a systems approach that combines the principles of decision analysis, scenario forecasting, and modern portfolio theory to develop a systematic methodology for analyzing and optimizing the technology investment decision process. The methodology is further demonstrated through successful case applications to the technology investment decisions of a large U.S. public power administration and an Asian government agency.

MB-01 Innovation Management 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Pavilion East
Chair(s) Leon Pretorius; University of Pretoria

MB-01.1 [R] Keys to Innovation: System Thinking, Strategic Alignment, Technology Focus

Dietmar H Winzker; University of Pretoria, South Africa
Leon Pretorius; University of Pretoria, South Africa

Innovation is crucial for any modern business, and especially so in a high-technology environment. For a fast-moving, dynamic and exponentially changing world, the demand on high-tech companies to initiate and implement breakthrough innovation for competitive positioning is increasing inexorably. The authors have considerable experience and research background in high-tech engineering companies as consultants, facilitators and academia and have researched the attributes required from different pertinent perspectives to enable breakthrough and sustainable innovation to take place. Innovation in terms of crucial elements for success is considered from the perspectives of Strategy-, System- and Technology Thinking. The paper represents the results of appropriate research conducted over the last couple of years and suggests a management model to nurture innovation. The research methodology rests on personal research, literature studies and analysis and shows the interaction / influence of various sub-dimensions related to the three keys, or crucial elements, of innovation. Judicious and effective engineering and technology management is a pre-requisite for elevating innovation practices, specifically the integration of system thinking in the widest possible sense, strategic alignment of all aspects of the business and a sharp focus on the appropriate technology to be utilized. Considering frequent quantum-jump changes in the global business environment due to (sometimes) revolutionary innovations by competitors create surprises and can lead to low-quality reactive responses. The results of the research lead to the development of an appropriate management methodology to proactively lead the way manage and enable effective innovation.

MB-01.2 [R] Co-Innovation Network Driven Entrepreneurship in High-Tech Technology-Evidences from China

Chun-Hsien Wang; National Chiayi University, Taiwan
Shi-Zheng Huang; National Chiayi University, Taiwan
Ching-Hsing Chang; National Chiayi University, Taiwan
Po-Jin Lin; National Chiayi University, Taiwan
Yuan-Yin Chiew; National Chiayi University, Taiwan

The establishment of high-tech industrial development zones (HID) is employed as an innovation policy instruments for developing industrial technological upgrading in emerging China. The government sponsored HIDs have proven to be remarkably in university-industry-government (U-I-G) coalition in driving academic knowledge and commercialized applications to which we refer as co-innovation network. The firms embedded in HIDs for obtaining co-innovation assistance resources as a new innovation and commercialization paradigm for government innovation policies. We applied an analytic inductive case-based method and social network analysis to study one particular co-innovation network for creating academic entrepreneurship firms in emerging market. Drawing on fine-grained two HIDs and large-scale survey firm-level data between 2010 and 2013 on Pearl River Delta (PRD), government sponsored co-innovation provide evidence of the different model through which university-industry (U-I) co-evolve and respective measures of commercializing academic knowledge success. Furthermore, the empirical results suggest that the government sponsored innovation is crucial drive force to the level of academic knowledge commercialization in emerging China market.

MB-01.3 [R] Alliance Partners Diversity for Open Innovation: The Role of Network Position and External Knowledge Acquisition

Chun-Hsien Wang; National Chiayi University, Taiwan
Ching-Hsing Chang; National Chiayi University, Taiwan
Chih-Cheng Lo; National Changhua University of Education, Taiwan
Sean Hsiang Yin; Chang Gung University, Taiwan

This study advances the research on alliance partner diversity and the network perspective by examining how a firm's network position and external knowledge acquisition strategically shape the relation between alliance partner diversity and open innovation. Building on the knowledge-based and social capital theories, this study extends the model by hypothesizing that the ways in which alliance partner diversity drives open innovation from the central position of an interfirm open alliance network will be further moderated by the breadth and depth of external acquisition. Using an original large-scale survey of high-tech firms, the results support the expectation that the breadth of external acquisition facilitates the conjunctive effect of network centrality and alliance partner diversity; however, the depth of external acquisition mitigates the conjunctive effect of network centrality and alliance partner diversity on the deployment of firms' open innovation. This study's findings contribute to the theoretical development of open innovation as well as the development of alliance network practice.

MB-02 Supply Chain Management 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Pavilion West
Chair(s) MD Sarder; University of Southern Mississippi

MB-02.1 [R] A Hybrid RFID Case-based System for Handling Air Cargo Storage Location Assignment Operations in Distribution Centers

K.H. Leung; The Hong Kong Polytechnic University, Hong Kong
King-lun T Choy; The Hong Kong Polytechnic University, Hong Kong
Migar M.C. Tam; CAS Logistics Limited, Hong Kong
C.H.Y. Lam; The Hong Kong Polytechnic University, Hong Kong
C.K.H. Lee; The Hong Kong Polytechnic University, Hong Kong
Stephen W.Y. Cheng; The Hong Kong Polytechnic University, Hong Kong

Logistics service providers (LSPs) often face the challenge of uncertainty in air import operations. Due to the limited capacity of aircraft, the problem of cargo offload occurs frequently. Without prior notice, cargoes are delivered in separate flights, which increase handling complexity. On the other hand, due to the short transit time between flights, the shipper at the origin does not have sufficient time to inform the LSPs the details of cargo being loaded before its arrival. This results in a lack of time for LSPs to assign storage location for the arrived cargo at the distribution center (DC). Hence, the order picking process becomes inefficient and time-consuming, which leads to trucks idling in the docking area waiting for the consolidated goods. The problems become more obvious when handling electronic components and high tech products. In this study, a hybrid RFID case-based decision support system, integrating RFID and case-based reasoning technologies, is proposed for handling air cargo storage location assignment operations in distribution centers. After a pilot study of the proposed system in a third-party LSP, the order-picking efficiency is improved while the truck idling time at the docking area is reduced significantly.

MB-02.2 [R] An Intelligent Fuzzy-based Storage Assignment System for Packaged Food Warehousing

Yasmin Y.Y. Hui; The Hong Kong Polytechnic University, Hong Kong
King-lun T Choy; The Hong Kong Polytechnic University, Hong Kong
G.T.S. Ho; The Hong Kong Polytechnic University, Hong Kong
C.H.Y. Lam; The Hong Kong Polytechnic University, Hong Kong
C.K.H. Lee; The Hong Kong Polytechnic University, Hong Kong
Stephen W.Y. Cheng; The Hong Kong Polytechnic University, Hong Kong

In the packaged food industry, fast cargo receiving, reliable storage and accurate order picking in warehouses within a short period of time are critical for achieving customer satisfaction. Food easily deteriorates when unloaded packaged food is exposed in an open area, waiting for inbound and packing operations, according to customer orders. In addition, the risk of damaging the packaging of food is higher when the food is frequently transported by forklift trucks during order picking. This highlights the need to provide decision support in warehouse zoning and storage assignment for preventing the above risks from occurring. This paper proposes a tri-modular intelligent fuzzy-based storage assignment system, integrating fuzzy logic and association rules mining techniques, to reduce the order-picking and cargo exposure time, as well as the transport frequency and distance. The fuzzy zoning module is used to allocate different types of packaged food to various warehouse zones based on their particular characteristics. The location assignment module reveals hidden relationships in the sales of products, in turns suggesting which products should be placed together in the same zone. A case study is carried out to examine the intelligent system.

MB-02.3 [R] The Impact of a Shared Pharmaceutical Supply Chain Model on Counterfeit Drugs, Diverted Drugs, and Drug Shortages

Jae Bong Choi; University of Texas at Arlington, United States
Jamie Rogers; University of Texas at Arlington, United States
Erick C Jones; University of Texas at Arlington, United States

The pharmaceutical supply chain in the United States of America (USA) is getting complicated and is often not controllable due to a globally open market, increasing online market, and many illegal activities. Some consumers who cannot afford to buy high priced genuine products are tempted by easily accessible counterfeit drugs on illegal web site pharmacies in or out of the USA. Corrupt participants including wholesalers or pharmacies in the supply chain take advantage of weak enforcement and a flawed drug supply chain for financial gain. The public health system and numerous patients are in, or could be in, painful situations caused from pharmaceutical supply chain problems including counterfeit drugs, diverted drugs, and drug shortage. In order to secure the drug supply chain, several solutions have been discussed, including a unit level serialized trace and tracking system, ePedigiree, and more. In this research, current problems and their causes will be discussed, and current solutions with their limitations will be presented. The proposed model, third party centralized integrated system (TPCIS), is presented, which overcomes some of barriers of existing solutions and several simulation models including ePedgiree, drug shortage, and recall models which have been developed for comparison. The simulation models show how the proposed model may help improve the current problems with public health systems.

MB-02.4 [R] Transitioning to Post-War Supply Chain System in Afghanistan

Tyler A Ross ; University of Southern Mississippi, United States
MD Sarder; University of Southern Mississippi, United States

As the United States begins to complete its 13-year war in Afghanistan, the pullout of troops and materiel is proving to be an extremely complex undertaking. As the pullout occurs, the major logistical undertaking for the United States is the retrograde of equipment and materiel, much of which has been in direct support of the Afghan military, and the general Afghan population, for over a decade. This direct logistical support cannot be sustained in a post-war environment. As such, this paper seeks to define the current supply chain system between the United States and Afghanistan, and then to propose a transition system that can provide the required support to Afghanistan, without direct military involvement post-war. In order to accomplish the task, this paper outlined the following research questions: To what extent should the United States Government rely on indigenous Afghan channel members to maintain the supply chain of goods flowing between the United States and Afghanistan? How does the United States Government transition from a military logistics model to a peace-time, civilian-driven supply chain to sustain post-war Afghanistan? And finally, what changes to the current supply chain, both domestic and international, must be made in order to sustain post-war Afghanistan at an acceptable level?

MB-03 NPD 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Broadway-1
Chair(s) Antonie J Jetter; Portland State University

MB-03.1 [R] Methodology for Optimizing Product Differentiation in Product Ranges

Guenther Schuh; RWTH Aachen University, Germany
Max Gerlach; RWTH Aachen University, Germany
Stefan Rudolf; RWTH Aachen University, Germany

The continuous occupation of niches within product ranges and the corresponding decrease in product differentiation are significant challenges for manufacturing companies. To address this challenge a methodology has been developed which allows recommendations for the positioning of new products within the product range in order to optimize the product differentiation. Unlike other approaches, this optimization is based on a quantified performance evaluation of products derived from their technical features using a performance index. This enables a specific and systematic differentiation on diverse levels of the product structure. The methodology is split into two phases: In the first phase, the performance of the individual product features is quantified based on a systematic evaluation method. The performance evaluations are aggregated into a product performance index. In the second phase, the feature specifications for a new product are derived from the previously calculated performance indices under consideration of the technical differentiation from the existing product portfolio. The developed methodology can be used to ensure product differentiation based on product features within the product range of manufacturing companies.

MB-03.2 [R] The Impact of Socio-Demographic Characteristics on New

Product Introductions

Titilayo O Olaposi; Obafemi Awolowo University, Nigeria
Sunday O Akintelu; Obafemi Awolowo University, Nigeria
Abiodun I Oyebola; Obafemi Awolowo University, Nigeria

Literature has established the importance of small businesses in contributing new things such as innovations and new jobs to the economy. In Nigeria there are many small businesses, but their effect on the national economy has not been felt. This may be due to a lack of innovation activity in the firms. Also, the nature of entry into micro-firms in Nigeria calls for concern. Participant observation showed that due to the high level of unemployment in the country, young people, some of whom have not acquired any meaningful education, start fragile micro businesses that can easily die off. Underperformance of the micro-firms might have been influenced by the entrepreneurs' age, academic background, firm age or firm size. This study investigates the extent of technological innovation/new product introductions and the impact of the four socio-demographic characteristics on technological innovation/new product introduction among technology-based micro-entrepreneurs in Lagos State, Nigeria. The survey method was used. Out of the 250 randomly administered questionnaires, 225 (90.00%) were retrieved. The results showed that the majority of the respondents were female, young and with low academic backgrounds. The majority of the firms developed 1 - 3 technological innovations in a period of five years, but these did not translate to new product introductions. The results revealed that the majority of the firms did not have any new product introduction in five years. All the four socio-demographic characteristics examined in this study were positively and significantly associated with technological innovations and new product introductions except entrepreneur's age, whose association with new product introduction was not significant. This study concludes that the technology-based micro-entrepreneurs in Lagos State Nigeria need governmental intervention, which should be directed towards increasing their level of education and provision of technical assistance in running the businesses to enhance their performance. Other results and their implications are discussed.

MB-03.3 [R] Project Management in Product Development: Toward a Framework for Targeted Flexibility

Antonie J Jetter; Portland State University, United States
Fatima M Albar; Portland State University, United States

As a discipline, project management has been accused of having lost its relevance for innovative initiatives because it emphasizes planning and control over the flexibility and learning-based strategies that are needed to succeed under uncertainty. Several authors therefore recommend adaptive project management practices - sometimes named "targeted flexibility" - that respond to project characteristics commonly found in innovation, namely novelty, complexity, speed and - as a result - uncertainty. This paper investigates how this proposed adaptation of project management occurs in a context with high levels of novelty that organizes work in projects and needs to accommodate projects of different pace, complexity and innovativeness: product development in small and medium enterprises that do research and development work in the same organizational unit. Results of a literature review and two exploratory studies, covering a total of 8 companies with multiple projects each, are presented. Implications for a future framework for targeted flexibility are developed, leading to the identification of the following needs for project management: (1) better understanding of the many ways in which project management impacts exploration and exploitation activities, (2) improved attention for the currently poorly supported pre-project and early initiation stages, (3) a shift of focus from monitoring against plans toward monitoring against achieved learning, and (4) the formulation of transition paths from current new product development practice to higher project management maturity.

MB-03.4 [R] Product Architecture and Product Development: Case Study of Korean Shipbuilding Firms

Youngwon Park; The University of Tokyo, Japan
Paul Hong; University of Toledo, United States

This study examines why shipbuilding firms use both standardized and customized design, and analyzes the impact of design architecture choices on competitiveness. Case study findings suggest that Hyundai Heavy Industry Corporation (HHIC) adopts a package unit development strategy for cost competitiveness. HHIC's product development processes utilize package unit design to its suppliers which then provide their product by units. In this way, HHIC has accomplished drastic reduction of production processes by half. On the other hand, instead of modular product architecture, Samsung Heavy Industry Corporation (SHIC) emphasizes dual strategic options which integrate both standardization and customization orientation. Low cost vessels use the standardized modules in its two Chinese subsidiaries by blocks which are transported to Gerje Island in Korea for final assembly and completion. Since standardized vessels in general have low added values, SHIC also adopts a customization strategy for high premium value products. These two-firm case analyses suggest the future product development strategy of the shipbuilding industry. Like HHIC, firms may respond to individual customer requirements through internal modular standardization and thus minimize overall development and production costs. On the other hand, like SHIC, firms may pursue both standardization (i.e., economies of scale) and customization strategy (i.e., economies of scope). Both HHIC and SHIC's strategy have both advantages and disadvantages. SHIC is sensible when the global shipbuilding market grows and order volume continues to increase. These two different types of strategies of leading Korean global firms have meaningful implications on other shipbuilding firms of other nations. As the shipbuilding industry moves toward military purpose of submarines and other large combat battleships beyond commercial ship and vessels, these case studies provide interesting insight from both theoretical and managerial standpoints.

MB-04 Project Mgmt 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Broadway-2
Chair(s) Paulo T. Nascimento; Universidade de Sao Paulo

MB-04.1 [R] Project Management with High Complexity and Uncertainty in a Government Organization: A Case Study of the Sao Paulo Tax Invoice System Development

Francisco M Matulovic; Universidade de Sao Paulo, Brazil
Abraham Yu; Universidade de Sao Paulo, Brazil
Bruno Paschoal; Hertie School of Governance, Germany
Paulo T Nascimento; Universidade de Sao Paulo, Brazil

This case study analyzes the development of an incentive system to avoid fiscal evasion named Sao Paulo Tax Invoice. It is an innovative way to use information technology (IT) to enforce tax collection in the retail sector, started in 2007 by a government department, Treasury State of Sao Paulo. The government stimulates buyers of products to ask for a tax receipt when at the checkout of retail stores by returning to them a percentage of the tax paid by the store. Every six months the government calculates tax devolution and consumers can register online and choose to receive the money direct to a bank account or state's tax deduction. Another incentive is an automatic lottery draw system that distribute money prizes and rewards assiduous users, which became the motto of marketing campaign, "the more you ask, the more you gain", with massive advertising, including television commercials, resulting in more than 17 million users registered. The objective of this paper is to address the origin of this initiative and the development process. Our results show that due to the political importance and many uncertainties involved, the project leader adopted a non-conventional project management approach. Studies suggest an increase of 22% in fiscal revenue, indicating the system success.

MB-04.2 [R] The Relationships between Organizational Socialization and Argumentation

Chun-Te Lin; Yu Da University, Taiwan
Chun-Ling Lu; Yu Da University, Taiwan

Socialization could be used for prediction or explanation of peoples' behaviors. Some re-

search indicates that more organizational socialization leads to less argumentation. On the contrary, other research shows that employees in an organization might use argumentation as a means for a specific goal or purpose; those phenomena showed that more organizational socialization leads to more argumentation. We wonder which one is in reality? It became the research problem of this study. This study's hypothesis is that more organizational socialization leads to more argumentation. The authors implemented a survey to be examined. Study results indicated that higher organizational socialization and middle organizational socialization those two groups compare with lower organizational socialization will lead to more argumentation when conflict happened between employees. These results do not consist with previous study findings.

MB-04.3 [R] PM Competency for New Businesses: A Case Study of a Precision Device Manufacturer

Nobuhiro Horie; Japan Advanced Institute of Science and Technology, Japan
Yasuo Ikawa; Japan Advanced Institute of Science and Technology, Japan

Many companies adopt project management organization to develop products. In the current business environment, it is getting more difficult for project managers to bring projects to success. The expectations are increasing for a methodology that helps to train project managers. Competency is the ability of an individual to do a job properly. It is a set of defined behaviors that provide a structured guide enabling the identification, evaluation and development of the behaviors in individual employees. Competency will be defined for every kind of job, and competency of project managers is called PM competency. In order to cope with the changing business environment, many companies entry into new businesses. There are many differences between conventional businesses and new businesses. Thus, PM competency required for conventional businesses and PM competency required new businesses may be different. In this study, we conducted a case study in a precision device manufacturer in Japan to investigate relationships between PM competency and new business.

MB-04.4 [R] Pre-Negotiated Influences on Business-IT Alignment in a Project Setting

Vernon Bachor; Simon Fraser University, Canada
Mike Chiasson; University of British Columbia - Okanagan, Canada

Joint-venture alliance project partners have different and sometimes conflicting goals and incentives, and project members often have short project stays and weak allegiance to overall project goals. Given this, the sources of alignment required for the diffusion of selected and mandated ICT on projects appear to be limited. We ask, how are individual, organizational and project incentives aligned so that ICT is diffused in projects to achieve coordination and success? The results from this exploratory study conclude that alignment occurs from the external and pre-negotiated influences of goal, work output, work value, technological expectations, and professional peers which aids in the diffusion of technology in project settings. The study findings contribute to various theories of diffusion and the implications for managers is to understand and employ these pre-negotiated influencers to shape ICT diffusion and acceptance in projects.

MB-05 Intellectual Property 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Broadway-3
Chair(s) Hsin-Ning Su; National Chung Hsing University

MB-05.1 [R] Intellectual Property: Tension on Open Innovation?

Peter M Bican; WHU - Otto Beisheim School of Management, United States
Carsten C Guderian; WHU - Otto Beisheim School of Management, Germany
Anne K Ringbeck; WHU - Otto Beisheim School of Management, Germany

As firms turn their innovation activities towards collaborating with external partners, they face additional challenges in controlling their property. Whilst different modes of intellectual property regimes are applied in closed innovation systems, there seems to be tension between the concepts of "open innovation" and "intellectual property". Existing literature yields inconclusive results concerning the en- or disabling function of intellectual property in open innovation. Further, as prior research concentrated on relations between intellectual property and open innovation on aggregate levels, we introduce the Open Innovation Life Cycle as a management tool to integrate success factors of intellectual property management over and beyond the collaboration process. Specifically, including considerations of collaboration terminations and deferred obligations early contributes to successful integrations. Additionally, the two main types of time disparity of the Open Innovation Life Cycle and different intellectual property regimes are discovered as the hinge factors in integrating intellectual property and open innovation.

MB-05.2 [R] Evaluate the Value of Inter-Industry Knowledge Diffusion

Pei-Hua Huang; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

It is well understood that inter-industry knowledge diffusion has become very significant in knowledge society where innovation based on interdisciplinary is always encouraged. To understand how significant inter-industry knowledge diffusion is, this study classifies USPTO patents granted between 1976 to 2013 into five industries, i.e., Chemistry, Mechanical Engineering, Electrical Engineering, Instruments and Other, to investigate knowledge diffusion among industries through patent citation analysis. Also, knowledge diffusion is characterized by Number of Claim, Number of Patent Citation Received, Number of Patent Reference, Number of Non-Patent Reference, and Number of Foreign Reference. It is observed that Patents cited by Mechanical Industry and Mechanical patents have Less Number of Non-Patent Reference, and Number of Claim. The results obtained in this study provide a possible way for valuing knowledge diffusion.

MB-05.3 [R] What is the Value of Internationalized Patent?

Chien-Che Chiu; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

This paper aims to evaluate the values of cross-country patent by analyzing characteristics of patent inventions based on international collaboration, and unveil how degree of internationalization and patent characteristics can be correlated to each other. To obtain the objective of this study, a total of 4,667,855 USPTO utility patents, comprising 457,309 Inventor-Assignee international patents, 194,633 Inventor international patents and 183,461 Assignee international patents granted by USPTO between 1976 and 2013 are downloaded and characterized, and subsequently the number of inventor countries as well as the number of assignee countries are compared with selected patent characteristics such as Number of Patent Reference, Number of Patent Citation Received, Number of Non-Patent Reference, Number of Claim. The results shows that correlation between degree of internationalization and some patent characteristics can be confirmed and therefore the value of international R&D can be more quantitatively evaluated. This paper finds out that the patent characteristics of international patents are significantly different with non-international patent, and the large number of value can be observed in international patents and finds out that more degree of patent internationalization implies that more patent values in term of patent characteristics.

MB-06 Knowledge Management 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Broadway-4
Chair(s) Charles M Weber; Portland State University

MB-06.1 [R] Recognizing Knowledge as Economic Factor: A Typology

Remy Magnier-Watanabe; University of Tsukuba, Japan

While knowledge has been recognized as a major source of competitive advantage long ago, this paper contends that knowledge should be treated and managed as an economic

factor of production on par with land, labor, and capital. Previous knowledge typologies have indeed shed light on the many characteristics and context of knowledge, but they remain difficult to apply for practitioners. This paper assesses whether knowledge is a public good, examines the interplay of tacit and explicit knowledge as complements, and explores knowledge price elasticity of demand and supply. The proposed model of knowledge based on breadth and depth can be applied for the firm to assess the existing stock of knowledge, spot knowledge gaps and the cost to fill them, and identify core knowledge worth safeguarding. This research argues that conventional knowledge management is missing this process of knowledge assessment, which should be added upstream when considering adding or creating knowledge, or downstream when evaluating existing organizational knowledge. Knowledge assessment can only take place once the economic characteristics of knowledge as a factor of production have been identified.

MB-06.2 [A] Application of Maturity Assessment Tools in the Innovation Process: Converting System's Emergent Properties into Technological Knowledge

Julio C Lemos; Instituto de Aeronautica e Espaco, Brazil
Milton F Chagas Junior; National Institute for Space Research, Brazil

This paper aims at establishing a theoretical construction between the concept of learning by using and the concepts of Technological Readiness Level (TRL) and System Readiness Level (SRL). The concept of learning by using reveals that the change rate that takes place in complex systems is given by the sum of small improvements in many different technological disciplines integrated in a specific configuration of this system. This kind of learning results from the iterative combination of scientific and technological knowledge, which is generated by the extensive use of products and their associated production processes. A stock of this combined knowledge might be required to cope with emergent properties of complex systems. The pattern of complex systems evolution involves the balance of technological and scientific frontiers as well as the fulfillment of customer expectation. Every innovation involves systemic uncertainty, which is positively correlated to the magnitude of the change introduced into the complex system. Maturity level of technological solutions allows organizations to assess pragmatically strategic risk exposure of implementing complex system innovation. The concept of SRL represents a proficuous tool to unveil emergent properties, which consider both the TRL of individual elements and how they are integrated into a complex system.

MB-06.3 [R] Based on Bibliometrics and Content Analysis of the Literature on Science and Technology Media

Xiaoli Sun; China Research Inst. for Science Popularization, China
Dan Wu; China Research Inst. for Science Popularization, China
Chao Zhang; China Research Inst. for Science Popularization, China

Taking "science and technology media" as the topic words, CNKI database as retrieval sources of date, 132 papers published during the period of 2004-2013 were obtained. Using the method of bibliometrics and content analysis, summarizing the general research of "science and technology media" articles in the past 10 years (2004-2013), the frequency of download count, citation frequency, subjects, authors, research field, literature research quantity, sources, influence, research status, research field and research themes were analyzed. The research development and dynamic on science and technology media were summarized, and improvements and methods in the research field for exploring the direction of future development in "science and technology media" field were proposed. In addition, the characteristics of papers which were published in different journals and the distribution and regional units of the first authors were analyzed with the hope to help in the publishing of papers on "science and technology media" and exploring a new research field.

MB-06.4 [R] A Novel Approach to Identify Research Fronts of Tourism Literature

Louis Y Lu; Yuan Ze University, Taiwan
John S Liu; National Taiwan Univ. of Science and Technology, Taiwan

This study applies a novel approach to identify the research fronts of literature in tourism over the past decades. A research front is a coherent topic addressed by a group of researchers in recent years. It is difficult to adopt any traditional methodology to explore the research fronts of tourism literature due to the large amount of data. We retrieve tourism articles over the period 1977 to 2013 from ISI Web of Science database and acquire 8799 articles for analysis. A citation network based edge-betweenness clustering approach is applied to group the tourism literature, and then a key-route main path analysis is used to identify the influential articles of each group. The keywords of all articles in each group and the major topics of the articles on the key-route main path are integrated to figure out the research focus. Five groups with more than 400 articles each are reported, and the major topics of each group are tourism sustainability, tourism destination choice, sociology of tourism, tourism demand forecasting, and climate change. The methodology presented in this study is a good means for identifying the research fronts of tourism literature. We believe that it is also applicable to other scientific or technological fields.

MB-07 Technology Diffusion
Monday, 8/3/2015, 10:30 - 12:00
Room: Studio Suite
Chair(s) Jan H Kwakkel; Delft University of Technology

MB-07.1 [R] Exploring the Structure of Patents Transaction Network: A Perspective of Network Analysis

Hung-Chun Huang; National Chi Nan University, Taiwan
Hsin-Yu Shih; National Chi Nan University, Taiwan
Tsung-Han Ke; Institute for Information Industry, Taiwan

Firms that participate in a patent transactions network are interdependent. The characteristics of a network include the complexity of the overall configuration. This work presents a dynamic approach to studying the structure of a patent transactions network. Network analysis is used to define the structural configuration of a patent transactions network based on its centralization, centrality, and linkage distribution. Data concerning patent transactions in the flat panel display sector from 1976 to 2012 were studied to empirically evaluate their networkship. The results thus obtained reveal that the structural configuration of patent transactions networks exhibits significant stratification of the constituent firms' capability in exporting technology and their brokerage advantages. Such a network is also evaluated as a complex system. This analysis yields insights into patent transactions networks, and also addresses policy implications for firms and authorities that are interested in market competition or market governance.

MB-07.2 [R] How the Diffusion of Smart Phones Will Change Public Opinion Surveys in Taiwan: The Feasibility of Using Blended Samples of Landline and Cell-Phone Numbers for Telephone Surveys

Mavis Tsai; Shih Hsin University, Taiwan

Since the 1980s, the telephone survey has become a primary form for gathering public opinion or market information. Polling can help understand the general population's opinions, consumers' behaviors or predict election results. Based on AAPOR, it became clear that most telephone surveys of the general population would require the combination of a sample reached via landline and one reached via cell phone in the US. There is a similar trend of the cell phone-only users as compared to the rate seen in the US. By 2009, Taiwan's mobile phone penetration hovered near 110%, with fixed line usage at a steady 55%. By 2014, more than 50% of Taiwanese owned smart phones. As a result, public opinion and market researchers have some advantages yet face some challenges in conducting Internet and phone surveys. Sixteen firms in Taiwan are qualified and sufficiently established to be members of ESOMAR, the European Society for Opinion and Marketing Research. This industry, market and public opinion research, is facing both growth and challenges given current mobile phone and mobile internet technology development. In Taiwan, cell phone-only usage is increasing, especially among the young generation. However, related research regarding ways in which the diffusion of smart phone and cell phone usage would change the method of gathering of public opinions, and methods for blending samples of

landline and mobile phone numbers to get better data are lacking for academic or professional fields in Taiwan. Thus in this study, the researcher will design and launch pilot studies to interview public opinion company owners in Taiwan to investigate ways to cope with the trend toward a cell-only generation. In addition, the researcher launched a pre-test survey and used participant observation records via auditing the telephone survey process to further investigate this issue.

MB-07.3 [R] The Adoption and Diffusion of Common-Pool Resource-Dependent Technologies: The Case of Aquifer Thermal Energy Storage Systems

Marc Jaxa-Rozen; Delft University of Technology, Netherlands
Jan H Kwakkel; Delft University of Technology, Netherlands
Martin Bloemendal; Delft University of Technology, Netherlands

The dynamics of technology diffusion and adoption have been studied extensively. There is broad agreement on the typical patterns that these dynamics follow, and models are readily available to forecast future technology adoption and diffusion. Most of the existing research, however, has not considered the dynamics of adoption and diffusion for technologies which rely on a common-pool resource (CPR). The sustainable exploitation of a common-pool resource imposes a natural limit on usage, and exploitation beyond this limit may deteriorate the resource. Aquifer Thermal Energy Storage (ATES) systems use aquifers in the subsurface for space heating and cooling. Although these systems may significantly reduce the energy consumption of buildings, over-adoption or exploitation of the aquifer will yield thermal interactions between systems, reducing their efficiencies. The aim of this paper is to provide insight into the adoption dynamics of ATES systems, notably in regards to the effects of overexploitation on subsequent adoption. We present a hybrid model that connects an agent-based model of ATES adoption with a geohydrologic model of the aquifer, including building energy flows. We explore the behavior of the model across a range of alternative parameterizations, identify typical dynamics, and analyze the conditions under which each of the dynamics occurs.

MB-08 TM in Service 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Directors Suite
Chair(s) Inthrayuth Mahaphol; Portland State University

MB-08.1 [R] The Business Model and Co-Creation Value in Music Industry: From Product Dominant to Service Dominant

Jie-Heng Lin; National Taiwan University, Taiwan
Pei-Yu Chien; National Sun Yat-sen University, Taiwan

With the popularity of digital music and the Internet, the music industry is facing a huge challenge. For example, a large amount of piracy leads to the physical store rapidly reducing. To respond to the circumstances, the business model of the music industry is changing from product dominant logic (PDL) to service dominant logic (SDL). In the context of SDL, the consumer is a co-creator of value. Therefore, this study investigates the consumer's co-creation effect on the value of service innovation in the music industry. In addition, while [29] has proposed the PFI model to demonstrate the effect of complementary assets and appropriability on technological innovation, we are curious whether complementary assets and appropriability cause the same outcome in service innovation of the music industry. And, due to the competitive industry environment, instantly responding to or predicting the demands of the environment or consumer are needed. Therefore, we also examine the effect of market sensing capability on the value of service innovation. Taiwan is the leader in the Chinese pop music industry. So, we collect the data from Taiwan senior managers, directors, and musicians, and use the AHP approach to enclose what factors will affect the value of service innovation, and we hope that these findings can contribute to the business strategy in the music industry.

MB-08.2 [R] A Study of Organic Food Consumption Behavior Using the Decomposed Theory of Planned Behavior

Her-Her Tsai; National Central University, Taiwan
Min-Jhih Cheng; National Central University, Taiwan
Shiu-Wan Hung; National Central University, Taiwan
Dong-Sing He; National Defense University, Taiwan
Wen-Sheng Wang; National Central University, Taiwan

Organic food is an achievement of agricultural scientific and technological innovations, in order to ensure the application of agricultural science and technology and innovation from organic agricultural producers and participants benefit. This study employed the decomposed theory of planned behavior to analyze the antecedent factors that influence consumer purchase of organic food by deconstruction of the constructs related to attitude, the subjective norm, and the perceived behavioral control. Based on these influencing effects, the study aimed to provide marketing suggestions to popularize organic food. In total, 441 effective questionnaires were collected. The data was analyzed using the structural equation model. The study results indicate that consumers with ethical consciousness will consider environmental protection when they make food purchasing decisions, and have a comparatively positive attitude towards the purchase of organic food. One of the main motives for purchasing organic food is the requirement that food ingredients are safe and natural. Additionally, with respect to external influences, consumers tend to trust information delivered by TV media, experts, and Internet word-of-mouth. Nonetheless, consumers with high or low involvement obviously have significant differences in the relationships between facilitating conditions and perceived behavioral control. Therefore, intensifying the environmental resources of organic food will enhance the purchasing intention of consumers who have low involvement.

MB-08.3 [R] Impacts of Collaborative Information Systems Quality on Software Development Success in Indian Software Firms

Rushikesh Ulhas Khire; National Chung Hsing University, Taiwan
Juite Wang; National Chung Hsing University, Taiwan
Jung-Yu Lai; National Chung Hsing University, Taiwan

With the rapid advances in information technology (IT) in last few decades, software development has become a high-growth industry. While the software development process is an extremely complicated, iterative, unpredictable, knowledge-intensive, as well as an expensive process, a supportive collaborative information system (CIS) is indispensable for allowing complex interdependencies among globally distributed team members. The current work studies the role of CIS qualities and their impact on individual, organizational, and project success using DeLone and McLean's (D&M) Information System (IS) Success Model as the basis for developing a theoretical framework. This study adopts a partial least square (PLS) approach to analyze data collected from 154 questionnaires distributed to Indian software companies. The results indicate that CIS qualities, especially service quality, strongly influence individual impacts and organizational impacts and hence software project success. This paper's contribution is the research into these three success areas in relation to CIS, and particularly, organizational success, as opposed to other current work being done on project success. The current study is the first to extend the IS success model into a collaborative context. In addition, because the study was done on the Indian software industry, it provides a glimpse into an industry that has rarely been studied. We hope that the current study can improve managerial understanding of a more productive and efficient IS for working within a distributed teamwork environment.

MB-08.4 [R] Communication System for Home Delivery Business Derived from Air Combat History

Yu Ito; Yamato Transport Co., Ltd., Japan

In today's home delivery business, drivers are often required to manage irregular-demands from customers. To cope with those demands smoothly is one of the main issue on home delivery, because when achieved, it will strengthen market competitiveness. The relation between the temporal labour capacities of the total driver and the amount of unsolved irregular-demands, in a particular area, can be theoretically drawn by the same numerical

formula that explains the relation between the amounts of fighting forces and casualties in warfare, presented by Lanchester and by Osipov which is called the "Lanchester's square law". By choosing proper historical data and applying the formula, the efficiency of several kinds of command and communication systems used in aerial battles can be found out in a numerical figure; historical evidences shows that the communication condition will influence the efficiency of air force. In addition, route delivery drivers and fighter pilots share one same condition: teamwork required under limited means of communication. From these facts, the author will construct the best communication system for delivery drivers, derived from air combat history, which is the main aim of this study. Also, communication devices needed to enhance the system will be argued.

MB-09 Collaborations for TM 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Council Suite
Chair(s) Michael D. Santoro, Lehigh University

MB-09.1 [A] Cooperation Models as Success Factor for Interdisciplinary, Inter-Organizational Research and Development in the Automotive Industry

Eva M Grochowski; Fraunhofer IAO, Germany

The automotive industry faces three major challenges—shortage of fossil fuels, politics of global warming and rising competition from new markets. In order to remain competitive, companies have to develop more efficient and alternative fuel vehicles that meet the individual requirements of the customers. Functional integration combined with new technologies and materials are the key to stable success in this industry. The sustaining upward trend to system innovations within the last ten years confirms this. The development of complex products like automobiles claims skills of various disciplines, e.g., engineering, chemistry etc. Furthermore, these skills are spread all over the supply chain. Hence the only way to stay successful in the automotive industry is cooperation and collaborative innovation. Interdisciplinary and interorganizational development has high demands on cooperation models, especially in the automotive industry. In this case study cooperation models are analyzed and evaluated according to their applicability to interdisciplinary, interorganizational development projects in the automotive industry. Following, the research campus ARENA2036 is analyzed. ARENA2036 is an interdisciplinary, interorganizational development project housing automobile manufacturers, suppliers, research establishments and university institutes. Finally, based on interviews with the partners and the preceding analyses of cooperation models, suggestions for implementation are given to ARENA2036.

MB-09.2 [A] Case Study: Nordic Windpower's Critical Blade Failures

John Bauer; Oregon Institute of Technology, United States
James Eastham; Oregon Institute of Technology, United States

In 2007, the start-up wind turbine generator (WTG) manufacturer, Nordic Windpower, officially launched in North America as a merger between Swedish, US, and UK development teams. Based on a design researched and funded by the Swedish Government, Nordic Windpower developed the N1000, a 2-bladed, 1MW WTG geared toward the distributed and community wind market. The N1000 was the first utility-scale, 2-bladed WTG of its size in North America. It was specifically the features of the 2-bladed design that made the WTG ideal for the community wind market - a growing market, whose capacity was expected to reach 600MW in the US in 2009, and the only market for which Nordic Windpower had a product offering. Serial production of the N1000 began in 2009, producing a total of eight units, with three units being installed in the US. During commissioning, field testing, and after grid production, repeated failures of the fixed-pitch and stall-regulated rotor braking system prevented Nordic Windpower from meeting contractual obligations. On August 28, 2013, Nordic Windpower LLC liquidated the business under Chapter 7. This case study examines Nordic Windpower's critical blade failures from a systems engineering perspective, identifies best practices, and offers potential solutions for Nordic Windpower's development process.

MB-09.3 [A] The Indexation Monitoring of the Civic Scientific Literacy Construction Capacity

Xiaoyan Guo; China Research Inst. for Science Popularization, China
Bai Xue; China CITIC Bank, China
Lei Ren; China Research Inst. for Science Popularization, China
Hui-Liang Zhang; China Research Inst. for Science Popularization, China
Junping Li; China International Conference Center for S&T, China

The innovation-driven development strategy was put forward in the 18th National Congress of the Communist Party of China. To enhance the innovation capacity is the most fundamental thing; to improve the civic scientific literacy level is the most basic thing for the innovation-driven development strategy. Therefore, to strengthen the construction of civic scientific literacy has become one of the hottest agendas for the government and people from all walks of life. Given this situation, how to monitor and evaluate civic science literacy construction work fairly and reasonably becomes important. In order to solve this problem, based on China's science popularization statistics, the paper mainly uses the quantitative research method to establish a civic scientific literacy construction monitoring index system from the aspects of the personnel, the venues and facilities, the funds, the media and the activities for science popularization, etc.

MB-10 Sustainability 1
Monday, 8/3/2015, 10:30 - 12:00
Room: Forum Suite
Chair(s) Dilek Cetindamar; Sabanci University

MB-10.1 [A] Sustainability and Social Innovation

Yuya Kajikawa; Tokyo Institute of Technology, Japan
Yuki Kaburaki; Tokyo Institute of Technology, Japan

Innovation means value creation with something new and gives economic, cultural and social values. However, previous research on technology and innovation management has limited focus on the process of economic value creation. The current increasing notice of social issues like climate change and financial crisis urged us to pay much attention to the social value of innovation. Social innovation is sometimes referred to as a process of social inclusion of excluded groups in the current social and economic system for social justice. In this application paper, the role of innovation to realize social innovation will be discussed. Theoretical arguments on ethical and normative concepts, including justice, economic efficiency, equity, and sustainability, are comparatively investigated and discussed. Cases are selected from crowd-funded and awarded projects for social innovation. Characteristics of those cases are extracted and analyzed. The integrated process of social innovation and economic innovation are stressed. And difficulties in social innovation processes are also discussed. These results offer a new research direction for research of technology and innovation management toward social innovation.

MB-10.2 [A] Using Participatory Process and Tool for the Assessment of Climate Change Adaptation Options

Hai-Chen Lin; STPI, National Applied Research Laboratories, Taiwan
Liang-Huey Lo; STPI, National Applied Research Laboratories, Taiwan
Yueh Wu; STPI, National Applied Research Laboratories, Taiwan
Yeun-Jeng Lai; STPI, National Applied Research Laboratories, Taiwan
Albert C. T. Lee; STPI, National Applied Research Laboratories, Taiwan

For better policy planning of adaptation under the influence of climate change, a good process design which engages experts with technical and local knowledge is vital for the success of adaptation since the complexity and uncertainty of the climate change impacts and the inter-disciplinary cooperation necessity for responding to these impacts. The theme of this study is about "adaptation issue of water resource management in Southern Taiwan" and the aim is to integrate upstream climate change related scientific knowledge into downstream policy-making process, whereas different perspectives for the adaptation options from stakeholders can be explored by incorporating a participatory process during the ad-

aptation assessment and then be taken into consideration by policy makers. The participatory process is designed by using a stakeholder workshop. For the preliminary arrangement of the stakeholder workshop, a mapping of resources needed for operating the workshop is conducted, including selection of the workshop participants by identification of the key stakeholders, the collection of state-of-the-art scientific knowledge for climate change in water resource area and the historical and local socio-political context and the related conflicting issues for the problems. Extraction and interpretation of the scientific knowledge are also performed and tested by introducing a training workshop and co-learning activities of core group of stakeholders. An assessment tool named "water diamond" is designed for the stakeholder workshop by integration of policy implementation assessment and outcome assessment dimensions while balancing the short term view with the long term view, to facilitate the different perspective interactions and knowledge exchange among stakeholders. This process and tool could be useful not only in the phase of adaptation assessment to envision different options for the future but also to help in the dialogue among stakeholders to explore the most effective adaptation actions.

MB-10.3 [R] Sustainability Knowledge Utilization: Challenges from Internal and External Perspectives

Nina K Tervonen; Lappeenranta University of Tehcnology, Finland
Ville Ojanen; Lappeenranta University of Technology, Finland

The issues of sustainability have been acknowledged to be in the heart of the 21st century innovations and competitive business. In a rising extent companies need to report their activities and levels of sustainability. The motivation rises from external sources (e.g. regulators, stakeholders, media) but also from companies' internal goals and management actions. The importance of sustainability measurement actions is widely recognized in modern companies. In best cases, measurement information guides in managerial decision-making, but only if the knowledge is analyzed properly and further utilized. Previous research does not focus on knowledge utilization beyond the measurement and reporting actions of sustainability. Practitioners in companies are also struggling with the utilization of large amounts of measurement data and ways to argue the sustainability value to their stakeholders. Our study discusses the challenges and reasons behind the insufficient utilization of sustainability measurement knowledge in management actions based mainly on the Finnish qualitative expert data. Practically, we take a step towards effective argumentation of sustainability value to promote the management of technologies and business.

MB-10.4 [A] Resolution of Outsourcing Conflict: A Case Study of an Electrical Component Manufacturer in China

Chihchang Chen; Taiwan ShouFu University, Taiwan
Ke-Chiun Chang; Wuhan University, China
Taihua Shih; Taiwan ShouFu University, Taiwan

In recent years, outsourcing strategies, to manufacturers, have become an ordinary approach for manufacturers to making their production more efficient. However, as soon as a long-term outsourcing agreement is signed, the parties' interests begin to conflict. This case explores the better solutions to resolving conflict caused by manufacturers when implementing outsourcing. Actually, the practice of outsourcing in China tends to be commonplace; thereby, one medium-size corporation, named as "B", was an early mover in outsourcing beginning in 1997 and is the subject of this study. Besides incurring probable dilemma, the outsourcing provider will face the severe problem of even losing their contract, especially when the buyer tries to improve the efficiency by means of production automation. In 2013, Company B utilized the win-win strategy (presented in most textbooks of Business Administration course) to solve the conflict between outsourcing buyer and provider. It invited its outsourcing providers to join the project of automation development and co-organize a new joint-venture company. As a result, both parties no matter buyer or provider fulfill mutual requirements without harming each other's benefits.

MB-11 ICT Mgmt 1
Monday, 8/3/2015, 10:30 - 12:00

Room: Executive Suite
Chair(s) Robert Harmon; Portland State University

MB-11.1 [R] Do Early Adopters Upgrade Early?: An Empirical Study of Mobile 4G Service

Chia-Hung Wu; Yuan Ze University, Taiwan
Fang-Mei Tseng; Yuan Ze University, Taiwan
Ju-Yin Weng; Yuan Ze University, Taiwan

Since Rogers proposed innovation diffusion theory, it has been used to analyze the new technology adoption behavior and divided the customer into five segments. Some studies compared the difference between early adopters and majorities. Some studies support the early adopters upgrade earlier; however, researchers usually employ self-report adoption intention as the proxy of actual adoption behavior. We argue that factors affecting adoption intention may differ from factors affecting actual adoption behavior. Therefore, we collect our dataset from a Taiwanese telecommunication service provider; the sample set includes 8,900 users who registered for the 3G service between 2005 and 2014 and their voice and data usage in August 2014. Some of them have upgraded to be 4G users. According to innovation diffusion theory, we divided the consumers into four groups: early adopter, early majority, late majority and laggards. The results show that the 3G early adopters have significantly higher usage of basic function than others. The 3G early adopters upgrade earlier for 4G than other groups, which is only partly supported. However, the 3G early adopters with higher usage of innovative function tend to upgrade earlier for 4G than their counterpart with lower usage of innovative function.

MB-11.2 [R] Knowledge Convergence between Cloud Computing and Big Data and Analysis of Emerging Technological Opportunities in Malaysia

Siong K Chan; Tokyo Institute of Technology, Japan
Kumiko Miyazaki; Tokyo Institute of Technology, Japan

Convergence essentially can be defined as at least two discernible entities moving toward union and is prominent in the ICT sector where combinations of different products and services have resulted in many meaningful innovations. Since convergence is triggered by knowledge convergence, we explore this phenomenon between cloud computing and big data by employing keyword co-occurrence analysis on scientific publications. Following that, this paper explores the case of Malaysia as cloud computing service sector has emerged and there is focus on adoption of big data. Subsequently, new opportunities for cloud service providers in Malaysia are derived from the result of knowledge convergence.

MB-11.3 [R] Identify the Best Alternatives to Help the Diffusion of Teleconsultation by Using the Hierarchical Decision Model (HDM)

Hamad A Alanazi; Portland State University, United States
Tugrul U Daim; Portland State University, United States
Dundar F Kocaoglu; Portland State University, United States

Healthcare is a very important issue in the U.S. and in the entire world, and the total healthcare spending in the U.S. has increased over the years; by the end of 2021 it will reach up to 20% of the U.S. GDP. The increase of health expenditure, a growing U.S. population, and a projected physician shortage are the top three trends in the healthcare industry. The literature highlights that researchers from different fields and with several interests recognize the important role of telemedicine in the healthcare industry. Teleconsultation is an advanced telemedicine application that offers great promise to address some of the challenges raised by these trends, and it is increasingly being included in discussions of medicine's future. Telemedicine faces many challenges in legislation and regulation, finance, technical, ethical and culture, but still the future is squarely on telemedicine. A Technology Acceptance Model (TAM) is integrated with a Hierarchical Decision Model (HDM) to identify the best alternatives to help the diffusion of teleconsultation.

MD-01 Innovation Management 2
Monday, 8/3/2015, 14:00 - 15:30

Room: Pavilion East
Chair(s) Nasir J Sheikh; State University of New York

MD-01.1 [A] Facilities Planning for a Creative Company

Gabriel B Barradas; Federal University of Rio de Janeiro, Brazil
Vinicius C Cardoso; Federal University of Rio de Janeiro, Brazil
Regina R da Costa Alves; Petrobras - Petroleo Brasileiro S.A., Brazil

This article presents a Facilities Planning project for fostering creative performance in the workplace of an IT developing company. The study of workspaces designed for encouraging creative and innovative outcomes in organizations is a developing field that still receives little academic attention despite the possible gains it can bring to workers and organizations. In order to address this issue we use a new approach for studying the design of physical environments that foster organizational creativity, combining the results of psychological studies on the impact of physical environment on creativity with the facilities planning body of knowledge applied by industrial engineers. Factories have been using plant layout tools for planning and acting on their work environment for decades now, and it has been shown that changes in the physical work environment may have great impacts on process performance. By acting on the work environment of the company, we believe that the developers' creative processes can be boosted and facilitated. It is also shown that both industrial engineering and creativity research have much to contribute to each other, and future research topics in the field are presented.

MD-01.2 [R] A Study on the Open Innovation Model for Win-Win Collaboration between Large and Small-Medium Enterprises

Hyejin Jang; Dongguk University, Korea, South
Keeeun Lee; Dongguk University, Korea, South
Byungun Yoon; Dongguk University, Korea, South

As the importance of mutual growth of large and small-medium enterprises has increased, the necessity for open innovation between them has been emphasized. However, few studies of open innovation have considered both sizes of firms, and they just analyzed differences of innovation from the empirical point of view. Based on a survey of manufacturing firms conducted in 2012, the Korean Innovation Survey, this study proposes open innovation models between large firms and SMEs for win-win cooperation, reflecting the circumstances and characteristics of innovation for each size of firm. For this, first, we derive their respective needs for open innovation between them by analyzing the importance of internal needs and the performance of potential cooperation by means of weighted sums of correlation coefficients. Secondly, we build a typology matrix of enterprises, considering the innovation needs with a 2 by 2 matrix. We utilize this for the next step of defining types of open innovation by matching each type of large firm and SME. Finally, we develop open innovation models by multi-flow charts consisting of layers (subjects), edges (open innovation activities), and boxes (innovation process). The research results support SMEs managing strategic open innovation with large firms, which encourages balance of the large enterprises and SMEs for coexistence.

MD-01.3 [R] Understanding Inter-assignee Dynamics of Technological Development

Yen-Tzu Chu; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

Interdisciplinarity in technology has been usually investigated by analyzing knowledge flow among different research fields or industry. However, very limited research has compared the innovation capability and evaluated the influence of knowledge among different knowledge owners. This research aims to first find the inventor position of first assignee types, and second to understand knowledge flow among different types of knowledge owners which are patent assignees in patented technologies. A total of 4,667,855 patents granted by USPTO between 1976 and 2013 are classified into seven types of assignees: 1) Individual, 2) Company, 3) Government, 4) University, 5) Hospital, 6) Private non-profit, and 7) Other. Subsequently, knowledge flow among the seven types of assignees is analyzed to understand how each type of assignee influences the others from the five characteristics, i.e., a) Number of Claims, b) Number of Patent Citations Received, c) Number of Patent References, d) Number of Non-Patent References, e) Number of Foreign Reference, that are recognized as important indicators for patent valuation. It is observed that hospital patents play the most significant role in knowledge flow, Number of Patent Citations Received and Number of Non-Patent References are more assignee-type sensitive. The inter-assignee dynamics obtained in this study provides a way toward understanding from where technological knowledge is created and how patent assignee moderates the change of patent characteristics.

MD-01.4 [R] Integration and Dispersion of Innovation and Marketing Capabilities: Case Studies of Japanese Global Firms in Korea

Youngwon Park; The University of Tokyo, Japan
Paul Hong; University of Toledo, United States

This paper presents a dynamic model that shows the evolving patterns of relationships between mother companies and their foreign subsidiaries. Specifically, this paper shows four different types of evolution between mother companies and their subsidiaries: (1) mutual dependence (early stage), (2) adaptation to local needs (intermediate stage), (3) mutual dependence (later stage), and (4) global expansion (mature stage). Based on this research framework, the case studies of three Japanese firms and their subsidiaries in Korea suggest four dynamic types according to external management environment and change in governance contexts. We summarize 4 stages of localization strategies based on the findings from these case studies. Further lessons and implications of this case will be discussed as well.

MD-02 PANEL: Al's View: Disagree But Not Be Disagreeable
Monday, 8/3/2015, 14:00 - 15:30
Room: Pavilion West
Panelist(s) Charles W. N. Thompson; Northwestern University
Eliezer Geisler; Illinois Institute of Technology
Donald Kennedy; Wilbros Canada Inc.
Simon P Philbin; Imperial College London

Al Rubenstein knew all the founders; he respected (and often disagreed with) them. Our disciplinary "silos" are part of the evidence that these divisions are still with us and hurting us. Most of the founders from Charnes and Morse to Shapero and Allen had mixed feelings about those at the other end of the dimension(s) they shared, but they were civil and open to conversation. My concern is that many of us may not realize that we are all in the same boat, that that problem we push aside because our "methods" don't work might be solved by another with a different tool - think spoon vs. fork. PICMET brings all of us together, face-to-face, face-to-face with our agreements and disagreements. What better place to examine, to share, to realize that we are all on the same side.

MD-03 NPD 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Broadway-1
Chair(s) Kumiko Miyazaki, Tokyo Institute of Technology

MD-03.1 [R] Mechatronics: From Systems Combination to Business Integration

Christian Koch; Chalmers University of Technology, Sweden
John B Mathiasen; Aarhus University, Herning, Denmark
Nathalie Nyffeler; HEIG, Vaud, Switzerland
Alain Schorderet; HEIG Vaud , Switzerland

The mechatronics approach has been around for decades, but many companies still struggle with realizing the business potential inherent in successful combination, or even integration of enabling technologies in systems for mechanical, computing, metrology, and

control topics. And the challenges are not only linked to combining systems, but also to realize them as products and create business value doing it. This paper takes an investigative stance and studies a systems and product development process, asking what enablers and barriers it encompasses for realizing an integrated mechatronics business, drawing on business model and mechatronic theoretical approaches. The case is development of wind turbines and their control systems. The SME, with long term experience of control systems for one turbine manufacturer, was approached by another with rather different ideas for the combined product, the wind turbine. Through an ethnographic study, the collaboration process in the multinational project organization was followed. The study shows how several types of engineering, sales, managerial and manufacturing concerns are woven together, but also disrupted over time. The transformation of a sales oriented (product) specification into technical specification proves problematic, issues of protection of company critical competences occurs, as well as technical and business integration issues on mechatronics engineering.

MD-03.2 [R] Developing a Design for Six Sigma Framework for the Analysis of Product Development Processes

Evelina Ericsson; Royal Institute of Technology, Sweden
Markus Buschle; Royal Intitute of Technology, Sweden
Joakim Lillieskold; Royal Institute of Technology, Sweden
Mathias Ekstedt; Royal Institute of Technology, Sweden

During the last decades the importance of product development (PD) has become apparent for organizations. A majority of companies' total business results is depending on the outcome of PD activities, results that crucially depend on new product's success and sales revenue. PD must be evaluated continuously, even without a physical final product accessible to measure. Therefore, in product development there is a need to evaluate the PD organization and project activities. This article presents a product development framework for analysis of organizations' project development performance according to Design for Six Sigma and evaluation of DFSS adopted companies' level of implementation.

MD-03.3 [R] Development of a Fuzzy-Rule Based System for Product Development in the Garment Industry

C.K.H. Lee; The Hong Kong Polytechnic University, Hong Kong
King-lun T Choy; The Hong Kong Polytechnic University, Hong Kong
G.T.S. Ho; The Hong Kong Polytechnic University, Hong Kong
Stephen W.Y. Cheng; The Hong Kong Polytechnic University, Hong Kong
C.H.Y. Lam; The Hong Kong Polytechnic University, Hong Kong
Jason C.H. Lee; The Hong Kong Polytechnic University, Hong Kong
Yufan Huang; The Hong Kong Polytechnic University, Hong Kong

The garment industry has been in a transformation since the emergence of the fast fashion trend. For business survival, garment manufacturers are required to shorten the time to market and develop products which can meet the changing expectations of customers. This exerts a great pressure on fashion designers who are urged to consider customers' preferences in their designs and develop new products efficiently. Historical data related to product design and customer purchasing behavior thus serves as important information for effective new product development (NPD). In this paper, a fuzzy-rule based system (FBS) is developed to discover relationships between product styles and customer preferences from historical data. The knowledge discovered can help the industry design products which are not only fashionable, but are also saleable in the market. To evaluate the proposed system, a case study is conducted in which a real-set of data are tested to generate fuzzy decision rules. The results reveal that the FBS can provide knowledge support to NPD in the garment industry.

MD-04 Project Mgmt 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Broadway-2
Chair(s) Leon Pretorius; University of Pretoria

MD-04.1 [R] Determining the Significant Factors for Implementing and Managing a Rural Development Program

Keamogetsoe I Maroo; University of Pretoria, South Africa
Richard Weeks; University of Pretoria, South Africa
Louwrence Erasmus; University of Pretoria, South Africa

Rural development is a process of engagement that is based on interactions between physical, economic, technological, socio-cultural and institutional dynamics with the aim of improving the wellbeing of people in rural areas. Unfortunately, many rural development initiatives both locally and internationally have not delivered the desired change. The challenge, therefore, is to identify factors that may hamper the attainment of the set goals of the programs and also to identify those factors that can potentially increase the success and limit the risk of failures. The Mpumalanga province championed the Comprehensive Rural Development Program (CRDP), which is a collaborative effort by various stakeholder entities in an effort to improve rural livelihoods. The research study was directed at uncovering the perceptions of the members of the CRDP Provincial Technical Task Team who represent the collaborating entities and play both a strategic and managerial role in the implementation of the CRDP. The research methodology constitutes a case study with a qualitative narrative inquiry as the basis for the empirical study. Information gathering was through a combination of three methods, namely, one-on-one interviews, direct observation, as well as a literature review. The findings revealed the three factors that are significant for rural development.

MD-04.2 [R] A Structured Approach to Risk Identification for Projects in a Research Environment

Eugene Swanepoel; University of Pretoria, South Africa
Leon Pretorius; University of Pretoria, South Africa

It has been noticed that one of the main problems with R&D projects is the high amount of risk. Standard risk management practices have historically proven to be inadequate in an R&D project where not all aspects of the project are known. The problem with the risk management process is not the management of the risks but the lack of identification of risks. Standard risk identification techniques such as brainstorming make use of the diversity and experience of large groups of participants, but in research and development projects the project teams are generally made up of small teams who are specialized in one field. This lack of diversity and few numbers causes general risk identification techniques to fail in identifying all possible risks. A structured brainstorming risk identification method was developed for use in R&D projects in order to lead the project teams in the identification process to identify more risks and increase the effectiveness of the risk management process.

MD-04.3 [R] Problems and Solutions for the Successful Introduction of a Phase-Gate Model for Domain-Specialized High-Tech Manufacturers in Japan

Hiroaki Kaneko; Globis University, Japan
Hiroshi Kubo; Chiba Institute of Technology, Japan

In Japan, manufacturers running a single business account for a high percentage of the sales of precision machinery and fine chemicals. There are numerous domain-specialized high-tech manufacturers who focus on a single business as their main field of technological expertise. Such organizations are constantly exposed to the risk of diminishing market opportunities for their business due to the emergence of alternative technologies. At the same time, as technological progress slows down, these firms also face the risks posed by industrial commoditization. Therefore, there is increasing appetite for new business within such organizations. To facilitate the creation of new business, high-tech manufacturers frequently adopt the stage-gate process. The phase-gate model is suitable for organizations facing numerous problems in the early stages of new business development. However, most domain-specialized high-tech manufacturers in Japan face relatively few problems in the early stages. This paper proposes a revised version of the phase-gate model, adapted to the specific needs of Japanese high-tech manufacturers moving into new business areas.

SESSIONS

MD-05 Intellectual Property 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Broadway-3
Chair(s) Rahul Kapoor; Lappeenranta University of Technology

MD-05.1 [R] Patenting Financial Innovation in Europe

Rahul Kapoor; Lappeenranta University of Technology, Finland
Anne-Laure Mention; Luxembourg Institute of Science and Technology, Luxembourg

Subject matter of financial and business methods is of questionable patentability in the European patent system. European Patent Office (EPO) adopted a 'no search' policy to counter a surge in applications clearly considered non-technical and method based. These applications are thus characterized by high refusal rates and low grant rates. Our evidence suggests that financial method patents have the lowest grant rate (only about 3%) among other business method inventions. We also observed a large number of pending applications. Not only are pending patents valuable, they may represent applications that are difficult to evaluate owing to the unclear picture related to their patentability. In this paper, we study the patent characteristics of pending applications along with successful and unsuccessful applications. The study offers a patent landscape related to financial innovation. It then compares early stage patent characteristics that could have an influence on the outcome of applications.

MD-05.2 [R] Patenting-Promoting Policies and Regional Utility Patent Output: Evidence from Provincial Level Data

Ling Wang; China University of Political Science and Law, China

The aim of this paper is to study the impact of the public patenting-promoting policies on patent output at the provincial level. Time-series cross-section data from 31 provinces of mainland China between 1999 and 2012 are used to perform panel analyses. Following two national public policies released around 2006, regional utility patent output has been striding forward in the quantity (utility patent application) and quality (utility patent granted). Exploiting the difference before (1999-2005) and after (2006-2012) policies by using the Paired-Samples T-test, the result shows that the public patenting-promoting policies contribute a lot to the motivation for regional utility patenting activities. Taking into account influential factors for regional utility patent output, the regression results show patenting-promoting policies, R&D expenditures, technology market turnover, educational standards, market structure and marketization index are positive and significant account for the contribution. Furthermore, the different significant level of patenting-promoting policies shows that the policies are more effective to improve patent quantity (utility patent application) than patent quality (utility patent granted).

MD-06 Knowledge Management 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Broadway-4
Chair(s) Sul Kassicieh; University of New Mexico

MD-06.1 [R] Managing Software Engineering Competences with Domain Ontology for Customer and Team Profiling and Training

Tarmo Robal; Tallinn University of Technology, Estonia
Deniss Ojastu; Tallinn University of Technology, Estonia
Ahto Kalja; Tallinn University of Technology, Estonia
Hannu Jaakkola; Tampere University of Technology, Finland

Software engineering has undergone remarkable progress in more than 40 years. New technologies and methodologies are established ever faster, making the management of the latter a challenging task. This has also set high expectations on domain conception both on developers and also on customers ordering software. Several factors play a crucial role in the success of developing custom-made software, driving its success or postponing product release, or even invoking its disastrous failure. In this paper we propose an ontology to manage software engineering competences on a team and customer level. This ontology describes and organizes domain concepts and through it delivers essential domain knowledge. It is applicable in the process of detecting customer and team competences.

MD-06.2 [R] Human Centric Cyber Security: What are the New Trends in Data Protection?

Sul Kassicieh; University of New Mexico, United States
Valerie A Lipinski; University of New Mexico, United States
Alessandro F Seazzu; University of New Mexico, United States

The debate about the use of automated security measures versus training and awareness of people with access to data (such as employees) to protect sensitive and/or private information has been going on for some time. In this paper, we outline the thinking behind security, what hackers are trying to accomplish and the best ways of combating these efforts using the latest techniques that combine multiple lines of defense. Different major categories of automated security measures as well as major training and awareness techniques are discussed outlining strengths and weaknesses of each method.

MD-06.3 [R] A Business-Intelligence-Based Concept for the Identification of Similar Parts

Jens F Lachenmaier; University of Stuttgart, Germany
Hans-Georg Kemper; University of Stuttgart, Germany

A growing demand for individualized products results in an increasing number of product variations. A first step to harmonize these variations is to identify similarities between products based on their technical properties. This paper follows the design science approach: The requirements for the concept are derived from interviews with experts from German industrial companies. Then a concept is developed and prototypically realized and its usefulness is evaluated during a workshop. The approach is based on the fact that each product has a digital representation - the digital product model, which is created during the design of the product and based on feature technology. Each part is described entirely by the total amount of all features and their parameters. By extracting the features from the Computer Aided Design (CAD) system and loading them into a Business Intelligence (BI) infrastructure, it becomes possible to analyze various parts at the feature level. The BI infrastructure enables the application of data mining algorithms, which can be used in order to classify parts based on their feature combinations. Regarding new parts, this concept can support the selection of production technologies by providing information on similar parts that have been produced in the past.

MD-06.4 A] Using a Disaggregated R&D Intensity Indicator to Identify Leading Countries in Specific Manufacturing Classes

Aymen A Kayal; King Fahd University of Petroleum & Minerals, Saudi Arabia

The R&D Intensity (RI) indicator is widely used by analysts and policymakers for international comparisons, benchmarking, and goal setting. It is believed that calculating a separate RI for each industrial class will reveal a more representative indication of the focus of various countries in that particular class. In this study, we named the disaggregated R&D Intensity "Class-RI". The study first investigated the indicator's validity by correlating it with an economic indicator at the manufacturing classes' level. A number of manufacturing classes were then singled out to identify which countries exhibited high RI. The study demonstrated the usefulness of Class-RI in ranking countries.

MD-07 Technology Adoption 1
Monday, 8/3/2015, 14:00 - 15:30
Room: Studio Suite
Chair(s) Tugrul U Daim; Portland State University

MD-07.1 [R] Complementary Products Providers' Technological Adoption and Evolution of the Business Ecosystem: The Case Study of Nintendo's Wii in Japanese Video Game Sector

Yuki Inoue; Tokyo Institute of Technology, Japan
Masaharu Tsujimoto; Tokyo Institute of Technology, Japan

Many previous studies have analyzed the business ecosystem that consists of the platforms and complementary products. Besides, the technological aspects of the business ecosystem were relatively not analyzed. Based on this recognition, we examined the relationship between complementary products providers' technological adoption and evolution of the business ecosystem. We focused on the ecosystem of Nintendo's Wii in the Japanese video game sector as the case study and collected a quantitative dataset for the statistical analysis using information of official web pages of each game titles and f-ism, which is the comprehensive database of the game industry in Japan. The dataset contains the information of the attributes and adopted technologies of all game titles for Wii platform from 2006 to 2012. Our results indicated that the most complementary product providers have not adopted or utilized the technologies, which was provided by the Nintendo. Consequently, we discussed that this mismatch would have caused the quick growth and decline of the Wii platform.

MD-07.2 [R] Exploring the Adoption and Use of the Smartphone Technology in Emerging Regions: A Literature Review and Hypotheses Development

Fahad Aldhaban; Portland State University, United States
Robert R Harmon; Portland State Univesity, United States
Tugrul U Daim; Portland State Univesity, United States

Users' acceptance of a new information technology (IT) is a determining factor of its market success. A solid understanding of the users' adoption process and use behavior enables a more robust definition of user requirements and better market alignment. This is especially important in markets characterized by rapid technological change such as smartphones. The Technology Acceptance Model (TAM) is often used to assess the factors affecting adoption of new technologies. However, TAM models often omit the role of important variables such as human and social factors in the adoption process. In developing markets such as China, cultural and social influences significantly impact the adoption and use of smartphones and related technologies. Similarly, Saudi Arabia has unique cultural and social contexts that may influence the adoption and use of smartphone technology, but as yet they have not been studied in a comprehensive manner. Accordingly, the purpose of this paper is to develop the foundation for a theoretical research model based on the Unified Theory of Acceptance and Use of Technology (UTAUT). The case of smartphone adoption and use in Saudi Arabia will be its focus.

MD-07.3 [R] Investigating the Adoption of Electric Vehicles Using Agent-Based Model

Yonghee Cho; Portland State University, United States
Kevin V Blommestein; Portland State University, United States

There have been various barriers such as range anxiety, technology resistance, long charging time, lack of infrastructure, uncertainty, safety, and price to mass household adoption of electric vehicles. Technology adoption and diffusion have gained much attention in many applications of agent-based model. This study attempts to investigate the adoption and diffusion of electric vehicles under various scenarios in an artificial society. This agent-based model incorporates word of mouth effect, socio-demographic information, incentives, and social network effect including threshold model. The adoption and diffusion model of electric vehicles is developed not only to explore heterogeneous agents' behaviors about whether or not to make a decision to adopt an electric vehicle based on their socio-demographic attributes, driving habits, and gas price, but also to provide some measures by sensitivity analysis to help electric vehicle manufacturers and policy makers in their decision-making. The preliminary simulation results present an agent's decision change over time as a result of interactions among agents and between agents and the environment, and suggest that the price of an electric vehicle and gas price are significant factors in the adoption of electric vehicles rather than government financial incentives.

MD-08 TM in Service 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Directors Suite

Chair(s) Antonie J Jetter; Portland State University

MD-08.1 [R] Diffusion of Innovation in the Public Sector: Twitter Adoption by Municipal Police Departments in the U.S.

Megan L Anderson; Universiteit Leiden, Netherlands
Kieran H Lewis; COT-AON, Netherlands
Ozgur Dedehayir; CeTIM - Center for Tech. & Innovation Management, Netherlands

While the literature on the diffusion of innovations has a long and rich legacy, there are few empirical studies on the diffusion of technological innovations across public sector organizations. In order to keep pace with the demands of growing urban populations, such organizations must constantly innovate technology, policy and practice. With local governments increasingly forced to deliver services more efficiently, it is important to question which factors foster innovation among local government organizations. Integrating Twitter adoption data across American municipal police departments serving populations over 100,000, we find weak support for the effect of organizational size and local demand, but find evidence of regional effects on the earliness of innovation adoption. Potential avenues for future research are presented on public sector innovation.

MD-08.2 [A] Explaining Health Technology Adoption: Past, Present, Future

Noshad Rahimi; Portland State University, United States
Antonie Jetter; Portland State University, United States

One of the most pressing challenges of healthcare innovation today is the lack of technology adoption. Research that improves our ability to understand, predict, and advance technology adoption in health care needs to be based on well-tested theories. With the interest to conduct high quality research in health technology adoption (HTA) in the future, this study reviews the theories used in this context to either identify the superior theory(ies) and or discover the issues that need resolution for improving future HTA research. To do that, the most popular social cognitive theories conceived over the past four decades are reviewed analytically from the perspective of their capacity to explain, predict and intervene in health technology acceptance, adoption and adherence. While all these theories are instrumental in conducting adoption studies, and some like UTAUT (Unified Theory of Acceptance and Use of Technology) are better than others at it, there is no perfect theory to study HTA. The literature repeatedly suggests that while utilizing general theories that have successfully passed the test of time could serve as a strong foundation, there is a compelling need for new and more empirical theories. There is a need for health researchers to expedite theoretical evolution by conducting comprehensive observation and rigorous evaluation to 1) manipulate and expand existing theories and or 2) create new theories that better address the specific needs and challenges of health technology application to enhance the utility and better reflect empirical findings. The structure of this paper is as follows. After summarizing the specifics of health technology innovations, the primary challenges in its acceptance are categorized. From there the body of this paper is dedicated to the review of the most popular social cognitive theories: 1) general human behavior repeatedly applied in healthcare studies and rooted HTA research, and 2) theories dedicated to the study of technology acceptance behavior and applied as the prominent theories in studying HTA. Each theory is reviewed, followed by examples of its applications, especially in modeling HTA behavior. Each theory is then evaluated based on the salient factors involved in the study of technology innovation in healthcare space in addition to the classical influencing concepts in technology adoption behavior. In the discussion section, these theories are compared and the applications studied are synthesized in the attempt to identify some of the best theories and state-of-the-art practices used in the study of HTA. The conclusion section summarizes the findings of the literature and recommends best approaches for conducting empirical studies and planning effective processes that stimulate theoretical evolution in HTA and facilitate enhancement of acceptance of health technology innovations.

MD-08.3 A] Compulsory Licensing in Medicine: Is It a Safeguard for the People or an Evil to Kill Innovation?

Yaeko Mitsumori; Osaka University, Japan

Compulsory License is the scheme where a government allows someone else to produce the patented product (or a process) without consent of the patent owner. The conditions are stipulated by the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), and many countries, including developed countries, have some forms of compulsory license in their patent laws. Over the past decade, several developing countries have issued a compulsory license "in order to secure access to medicine for their people." Indonesia was one of them. Indonesia in 2012 issued a compulsory license against seven HIV/AIDS medicines. Unlike many other developing countries, Indonesia has a certain scale of pharmaceutical industry and holds three large state-run pharmaceutical companies which have a new drug developing function. In the wake of issuance of a compulsory license in 2012, the government assigned one of the three state-run pharmaceutical companies to develop these targeted medicines. This study is aimed at analyzing the meaning of compulsory license in medicine in developing countries, taking the Indonesian compulsory license in 2012 as a case.

MD-09 Collaborations for TM 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Council Suite
Chair(s) Michael D. Santoro, Lehigh University

MD-09.1 [R] A Methodology to Build an Initial R&D Portfolio for Industry-University Cooperation

Jessica Castilho; Universidade Federal de Minas Gerais, Brazil
Jamile Dias; Universidade Federal de Minas Gerais, Brazil
Raoni B Bagno; Universidade Federal de Minas Gerais, Brazil
Jonathan S Freitas; Universidade Federal de Minas Gerais, Brazil
Lin Chih Cheng; Universidade Federal de Minas Gerais, Brazil

How to build an initial portfolio of R&D projects to start industry-university cooperation? This paper reports an attempt to answer this question. Particularly, it presents a methodology devised from an 18-month action-research program held between a large multinational automotive manufacturer and the engineering school of a top-ranked Brazilian university. The paper proposes a 3-stage process oriented by the construction of QFD-like correlation matrices. A first matrix is built in order to correlate industry product performances and product components. Clusters of high correlations are identified and analyzed in order to define broad research strands of interest. These are, then, correlated with engineering competences to highlight the main types of know-how that are associated with each of the identified research demands. University experts in these competences are finally interviewed in order to fill a roadmap-like layer with possible cooperative R&D deliverables over time. Techniques used for data collection, analysis and visualization in each stage are presented. Possibilities of customizing the process are suggested when appropriate. Finally, based on the results, more general theoretical and methodological reflections are proposed in order to help managers tackling the long-standing problem of setting a shared R&D agenda between industry and university.

MD-09.2 [R] Loosely Coupled SME Network in Manufacturing Industry: A Challenge in Niigata Sky Project

Babur Amjad; Shibaura Institute of Technology, Japan
Makoto Hirano; Shibaura Institute of Technology, Japan
Nobuaki Minato; Keio University, Japan

As emerging nations add influence to the state of the global economy, the new demand in air logistics is expected to catapult the increase in aircraft production, introducing a new horizon for potential suppliers to enter into the supply chain regime. This scenario may capture the attention not only from the industry institutions, but also from public entities that are interested in plotting the economic viability of the underlying jurisdiction. With such an objective, the aviation cluster incubation project of "Niigata Sky Project (NSP)," which is implemented by the City of Niigata, Japan, implies a new perspective of implementing a sustainable industry cluster. Current commercial aircraft production is configured under the fundamental of securing a high standard of quality assurance. This prevalence has embedded a structure that requires a highly competitive supplier selection policy, which public case can be observed through Germany. Niigata in this regard demonstrates a lenient non-competitive attribution, and where the suppliers' competency is developed through their collaborative participation in the project. This case can be represented as "collaboratively institutionalized" versus the German case of "competitively institutionalized" cluster formation. Defining these distinctive practices' character and finding its applicable phases in the cluster's lifecycle shall provide a new view for the cluster managers and SMEs in developing their organizational strengths for regional development.

MD-10 Sustainability 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Forum Suite
Chair(s) Dilek Cetindamar; Sabanci University

MD-10.1 [R] Identifying Critical Technology Actors in Waste Flow Management

Tero H Peltola; CITER / Tampere University of Technology, Finland
Saku J Makinen; CITER / Tampere University of Technology, Finland

Waste flow business ecosystems include numerous actors ranging from regulatory bodies actively involved in numerous businesses to non-governmental actors. A high amount of actors can be considered as an entry barrier for new technological actors. Yet, business potential that relates on waste flow management is enormous globally but without conceptualizing the ecosystem in detail level, the business potential might not be fully discovered. In the present study we followed existent insights in literature and applied business ecosystem theories into Brazilian waste flow business. Based on our framework, critical technology actors can be identified in the waste flow management and possibilities they enable may be revealed. We also discuss fruitful avenues to continue the research further.

MD-10.2 [R] Social and Environmental Sustainability Strategy in Petroleum Organizations in the United Arab Emirates

Moosa A Alhanshi; British University in Dubai, United Arab Emirates
Hussain Albreki; British University in Dubai, United Arab Emirates

Although oil and gas organizations use the term "sustainability" in their strategy overviews, there seem to be many interpretations of the meaning of the term and how it should be implemented. This unclear understanding of how a sustainability strategy should be created and implemented makes it difficult for an organization's management to adhere to sustainability. Many studies reveal that there is a lack of commitment towards sustainability implementation, particularly when a strong business case cannot be achieved, in which case the enterprise will only consider sustainability if it provides a competitive advantage or growth opportunities. This paper investigates the notion of sustainability in a literature review from social and environmental perspectives and how that view of sustainability strategy can be implemented across organization projects. In addition, the paper maps sustainability initiatives in oil organization projects in the United Arab Emirates; it looks at what role the project management plays in sustainability, and at how project management teams react towards sustainability strategy and initiatives. The study is exploratory in nature, and case studies are used from three petroleum organizations. The qualitative nature of the study follows a case study approach in which data are collected by semi-structured interviews, in addition to focus groups and secondary data. In all cases semi-structured interviews were conducted among project managers and the practitioner.

MD-10.3 [R] Organizations with Purpose: Benefit Corporations

Dilek Cetindamar; Sabanci University, Turkey

The article explores the practices of benefit corporations associated with triple-bottom line. The Benefit Corporation is a legal form of social enterprises adopted in the US since 2010; more than half of the state governments offer this corporation status that allows firms incorporating social and environmental goals as a legitimate element of their business. By

design, it has the potential to flourish a new breed of corporations to positively transform society. Since imprinting takes place in the early years of companies, this paper attempts to understand the nature of benefit corporations by studying their practices. This might shed light on how benefit corporations might survive and thrive in the complex business world.

MD-11 ICT Mgmt 2
Monday, 8/3/2015, 14:00 - 15:30
Room: Executive Suite
Chair(s) Scott W Cunningham; Delft University of Technology

MD-11.1 [R] Exploratory Study on the Relationship between Knowledge Attributes and Innovation Behavior in SMEs in the Information Service Industry

Chien-Hsin Wu; National Chengchi University, Taiwan
Feng-Shang Wu; National Chengchi University, Taiwan
Wei-Yin Chen; National Chengchi University, Taiwan

Studies conducted in recent years have indicated that the innovation behaviors of a company are determined by its knowledge attributes. Research conducted on these topics has mainly focused on the manufacturing industry, and limited emphasis is placed on service-oriented industries such as the information service industry. Most of the companies in the information service industry are small and medium-sized enterprises (SMEs). Therefore, this study focused on information service SMEs and aimed to determine the relationship between knowledge attributes and innovation behaviors in information service companies. An exploratory study involving qualitative interviews with five software companies was performed, and the results indicated that 1) knowledge attributes influence innovation behaviors and management in software companies, and 2) R&D personnel autonomy in information service SMEs also influences innovation behaviors and management. The findings of this study have potential applicability in both the theory and practice of knowledge management.

MD-11.2 [R] Exploring the Adoption Intentions through Decomposed Theory of Planned Behavior: An Empirical Study on Mobile Applications

Min-Jhih Cheng; National Central University, Taiwan
Her-Her Tsai; National Central University, Taiwan
Shiu-Wan Hung; National Central University, Taiwan
Ping-Wen Chen; National Central University, Taiwan

Downloading or buying mobile applications are becoming increasingly popular activities, which would seem likely to affect the daily life of human beings. However, little empirical evidence about the factors which influence the downloading of mobile applications is available. This study examines the concepts of attitude, subjective norm and perceived behavior control with reference to the extended theory of planned behavior model to explain why people download mobile applications. We collected 320 valid questionnaires through Google Doc, and used a structural equation model to conduct the empirical study. The results indicated that attitude, subjective norm, and perceived behavior control have a significant effect on the downloading intention of mobile applications. However, the results show that compatibility and self-efficacy have no significant effect on the downloading behavior of mobile applications.

MD-11.3 [A] Influencing Factors on User Satisfaction of the USONET Community Service Center: A Case Study in Khon Kaen, Thailand

Arnon Tubtiang; King Mongkut University of Technology, Thailand
S. Viseth; King Mongkut University of Technology, Thailand

According to Thailand ICT Policy Framework targeted for 2020, one of the main objectives is to move up Network Readiness Index (NRI) rankings by WEF (World Economic Forum) back to the top quartile of initiatives to accomplish the target is the USONET implementation. The USONET stands for Universal Service Obligation Network, which is being financed by USO funding. It has been providing Internet access to the public by the National Broadcasting and Telecommunications Commission (NBTC) as a mechanism to bridge the digital divide in the rural area of Thailand. It may be referred to by several names such as Tele-center, Community Service Center or Community Hub. This paper is focusing on the study of factors which influence user satisfaction in using the USONET. This is a survey study through 400 samples representing the population of Khon Kaen, a province in the northeastern part of Thailand. The results were analyzed by SPSS, a statistical analysis software. The factor that got the highest satisfaction level with the USONET are place and facilities, followed by quality of service. The third and fourth factors affecting the USONET satisfaction are personnel and process to obtain the service, respectively. The result of this study will help in formulating the framework for the next phase of USONET to achieve the ultimate goal.

ME-01 Innovation Management 3
Monday, 8/3/2015, 16:00 - 17:30
Room: Pavilion East
Chair(s) Paulo Tromboni de Souza Nascimento; Universidade de SÃ£o Paulo

ME-01.1 [A] Capability Building in Fuzzy Front End Management in a High Technology Services Company

Claudio M Vigna; University of Sao Paulo, Brazil
Abraham S Yu; University of Sao Paulo, Brazil
Paulo T Nascimento; University of Sao Paulo, Brazil

This study analyzes the fuzzy front end (FFE) management process of a multinational company of high-tech services. We evaluate the adherence of the enablers reported in the literature of FFE management in this company's innovation process. We choose, from literature, a framework of FFE´s management in order to guide the interviews with managers. The interviews provide information that could help to identify some enablers which are fully adopted by the company, although adopted with different terminology, or are partially adopted. At the same time it is possible to verify which part of the FFE process is more structured and which one should be improved in the company. The framework allows one to capture the holistic view of the FFE's enablers application in the company. A result of this paper is an outline of the theoretical elements adherence practiced in the company, as well as the gaps, providing support to improve the FFE process in the company. Finally, based on this case study, we present some suggestions to improve the theoretical framework of the FFE management process. For example, it was identified that the opportunities selection is informal, and could be more formalized.

ME-01.2 [R] Study on the Correlation Characteristics of New Industries Based on Technical Perspective: The Case of 3D Printing-Related Industries

Lucheng Huang; Beijing University of Technology, China
Yuanyuan Shi; Beijing University of Technology, China
Feifei Wu; Beijing University of Technology, China

The emergence of new technologies will eventually create relationships among different industries, and the different relationships among industries will reversely promote the continuous development of new technologies. This article proposes a procedural method with patent data to identify technology-related industries and analyze the inter-industrial relationships from a technical point of view. A matrix of correlation relationships within technologies is constructed through the international patent classification co-occurrence matrix to represent knowledge flows in the technical fields. Consistency between the technical fields and industries will expand to the knowledge flow among different industries. Finally, the interrelationship among industries has been obtained through knowledge flow analysis. The concrete analysis of 3D printing techniques not only demonstrates the effectiveness of this method, but also provides a detailed description of the relationships among related industries. Current development of 3D printing technology focuses mostly on foundation research, whereas the industrial development of downstream applications is relatively slow. This means that the application industry has great development potential in the future, and it can provide future opportunities for technologies and new industries in China.

SESSIONS

ME-01.3 [R] Innovation in Innovation System in a Large Service Corporation in Colombia

Angela Benavides Gordillo; Sao Paulo University, Colombia
Abraham Sin Oih Yu; Sao Paulo University, Brazil
Paulo T. Nascimento; Universidade de Sao Paulo, Brazil
Alceu S Camargo; Sao Paulo University, Brazil

This research focuses on the innovation system of a large service corporation and its evolution over the last ten years. This corporation has business companies such as property insurance, health insurance, a clinic, and business capitalization. It is the largest insurance corporation in Colombia. Different from other service firms with comparable size, this corporation has centralized its innovation activities with functions such as quality assurance and project management since 2004. The corporation adopts a fast follower strategy for innovation. This research analyzes the evolution of innovation system after centralization, including the key tasks in its development funnel such as technology and market monitoring. We also discuss barriers and challenges confronted by management when implementing the centralization and to improve the performance of this innovation system in the last few years. Finally, the findings of this case study are compared with the literature of service innovation. This paper contributes to the understanding of innovation management in service corporations which are increasing the main providers of employment in most large metropolitan areas in the world.

ME-02 Resource Management
Monday, 8/3/2015, 16:00 - 17:30
Room: Pavilion West
Chair(s) Timothy Anderson; Portland State University

ME-02.1 [R] Decoding Data Analytics Capabilities from Topic Modeling on Press Releases

JeanCarlo Bonilla; New York University, United States
Bharat Rao; New York University, United States

In their quest for data-driven insight, firms align their resources to produce information that is actionable. Moreover, the bundling and utilization of these valuable resources are what define an organizational capability. Thus, in this paper we conceptualize a new type of capability, data analytics capabilities (DAC), as the ability to assemble, coordinate, mobilize, and deploy analytics-based resources with strategic purpose. Using text as data, we explore the use of probabilistic topic modeling on historical press releases in an attempt to identify types of DAC from successful data analytics investments. Press and news releases frequently articulate a firm's resource allocation strategy, proving an opportunity to automatically classify these into topics that can suggest categorization of DAC. We explore 8-year historical press releases and apply Latent Dirichlet Allocation topic modeling to 273 press releases.

ME-02.2 [R] Multiple Objective Evolution Strategies Using Data Envelopment Analysis

James V Lill; Engility Corporation, United States
Timothy Anderson; Portland State University, United States

Often in science and engineering we are faced with complicated nonlinear problems in optimization that involve simultaneously minimizing or maximizing various non-commensurate quantities. For example, a basic task in design engineering or technology management is to balance suitable measures of performance against the cost. We present a simplified approach for performing multiple objective optimization by combining standard single objective Evolution Strategies with Data Envelopment Analysis. This latter method employs linear programming to compute an L1 distance of a given solution from the Pareto frontier defined by the evolving population of solutions, or from a related frontier defined by DEA. This quantity is then used in a fitness function. Real variable linear programs must be solved for the optimization of convex problems, while the solution of mixed integer linear programs is required to optimize general non-convex problems. This hybrid method yields highly converged results with good coverage of the Pareto frontier when applied to a standardized suite of multiple objective problems. Several current applications will be discussed that employ a massively parallel program (MOES) written in C and MPI that runs on supercomputers. This material was assigned a clearance of CLEARED, Case Number 88ABW-2015-0638.

ME-03 NPD 3
Monday, 8/3/2015, 16:00 - 17:30
Room: Broadway-1
Chair(s) Antonie J Jetter; Portland State University

ME-03.1 [R] Service Modeling Method for Machine-to-Machine Businesses to Overcome Difficulties

Naoshi Uchihira; Japan Advanced Institute of Science and Technology, Japan
Hirokazu Ishimatsu; Japan University of Economics, Japan

With the popularization of high-speed and high-capacity communication networks, machine-to-machine (M2M) communication has received significant attention. However, although the related technologies have been actively investigated, creating new businesses based on M2M communication is difficult. The information and communication technology community should take not only system modeling but also business modeling into account for monetization. This study proposes a service design and modeling method of M2M businesses based on the SCAI (Share-Connect-Analyze-Identify) model, which was proposed in PICMET 2014. The proposed method is explained using a trial application to smart home M2M services.

ME-03.2 [R] A Comparative Study of a Product Planning Experiment between Thailand and Japan: Why Have Specific Innovations in Emerging Countries been Realized?

Nanami Furue; Hitotsubashi University, Japan
Yuichi Washida; Hitotsubashi University, Japan

In recent years, researchers have been focusing on innovations launched from emerging countries. Former studies have shown that these innovations are rooted deeply in not only particular emerging countries markets' needs but also their unique spirits. In order to reveal the differences and investigate the reasons of the "unique" spirits, a comparative experiment has been conducted between Thai and Japanese well-educated university students; after collecting ideas, engineers and marketers from a Japanese manufacturer evaluate the ideas, and then the exceptional few ideas are selected in some group discussions by students. Through this experiment, some differences and characteristics in their product ideas and discussion styles were examined. First, differences have been discovered about the contents of product ideas; Thai students set a shorter new product development period, a durability period, and proposed more altruistic product ideas than Japanese students. Second, differences have been found about attitudes towards the discussions; Thai students were less sensitive to the evaluations from knowledgeable authorities, were able to change their own ideas more flexibly and possess more self-confidence than Japanese students. This study implies the capability of taking high potential human resources in emerging countries for their unique innovations not generated by only high potential human resources in developed countries.

ME-03.3 [R] Connecting Customers with Engineers for the Successful Fuzzy Front End: Requirements of Tools

Byung Sung Yoon; Portland State University, United States
Antonie J Jetter; Portland State University, United States

In technology-driven enterprises, marketing typically acts as a "go-between" that captures customer needs and experiences and aggregates and interprets them for engineering. Knowledge exchange thus occurs through an indirect path. However, as a result of rapidly changing and unpredictable environments and complex products with tacit requirements, companies increasingly emphasize the need for engineering to be more strongly engaged

with customers. Accordingly, an increasing number of methods for customer research in early stages of new product development, the so-called fuzzy front end (FFE), emphasize direct knowledge exchange and collaboration between engineering and customers. Based on a review of the literature, this paper establishes six requirements for such methods from the perspective of engineering: information processing, simulation of scenario, reflection of dynamic customer knowledge change, interactive communication, exchange of subjective interpretation and drawing organizational interpretation. Subsequently, 10 tools which are typically applied for customer involvement activities and capturing customer knowledge in the FFE are evaluated according to the requirements. As a result, simulation of scenario is hardly dealt with by any methodologies. In addition, some methodologies require additional help or education for engineers and have difficulties with being diffused throughout general fields from specific industries.

ME-04 Decision Making 1
Monday, 8/3/2015, 16:00 - 17:30
Room: Broadway-2
Chair(s) Fred Phillips; Stony Brook - State University of New York

ME-04.1 [R] Model Ontology and Information Architecture

Frederick Betz; SUNY Korea and Portland State University, United States
Fred Phillips; Stony Brook - State University of New York, Korea, South

Earlier in addressing the issue of having models-talk-to-models through computers, we had introduced the concept of a model ontology. We next applied this to economic models, which need to communicate information between economic processes; and we examined how the concept of perfect information in economic markets did not fit financial market reality. Accordingly, model ontologies for economic processes were more complicated than merely information transformation between models; but they also involved additional economic processes as transforming information between economic models. In this paper we further explore this aspect of model ontology - but now not merely as information transfer but also as information processing. The concept of a model ontology can provide the architecture for focusing information systems around important policy issues.

ME-04.2 [R] Developing Strategic Decision Making Process for Product and Service Planning

Yonghee Cho; Portland State University, United States

It is imperative to forecast advanced or emerging technologies to aid in decision making on firm's R&D investments and business plan for commercialization efforts. Even though a company must align R&D planning with overall business planning such as manufacturing, sales and marketing, personnel, and finance, systematic management approaches are limited in it based upon the prediction of technological change and speed. This paper aims to provide a decision support tool to aid in strategic service planning and technology development in a firm. The study is to enhance strategic development of service and product with the consideration of emerging technologies. This model helps decision makers to easily identify emerging technologies and new research fields with a systematic decision making process.

ME-04.3 [R] Siting a Wind Farm in Oregon: Considering a Hierarchical Decision Model with Four Scenarios

Diane Yates; Portland State University, United States

This paper primarily serves two purposes: first, it looks to develop a methodology that takes scenarios and certain hard-to-measure intangibles such as politics, social impact, and even religion; as well as more tangible and measurable variables such as environmental impacts, cost and types of materials, storage and wind turbine technologies, to name a few, that then could be used as input to a decision-making model on where to build a wind farm. The hierarchical decision model (HDM) then analyzes these variables, based on an independent judging panel, in order to come up with a recommendation for the best site on where to build the wind farm. Second, the preliminary discussion of this paper serves as a prototype of developing a methodology that might one day serve as part of an overall comprehensive energy policy for the State of Oregon.

ME-05 Intellectual Property 3
Monday, 8/3/2015, 16:00 - 17:30
Room: Broadway-3
Chair(s) Bo Wang; National University of Singapore

ME-05.1 [R] Factors Related to Academic Patenting in a Mexican University

Claudia Diaz-Perez; Universidad Autonoma Metropolitana Cuajimalpa, Mexico
Alejandro Alarcon Osuna; Autonomous University of Sinaloa, Mexico

The research describes the factors related to academic patents production in a Mexican university. Mexican universities have had a very low production of knowledge codified through patents. However, some researchers have oriented their capabilities to do it. What kind of problems do the researchers face in this process? What are the main obstacles to patent production in Mexican universities? What are the main factors related to a successful patenting processes? The Metropolitan Autonomous University in Mexico City has the fourth place among universities in terms of patents. Fieldwork was done through an institutional patents database and 33 unstructured open ended interviews with main inventors. Fifty patenting cases were identified: 40 were groups and 10 isolated inventors. A Probit Model was used to calculate the probability for a group or inventor to produce patents and to become a prolific inventor. The results suggest that patenting production decreased at the university since 1994, when the North American Free Trade Agreement (NAFTA) was signed, even when there are not conclusive patterns. Students' participation, collaboration with business personnel, and researchers' seniority are some of the main factors related to prolific patenting groups that have more than five patents. These finding are related to some previous research in this field.

ME-05.2 [R] Patent Strategy in Exploration and Exploitation Alliances: The Case of Biotechnology Start-ups

Bo Wang; National University of Singapore, Singapore
Annapoornima M Subramanian; National University of Singapore, Singapore
Kah-Hin Chai; National University of Singapore, Singapore

In technology-intensive industries, firms form alliances with each other to promote knowledge transfer and pool resources. The benefit that a firm is able to obtain through its alliance activities depends on a variety of factors. The patent portfolio of the focal firm is one of such factors that influences the role of alliance in enhancing firms' performance. Different facets of a firm's decision making process, alliance strategy and patent strategy need to be coordinated in a way that optimizes its innovative performance. Using a dataset comprised of 182 biotechnology start-ups, we show that a firm's alliance strategy and its patent strategy interact in subtle ways to impact innovative performance. The results indicate that firms engaging in more exploitation alliances should maintain a patent portfolio that is comprehensive in both depth and breadth. In contrast, for firms with more exploration alliances, a deep and broad patent portfolio would decrease the positive role of alliance in improving performance.

ME-05.3 [R] Profiting from Strategic Legal Activities: Implication from Non-Practicing Entities

Syuan-Yi Jiang; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

This paper is to disclose NPEs' patent portfolios internationally. The operation of NPEs has aroused impacts on society, and its patents have been considered as valuable patents, which are more valuable than ITC patents and litigated patents. The value of NPE patents is not occasionally. Hence, this paper uses application and publication of nations, and NPE patents applied under PCT procedures, NPE patents in patent families to find how NPEs withhold patents internationally as their patent portfolios. Three contributions found in this study: 1) NPEs prefer patents from developing countries comparing the application condi-

tions around the world, 2) PCT patents occupied in third place of NPE patents, which implies that NPE patents prefer hold patents published internationally, and 3) the patent families, which include NPE patent members, have at least 25% patent families with its patent members publishing in the U.S., Japan, and Europe. Lastly, this paper displays that NPEs withhold patents strategically and internationally.

ME-06 Knowledge Management 3
Monday, 8/3/2015, 16:00 - 17:30
Room: Broadway-4
Chair(s) Charles M Weber; Portland State University

ME-06.1 [A] Knowledge Management Maturity Level in a Brazilian Air Force Flight Test Environment

Roberto C Follador; Instituto Tecnologico de Aeronautica, Brazil
Luis G Trabasso; Instituto Tecnologico de Aeronautica, Brazil

The research described herein investigated how Knowledge Management (KM), in a Brazilian Air Force (BAF) flight test environment, was impacted by the establishment of a science and technology management structure. The research was conducted initially by a bibliographic revision on the main KM theories. A documental research regarding the flight test environment KM was done and a questionnaire was submitted to identify KM characteristics previous and after the structure change. With the data obtained, the KM maturity level and the core competence in each moment were identified. Results show that both environments had the same KM maturity level. Particularly, after the structure change, it was possible to observe some development in KM processes. Both environments pointed out the capability of performing flight test campaigns as its core competence. The research revealed that the structure change did not impact, in a clear way, the BAF flight test KM maturity level and, as a lesson learned, that the simple adoption of a science and technology management structure has a poor impact on knowledge management maturity level of an organization.

ME-06.2 [R] A Study on Effective Knowledge Reuse in Multi-Platform Web Applications User Interfaces

Jevgeni Marenkov; Tallinn University of Technology, Estonia
Tarmo Robal; Tallinn University of Technology, Estonia
Ahto Kalja; Tallinn University of Technology, Estonia

With the increasing popularity of portable devices and the variety of platforms for such devices web applications correspondence to, critical user requirements becomes one of the key factors in user satisfaction and application success. More and more applications are being migrated from desktop to mobile platforms. Due to the different screen resolutions and device usage behavior, user experience can be extremely different on desktop and portable devices. Flexible and responsive frameworks, mobile development guidelines and best practices are the solutions that help to migrate smoothly from one platform to another. Nevertheless, these solutions mostly do not consider enough the migration of knowledge about the application structure and navigation to a new platform. The main focus of current research is on the effective reuse of users' previous experience in the context of porting the same web application onto different platforms. Web application users mostly do not need to feel any difference between application usages on different devices; for them it should be smooth and intuitive. After using a web application on a desktop device, users should be able to reuse gained experience and knowledge on a new platform, i.e., mobile platform. In this paper we show how users accustom to the same web application on different platforms. Moreover, the results demonstrate that some users apprehend the difference of application user interfaces in a way that they do not have the feeling of using the same web application. For the latter, user tests with eye tracking support were performed in order to analyze the process of accustoming to the new platforms. The paper also delivers solutions to the explicit problems of adaption of web applications user interfaces.

ME-06.3 [A] Knowledge Recycling and Transformation in Design

Fakhrosadat Mohammadi; Chamran University, Iran
Mansour Rostami Kouhi; Chamran University, Iran

Knowledge management constitutes some important tasks, namely knowledge management, analysis, modeling, organization, implementation, and evaluation. The main objective of this article is to model uses layers and components in an inductive reasoning approach: to conclude whole from single parts.

ME-07 Technology Adoption 2
Monday, 8/3/2015, 16:00 - 17:30
Room: Studio Suite
Chair(s) Hongyi Chen; University of Minnesota

ME-07.1 [R] The Diffusion and Adoption of Technology among Engineering and Business Management Students: A Proposed Structural Equation Causal Model

Marcelo L Gabriel; Nove de Julho University, Brazil
Dirceu Silva; Nove de Julho University - UNINOVE, Brazil
Evandro L Lopes; Nove de Julho University - UNINOVE, Brazil
Sergio S Braga Jr; UNESP, Brazil

This study identifies technology adoption profiles of engineering and business management students based on Rogers' theory of the diffusion of innovations and Hirschman's studies of innovativeness, novelty seeking, creative behavior, and role accumulation. We performed a systematic literature review and generated an item pool to measure the theory constructs. We administered a questionnaire to an expert panel for content validity and to a sample of population subjects for semantic validity. We submitted the final research instrument to 390 students from private and public universities in Brazil. The mean age of the sample was 22.5 years (SD = 4.9), and the sample was evenly distributed between males (50.6%) and females (49.4%). We used SPSS 22.0 and SmartPLS 2.0 for the data analysis. We specified a hypothetical model and alternative models. We tested univariate and multivariate normality and selected PLS-SEM because of the non-parametric nature of the collected data. The final results proved that Rogers' theoretical profiles (e.g., innovator, early adopter) are predictors of Hirschman's adoption typology, and these findings explain the generational patterns of technology diffusion and adoption and support corporate initiatives on technology deployment among employees.

ME-07.2 [R] Technology Management Tools for Assessing Emerging Technologies: The Case of Grid-Scale Storage

Kourosh Malek; NRC, University of Waterloo, Canada
Jatin Nathwani; University of Waterloo, Canada

We apply business and technology management concepts to describe a new framework for valuation and adopting grid-scale emerging storage technologies. The main challenge of adopting emerging storage technologies among utilities is how to match the right energy storage technology to appropriate business-operation strategy for a site-specific grid configuration. With exclusive application in the electricity storage market, our analysis approach integrates the technology road map, storage performance matrix, and storage valuation models into business opportunity assessment with additional features that enable fast screening of the emerging storage technologies. The results from this phenomenological study can form the basis of a unique management methodology that assesses alternative technology solutions. It can also provide unbiased information upon which reliable management decisions can be made for adopting new technologies.

ME-07.3 [R] Barriers to the Wide Adoption of Electric Vehicles: A Literature Review Based Discussion

Shima Hosseinpour; University of Minnesota, United States
Hongyi Chen; University of Minnesota, United States
Hua Tang; University of Minnesota, United States

As a promising alternative toward green transportation, the electric vehicle (EV) technology is regaining attention from the public. A technology that emerged more than a century ago,

EV failed in its several encounters with the gas powered cars and the efforts to penetrate the market. Though much progress has been made in the past decade, the wide adoption of EVs is still in question. Through a review of EV's history, an extensive summary of factors reported in literature, and our own discussion of the EV as a disruptive innovation, we explore the barriers of EVs' wide adoption from multiple perspectives in hope of shedding light on the successful diffusion of EVs in the near future.

ME-08 TM in Energy 1
Monday, 8/3/2015, 16:00 - 17:30
Room: Directors Suite
Chair(s) Tugrul U Daim; Portland State University

ME-08.1 [R] A Comprehensive Assessment of Cloud Computing for Smart Grid Applications: A Multi-Perspectives Framework

Nina Chaichi; Portland State University, United States
Joao Lavoie; Portland State University, United States
Soheil Zarrin; Portland State University, United States
Rafaa Khalifa; Portland State University, United States
Felix Sie; Portland State University, United States

The IT system is one of the key infrastructures in order to add intelligent features to power grids. Many papers anticipated a rocky road for IT system integration into power systems and suggested the cloud computing adoption as a smart grid IT infrastructure to smooth the integration. Though cloud computing could overcome some of these integration challenges, it would bring some of its own. This study intends to give more insight to decision makers or utility companies to make a better decision about whether to adopt cloud computing with regards to their needs or not. In the problem statement section it is explained why the current approach to define advantages and disadvantages of cloud computing from selective point of views is not enough and might not be accurate, and a comprehensive assessment is required. The proposed multi-perspective framework takes all the criteria that would affect the assessment of cloud computing and put them into organizational, technical, economical, social and political categories. This framework would guide players in smart grid to better define benefits and challenges of cloud computing according to their needs.

ME-08.2 [A] Opening the Door to Breakthroughs that Address Strategic Organizational Needs: Applying Technology Roadmapping Tools and Techniques at an Electric Utility

James V Hillegas-Elting; Bonneville Power Administration, United States
Terry Oliver; Bonneville Power Administration, United States
Joshua Binus; Bonneville Power Administration, United States
Tugrul Daim; Portland State University, United States
Judith Estep; Bonneville Power Administration, United States
Jisun Kim; Portland State University, United States

Over the course of a decade, the Bonneville Power Administration's Technology Innovation Office has developed a roadmapping approach that captures business challenges and opportunities critical to the agency, links these with barriers to success, and connects these with technical solutions and research questions. Senior leaders from across the agency establish strategic goals and objectives, and international technical subject matter experts are convened to articulate technology-associated paths to achieve these. Each roadmap captures insights from diverse experts in highly collaborative environments and focuses them on critically important topics. These roadmaps are an important element in the Bonneville Power Administration's strategic approach to technology research and development.

ME-08.3 [A] Analysis on Impact of Introducing Renewable Energy on Local Community: In Case of Micro Hydro

Yaeko Mitsumori; Osaka University, Japan

After 3.11 (Great East Japan Earthquake), energy security has been one of the hottest issues in Japan. Since all of the nuclear plants were shut down, Japanese people have been carefully considering utilization of renewable energy. Among renewable energies, hydro energy (or hydroelectric power) has been occupying the largest share. However, a big hydroelectric power plant which requires a huge dam construction cannot be built easily these days. Alternatively, a micro hydro, which does not require construction of a huge dam, is winning attention. A micro hydro generates just a small amount of electricity; but it brings many benefits - it does not require construction of a huge dam (and thus does not destroy nature), and it uses a small river or an irrigation channel or water supply and sewerage works. Some communities have successfully revitalized their society by building a micro hydro and using the energy generated by the facility. This study is aimed at analyzing the impact of a micro hydro on a community and seeks an efficient way to introduce the most eco-conscious renewable energy.

ME-09 Collaborations for TM 3
Monday, 8/3/2015, 16:00 - 17:30
Room: Council Suite
Chair(s) Nazrul Islam; University of Abertay Dundee

ME-09.1 [R] Thailand's National Research Universities (NRUs) and Their University-Industry Linkages (UILs) Based on University-Industry Co-publications (UICs)

Naparat Siripitakchai; Tokyo Institute of Technology, Japan
Kumiko Miyazaki; Tokyo Institute of Technology, Japan

In 2009, the Thai government initiated the NRU project to enhance the country's research activities and to promote better UILs. The objective of this study was to identify the existing pattern of joint R&D collaborations. We explored the NRUs' research areas that were needed and attractive to the domestic firms. The NRUs' joint R&D collaborations were investigated through co-publications retrieved from the ISI database. We found that most of the UICs were from firms in low-tech and medium-low tech sectors such as food and agriculture. The NRU project was successful in creating and sustaining the collaboration between the NRUs and the firms in low-tech to medium-low tech sectors. However, in the case of the high tech sector, the NRU project only strengthened the existing collaborations. Although the findings confirmed the expanding cooperation in a wider range of firms in a broad range of industries related to the Thai government's strategic plans, a number of UICs were from a few large incumbents, not from SMEs as the policy makers expected. Therefore, policy makers and NRUs should use a proactive strategy to promote collaboration with firms from high tech industries and also sustain the collaboration within the other sectors.

ME-09.2 [R] Association Rules in Innovative Technology Collaboration

Irem Duzdar; Istanbul Arel University, Turkey
Gulgun Kayakutlu; Istanbul Technical University, Turkey
Bahar Sennaroglu; Marmara University, Turkey

SMEs are motivated to collaborate for research and innovation in order to survive in global competition. Recent studies showed that using advanced communication and information technologies will improve innovative collaboration among the SMEs. In a competitive environment, technology based SMEs need to constitute successful collaborations for sustainability. Randomly chosen collaborators have shown failures that caused the fear to become an obstacle. Failures are mainly faced by the lack of innovation culture and the wrong collaboration type. Technoparks are the main field of research of high technology business catalyzing the innovation. Different units in technoparks may emerge perceptible competences and productive businesses. The most effective players of regional innovation are innovation stimulating institutions. This study aims to define and validate the association rules for success for collaborations in the techno parks. A survey is run on more than 110 SMEs at four techno parks in Turkey. Statistical analysis and machine learning methods are applied to define the association rules for success. Rules achieved by applying the logistic regression are cross validated with the rules detected by applying support vector machine.

The validated collaboration rules extracted as a result of the study will support strategic decisions for innovative technology collaboration.

ME-10 Enterprise Management
Monday, 8/3/2015, 16:00 - 17:30
Room: Forum Suite
Chair(s) Dilek Cetindamar; Sabanci University

ME-10.1 [R] Factors for Successfully Integrating Operational and Information Technologies

Anastasia M Kuusk; University of South Australia, Australia
Jing Gao; University of South Australia, Australia

Technology, organization and people factors influence the success of technology integration. This paper explores recent research findings of integration of operational technology (OT) and information technology (IT) in organizations with a primary function of managing assets. The main differences between the two technologies are that one is attached to assets and governs real time asset control and performance data, the other has static information and is traditionally used to make decisions. Understanding the factors for integrating the technologies is important because if organizations can leverage understanding of the influencing people, process and technology factors on the phases of integration of OT and IT, organizations can improve asset performance and control and therefore influence the consumption, cost, maintenance and consistent, reliable, secure provision of critical services such as energy and water. Integration theory applicability may be extended to the asset management environment and provide practitioners with a holistic, end to end, integrated framework to guide the efficient integration of OT and IT. The paper explores the integration phases, influencing factors and challenges such as the role of information governance, security and reliability decision rights identified in survey and case study research with asset management practitioners. The research concludes by suggesting a validated holistic framework for integrating OT and IT in asset management oriented organizations.

ME-10.2 [R] Loss-Aversion in R&D Investment Propensity Responding to Profitability

Joon Kim; Hanyang University, Korea, South
Hokyoung Ryu; Hanyang University, Korea, South

R&D investment strategy is important for the growth of an enterprise's profit. However, there is always a trade-off between short-term profits and R&D expenditure for the firm's decision-making. In this decision-making, R&D investment by an enterprise is considered as a combination between the "genotype" of the industry that the enterprise belongs to and the "phenotype" of the enterprise that has been acquired from its past investment experiences. In short, the enterprises tend to carry out their routine R&D investment, but in some cases, the same enterprises might reveal a phenotypical pattern in response to the decline of the profitability, which results in "loss aversion." In this study, the financial statements of 1,592 enterprises were analyzed by their R&D investments strategy, finding that the loss aversion differently appears responding to the short-term profitability, and different R&D investment patterns were observed according to the type of industry and the lasting period of the profitability.

ME-10.3 [R] Rain is the Best Blessing During Severe Drought: A Venture Capital Study of Bangladesh

Md Zakir H Khan; Tongji University, China
Song Chen; Tongji University, China

Traditional financial institutions such as banks are very customary and strict in Bangladesh and require collaterals almost double the size of requested loans. The banking system does not prefer to bank on uncertainties. Non-government organizations and the capital market in Bangladesh also face systematic problems in catering to financial needs of local industries. As a result, young new entrepreneurs lack access to capital and other resources to convert potential business ideas into products and services, causing Bangladesh no participation in the global economy. Based on the current financing problems faced by small and medium enterprises (SMEs) in Bangladesh, this paper uses three active pioneer venture capital (VC) firms in Bangladesh and successful projects were financed by a VC company as research samples. Through secondary data collection analysis, this paper draws a conclusion that Bangladeshi authorities might recognize the importance of the VC industry as a means of supporting the development of high-tech ventures with innovative technology and marketable products, bringing finance and technology together, raising the overall technological level of traditional industries, and promoting economic progress through technological advancements. So the government might introduce and support the VC industry to develop as a significant mechanism for encouraging scientific and technological capabilities.

ME-11 ICT Mgmt 3
Monday, 8/3/2015, 16:00 - 17:30
Room: Executive Suite
Chair(s) Scott W Cunningham; Delft University of Technology

ME-11.1 [R] How the Usage of Mobile Multimedia Internet Devices Changes Internet TV Consumer Behaviors in Taiwan: Using PPS.tv (PPStream) as an Example

Mavis Tsai; Shih Hsin University, Taiwan
YiFang Lin; Shih Hsin University, Taiwan

With the rapid progress of internet technology, the manner in which the audience watches videos via traditional TV could differ when watching internet TV. In addition, with the unbounded capabilities for sharing information and for being online anywhere, the mobile multimedia internet device (MMID), that is, a device such as the smart phone or tablet, is technologically taking the world by storm. The MMID offer a different way for audiences to watch videos and TV programs, and the audience is no longer bound to the TV set or computer. PPS.tv (PPStream/PPS TV) is a Chinese peer-to-peer streaming video network software and now it has a MMID Apps version. The majority of PPS.tv channels are from East Asia, primarily Mainland China, Taiwan, Japan and Singapore. This study aims to investigate how these technological changes and other factors impact consumers' TV-watching behaviors. The researchers launched an online survey to gather data from 659 PPS Taiwanese internet TV (PPStream and PPS App) users to analyze their behaviors in viewing TV programs or videos, and how the usage of MMID changes their Internet TV watching behaviors.

ME-11.2 [R] Emerging Revenue Model Structure for Mobile Industry: The Case for Traditional and OTT Service Providers in Sub-Sahara

Unathi Mahola; University of Pretoria, South Africa
Louwrence D Erasmus; Council for Scientific and Industrial Research, South Africa

With the emergence of internet-based service providers, known as Over-the-top (OTT), the business landscape has changed massively, hence the current traditional service provider's business models are transforming. The question treated in this paper is: "What are the emerging or revised revenue models that an operator must adopt to deal with OTT service providers in Sub-Saharan Africa?" Utilizing literature reviews around organization business models, revenue models, and value networks components, a conceptual framework is presented which includes price, payment, offering, services and the market structures as part of the components of the framework. Two rounds of Delphi studies were conducted to evaluate the proposed framework. The conclusion is that network operators can no longer ignore the presence of OTT. There is a change in dominance of the revenue model between the existing and impending revenue models due to OTT presence, with advertisements and revenue-share agreements possibly being the revenue models in the future. This is a shift from the current transactions- and subscription-based revenue models used by operators. Furthermore, donations and commissions-based models remain to be the least applied mobile operator revenue models.

ME-11.3 [R] An Analysis about Internet Communication Competence for Science and Technology in China

Dan Wu; China Research Inst. for Science Popularization, China
Qi Zhong; China Research Inst. for Science Popularization, China
Ying Xu; Changchun Science and Technology Daily, China
Lihui Wang; China Research Inst. for Science Popularization, China

The rapid development of the Internet provides a more convenient, effective platform for science and technology communication. In recent years, many websites in China have played an important role for science and technology communication, and promote the popularization of science and technology. But at the same time, there are some problems inevitably in the process of development. How to objectively evaluate the current Internet communication competence for science and technology is the important content of this paper. The paper consists of five parts: the first part is to introduce the current development situation of the Internet for science and technology communication, and outline the architecture of the Internet for science and technology communication; the second part is to establish the index evaluation system from quantitative and qualitative aspects on the basis of the characteristics of the Internet; the third part is according to the data of typical examples obtained by monitoring, to analyze the Internet communication competence for science and technology through the index system; the forth part draws some conclusions; the last part gives relevant suggestions..

TA-00 PLENARY - 2

DATE: TUESDAY, 8/4/2015
TIME: 08:30 - 10:00
ROOM: PAVILION
CHAIR(S): KIYOSHI NIWA; PROFESSOR EMERITUS, THE UNIVERSITY OF TOKYO

TA-00.1 [K] Social Innovation for the Future: New Collaborative Creation for Growth

Shinjiro Iwata; Hitachi, Ltd., Japan

Even in the face of a number of social issues, the global economy's borders are vanishing and continue to grow. The Hitachi Group is committed to the social innovation business and believes that innovation holds the key to solving the issues that face society and to further growth. The Hitachi Group will work to solve the social and administrative issues for our customers. To do this, we will establish a broad partnership that is beyond industry and more into society which will promote a long-term collaborative creation of value. These efforts will help create a better society on a global scale by revolutionizing the services and social infrastructure that support our lives and businesses.

TA-00.2 [K] Forecasting Innovation Pathways: The Case of Big Data

Alan Porter; Georgia Institute of Technology, United States

PICMET's primary mission is to advance analyses of changing technologies to inform technology management. That reflects balancing expert and empirical components to provide effective intelligence. Are managers ready for that? Doubts remain. I'd like to share an example of our group's efforts to "Forecast Innovation Pathways" (FIP) for the case of "Big Data." In tackling such a challenge, we strive to understand the target technology and its attendant "Technology Delivery System" (i.e., contextual factors affecting development of novel applications). We then perform "tech mining" - text analyses of research publication, patent, and contextual abstract records on the topic, retrieved from databases. One aspect of special interest is detecting "emergence." Our process engages various experts and stakeholders to interpret the story of technology development to date. We then work to anticipate promising paths to diverse applications, and attendant issues, potential impacts, and policy/management leverage points. "Big Data" offers an intriguing case. The explosive growth in R&D, business, and diverse popular interests, concurrently, fuels generation of challenging scenarios for technology managers.

TB-01 Innovation Management 4
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Pavilion East
Chair(s) David J Kruger; University of South Africa

TB-01.1 [R] Bibliometric Analysis of the Front-End of Innovation

Glauco S Mendes; Federal University of Sao Carlos, Brazil
Maicon G Oliveira; Federal University of Alfenas, Brazil

The research into the front end of innovation has increased substantially in the last decades. In spite of this, it seems that many studies lack alignment in terms of knowledge building, which results in disconnected lines of research. This fact indicates the need of addressing the state-of-the-art concerning the front-end of the innovation research field, guiding new attempts towards the most important knowledge gaps. Currently, few attempts have been made to provide an overview of this field. This paper presents a bibliometric analysis conducted to describe the evolution of the knowledge structure of the front-end of innovation. It considers a sample of papers published from 1988 to 2014 and indexed in the Web of Science scientific. This sample is used to develop metrics regarding journal publications and investigate collaboration networks, clarifying opportunities for partnerships and supporting the formulation of research policies. As a result, this study provides useful information for new entrants to assimilate the state-of-the-art of the front-end of innovation as well as for experts to consolidate their view of the knowledge structure.

TB-01.2 [A] A Systemic Complex Problem Solving Approach to Process Improvement

David J Kruger; University of South Africa, South Africa

Organizations often discover process improvement implementation crash. Consequently, they are at a loss to explain the reasons for the failure. The team fails to understand processes often function within other systems and sub systems. Therefore, the complexity of the system(s) is not taken into account during process improvements. Process improvement teams often operate under the misunderstanding that there will be order in the process or system being improved. The improvement team is unaware that their actions in a process might influence the system or a sub system negatively. It is as a result that a human that functions in a process, system or sub system can assume many roles or identities. It is imperative the team undertaking the improvements understand the complexity of systems. The team must understand who the customer of the process or system is. Furthermore, an understanding of the actors and transformation process in the process or system is required. The implementation team must take into account the environment in which the process or system operates and who the owner of the process and or system is. The paper attempts, by utilizing a current project, to implement a systemic complex solving approach facilitating improvement.

TB-01.3 [R] The Fuzzy Front End Integration in Packaging Development Management

Lilian C Schreiner; University of Sao Paulo, Brazil
Adriana Marotti; University of Sao Paulo, Brazil
Paulo T Nascimento; University of Sao Paulo, Brazil
Abraham S Yu; University of Sao Paulo, Brazil

The objective of this case study is to describe how the fuzzy front end (FFE) occurs in the packaging industry, how the ideas are selected, and what the information and knowledge activities are. In the packaging creation there is a triadic relationship among companies: consumer goods industry, design agency and packaging producers. This is a complex re-

lationship with explicit information and knowledge interfaces. This case study seeks to understand these unique explicit interfaces, which have new things to be gleaned about the FFE, such as the constituent parties' efforts in order to work in a more integrated manner and through the sharing of more information. Among other things, this study has found that there is integration between the companies and there is shared learning among these companies in the FFE. It was also found that there are different arrangements when defining who does what in the work breakdown. This, in turn, suggests that companies are able to separate clearly the tasks and coordinate results, even in such a fuzzy environment as the FFE of new product development (NPD). If correct, this may be an opportunity that helps one to understand how to remove the inaccuracy from the FFE.

TB-01.4 [A] Arizona State University's EcoCAR3 Development Project

Brian Hennesy; Arizona State University Polytechnic, United States
Jane E Humble; Arizona State University Polytechnic, United States
Abdel Mayyas; Arizona State University Polytechnic, United States

Arizona State University has been selected to participate in an advanced vehicle technology competition, called EcoCAR 3. This competition requires a dedicated student project manager, project management student team, teams of engineering students to develop the next generation environmentally friendly automobile, a team of engineering faculty, and a project management faculty advisor. This three-year vehicle development program includes management of student teams in the areas of vehicle engineering, technological advancement, and innovation. Project management includes developing the overall project timeline, work plan, and tracking all project activities. Our presentation is a summary of the first year development program for EcoCAR 3.

TB-02 Technological Changes
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Pavilion West
Chair(s) Kunio Shirahada; JAIST

TB-02.1 [R] Conceptual Evolution of Technological Regime and Sociotechnical Change: A Theory of Paradigmatic Schools

Jonathan C Ho; Yuan Ze University, Taiwan
Hsin-Wen Liang; Yuan Ze University, Taiwan

This paper studies the conceptual evolution of technological regimes and relates it to the interactive process between technological advancements and social change. Schools of thought on technological regime are identified based on research community, belief, perceived problem, and intent solution which Kuhn used to specify scientific paradigms. Over a time sequence, these schools collectively depict the course of technological regime evolution. By summarizing the scope and underlying dimensions, technological regime plays a role of a selection mechanism for technological changes. Through an extensive literature review and bibliometric analysis, the critical dimensions of technological regime evolution are reported in terms of interaction with technological innovations and social change. The research result provides systematic information for technological and scientific policy-makers to support decisions regarding technology selection and resource allocation.

TB-02.2 [R] Technological Change as Evolving Citation Networks: The Analysis of Proton Exchange Membrane Fuel Cell

John S Liu; National Taiwan Univ of Science and Technology, Taiwan
Louis Lu; Yuan Ze University, Taiwan
Shih-Chang Hung; National Tsing Hua Univeristy, Taiwan
Chia-Chieh Shen; Yuan Ze University, Taiwan
Shuo-Jen Lee; Yuan Ze University, Taiwan

Proton exchange membrane fuel cell (PEMFC) is the dominant fuel cell technology in terms of system shipments. Although the applications of the technology have already been on the market for several years, efforts to improve its performance, cost, and stability continues. There have been around 500 PEMFC research articles published every year recently. As the first step of a longer term effort to systematically detecting technological changes, this study selects PEMFC as the target technology to visualize its technological development and uncovers its recent research fronts. We collect PEMFC research articles from the Web of Science database and establish a citation network using the associated citation information. Main PEMFC development paths are uncovered through key-route main path analysis. The main path results show that modeling is the main focus of PEMFC technology development which evolves from simple to more complicated structures and from static to transient phenomena. The citation network is further separated into groups using the Girvan-Newman edge-betweenness clustering method, which successfully identifies ten groups of articles with strong internal coherence. These groups can be regarded as the research fronts of the technology.

TB-02.3 [R] Methodology for the Integration of Business Model Canvas and Technological Road Map

David Guemes-Castorena; Tecnologico de Monterrey, Mexico
Miguel A Toro; Tecnologico de Monterrey, Mexico

The importance of linking efficiently the outputs of R&D processes with the business world has become evident. Researchers and practitioners have developed tools to help build business from a starting-point (business-idea) to the description of elements that make the business possible. The Business Model Canvas (BMC) identifies the essential parts of a business; it´s applicability and simplicity has given it greater acceptance and dissemination. Furthermore, the Technology Roadmap (TRM) is presented as a valuable tool to visualize the relationships over time among market, technology and product strategies; TRM allows decision makers to identify gaps between the current and the future business strategy. BMC and TRMs have been used independently of each other; BMC allows the modeling of value proposition and TRM allows the planning of the future strategy, but if used together, their synergy helps to construct the value generation and value delivery through time. This paper presents a methodology and an application of the integration of these tools - BMC and TRM - to provide a combined business model and technology roadmap for a business-idea or a new product concept, doing it in a single structured process.

TB-03 NPD 4
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Broadway-1
Chair(s) Hongyi Chen; University of Minnesota

TB-03.1 [R] Linking Product Design and Technology: An Empirical Study on Performance and Experience in Novel Product Development Teams

Tohru Yoshioka-Kobayashi; The University of Tokyo, Japan
Toshiya Watanabe; The University of Tokyo, Japan

Management studies have stressed the importance of adjusting between design teams and other functional teams in product development to achieve qualified products; however, little attention has been paid to the optimal conditions for an effective balance. In particular, the relationship of these teams with research and development (R&D) remains unclear, although it may bring innovative product design. This study focuses on two factors: design experiences and joint work with R&D-experienced members. Using Japanese patent applications and design rights registrations from four major Japanese home electronics manufacturers, we investigated the effect of product design experience on individual design performance based on the fact that experience is a committed knowledge that enhances creativity by providing various inspirations while simultaneously invoking "design fixation." The empirical outcomes show that the breadth of product design experiences of colleagues stimulates creative product designs that generate a high impact for organizations and competitors. They also reveal a design fixation aftermath following the creator's initial design experiences. In addition, a positive but conditional effect of collaboration with R&D-experienced colleagues is discovered. This implies a benefit of involvement for engineers who have deep, but not wide, experience in a specific field. Such negative effects are assumed from "inventing fixation," or a lack of autonomy of design sections within organizations.

TB-03.2 [R] Lean Product Development: Multiple Case Research in Group of Companies

Alvair Silveira Torres Jr.; Universidade de Sao Paulo , Brazil
Ana A Torres; Federal University of ABC, Sao Paulo State, Brazil

The article studied the application of lean development in five Brazilian companies of different businesses - aeronautics, wind power, steel, oil, casting - through the action research method and as a result, has five standard deployment steps that are linked with the lean development tools. The conclusion is that the roadmap built along with practitioners of companies has the capacity to be validated as a general model of deployment.

TB-03.3 [A] The Impact of Platforms in Product Development: A Case Study in the Brazilian Software Industry

Ana Lucia F Facin; University of Sao Paulo, Brazil
Mauro M Spinola; University of Sao Paulo, Brazil
Leonardo A de Vasconcelos Gomes; University of Sao Paulo, Brazil

The role of product platforms within companies and in mediating the activities of business conglomerates or ecosystems has been widely recognized as being of great importance to the management processes of new businesses, to the development of new products, and to innovation. The objective of the present work is to help in the understanding of what the benefits found by Brazilian software companies are in the use of platforms for software development and associated services. Firstly, an analysis of the evolution of the scientific research on the concept of "platform" was carried out. A bibliometric methodology was employed for a quantitative analysis and identification of the most relevant references, and a subsequent qualitative content analysis allowed establishing an analysis model that supported the case study. Analyzing a leading Brazilian company in the national market of software production, the benefits gained by this company, which uses a platform as the basis of its products, were observed to go beyond the improvement of its capacity to produce software efficiently, also allowing the construction of a business model that stimulates external suppliers to develop solutions that complement the company's product portfolio.

TB-03.4 [R] Through Open Innovation Conceptual Model Exploring the Relationship between Patent and the Key Technology of Smart Battery

James K Chen; Asia University, Taiwan
Shu-Ching Lai ; Asia University, Taiwan

Energy savings and carbon reduction issues have become key themes in green studies nowadays. The battery is a core power of the electric vehicle. Due to the development of the battery, technology from a single function changed to multiple-function that provides a main power for electronic vehicle which was called smart battery. This study aim on through Open Innovation (OI) to explore the relationship between patent and the key technology of Smart Battery. Open Innovation was introduced by Chesbrough in 2003, then that the theory concept has been widely used in industry's research and academic fields. This study is based on Open Innovation theory to find out the key technology of Smart Battery. The data was collected from domestic and foreign academic journals, and new technology reports. In addition, this research focuses on applied patents of smart battery of advanced countries. Eventually, this study uses cross-comparison method to do analysis in discovering the relationship between patent and key technology, and proposes the key technology module of Smart Battery. Finally, the study provides useful information for industry, government, and research institutes to develop the technology of smart battery.

TB-04 Decision Making 2
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Broadway-2
Chair(s) Nasir J Sheikh; State University of New York

TB-04.1 [R] Dissent and Games as a Consideration in Decision Making: Case of Solar Photovoltaic Technologies

Nasir J Sheikh; State University of New York, Korea, South

Research in decision modeling has mainly focused on the ranking of alternative choices based on a consensus or combined judgments of experts and decision makers. However, a decision model can also be used to form the basis of rational conflict and dissent. This is a novel approach. This paper examines the case of a hierarchical decision model that is used to assess alternative solar photovoltaic (PV) technologies under multiple perspectives. The perspectives include: social, technical, economic, environmental, and political. Dissent is evident if only one dominant perspective is considered to evaluate the alternate PV technologies. By using such a decision modeling approach we are able to observe outcomes for both consensus and dissent scenarios. In recent times game theory is defined as the science of interactive decision making. We can also consider a more general definition of game theory as a field of strategic decision making utilizing mathematical models that represent rational decision-makers for conflict and cooperation. This study could be developed further to form a basis of game theory with a large number of players and preferences.

TB-04.2 [R] Technology Assessment of Waste Disposal Technologies for Tillamook County

Jing Jiang; Biamp Systems, United States
Abhishek Jain; Portland State University, United States
Jonathan Lui; Portland State University, United States
Jorge L Garcia; Portland State University, United States
Standley Limarta; Portland State University, United States

We propose a two-level filter system to evaluate the potential for alternative waste management practices by conversion of locally generated waste products such as animal mortality, manure, and wood waste into beneficial products such as energy in Tillamook county of Oregon. At the first level - coarse grained filter, three basic factors, technical readiness level (TRL), scaling capacity, and feedstock, are used to initially filter out the scanned technologies which can be potentially used in waste management. At the secondary level filter - fine grained filter, a numeric scoring model is created to evaluate technologies from the output of the first level filter. Since many factors will impact the selection of a technology, HDM (hierarchical decision model) is used to score technologies. From technical, economic, social, and environmental perspectives, a hierarchical multi-criteria factor structure is created, and constant-sum and pair-wise comparison are used to subjectively create the priority probability list about technologies. Composting technology, rendering technology, and hydrolysis are analyzed in detail. This developed alternative strategy will help to mitigate local liabilities, promote green jobs, develop clean energy, and reduce the carbon footprint in Tillamook County.

TB-04.3 [R] Improving Long-Term Strategic Planning: An Analysis of STEEPLE Factors Identified in Environmental Scanning Brainstorms

Elliott G More; University of Cambridge, United Kingdom
David Probert; University of Cambridge, United Kingdom
Rob Phaal; University of Cambridge, United Kingdom

Given that an understanding of factors that drive change in a firm's external environment is an important element of strategy development, some form of environmental scan to identify factors tends to be included. This paper presents findings from an analysis of environmental scans conducted by 76 manufacturing firms. Firm's senior decision makers brainstormed factors using the standard STEEPLE framework to prompt participants to consider social, technological, economic, ethical, political, legal, and environmental factors. The first finding reveals that participants' perspectives are dominated by events rather than trends. When the 886 responses were categorized as events, trends, requirements or uncertainties, over 70% of responses related to events. This finding is significant for advocates of systems thinking in strategy, and in addition the finding may provide quantitative evidence of cognitive bias in scanning. Second, the brainstorms were found to vary significantly across two key dimensions: the breadth of factors identified within STEEPLE categories, and the number of factors identified in the most distant future time-period. Four brainstorm archetypes are suggested, and while the validity of the archetypes is subject to ongoing research work, the finding could aid workshop facilitators to tailor their approach to future scans.

TB-04.4 [R] Project Ranking Using Partial Ranks

Jiali Ju; Portland State University, United States
Pei Zhang; Portland State University, United States
Timothy Anderson; Portland State University, United States

A competition was recently held for new elder care technologies, and a method was needed for selecting an audience favorite project. Since each of the eight projects received a half hour presentation time slot spread out over a full day, attendance varied significantly with morning projects having a much lower attendance. An algorithm was desired that was robust with respect to varying evaluators. A new algorithm for aggregating ranks from a large number of incomplete judgments was developed and applied to the projects to select a winner. This paper presents the new algorithm, tests the new approach against others in the application, and discusses relative tradeoffs.

TB-05 Emerging Technologies 1
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Broadway-3
Chair(s) Robert Harmon; Portland State University

TB-05.1 [R] Smart Cities and the Internet of Things

Robert R Harmon; Portland State University, United States
Enrique G Castro-Leon; Intel Corporation, United States
Sandhiprakash Bhide; Intel Corporation, United States

The smart city concept represents a compelling platform for IT-enabled service innovation. It offers a view of the city where service providers use information technologies to engage with citizens to create more effective urban organizations and systems that can improve the quality of life. The emerging Internet of Things (IoT) model is foundational to the development of smart cities. Integrated cloud-oriented architecture of networks, software, sensors, human interfaces, and data analytics are essential for value creation. IoT smart-connected products and the services they provision will become essential for the future development of smart cities. This paper will explore the smart city concept and propose a strategy development model for the implementation of IoT systems in a smart city context.

TB-05.2 [R] Assessing the Effectiveness of Big Data Initiatives

Nayem Rahman; Portland State University, United States
Fahad Aldhaban; Portland State University, United States

There is a great enthusiasm with the prospect of big data among business and industry leaders, academia and researchers. A lot of big data tools and technologies have emerged recently to capture, store, process and analyze big data. One remarkable achievement is that a handful of open source technologies have been introduced by Apache Hadoop Foundation that allow any organization to undertake big data projects. Many big data projects have been implemented during the last few years. This paper explores the benefits achieved with those projects. Big data has been applied in diverse fields including scientific and medical discovery projects, studying social science phenomena, conducting meaningful observations of real-world phenomena and running analytics for healthcare and business. Many business organizations want to find new business opportunities such as fraud detection, customer sensitivity analysis, and new product offerings, while some other business organizations are still pondering the long term value of big data investments. Business leaders and managers want to be sure that big data projects can deliver true value and provide long term benefits. This paper provides an account of how recent big data project initiatives have been successful in delivering business value and highlights what technology solutions are primarily used by those big data projects.

TB-05.3 [R] Forecasting of Demand for New Technology Using Data on Analogies: The Case of Long-Term Evolution Mobile Telecommunications in Taiwan

Fang-Mei Tseng; Yuan Ze University, Taiwan
Tzu-Chun Lin; Yuan Ze University, Taiwan

Reliable pre-launch forecasting of a new product plays an important part in helping companies to make investment decisions, allocate resources, and minimize risks. However, the creation of such forecasts is difficult and challenging because historical sales data are lacking. A popular approach to solve this problem is to use data from analogous products. However, the accuracy of this method depends on the set of similar products used for the analogies and their weights, and a more objective weighting method would be an improvement. Therefore, we developed a new integrated demand forecasting method that combines similarity analysis and the Bass model, which we used in an analytic hierarchy process (AHP) model to appropriately weight the forecasting results from the diffusion model of analogies. We illustrate the applicability of this forecasting method by simulating future Long-Term Evolution (LTE) 4G mobile communication subscribers in Taiwan.

TB-06 Global Issues 1
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Broadway-4
Chair(s) Ed Camargo; National Chin-Yi University of Technology

TB-06.1 [A] Global Deployment of Japan's Infrastructure Systems

Takashi Iwamoto; Keio University, Japan
Hidetaka Aoki; Keio University, Japan
Eri Hanao; Keio University, Japan
Fengfeng Yin; Keio University, Japan
Yoshihiko Sakamoto; Keio University, Japan

Technologies and services of Japan's infrastructure systems have the highest levels in the world, but the businesses have been deployed mostly inside Japan. In order to deploy Japan's infrastructure systems globally, the Japanese government came up with a new policy by the name of the Strategy for Export of Infrastructure Systems and started to support Japanese firms. To succeed in the global deployment of Japan's infrastructure systems, there are several key points that Japanese firms should take care of. In this research, case studies of various infrastructure industries were done, and the key points for success were extracted so that Japanese firms will be able to deploy their businesses in the world smoothly. The industries studied include water industry, energy industry, railway industry and commercial aircraft industry. It was found that the major key points would be to have business scales competitive with global firms, to have influence with infrastructure operations by standardization, ruling, negotiation between governments, etc., and to collaborate closely with the Japanese government in sales and finance.

TB-06.2 [R] A Pilot Study on the Internationalization of Taiwanese Agri-biotech SMEs: A Technology-Organization-Environment (TOE) Perspective

Ed Camargo; National Chin-Yi University of Technology, Taiwan
Min-Ying Wang; National Chin-Yi University of Technology, Taiwan

Biotechnology will play a vital role in the overall technological development of the 21st century. Given the rapid speed of globalization coupled with the continuous development of communication technology, small- to medium-sized enterprises (SMEs) in a variety of high-tech industries in many countries, such as the agriculture biotechnology (agri-biotech) industry in Taiwan, now have a clear path to internationalization. This work is a preliminary attempt to identify key drivers and their relationships in order for Taiwanese agri-biotech SMEs to better understand their internationalization prospects. To do so, the Technology-Organization-Environment (TOE) framework was used as a theoretical basis to first specify the key drivers, and second to assess the factors that compose the value of internationalization. This study utilized a survey approach to collect data from Taiwanese agri-biotech SMEs. To test hypothesized relationships, a Partial Least Squaring (PLS) tool was employed. The results of the analyzed data show that organizational factors have the biggest impact on the value of internationalization, followed by technology and environmental factors, which surprisingly had an insignificant influence. These results indicate that by placing a priority on having a global scope, developing adequate financial resources, and improving marketing capability, SMEs can improve their readiness for internationalization. This study

contributes in a more practical sense to an understanding by SMEs of where their efforts should be placed in order to be more effective in their international endeavors, and to the government in developing policies that promote the organizational growth and development of its agri-biotech SMEs.

TB-06.3 [R] Exploring Influence of R&D Investment, Import and Export Performances to Patent Value

Chuan-Wei Kuo; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

Patent valuation has been an important research topic in a globalized knowledge economy where intangible assets and internationalization play crucial roles. The objective of this study is to understand how the two factors, which are 1) intangible assets: patenting activities and R&D investment, 2) tangible goods: international import and export, influence patent value. More specifically, several patent information, e.g., Number of Patent, Number of Inventors, Number of Patent Citation Received, charge and payment for the use of patent (from USPTO and World Bank), reflecting intangible asset, together with US import and export data (from UN-COMTRADE) reflecting globalized tangible goods are employed to test if the selected data have any explanatory power in estimating patent value. The results show that the correlation is positive and the explanatory power can be confirmed.

TB-07 Tech Assessment & Evaluation 1
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Studio Suite
Chair(s) Steven D Eppinger; MIT

TB-07.1 [R] Technological Feasibility and Cultural Acceptability Study of Solar Power Systems for Microwave Assisted Sandstone Artisanal Mining

John Francis J Agwa-Ejon; University of Johannesburg, South Africa
Antoine F Mulaba-Bafubiandi; University of Johannesburg, South Africa
Jan-Harm Pretorius; University of Johannesburg, South Africa

This paper investigates the technical feasibility of microwave assisted artisanal mining in the production of Sandstone from QwaQwa in South Africa. It further discusses the cultural acceptability by the rural community of the synergetic application of the emerging technology (microwave energy) and the renewable resource (solar). Sandstone in QwaQwa, Free State is artisanally mined using chisels and hammers. This form of mining is extensively laborious and is normally accompanied by numerous casualties. The paper demonstrates the existence and the possible utilization of alternative methods including emerging technologies which are more productive, efficient, effective and sustainable. The solar energy systems are used to trigger the microwave magnetron which results into high energy microwave dosage. The dosage causes differential or selective heating on the rocks which culminate into rock breaking along the interfacial grain boundaries between the different constituting minerals. The data used in the analysis was collected by administering questionnaires to the artisanal mining community in QwaQwa and from observations made on site as well as desk top information obtained from secondary sources. The paper contributes to knowledge by drawing on the solar energy systems to generate the dosage required to trigger the microwave magnetron used to facilitate a more efficient and economical artisanal mining of sandstones. In conclusion the paper recommends to policy makers the application of microwave energy in mineral artisanal mining and processing instead of the manual chisel and hammer currently being utilized country wide. It then gives a detailed analysis of the technical, scheduling and economic analysis of the sandstone artisanal mining in QwaQwa.

TB-07.2 [R] Technology Readiness Levels at 40: A Study of State-of-the-Art Use, Challenges, and Opportunities

Alison Olechowski; Massachusetts Institute of Technology, United States
Steven D Eppinger; MIT, United States
Nitin Joglekar; Boston University, United States

The technology readiness level (TRL) scale was introduced by NASA in the 1970s as a tool for assessing the maturity of technologies during complex system development. TRL data have been used to make multi-million dollar technology management decisions in programs such as NASA's Mars Curiosity Rover. This scale is now a de facto standard used for technology assessment and oversight in many industries, from power systems to consumer electronics. Low TRLs have been associated with significantly reduced timeliness and increased costs across a portfolio of US Department of Defense programs. However, anecdotal evidence raises concerns about many of the practices related to TRLs. We study TRL implementations based on semi-structured interviews with employees from seven different organizations and examine documentation collected from industry standards and organizational guidelines related to technology development and demonstration. Our findings consist of 15 challenges observed in TRL implementations that fall into three different categories: system complexity, planning and review, and validity of assessment. We explore research opportunities for these challenges and posit that addressing these opportunities, either singly or in groups, could improve decision processes and performance outcomes in complex engineering projects.

TB-07.3 [R] Assessing Emerging Automotive Technologies for the Future

Aurobindh Kalathil Puthanpura; Portland State University, United States
Rafaa Khalifa; Portland State University, United States
Leong Chan; Portland State University, United States

A scenario-based multi-attribute decision-making (MADM) methodology has been developed and applied for the selection of automotive technology. The present study discusses what the problems for the current automotive technologies are and what requirements are outlined in the literature and government guidelines/publications, considering different aspects of technological needs, public needs, policy measures, etc. A set of criteria are developed, which cover multiple perspectives; reflecting the diverse stakeholders in the technology assessment, acquisition and adoption, in this case the government, the general public which includes drivers and pedestrians, automobile manufacturers. Three emerging technologies (Vehicle-to-Vehicle communication, Vehicle-to-Infrastructure and Full autonomous) were identified and evaluated based on the mentioned criteria using Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), a multi criteria decision tool. Since the technologies are still being developed and some are barely emerging, it is considered appropriate to use speculative values from the publications from industry and other credible sources and consider multiple scenarios, each of which could occur. In our case, we considered 9 main scenarios and evaluated the three technology candidates under each of them.

TB-08 TM in Energy 2
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Directors Suite
Chair(s) Tugrul U Daim; Portland State University

TB-08.1[A] Interactive Energy Demand, Production and Usage Optimization in Manufacturing

Meltem Kunt; Istanbul Technical University, Turkey
Gulgun Kayakutlu; Istanbul Technical University, Turkey
Baris Selcuk; Bahcecehir University, Turkey

Renewable energy resources and improvements in energy generation and usage are critical policies of energy dependent countries. A 2012 BP report states that 48 percent of both electricity and natural gas consumption is realized by industrial usage. In developing countries, manufacturing sites are increasing at least 4 percent a year. Cogeneration is a good solution for the efficiency improvement since it reduces costs about 30-50 percent compared to the individual usages. In the whole globe, only 9 percent of the energy demand is responded to by cogeneration systems. One of the barriers of cogeneration implementation is the visionary difference among the production groups and the energy management groups. Research states that defining requirements per turbine and planning the load capacity provide incremental benefits. Energy generation plans for trading energy with the grid

allow further economic advantages. This paper is one of the rare studies on integrating the energy load plans and the production plans. The combined plans can be updated interactively either by the energy management or by the manufacturing sites. The proposed mixed integer-programming (MIP) model allows using scenarios, which would allow considering energy costs per unit of product. The objective of the study is to reduce energy costs in parallel with the production costs. The proposed system is constructed for the stock-based production type where energy costs have an important share in the operational costs. The system can be used both with a single fuel resource or hybrid renewable resources.

TB-08.2 [R] The Development Trajectory and Technological Innovation Capabilities in the Global Renewable Energy Industry

Ching-Yan Wu; Fu Jen Catholic University, Taiwan
Mei-Chih Hu ; National Tsing Hua University, Taiwan

This study investigates the developmental trajectories of seven renewable energy technologies, namely geothermal, ocean, hydro, solar thermal, photovoltaic, thermal-PV hybrids, and wind energies, as well as the technological innovation capabilities of the global major players and countries. By using a set of patent classifications dedicated for renewable energies, this study identifies and analyzes a total number of 127,705 renewable energy patent grants between 1970 and 2013. The results show that the technological development of renewables evolved as a consequence of, and focused on, solar thermal in the 1980s, but it has extended to photovoltaic in the 2000s. Using the Relative Growth Rate indicator, our results reveal the developmental trends of future renewable energies in relation to R&D concentration in major countries. This study also demonstrates the various technological innovation capabilities of major countries, such as the US, Japan, Germany, China, and Korea in developing the seven above-mentioned renewable energy industries, by means of Relative Patent Position and Revealed Patent Advantage. One of our striking findings is China's astonishing accomplishments in patenting activities in relation to renewable energies, which have surpassed those of Western technologically advanced countries since the year 2000. China is now ranked first in terms of renewable patenting activities, demonstrating China's ambition in leading not only the production power house of the world but also that it is a pioneer in global renewable energy technologies.

TB-08.3 [R] Privatisation of Power Infrastructure in Nigeria: Consumer Perception

Billy A Oluwale; Obafemi Awolowo University, Nigeria
Titilayo O Olaposi; Obafemi Awolowo University, Nigeria
Timothy O Fadare; Power Holding Company of Nigeria, Nigeria
Oluwatoyin S Ayanlade; Obafemi Awolowo University, Nigeria
Gbonjubola O Binuyo; Obafemi Awolowo University, Nigeria

There has been a hot debate both in academia and in the manufacturing sector as to whether the success recorded in the privatization of the Nigerian telecommunication sector can be replicated in the power sector. This paper therefore sets out to determine the consumer perception of the electric power infrastructure in Nigeria. Two sets of questionnaires totaling 500 were administered, the method of administration being by hand delivery. The questions posed were to elicit the perception of electric power consumers in the selected states on the current state of electric power infrastructure, as well as their disposition to the sector being privatized. The results showed that electric power workers and consumers support privatization of the sector and believe it could lead to better service delivery, with the former recording a greater percentage of non-supporters. Their fear is premised on fear of job loss, underpayment of severance package, and inadequacy of remuneration from new owners. The study recommends that the government should go ahead with her privatization of the electric power sector as the move enjoys the support of electricity consumers. However, policies should be crafted to regulate the operation of the sector to cater for consumers' and employees' interests.

TB-09 Collaborations for TM 4
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Council Suite
Chair(s) Nazrul Islam; University of Abertay Dundee

TB-09.1 [R] Industry-Academia Linkages in a High Tech Research Field

Sercan Ozcan; Bahcesehir University, Turkey
Nazrul Islam; University of Abertay Dundee, United Kingdom

Currently, academic researchers' focus started changing towards protecting IP rights and to transferring them into industrial actors. Accordingly, it is argued that an academic's basic research focus started shifting towards applied research as it is essential for the radical inventions to be introduced in a competitive market. This research seeks to understand industry-academia linkages in a high tech field such as nano-crystals. In regards to supporting the technology transfer process within or cross country, this study illustrates the technology development trends and actors' engagement; nano-crystals technology and their interconnections; and maps the organizational (industry-academia) linkages that enhance the commercialization of radical inventions. The results show that the industry-academia linkages that appeared as decentralized structure are more stable compared to other linkage types. Korean and Japanese organizations present such stable linkages. The linkages are even stronger when they appear as a mono-linkage type. Chinese organizations show a great illustration of such an effective mono-linkage of co-inventorships in high tech research fields. The organizations in the US maintain international linkages.

TB-09.2 [R] Challenges of R&D Institutions for Technology Collaboration with Alliances in an Emerging Economy

Kusumaphorn Sompong; NECTEC, Thailand
Kalaya Udomvitid; NECTEC, Thailand

This paper proposes the key challenges that can be used to improve a partner collaboration between an R&D institution and industrial alliances. The focus group and in-depth interviews were adopted as exploratory means to extract insights and perspective of technology collaboration with alliances in the light emitting diode industry in Thailand, an emerging economy context. The findings show that catching up opportunity and practical collaboration are the big challenges for taking R&D alliances appropriately. We then investigated how each key challenge determined the aspects in practice influences decision-making on partnership. It is demonstrated framework that R&D institutions and policies should take into consideration these challenges of alliance collaboration for growth economy.

TB-09.3 [A] Promoting Services Using Public Data of Science and Technology

Do Bum Chung; KISTI, Korea, South
Sung Uk Park; KISTI, Korea, South
Eun Jin Kim; KISTI, Korea, South

An open data policy to open up public data on the private sector is emerging around the world. South Korea has also presented a "government 3.0" policy with its part as a major policy challenge. However, the "government 3.0" examples of science and technology are relatively lacking, compared to other sectors. This study clearly understands the concept of "government 3.0," and the departmental service best practices are highlighted to explain the "government 3.0" implementation. In particular, we propose the practices of Korea Institute of Science and Technology Information (KISTI) in order to facilitate services of science and technology. This study will do much for promoting services of science and technology, and then people will be able to experience the "government 3.0" performance.

TB-10 Educational Issues 1
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Forum Suite
Chair(s) Kem Ramdass; University of South Africa

TB-10.1 [R] Leadership Challenges: A Higher Education Perspective

Kem Ramdass; University of South Africa, South Africa

Institutions of higher learning in South Africa have undergone minor as well as major changes in their core business and have applied different modes of transformational strategies to deal with the changing environment. There are problems in terms of public funding, student demographics are changing, and the marketplace is expanding in response to a technological society. Through continuous restructuring, employer-employee relations are affected as loyalty to one employer is no longer possible. Public trust in higher education is decreasing as more graduates are unemployed. In view of these challenges, universities need to adapt and be open to change. There needs to be strong, capable leadership that drives the core function of teaching and learning in this dynamic environment. In view of the diverse demographic profile of the South African workforce, both white and blue collar workers, it is perceived that each individual takes care of their own interests. With diminishing levels of trust among peers, and the escalation of costs, South Africa needs to adapt to these drastic changes to survive the global landscape as international private institutions infiltrate the higher education market. The objectives of the paper are to highlight some of the challenges experienced by staff and to emphasize that managers need professional development in management and leadership qualities in academia in order to improve relationships. It is important to note that without effective leadership, the possibility of improvement in teaching and learning is limited. Secondary literature surveys were conducted to outline the qualities that need to be instilled in a diversified society such as South Africa.

TB-10.2 [R] Student Reflections on Teaching, Learning and the Workplace at a University in South Africa

Kem Ramdass; University of South Africa, South Africa

The declining number of students enrolling for a qualification in clothing management was evident at a university in South Africa. Higher education institutions experienced difficulties in recruiting students for textile and clothing manufacturing programs due to a negative public perception of the industry. This has brought with it the need to revise the Clothing Management program in order to keep abreast with the changes in the industry and to align the program to meet the regional demand for graduates. Work integrated learning aims to incorporate academic study from a theoretical perspective to practical application, therefore infusing a reflexive component of knowledge, skills and attributes that employers value. It provides an opportunity for students to reflect on what is being learnt in their respective fields and use the work integrated learning aspect to reflect on the application of theory to practice. The fashion production program (previously known as clothing management program) implemented in 2013 after a rigorous re-curriculation process has enabled students to be exposed to industry in all years of study, thereby breaking the work integrated learning (WIL) aspect into the three years of study (previously 6 months in the 3rd year). The objective of this paper is to highlight the experiences of students in relation to their teaching, learning and experiential learning. Quantitative and qualitative data was gathered through a series of questionnaires over a four-year period and analyzed to determine students' experiences in relation to teaching, learning and the workplace.

TB-10.3 [R] How Much Do They Know? A Survey of the Foundational Knowledge of Incoming Technology Management Undergraduates

Guy H Downs; Eastern Michigan University, United States
Dorothy K McAllen; Eastern Michigan University, United States

As technology management continues to evolve as an academic discipline, it becomes increasingly important for educators to determine an incoming student's foundational knowledge. This study examined the results from 149 surveys distributed to incoming students in an undergraduate technology management program to determine what technology management related strengths and competencies they identify themselves as possessing. The study also looked for correlations between the results of these self-assessments and key variables (i.e., age, gender). The results indicated that students felt most confident in their understanding of technology project management and least confident in understanding quality management. An ANCOVA was used to identify whether age or gender had a statistically significant relationship with the results from the self-assessment. The analysis resulted in two statistically significant relationships: (1) the relationship between gender and the assessment/evaluation of technology, and (2) the relationship between age and strategic management of technology. The results of this study did not provide evidence to explain these relationships; however, it uncovered outcomes indicating a future line of inquiry focusing on age, gender, and curriculum design.

TB-10.4 [R] A Study on Chinese High School Students' Attitudes towards Science & Technology

Xiuju Li; China Research Inst. for Science Popularization, China
Ling Chen; China Research Inst. for Science Popularization , China
Hui-Liang Zhang; China Research Inst. for Science Popularization, China
Lihui Wang; China Research Inst. for Science Popularization, China

The investigation of students' attitudes towards science and technology has been a substantive feature of the work of the science education research community for the past 30 to 40 years. In order to investigate Chinese students' attitudes towards science and technology, we conducted a survey of high school students' attitudes towards science and technology through the instruments from PISA science 2006. The instruments include four parts: students' interest in science and technology; students' attitudes about general science and technology; students' attitudes towards science careers; students who participated in science related activities. The samples of this survey are 6356, valid are 6238, which are from 20 high schools in four provinces across China. The findings of this survey are: (1) respondents are much interested in science and technology; (2) 57.6% of respondents would like to pursue science related careers, 67.8% of respondents would like to study science after high school; and (4) most of the respondents are positive to science and technology. This paper also gives some suggestions for cultivating students' attitudes towards science.

TB-11 Environmental Issues
Tuesday, 8/4/2015, 10:30 - 12:00
Room: Executive Suite
Chair(s) Dilek Cetindamar; Sabanci University

TB-11.1 [R] Analysis of the Impact of Internationalization on Management for Sustainability and Business Performance

Clandia M Gomes; Santa Maria Federal University, Brazil
Isak Kruglianskas; Sao Paulo University, Brazil
Jordana M Kneipp; Santa Maria Federal University, Brazil
Roberto Bichetti; Santa Maria Federal University, Brazil
Beatriz Maffini Gomes; Santa Maria Federal University, Brazil

The study aimed at analyzing the use of management for sustainability and business performance, according to the international presence of companies in the mining sector. The descriptive and quantitative research was conducted through a survey carried out on member companies of the Brazilian Mining Institute. The results showed that, in general, the behavior of companies is different with regard to the use of management for sustainability and business performance according to their international presence, supporting the study's core hypothesis.

TB-11.2 [R] Predicting the Technological Paths in Automotive Industry and the Environmental Impacts of Electrification of Automotive Industry in Selected OECD Countries

Matti Karvonen; Lappeenranta University of Technology, Finland
Kimmo Klemola; Lappeenranta University of Technology, Finland
Samira Ranaei; Lappeenranta University of Technology, Finland
Tuomo Kassi; Lappeenranta University of Technology, Finland

First, this paper reviews the literature of technology competition in car industry. Secondly, technology forecasting method used in this study utilized retrieved patent data to define the technological life cycles of battery electric vehicle technology. Thirdly, life cycle assessment (LCA) is made for six selected OECD countries (Estonia, Finland, France, Iceland, Israel and

Norway) in order to compare the environmental impacts of internal combustion engine and electric vehicle technologies with widely different electricity generation mixes. For cars, the life cycle assessment considers the environmental impact throughout the entire life cycle, from raw material extraction and acquisition, through energy and material production and manufacturing, to use and end-of-life treatment and final disposal. For fuels and electricity, the whole life cycle from cradle to gate is considered. The results show significant differences in the environmental impacts between the countries. In addition to analyzing industrial dynamics and environmental impacts, we also provide policy recommendations for how a government's policy can support the transition towards more sustainable automobile transportation.

TB-11.3 [A] Recycling Networks Of Cooking Oil Waste: Experiences From Brazil, Canada And South Africa

Mauro S Ruiz; Nove de Julho University - Uninove, Brazil
Rosicler B de Oliveira; Instituto Triangulo de Desenv. Sustentavel, Brazil
Aldo Struffaldi; Ecoleo, Brazil
Marcelo L Dias da Silva Gabriel; Universidade Nove de Julho - Uninove, Brazil
Ana C de Faria; Universidade Nove de Julho - Uninove, Brazil
Evandro Bocatto; MacEwan University, Canada

The recycling of used cooking oil is gaining importance in some countries due to both the increasing generation of this waste and the growing awareness of the environmental impacts of the inadequate disposal of this material. Lately, the growing demand for biodiesel seems to be motivating new forms of organizations of the players engaged in the supply chain of the used cooking oil. Collectors, nongovernmental organizations (NGOs), ecopoints, civil society organizations of public interest (CSOPIs), public and private partnerships (PPPs), and companies are organizing themselves into recycling networks to improve collection, recycling and disposal of that oil. This study aims to analyze how cooking oil recycling networks are being organized in Brazil, Canada and South Africa as well as to compare their practices in these countries. The research is both qualitative and exploratory in nature and is being developed through multiple case studies in Brazilian, Canadian and South African networks. Data were collected via multiple sources of evidence, such as direct observation, document analysis and semi-structured interviews. As a result, similarities and differences among the practices of these three countries were collated with the literature review findings in order to support the conclusions.

TD-01 Innovation Management 5
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Pavilion East
Chair(s) Nathasit Gerdsri; Mahidol University

TD-01.1 [R] Modeling Innovative Search Processes with PR Landscapes

J. Richard Harrison; University of Texas at Dallas, United States
Alf Steinar Saetre; Norwegian University of Science and Technology, Norway

This paper develops and analyzes a stylized simulation model of the process of innovation, with emphasis on the differences in outcomes for innovation strategies having a high tolerance for ambiguity and those with a low tolerance. The model is implemented in the context of new product development (NPD). The market value of potential products is represented by the height of a PR landscape, where P is the number of peaks and R is the ruggedness or narrowness of the peaks on the landscape. Innovation teams search the landscape for the best product concepts, but can observe only noisy estimates of the value of a landscape position. At each point, teams consider possible interpretations of their observations in determining their next move. Teams also incur costs during the search process. Teams with a high tolerance for ambiguity, as opposed to those with a low tolerance, are likely to take larger steps across the landscape and to move to new locations more quickly. Since high and low tolerance for ambiguity can be associated with tendencies for exploration and exploitation, we then turn to the consideration of the decomposition of exploration and exploitation into search depth and search breadth or scope.

TD-01.2 [R] Innovation Design from an Evolutionary Perspective: Explaining Evolutionary Traps in the Competitive Mobile Phone Market

Sangyub Han; Hanyang University, Korea, South
Hokyoung Ryu; Hanyang University, Korea, South

Evolutionary traps have been frequently observed in the natural ecological setting. This is a phenomenon of the maladaptive choice of organisms when it comes to choosing the wrong or poor habitat though they do not have such level of fitness. The same conception can be applied to a firm's market choice, and a case study of the mobile phone manufacturing industry has been described in this article. Also, compared were a few important conceptions relating to evolutionary traps such as Henderson & Clark's architectural innovation and competence trap in the technology management literature.

TD-01.3 [R] Customer Relationship Management and Innovation as Performance Drivers

Hsin-Hui 'Sunny' Hu; Ming Chuan University, Taiwan
Hsin-Yi Hu; National Cheng-Chi University, Taiwan
Haragopal Parsa; University of Denver, United States

Good customer relationship management (CRM) between service firms and customers not only retains customers but also encourages them to provide important suggestions for improving products and service. Service firms have been described as facing a dilemma between serving customers for short term financial profits or for enhancing long term position by creating customers through the development of unique and differentiated products. The effectiveness and efficiency of CRM are increasingly recognized as means for developing innovation and providing a lasting competitive advantage. This study first examines the direct effects of CRM on service firm's innovation. The effects of CRM and innovation on both organizational financial and non-financial performances are further investigated. This study integrates the CRM association with innovation and organizational performance. The conceptual model and hypothesized relationships were tested using data collected from restaurants in Taiwan involving 203 valid responses. A structural equation analysis was used to test the hypothesized model. Current results demonstrate customer relationship management is positively related to product innovation, managerial innovation, and marketing innovation. Service firm's managerial innovation has significant impacts on organizational performance. Customer relationship management does have significant influence on organizational performance.

TD-01.4 [R] Proposed Steps to Analyze Organizational Characteristics and Develop a Roadmap for Being an Innovative Organization

Norawat Chutivongse; Mahidol University, Thailand
Nathasit Gerdsri; Mahidol Univeristy, Thailand

Innovation has become a key driver for an organization to promote sustainable organizational competitiveness in a business competition. The purpose of this paper is to propose the approach to help the management of an organization to identify the areas needed for improvement based on the difference between the current status and organizational targets. The strategic gaps are used to facilitate the management team of any organization to set and implement the proper strategic directions for leading their organization to become an innovative organization.

TD-02 Commercialization of Tech 1
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Pavilion West
Chair(s) Michael D Santoro; Lehigh University

TD-02.1 [R] Assimilating External Knowledge: A Look at University-Industry Alliances

Michael D Santoro; Lehigh University, United States
Shanthi Gopalakrishnan; New Jersey Institutute of Technology, United States

Expanding on the notion that absorptive capacity is a multi-dimensional construct, we elaborate on a pivotal component of absorptive capacity, assimilating external knowledge (AEK), by examining the extent to which certain key internal and external factors are related to AEK and whether the type of knowledge (tacit knowledge versus explicit knowledge) moderates these relationships. Using survey questionnaire data from senior executives in firms collaborating with university research centers, our focus in this study was AEK in the way of the firm advancing new products, new processes, and improvements to existing products and processes. Our results show that a more technologically uncertain external environment is positively associated with AEK, and firm age is associated with AEK in a curvilinear, inverted U-shape fashion such that as firms mature, they assimilate external knowledge better up to a certain point when diminishing returns come into play. We also found tacit knowledge and explicit knowledge moderate these relationships in different ways. Our findings can help managers develop strategies to maximize AEK to increase innovation, shorten technology development time, and reduce R&D costs. We also inform managers and policy-makers on the value of university-industry alliances for driving innovation and advancing new technologies. We conclude with additional implications for future theory development, empirical research and management practice.

TD-02.2 [R] Benefiting from External Knowledge: Commercialization Capability as a Moderator

Bou-Wen Lin; National Tsing Hua University, Taiwan
Chung-Jen Chen; National Taiwan University, Taiwan
Yi-Ching Wu; Chihlee Institute of Technology, Taiwan

Although more knowledge might be better for a firm, not all technological knowledge can create and realize economic value. Firms must commercialize their knowledge or resources. Based on panel data of the bio-pharm industry from 1987 to 2008 by combining USPTO Patent Assignment, NEBR, SDC, and Compustat database, 96 US-based technology public firms comprised the empirical base for testing the moderating role of commercialization capability on the relationship between external knowledge and firm performance. The results confirm the strategic role of a firm's commercialization capability for its competitive advantage. However, commercialization efforts do not have the same effects on all external knowledge resources. While the interaction effect of partnership-based knowledge and commercialization capability is found to be positive and significant on short-term and long-term performance, the interaction effect of transaction-based knowledge and commercialization capability contributes positively and significantly only to short-term performance. Therefore, a commercialization strategy is contingent on the characteristic of technological knowledge.

TD-02.3 [A] A Mobile and Visual Searcher for Dadaocheng Scenic Spots

Sheng-Chih Chen; National ChengChi Univa

An array of elements such as history, culture, and delicacy can easily attract travelers' attention. In this paper, we attempt to design a mobile and visual search platform to help tourists understand these elements easily. Our target area is Dadaocheng, which is a well-known destination in Taiwan. We focus on local shops and design customized signboards for their digital marketing, cultural and creativity value-adding services. In addition, these signboards can serve as user's search target. The platform of our design provides search engine services with a monitoring mechanism at the server. Each query image is captured by the mobile phone's camera, and search results on time and accuracy are recorded on the monitoring platform. This research focuses on the performance of visual search accuracy under ordinary circumstances. The overall process can be completed in one second. Current experimental results indicate that recognition rate can reach 88 percent.

TD-03 **NPD 5**
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Broadway-1
Chair(s) Tugrul U Daim; Portland State University

TD-03.1 [R] Organizational Context Variables to be Considered in the Design of Rewards System Oriented to Product Innovation

Roberto Marx; University of Sao Paulo, Brazil
Joao Paulo F Soares; University of Sao Paulo, Brazil

This paper aims to contribute to the existing body of knowledge regarding the organizational context variables to be considered in designing a rewards system geared towards fostering innovation in products at organizations. Based on the existing literature, a preliminary reference chart is created using context variables and their implications for the design at issue, specifically: organizational strategy, type of innovation to be encouraged, beliefs and cultural traits of the company, and previously established systems of goals and rewards. Field research is then done using qualitative interviews with five specialists, consultants and scholars in strategic human resource management and in rewards systems, as well as by using case studies of four large-scale industrial companies known for being innovative. The subject researched showed that little knowledge has been accumulated by specialists as well as by designers of rewards systems at organizations operating in Brazil concerning the issue studied. Nevertheless, the four main context variables listed previously were maintained, and the field research permitted a set of analysis that changed relevant aspects of the details of this chart. It is believed that this paper can contribute to close the gap that exists in literature on the design of rewards for innovation.

TD-03.2 [R] Developing Measurement Matrix for Lean Product Design

Amin Sabzivand; University of Minnesota, United States
Hongyi Chen; University of Minnesota, United States

Many companies today are familiar with the concepts of lean enterprise management and have applied the lean philosophy to their product design process. To study the impact of such practices, measurements need to be developed to evaluate the leanness of a company's product design process. An overwhelming amount of literature on lean management and its application to new product development exists. However, most of it focuses on the overall strategies and no consensus definition of lean design exists, not to mention a measurement matrix for lean design practices. In this research, we develop a lean product design measurement matrix based on a comprehensive review of literature on lean product designs. Factors that can be used to assess a company's lean product design practices are identified. The lean design matrix developed in this study will help companies to measure and evaluate their lean design process and, therefore, focus on key elements needing improvement. It will also facilitate research that studies the impact of lean design practices on a company's performance overall and in specific areas.

TD-03.3 [R] Exploring the Design Factors of Smart Glasses

Ali Emre Ok; Izmir Institute of Technology, Turkey
Nuri A Basoglu; Izmir Institute of Technology, Turkey
Tugrul Daim; Portland State University, United States

Advances in information technology (IT) have started to focus studies on human computer interaction (HCI), which is an area in computer science embracing cognitive science. In this approach there are various aspects of research about HCI in order to explore how people design, implement, and use interactive computer systems and how computers affect individuals, organizations, and society. This study represents exploring the adoption factors of smart glasses. The technology adoption process establishes preferences and needs of people who use computers and smart systems. To address this issue, technology adoption is essential for a rapidly changing world where technology has become central to our lives. In that context, user interface (UI), which provides interaction between the user and computer, plays a significant role for the technology adoption process. The purpose of the study is to examine the effects of smart glass design features: stand-alone device, field of view, interaction, price, and display resolution on user preference through an experimental study by using conjoint analysis. In order to apply this study, an experimental study including a survey was designed. This survey also analyzed social characteristics such as self-efficacy, anxiety, involvement, risk- task characteristics, enjoyment, usefulness, ease of use, attitude and intention for user smart glasses interaction.

SESSIONS

TD-04 Decision Making 3
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Broadway-2
Chair(s) Robert R Harmon; Portland State University

TD-04.1 [R] A Study on the Optimal Ratio of R&D Investment

Jungwoo Shin; The University of Texas at Austin, United States
Hongbum Kim; University of Pittsburgh, Korea, South
Eung-Do Kim; Chungbuk National University, Korea, South

Generally, most previous research indicates that increasing investment in research and development (R&D) positively affects economic growth. However, there is limited discussion about the optimal ratio of R&D investment for both the public and private sectors and for each stage of the product development process (basic, application, and development research). Therefore, this study conducted empirical analysis of the optimal ratio of R&D investment based on data from the National Science & Technology Information Service in Korea. Specifically, we estimated the optimal ratio after dividing the R&D process into three stages (basic, application, and development) and dividing funding sources into two sectors (private and public). We assumed a 15.1% ratio of investment in basic R&D (the average ratio from 1982 to 2011) in conducting our analysis. Our results indicate that investment in the application stage of R&D should be increased, but investment in development R&D should be decreased. In addition, R&D investment should be increased in the public sector rather than in the private sector. Based on the results of this study, we can recommend a justifiable direction for government policy on budget allocation.

TD-04.2 [A] Cloud Service Adoption Decision

Gregory Wease; Portland State University, United States
Chih-Jen Yu; Portland State University, Taiwan
Kwasi Boateng; Portland State University, Ghana
Leong Chan; Portland State University, China

Many organizations with an IT infrastructure consisting of a combination of hardware and software look for ways to achieve greater efficiencies, cost-savings associated with maintenance and upkeep, and ease of use, while maintaining a great level of security. The main idea behind this research paper is to better understand the decision-making process with respect to how an IT organization evaluates its needs and chooses between different computer-hosting environments, i.e., public cloud, private cloud, hybrid - combination of public and private cloud, and lastly, an in-house platform, which is hosted internal to the organization and/or via a datacenter. A widely accepted definition of "Cloud Computing" is applications delivered as services over the Internet AND the hardware and systems software in the data centers that provide those services.

TD-05 Emerging Technologies 2
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Broadway-3
Chair(s) Nazrul Islam, University of Abertay Dundee

TD-05.1 [A] Managing Cloud Computing Risks in Financial Services Institutions

Paul Rohmeyer; Stevens Institute of Technology, United States
Tal Ben Zvi; Stevens Institute of Technology, United States

The integration of Cloud Computing with information systems architectures continues to grow at a rapid pace due to the availability of high quality, low cost computing services and organizational efforts to improve efficiency and productivity. Enterprises are increasingly comfortable turning to the Cloud for IT solutions, where teams of dedicated, specialized experts deliver important capabilities and outcomes, instead of investing in the development of internal architectures. While data and systems security concerns remain, for many firms the economic arguments are so compelling in favor of Cloud deployments that adoption tends to proceed regardless of security and assurance worries. As a result, enterprise IT functions find themselves managing an array of risk issues in an environment of diminished transparency and with limited opportunities to directly treat observed risks. The mechanisms for managing technology risks associated with Cloud models differ from traditional approaches taken to control risk in internal architectures. This paper examines emerging threats in Cloud Computing within a financial services organization. This includes consideration of insider threats, data leakage, insecure software, and new Cloud attack patterns. The nature and characteristics of the threats are explained and the paper explores the risk treatment options chosen by the sample organization. The authors' observations are synthesized in a general model that describes Cloud Risks and Controls for financial services institutions.

TD-05.2 [R] Evolution of Emerging iPS Cell-Based Therapies for Age-Related Macular Degeneration (AMD)

Alfonso Avila-Robinson; Kyoto University, Japan
Nazrul Islam; University of Abertay Dundee, United Kingdom

Stem cell-based regenerative medicine is poised to revolutionize the way diseases are treated. In recent years, induced pluripotent stem (iPS) cells, a new stem cell species, has attracted significant attention. This paper seeks to understand the pathways along which emerging clinical research efforts in the field of iPS cells is evolved. In particular, the empirical case of age-related macular degeneration (AMD) is used, which is the world-pioneering clinical application of iPS cells. In line with the literature, this study explores the interrelations among three different pathways, such as biomedical scientific understanding, development of medical technologies, and learning in clinical practice. For this, a tech-mining approach is used including co-term, co-citation, and direct citation methods. Scientific publications indexed in the Thomson Reuters' Web of Science and Elsevier's Scopus databases form the basis of the study. This research first explores the iPS cell research landscape through the construction of a co-term map, particularly stressing the location and intensity of disease-tackling efforts, then focuses on the evolution of scientific knowledge on AMD through co-citation networks and the main path algorithm on direct citations. At the researcher level, the development of four different research groups working on cell therapies for AMD is evaluated through the software CitNetExplorer. By integrating these approaches, the result shows a wider picture of the complexities inherent in the translation of knowledge into revolutionary clinical methods.

TD-05.3 [A] Evaluation Thinking in Emerging Technology Dissemination Management: A Case Study on the Gene Technology

Xuan Liu; China Research Inst. for Science Popularization, China
Lihui Wang; China Research Inst. for Science Popularization, China
Nian Zheng; China Research Inst. for Science Popularization, China

The rapid development of an emerging technology promotes the development of society and the economy. But due to the limited understanding of an emerging technology, it is inevitable to exaggerate its role in the process of dissemination and application of a new technology, and may even lead to various negative effects. Taking gene technology as a typical case, this paper introduces both the positive and negative effects of application gene technology. The authors proposed to embed evaluation thinking in the dissemination and application of gene technology in order to better guide the decision makers, scientists and the public to make good use of gene technology, which is a "double-edged sword," and then to promote the healthy development of gene technology. Besides literature research, a series of face-to-face interviews at the typical gene technology corporation were conducted during this study, and the qualitative analysis method is applied during the research.

TD-05.4 [R] Financial Analysis and Comparison of Compact Electric and Gasoline Cars

Jing Jiang; Biamp Systems, United States
Alexander Blank; Portland State University, United States
Felix Maier; Portland State University, United States
Anjan Bharthepudi; Portland state University, United States

Pramod Kumar; Portland State University, United States

In the paper, a PESTLE (political, economic, social, technical, legal, and environmental) analysis is used to conduct an initial evaluation for electric vehicles (EV) and gasoline cars. Furthermore, two cash flow models are created to describe the scenarios of both gasoline and electric car respectively. Based upon the proposed models, the equivalent uniform annual cost (EUAC) methodology is used to calculate the cost during the period of car ownership. Four compact EVs and five compact gasoline cars are selected in the analysis. The results expose that the actual return of federal tax credit impacts the EUAC value. The 50% return of tax credit will cause that the gasoline car is the winner during ownership. A EUAC sensitivity analysis against gasoline prices and different return of tax credit is also performed. Our work can help individuals to create some sort of economic awareness on buying EVs or gasoline cars.

TD-07 Tech Assessment & Evaluation 2
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Studio Suite
Chair(s) Steven D Eppinger; MIT

TD-07.1 [R] Technological Competences: Identifying, Describing and Exploiting

Guenther Schuh; RWTH Aachen University, Germany
Julius von Mangoldt; Fraunhofer Institute for Production Technology, Germany
Toni Drescher; Fraunhofer Institute for Production Technology, Germany

Technological competences are the success-determining factors for the competitiveness of every technology-oriented company. Identifying, fostering and exploiting technological competences are amongst the crucial activities within technology management in order to strengthen the market position of a company in the long term. New market opportunities for future company growth have to be identified and evaluated against the background of a company's own competence profile. However, companies find it difficult to identify, evaluate and consistently describe their technological competences due to a lack of methodology. As a result, decision makers often struggle to derive their superior technological competences and to search for promising new markets suitable for the company's unique technological expertise. The identification and selection of a diversification alternative is therefore often done without a systematic and profound decision basis. In this paper, the authors introduce an approach to identify and systematically describe technological competences. This is done by presenting a description syntax for the consistent description of technological competences. The development of the syntax is performed by using a deductive approach on the basis of existing literature, theories and models. The syntax enables companies to consistently describe their technological competences. The paper furthermore includes a case study of a recent consultancy project in the industry performed by Fraunhofer IPT.

TD-07.2 [R] How to Analyze Technology Life Cycle from the Perspective of Patent Characteristics?

Pei-Chun Lee; Taiwan Research Institute, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

There has been a good deal of studies investigating technology life cycle by measuring patent activity indicators, especially patent applications. As for the four main stages of the technology life cycle, there is consensus on the interpretation of technology evolution depicted as an S-shaped curve. For measuring market value of a patent, there have been a lot of empirical studies that test patent indicators concerning their appropriability as predictors of monetary patent value. This study aims to observe technology life cycle from the perspective of dynamics of patent characteristics, which are newly proposed as an approach for characterizing technology life cycle in this study. To obtain the objective of this research, DVD technologies which have already experienced four stages of a life cycle, i.e., 1) Introduction, 2) Growth, 3) Maturity, 4) Decline, is selected for analyzing its patent characteristics as a function of different stages in its life cycle. The results obtained in this study can serve as a basis for creating a model for forecasting the size of the potential market in each of the above four stages. The larger numbers of patent reference, non-patent references and foreign reference, which occurred in the Maturity stage and Decline stage, suggest that mature and declined technology encourages patent inventors to cite prior patents in order to seek opportunity for radical and discontinuous technological innovation.

TD-07.3 [R] Investigating Technological Evolution of Mobile Telecommunication Industry by Integrating Dynamic Competitive Analysis and Patent Analysis

Yi Cheng Luo; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

This study investigates the evolution of the technological development and competitive situation of the mobile telecommunication industry by the use of patent analysis from the perspective of dynamic competitive. The four-step framework of the dynamic competitive theory proposed by Chen in 2008 is adapted to investigate the dynamic evolution of eight firms in the mobile telecommunication industry, i.e., Apple, Samsung, Sony, Nokia, Motorola, Ericsson, HTC and BlackBerry. More specifically, important elements in dynamic competitive theory such as actor, responder and industry competitive environment are analyzed by the insights obtained from patenting behaviors and patent characteristics of the eight firms. The results obtained from the research provide several contributions: 1) developing a new approach integrating dynamic competitive indicators and patent analysis; 2) understanding the overall competitive trend of the mobile telecommunication industry; 3) proposing a research approach which allows one to correlate among patent characteristics, technological evolution and dynamic competitive.

TD-08 Technology Planning
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Directors Suite
Chair(s) Kazuo Hatakeyama; UNISOCIESC

TD-08.1 [R] Methodology to Develop a Technological Front Route of Exploration

David Guemes-Castorena; Tecnologico de Monterrey, Mexico
Karina Blando; Tecnologico de Monterrey, Mexico

In today's increasingly global and knowledge-based economy, innovation is a key factor for organizations' competitiveness and growth. Even when different lines of action for innovation can be taken, firms have increasingly sought to create greater value through technological innovation. Central to the subject of technological innovation is the definition of the areas or topics where technological innovation should be developed to compete. These areas are known as technological fronts, which are aligned to the strategy of the organization. This paper proposes a generic methodology to develop a technological front route of exploration. The methodology helps the analysts to increase the knowledge on a technological front by gathering specific information in a step-by-step process. The methodology was validated through the collaboration of experts. The result of the methodology is a set of graphs that helps the decision maker in selecting the projects that will close the technological gaps.

TD-08.2 [R] Initiatives for Multi Cross Industry Innovation: The Case of Universal Home

Alexander Kerl; University of Bremen, Germany
Martin G. Moehrle; University of Bremen, Germany

The development of Multi Cross Industry Innovation as a specific form of cross-industry innovation is more and more important in various industries. Many companies have to face the challenges of recent market trends like the continuous blurring of industry boundaries or the increasing complexity of innovations. One option to deal with these challenges is the cooperation across industry boundaries which can lead to Multi Cross Industry Innovation. In order to further investigate this phenomenon, we pose the following question: How do

Multi Cross Industry Innovation initiatives emerge and what organizational framework supports the cooperation process in a cross industry network environment? Due to this question, we develop an in-depth case study of UNIVERSAL HOME, a German cross-industry network with one single dominant player. In a first step we present the organization model and specific network characteristics before showing how initiatives were formed and/or emerged in the case. Our findings highlight the support of the participating players' top managements and the connection between the different network activities and the innovation activities of the participating companies.

TD-08.3 [R] Knowledge Networks to Improve the Technological Capability in a Solar Energy Enterprise Cluster

Jose C Alvarez; Universidad Peruana de Ciencias Aplicadas, Peru
Kazuo Hatakeyama; UNISOCIESC, Brazil

The sector of renewable energies is studied for the possibilities that offer to take care of the environment and energy saving. In the production areas, it is necessary to understand some topics like the technological capability and absorption capacity to identify the patterns of learning for improving the knowledge generation, innovation and competitiveness. This is applied specifically in the cases of small enterprises that belong to an incipient cluster, in a region with availability of solar energy resources, like Arequipa in the southwest of Peru. In this context a study was developed to identify the technological capability and learning aspects for a solar enterprise cluster acting in Arequipa in Peru. The methodology is the case study, through applying a questionnaire to seven enterprises. The questionnaire was formulated according the theoretical backgrounds regarding this theme. The results of the research are useful for planning the local development through the application of tools such as technological surveillance and technological forecasting, and also for the local technology improvement through the incentive of knowledge networks.

TD-08.4 [R] Production Planning and Control in Small Engineer-to-Order Companies: Understanding Difficulties and Pragmatic Approach

Ruy S Nakayama; Universidade de Sao Paulo - USP, Brazil
Mauro M Spinola; Universidade de Sao Paulo - USP, Brazil

Globalization and advances in information and communication technology (ICT) are changing the business and manufacturing processes. The new model for manufacturing systems, even for mass production industry, is demanding more flexibility and agility in manufacturing installations. Although ICT and automation technology (AT) provide most of these features, the manufacturing installation cannot dismiss physical hardware, which comprises machines, tools and special bespoke devices. In this context, tooling companies produce customized hardware in an engineer-to-order (ETO) environment for these mass production companies. While most mass production companies have improved their efficiency to handle these market demands through ERP systems, tooling companies, characterized by the diversity of products and their small size, seem to find difficulties in adopting these systems, in particular to integrate the planning and control of the shop floor. This research aims to understand how tooling companies are dealing pragmatically with their production planning and control (PPC) and understand their difficulties about the use of ERP systems for production planning. The expected contribution is to give an insight of how tooling companies are dealing with PPC, providing deeper understanding about the needs and difficulties in adapting the lighter ERP systems for PPC in typical ETO/SME companies.

TD-09 **TM Framework**
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Council Suite
Chair(s) Kunio Shirahada; JAIST

TD-09.1 [R] The Great Recession vs. The Great Depression: Lessons Learned? Lessons Lost?

Terry R Schumacher; Delft Technical University, Netherlands

The magnitude and duration of the current economic turmoil, the "Great Recession," has its closest analogy to the Great Depression of the 1930s. Current political and economic debate most often use post-WWII recessions as analogies to offer prognosis for the unfolding situation but rarely examine the Great Depression as a source of understanding. The lack of a definition for economic depression contributes to this inaccurate analogy selection and is discussed as a weakness in economic theory. The literature on Kondratieff or "Long Waves" offers some insight for today. Mensch proposed that cycles in basic innovations drove Long Wave business cycles, and Marchetii produced accurate, 20 year-forecasts of energy prices using this framework. Our economic system continues to evolve, and today it has a substantially different composition than in the 1930s. Deposit insurance, Social Security, and having the world's second largest economy growing at 9% throughout the early years of the Great Recession are all significant differences from the 1930s. The insights that could be drawn from distant historic events are therefore limited, and this paper attempts to articulate implications of such differences.

TD-09.2 [R] Framework for Standardization Programs in the Engineer-To-Order Industry

Jan Vollmar; Siemens AG, Germany
Michael Gepp; Siemens AG, Germany

The Engineer-To-Order business encompasses companies producing a broad range of industrial products. Projects in this business are becoming increasingly complex, both from a technical and a management perspective. In this context, standardization programs have become a common approach to improve competitiveness and profitability of ETO companies. Standardization programs have their origin in the product business, which significantly differs from ETO business, e.g., by the volume produced and the complexity of functional requirements. Nevertheless, the use of standardization programs has increased during the last years. However, there is a methodological deficit for standardization, since approaches and principles which have been proven in product business cannot be easily transferred to ETO business. As a consequence, guidelines describing how standardization programs can be implemented in ETO companies are very scarce. Based on the analysis of six standardization programs, good practices and lessons learned for standardization in the ETO business have been derived, and a framework was developed to support planning and implementation of standardization programs. The framework consists of a procedure model (step-by-step process for implementation), cross-process topics which are important in several process steps (e.g., change management, roles, tools) as well as utilities (e.g., templates, tools, glossaries). The framework provides companies a structured guideline for the planning and implementation of standardization programs in ETO business.

TD-09.3 [R] Evaluation of Self-Service Technology on Household Waste Management in Emerging Countries: A Case of Bangkok, Thailand

Pitchayanin Sukholthaman; JAIST, Japan
Kunio Shirahada; JAIST, Japan

Self-service technologies (SSTs) have been exploited to decrease face-to-face interactions between service recipients and service providers, and to allow accurate and convenient services. Incentives have been adopted as a strategy to draw public attention to participate in waste management activities. With respect to municipal solid waste (MSW), applying the concepts of SSTs and incentives to allow citizens be part of the management system has gained much attention from municipalities. Therefore, this research aims to provoke citizens' attitudes on waste management by letting them put segregated recyclable waste in Automated Eco Machine (AEM), an SST equipped waste bin, to get incentives back as reward. The research studied the possibility of applying AEM in communities of an urban city. In addition, possible amount of collected recyclable waste from AEM was analyzed. By conducting questionnaire survey in Jatujak district, Bangkok, Thailand, the statistical analyses showed that 20.7% of respondents conducted waste segregation. Over 88% were interested in participating in incentive recycling activities, and cash was the primary preferable incentive. In terms of applying AEM, 86% of respondents agreed that the AEM would increase management efficiency. Possible amount of collected recyclable waste by using AEM would be about 10 - 30% of total waste generation at source.

TD-10 Educational Issues 2
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Forum Suite
Chair(s) Kem Ramdass; University of South Africa

TD-10.1 [R] Exploring the Challenges and Opportunities for Higher Education Institutions: Work Domain Analysis and Development of Strategic Options

Simon P Philbin; Imperial College London, United Kingdom

This paper provides an exploration of the challenges faced by higher education institutions (HEIs) in the United Kingdom in the context of reductions in the level of public funding along with increased competition both on a national and international level. This competitive landscape has been reviewed through analysis of supporting data and information in order to identify the underlying trends impacting HEIs as well as the emerging opportunities especially in the context of research, technology development and industrial engagement. An extensive literature review has been carried out and was used as the basis for work domain analysis involving a structured process methodology to capture the domain specific drivers that contribute to academic strategy development especially relating to science and engineering areas. Subsequently, strategic options for operating in this landscape have been synthesized according to the research, education and knowledge exchange capabilities of HEIs. This strategy development includes discussion of a number of practitioner-oriented strategic options that may be adopted by HEIs to support the establishment of leading organizational capabilities, contribute to financial sustainability and deliver value for key stakeholders.

TD-10.2 [R] Framework Assessment for Costs of Poor Quality in Higher Education Processes

Mukondeleli G Kanakana; Tshwane University of Technology, South Africa
Ben Van Wyk; Tshwane University of Technology, South Africa
Jan-Harm C Pretorius; University of Johannesburg, South Africa

Higher education quality costs are escalating daily and the cost of poor quality is becoming excessive. The higher education department has indicated that inefficiencies within the higher education environment are affecting the performance and the return of investments. This research uses 2011 and 2012 records retrieved on the Industrial Engineering department from the Management Information System unit of Tshwane University of Technology, Pretoria, South Africa. It focuses on how cost of poor quality can be categorized within the higher education environment, and identifies methods which can be used to minimize these costs with the purpose of improving the performance and return of investments. The paper established the cost of poor quality for the department using the teaching input grant, teaching output grant, research output grant, and institutional factor grants, teaching input unit, student's full credit load, and among other factors. The results of this research indicated that USD94,3166.24 and USD933,431.92 were lost for the year 2011 and 2012, respectively, on just one department and affirmed that failure cost and preventative costs are the main costs associated with higher education inefficiencies and shortfalls. Thus, application of lean enterprise or lean six sigma tools is recommended to salvage the situation.

TD-10.3 [R] An Analysis of Relationship of Exercise and Creativity of College Age Generation in Taiwan: Creativity Evaluation for Future Technological Environment

Yao-Jen Liu; Shih Hsin University, Taiwan

Innovation is a critical element of competitive advantage of industries, no matter the visual design of product creation or business model innovation. The college-age generation is a major human resource supply for any cooperate in the next decade, and high-creativity students mean high development possibilities for any company in the future. Taiwan has had a good reputation for high quality and high productivity in high-tech industries for several decades, and has invested much more resources not only in government but also universities and industries to develop creation capability in the young generation for future competition in the world. A paradigm shift from manufacturing service-driven to creation-driven has been the national economic policy since the late 1990s: industrial designs, services innovation, and cultural-creativity industries are some well-developed fields. This paper is based on a research project funded by the National Science Council of Taiwan, and the research goal is to find out the relationship between exercise habits and creativity in the college-age generation, and to develop a creativity evaluation model for a creation-driven human resource development program.

TD-11 Entrepreneurship 1
Tuesday, 8/4/2015, 14:00 - 15:30
Room: Executive Suite
Chair(s) Charles M Weber; Portland State University

TD-11.1 [R] Entrepreneurial Self-Efficacy and Temporal Construal Effects in Identifying Nascent Technology Entrepreneurs

Cory Hallam; The University of Texas at San Antonio , United States
Gianluca Zanella; University of Texas at San Antonio, United States
Alberto Dorantes; Tec de Monterrey, Queretaro, Mexico
Cesar Cardenas; Tec de Monterrey, Queretaro, Mexico

This research focuses on measuring the effect of perceived self-efficacy on entrepreneurial intent in university students as a precursor input to new tech start-ups that drive technology-based economic development. Entrepreneurial intent is defined as the voluntary conscious intentionality to create a new firm. We look at the impact of cultural context and distance in time (temporal construal) on that intent. The perceived self-efficacy refers to people's beliefs about their capabilities to control the performance of their own behavior. Temporal construal is the distance in time between the present and the point at which the subject intends to undertake entrepreneurial activity. Our study analyzes the influence of self-efficacy and temporal construal on entrepreneurial intent using the categorical variable of college major to validate our methodology. We surveyed 967 undergraduate business and engineering students from three countries (Mexico, Spain, and US) over a five-year period. Our findings show that the temporal construal has a major effect on student entrepreneurial intent. Furthermore, the perceived self-efficacy correlates more strongly with short-term intent, consistent across cultural and disciplinary boundaries. It is potentially a key consideration for future studies aimed at identifying and developing nascent technology entrepreneurs within the student populations.

TD-11.2 [A] A Study of the U.S. Intrastate Crowdfunding Exemptions

Ahmed Bohliqa; Portland State University, United States

The enactment of intrastate crowdfunding exemptions around the United States has built up a lot of excitement. Crowdfunding became a popular phenomenon in the past 15 years for art and design projects. Crowdfunding companies only allowed raising money by receiving donations or loans without giving funders any security interests in the project's company. This is because any potential economic return could turn the transaction into a securities offering subject to the costly federal and state laws and regulations. Nonetheless, crowdfunding has been effective in enabling new innovations and ideas bloom. Intrastate securities crowdfunding might prove to be one of the most rewarding and game changing financial movements in the United States. It will strengthen the local economy represented by small businesses and help launch innovative new startups. However, its unique position between non-securities-based crowdfunding and private equity investments introduces complexity that must be mitigated before rewards can be harnessed. The paper analyzes this complexity by breaking it down into advantages and disadvantages. Each potential advantage and disadvantage is discussed and recommendations are made. Recommendations will be found useful for technology managers, technology entrepreneurs, organizations and agencies that plan to provide technical business services to entrepreneurs and small businesses, as well as advocates and regulators.

TD-11.3 [R] Research on Partner Selection Mechanism of Technological Standard Alliance: From the Perspective of Network Embeddedness

Jing Hu; China Jiliang University, China
Yueyi Zhang; China Jiliang University, China
Xinghua Fang; China Jiliag University, China

Under the background of networking, enterprises obtain such alliance resources as technology and knowledge in technical standard alliance and gain constant competitive advantages by means of "embedding." Partner selection has become a significant factor and key step in the successful operation of technical standard alliance. However, there will be, due to "paradox" in relational embedding, certain deviation in analyzing the impact of partnership on alliance without due consideration of the organization's resources and the environment it is in. Therefore, it is possible to resolve the mystery of "paradox" in network by including network embedding into the analysis framework to examine the member relationship in technical standard alliance. In line with the logical order of "selection of alliance partner -context of network embedding -technical standard alliance performance," influencing factors and functional mechanism of a partner's selection in technical standard alliance are analyzed and the impact of alliance partnership on standard alliance performance is explored in the paper. First, the partnership selection model is established for technical standard alliance based in the context of network embedding by such means as literature research, exploratory case study and social network analysis. Second, the essential factors of partner selection are identified, and the path of partner selection affecting technical standard alliance performance by using Structural Equation Model. At last, the paper makes targeted recommendations so as to help both increase operational efficiency of standards alliance and decrease cooperation risk of enterprises in alliance.

TE-01 Innovation Management 6
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Pavilion East
Chair(s) Nasir J Sheikh; State University of New York

TE-01.1 [R] Innovation Strategy of 'Global Niche Top Companies': Comparison Study of Japanese and German Companies

Masanori Namba; Ritsumeikan Asia Pacific University, Japan

Nowadays, among small- and medium-sized enterprises (SMEs), there is a group of companies which can maintain the top position in a global specific market for years. We define them as "global niche top companies." The purpose of this paper is to clarify the innovation strategy of global niche top companies starting from their establishment to the current global top position based on the viewpoint of technology management, focusing on innovation creation and appropriability of innovation. The methodology of the study is a comparison study of interview-based case studies targeted to top management or executives. We will approach this theme from micro comparison in corporate level point of view and also macro approach in national innovation system point of view.

TE-01.2 [R] Bringing Your Customers to the Lab: Barriers and Facilitators for Consumer Coinnovation

Jose Albors-Garrigos; Univ. Pol. Valencia, Spain

Co-innovation in the consumer sector has not attracted a great deal of academic attention. Some experiences and research have been published on this subject, some in relation to sports equipment or leisure goods. Researchers studying new concepts, such as creative consumers, have examined this aspect. Along these lines, living labs have presented another paradigm attempting to approach science and technology for the public from an ethnographic point of view. The so-called paradigm of co-innovation with customers has a number of barriers to overcome such as customer segmentation, motivation, and communication, capture of customers' needs, and interaction and involvement of consumers with product development processes, and so on. However, some authors have proposed certain enablers to facilitate this, such as meaningful work, risk-taking culture, strong customer orientation, agile decision making, business intelligence, open communication, empowerment, learning organization, and so on. Another phenomenon that can help in understanding this issue is crowdsourcing, though this may cause some controversy. It is defined as "the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call." The basis of crowdsourcing relies on the wisdom of the crowd. Although it has been defined in the context of Web 2.0, progressively, its application has been extended to other contexts. In our context, it may be considered a form of integrating consumers in processes of value creation. We will base this article on a case study, a sort of heterodox and successful experience launched by Mercadona, a leading merchandise retailer in Spain. Mercadona's system, which they dubbed "Apron strategy," consists of bringing consumers to innovation labs and asking them to analyze, in a suitable context, how they use the firm's products and what suggestions they have for alternative uses or improvements. The firm started this initiative in 2011 with an initial budget of six million euros. Since then, more than 9,000 customers have been involved in the firm's labs, which are set up to resemble areas of a real food retail store combined with a home setting. These labs, which are located adjacent to their grocery stores, cover various areas such as personal hygiene, cleaning, and home maintenance, breakfast and lunches, and so on. The labs are monitored by dedicated employees. In 2014, this initiative resulted in more than 100 product improvements of which 30 could be considered new to the market products.

TE-01.3 [R] Comparing the Innovation Strategies of Asian and European Wind Turbine Firms through a Patent Lens

Xiuqin Wang; Tsinghua University, China
Yuan Zhou; Tsinghua University, China
Xin Li; Beijing University of Technology, China
Meijuan Pan; Beijing University of Posts and Telecommunications, China

Based on a patent-analysis method, this paper compares the firm-level technology pathways of wind turbine firms across Asia and Europe, and examines the firms' specific innovation strategies that may lead to these pathways being modified in response to any opportunities that may arise. This paper finds that Asian wind turbine firms have different firm-level pathways compared to their European counterparts, whereby they are influenced by different innovation strategies that involve technology foci, learning and R&D collaboration, as well as globalization strategies. Specifically, European wind turbine firms are stronger in most of these strategic dimensions, which enables them to continue to take the lead in terms of technology innovation, while Asian wind turbine firms present a strong learning capacity and customized innovations so that they may challenge European firms in the markets. Based on the analysis, we propose that there might be a limited divergence of the sector-level technological trajectories between Asia and Europe. In addition, we suggest that there is limited opportunity for Asian wind turbine firms to leapfrog with regard to the existing technology trajectories and surpass their European counterparts in the near future. This study will be of interest to policy makers, industrialists, and academics.

TE-02 PANEL: Meet the Editors
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Pavilion West
Panelist(s) Tugrul U Daim; Portland State University
Harm-Jan Steenhuis; Eastern Washington University
Gloria Barczak; Northeastern University
Toni L Doolen; Oregon State University
Scott W Cunningham; Delft University of Technology
Nazrul Islam; University of Abertay Dundee
Charla Griffy-Brown; Pepperdine University - GSBM
Robert Harmon; Portland State University
Dilek Cetindamar; Sabanci University

Meet the editors of Technology Management related journals. The editors will discuss the philosophies, criteria, and submission processes of their journals and answer questions from prospective authors.

TE-03S&T Communication

Tuesday, 8/4/2015, 16:00 - 17:30
Room: Broadway-1
Chair(s) Timothy Anderson; Portland State University

TE-03.1 [R] A Case Study Analysis of Social Organizations Participate in Science Communication in China

Xiaoyan Guo; China Research Inst. for Science Popularization, China
Wei He; China Research Inst. for Science Popularization, China
Chao Zhang; China Research Inst. for Science Popularization, China
Lei Ren; China Research Inst. for Science Popularization, China
Hui-Liang Zhang; China Research Inst. for Science Popularization, China

The research mainly uses the case studies method, the qualitative research method, and the comparison study method to analyze whether social organizations that participate in science communication in China are valid. The study firstly introduces the establishment of the Activity Center in the First Senior High School in Hong he county, Yunnan province. Secondly, the study describes the management and operation mode of the center. Next, the study focuses on whether the Activity Center as a science communication approach is a feasible way, and in this part of the paper, it compares the functional properties of the Activity Center in the case and the general science and technology activity centers in China. The conclusion of the study is that the Activity Center in the case can be used as a carrier for science communication, for it disseminates science knowledge, has a scientific concept, puts emphasis on scientific training methods, and can improve the scientific literacy of students. The research also analyzes the conditions for social organizations involved in science communication. The conditions include establishing interests sharing, investment, motivation and supervision mechanisms to form a multi-win-win situation.

TE-03.2 [R] Research on Construction and Evaluation of the Indicator System for Company Science Popularization Capabilities in Mainland China

He Li; China Research Inst. for Science Popularization, China
XiaoMei Zhang; China Research Inst. for Science Popularization, China
Lihui Wang; China Research Inst. for Science Popularization, China

A company's capability to be involved in science popularization plays a very important role in advancing the nation's innovation capability. Based on the definition of a nation's science popularization capabilities, the company's science popularization's capability is put forward. In addition, the theoretical model and indicator system of a regional company's science popularization capability is also constructed from the perspective of the company's science popularization innovation. Establishment of the four indicators includes investment input and output capabilities for company science popularization, support capability for science popularization, and the diffusion capability for science popularization innovation. The company's science popularization evaluation indicator system has nine secondary indicators, with the data coming from the Statistical Yearbook and a factor analysis method used in order to evaluate the company's science popularization capability in the 31 provinces in mainland China.

TE-03.3 [A] How Can University Patenting Assist Industry Development in the Face of Growing Patent Wars?: The Case of Taiwan

Shihmin Lo; National Chi Nan University, Taiwan

The statistics from Taiwan's Central Bank show that the deficit of international payment balance on intellectual property rights has hit historically high levels, up to 5 billion U.S. dollars in 2011. In 2012, the share of Taiwanese respondents of patent infringement cases in the U.S. International Trade Commission (USITC) has approached 20% of total investigation. Moreover, the 2012-2013 Global Competitiveness Report (GCR) of the World Economic Forum (WEF) indicates that "Insufficient Capacity to Innovate" is the fourth "most problematic factor for doing business" in Taiwan. All those evidences listed above have demonstrated the weakness of Taiwan's innovative capacity which originated from the mindset and the business model of fast replication and mass production, even for patent application. Taiwan has failed to continue its past winning formula in today's innovation-driven, complementarity-centered knowledge economy. No wonder Taiwan lost its position in the market of technology licensing and the battlefield of patent lawsuits. In the face of this uneasy predicament, this research intends to clarify, examine and prepare solutions for the growing patent challenge to Taiwan companies. Patent infringement cases with regard to Taiwanese respondents in USITC, published applications and granted patents in U.S. Patent and Trademark Office (USPTO) of Taiwan's universities will be collected and analyzed. Both datasets will subsequently be sent for technology classification and comparison in order to identify the opportunity of academia-industry collaboration and the gap between two parties.

TE-05 Disruptive Technologies

Tuesday, 8/4/2015, 16:00 - 17:30
Room: Broadway-3
Chair(s) Bharat Rao; New York University

TE-05.1 [R] Model to Design Technology Scanning Architectures for Reaction to Disruptive Technologies: Conceptual Research Design

Guenther Schuh; RWTH Aachen University, Germany
Patrick Kabasci; Fraunhofer Institute for Production Technology IPT, Germany
Toni Drescher; Fraunhofer Institute for Production Technology IPT, Germany
Julius von Mangoldt; Fraunhofer Institute for Production Technology IPT, Germany

Technology scanning is the activity of technology intelligence responsible for finding and evaluating (potentially disruptive) technologies and relevant technological trends from outside a company's core technological competences. In the technology age, disruptive changes happen more often, and affect more industry sectors than before. Companies struggle to allocate and organize their resources for technology scanning according to their specific goals of scanning activities. In this paper, we present a research program on deriving a technology scanning architecture for specific companies which takes their individual goals into account and focuses on enabling the company to react to disruptive changes. The research program presented uses a systemic approach with individual model components derived using a deductive approach and verified using case studies. To drive towards deriving such an architecture for a specific company, we also present a literature review on currently existing research in technology scanning. This review will be focused on building a framework of methods, organizational aspects, cultural aspects, and interfaces between technology scanning and other management functions which have been proposed as building blocks of a reaction to disruptive changes.

TE-05.2 [R] 3D Printing: On Its Historical Evolution and the Implications for Business

Elizabeth Matias; NYU School of Engineering, United States
Bharat Rao; New York University, United States

Additive manufacturing technologies have gained prominence in the recent past, and are increasingly entering the mainstream. Extant research on these technologies is typically focused on the mechanics, and user analysis is largely theoretical. Minimal applied research exists regarding why these technologies transform underlying business models, and how users (both business and consumer) approach them as they consider adoption. In this paper, we briefly describe the historical evolution of additive manufacturing technologies, highlight current 3D printing applications in both the consumer and business markets, and evaluate current skill sets of business users and potential consumers. We identify five factors that may affect users' understanding of 3D printing technologies, thereby influencing users' likelihood of adoption. The results from an exploratory study are then presented.

TE-05.3 [R] Innovation Cascades and the Emergence of the Bio-Economy

Maureen McKelvey; University of Gotteburg, Sweden
Jorge E Niosi; Universite du Quebec a Montreal, Canada

This paper argues that innovation has evolved, from the slow, path dependent, and foreseeable world of technological trajectories, to the less predictable world of innovation

cascades, after incorporating the analysis of radical innovation in the last three decades. Innovation cascades are long series of radical innovations in one particular technological domain. Two types of innovation cascades are distinguished in the paper: those emerging before the Industrial Revolution and the modern high-tech ones. The previous innovation cascades usually petered out fairly soon by lack of institutional support, as the inventor and innovator was an individual or a company trying out its luck through serendipity in a less than friendly environment. Present day innovation cascades benefit from innovating firms, research universities and government laboratories, science, technology and innovation policies, an increasing number of countries investing in R&D and innovation, as well as reduced costs of access to information, communication and transportation. Thus, present day innovation cascades tend to be more extended through time and space. Their systemic effects are probably more widely diffused in global terms. The research paper will include data and a theoretical discussion on the emergence of a bio-economy in OECD countries.

TE-06 Global Issues 2
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Broadway-4
Chair(s) Kunio Shirahada; JAIST

TE-06.1 [A] Museums Pool: A Mobile Application for Museum Network

La-or Kovavisaruch; NECTEC, Thailand
Taweesak Sanpechuda; NECTEC, Thailand
K. Chinda; NECTEC, Thailand
Thitipong Wongsatho; NECTEC, Thailand
Anuwat Chaiwongyen; NECTEC, Thailand
Sodsai Wisadsud; NECTEC, Thailand

In an era of smartphone ubiquity, many museums have developed mobile applications, either for the purpose of providing basic museum information or guiding visitors through museum exhibits. Such applications have been provided in both free and paid formats, and select museums are known to offer multiple applications for one location. From a museum operator's perspective, a smartphone can act as a direct channel between the museum and its visitors; it functions as a means of advertising, informing and guiding the visitor through the experience. However, from the visitors' perspective, it is highly inconvenient to download a new application for each individual visit and delete it afterwards in the interest of smartphone memory. As such, the concept of an integrated app across museums was initiated for the convenience of museum goers. In order to implement this idea, collaboration between museums is necessary. The system design consists of a central database center that it is connected to various museum databases. This allows potential visitors to access information via the central database center without being on museum grounds. The central database collects necessary data from each museum database and displays this on the mobile application, so users can retrieve museum locations, directions, and highlighted exhibitions. When the visitor is located at a participating museum, the mobile application connects to the local museum database to acquire further details such as floor plans, and media items that elaborate on specific displays. Currently, this application includes information from the Science Museum, Information Technology Museum, and Chaosamphraya National Museum. The foremost issue on implementation is the collaboration required from museums to generate content. One solution is to generate sufficient budget to outsource this component of the project. As the application remains within its trial period, we hope to continue to receive more feedback from museum visitors in order to improve the system.

TE-06.2 [R] Challenges in Globalization to Protect Technological Knowledge

Kentaro Umeda; Japan Advanced Institute of Science and Technology, Japan
Kunio Shirahada; Japan Advanced Institute of Science and Technology, Japan

Advanced globalization has led to information sharing among the overseas bases of companies. Technical information should be protected as it is the knowledge asset of companies. Therefore, companies establish general standards within enterprises, and it is necessary for all employees of an organization to act under their regulations and rules. This study was aimed at finding success factors in the global expansion of standards in the overseas business bases of a Japanese manufacturing company consisting of 50 business units and approximately 8,000 employees. We conducted action research from 2014 in a subsidiary company that consisted of eight bases and approximately 1,500 employees in the Asian area. It was important for personnel to recognize values from the results and begin to think of ways of achieving goals. Therefore, managers and employees co-created knowledge to positively visualize shared goals. In addition, we found that the person in charge who held the key to on-site activities had an influence. The international activities of knowledge creation caused employees to act under unified standards in a company, and led to safe and secure innovations in technological knowledge.

TE-07 Technology Acquisition
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Studio Suite
Chair(s) Tom Shott; Portland State University

TE-07.1 [R] Technology Development Tools in Biomimetics Utilizing TRIZ: Biomimetic-TRIZ Matrix

Chaeguk Lim; Dongguk Univ., Korea, South
Inchae Park; Dongguk Univ., Korea, South
Byungun Yoon; Dongguk Univ., Korea, South

The trials of biomimetics using the methods that nature has already used are conducted in various fields to find the solution for technology development. However, there are few studies on the effective methodology that connects the solution of nature to technology development. Previous research assumes that nature is fundamentally different from technologies and divided into biological and technological TRIZ to solve the problem. To solve the limitations of previous research, we made biomimetic-TRIZ, which solves the problem by using only one Contradiction Matrix. Thus, the aim of this research is to overcome the limitations of previous studies and create a biomimetic-TRIZ that meets all the technical and biological points of view in a single Contradiction Matrix. This study utilizes the 40 inventive principles, 39 engineering parameters of TRIZ and cases of biomimetics from the database of AskNature.org. The proposed method suggests both new inventive principles and existing inventive principles from cases of biomimetics and constructs biomimetics-TRIZ to substitute the inventive principle of the TRIZ Contradiction Matrix. The proposed biomimetic-TRIZ will be used as a tool to support the technology development practitioners.

TE-07.2 [A] Synergy Valuation Model

Hairong Karen Gui; Portland State University, United States
Tom Gillpatrick; Portland State University, United States
William Bloom; Portland Community College, United States

As globalization increases, business and capital investments must incorporate the acquired target's intrinsic value, macro scale, industry-related risk & return. There is not (yet) true wisdom or consensus on how to integrate these dimensions. Traditional valuation methods are limited in capturing macro-& industry risk & returns. This paper introduces a new tool - the Synergy Valuation Model ("SVM") - based on the Black-Scholes Option Pricing Model (BSOPM) and the "Real Options" (RO) concept. The BSOPM constitutes a well recognized methodology for valuation of financial options. RO methodology, introduced by Myers in 1977, extended the logic of the BSOPM to non-financial ("real") options. The SVM utilizes the BSOPM's logic and applies its calculation value the option value embedded in the "real" tangible investment versus intangible financial instruments. The SVM reconfigured its variables uniquely to suit in the acquisition valuation. This is particularly applicable in the irreversible investments, such as mergers & acquisitions. The significance of this study are: SVM supplementing traditional valuation methods to enable holistic managerial decision making, particularly in measuring "synergic values" in "Under-invest", "Over-invest", and "Unknown-invest". It is anticipated that the SVM will provide more effective guidance to decision-makers, particularly on how to relate the investments' risk & return with macro- & industry's, and hence how to best deploy capital to maximize business value and sustain

growth.

TE-07.3 [R] Design of a Balanced Scorecard for Automotive Suppliers in the Electromobility Market

Katrin Seeger; FAU Erlangen-Nuremberg, Germany
Florian Steinmann; FAU Erlangen-Nuremberg, Germany
Kai-Ingo Voigt; FAU Erlangen-Nuremberg, Germany
Joachim Blunck; Siemens AG, Germany
Sabine Menzyk; Siemens AG, Germany
Michael Gepp; Siemens AG, Germany

Environmental sustainability plays an important role for future mobility and thereby for car manufacturers and their suppliers. Regarding the increasing focus on renewable energy and on an efficient use of energy, electromobility is seen as a solution for energy and environmental challenges. Many countries want to increase the share of electric cars and have set themselves ambitious targets. Car manufacturers are working on the development of drives with experienced companies in the electrical engineering. Regarding the production of electrical drives, the main challenges are creating simple and robust automotive products for a new and very dynamic market environment. In this context manufacturing management ensures the necessary productivity and quality to match the requirements of the automotive industry. In this research paper we analyzed the requirements for a balanced scorecard that can be used within the production of an automotive supplier for electric drives. The work is based on a qualitative analysis of requirements for balanced scorecard. The resulting balanced scorecard consists of three main components: communication and promotion, transparency and information, and control. We identified 22 KPIs to manage and control the production of electric car drives.

TE-08 Quality Management
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Directors Suite
Chair(s) David Kruger; UNISA

TE-08.1 [A] Developing and Improving Quality Efficiency in the South African Energy Industry

Andre Vermeulen; Unversity of Johannesburg, South Africa
Jan-Harm C Pretorius; University of Johannesburg, South Africa
Vinny Motjoadi; University Johannesburg, South Africa
David Kruger; UNISA, South Africa

Businesses today need to be more effective and efficient in order to design the best products and provide outstanding services to their customers. The purpose of this research is to develop and improve quality efficiency while sustaining continuous improvement at a South African energy provider's Mpumalanga plant, which is one of the nine regions in South Africa. Accomplishing quality efficiency is challenging, as customers expect quality of service at all times. In general, an organization's or a business's success depends on the reliability of delivering electricity. Therefore, the South African energy provider should be able and capable to deliver electricity at all times. Current research results revealed that: (1) organizations need to do more to raise quality awareness and inform other employees about the quality unit, (2) organizations should go the extra mile in planning, monitoring and evaluating quality, (3) departmental quality objectives and goals should involve employees in formulating the goals and objectives, eliminating misunderstanding and mistakes committed by the workforce where quality is concerned, (4) management should be committed and involved in accomplishing quality efficiency in any capacity and making sure that continuous improvement is sustained, and (5) commitment by management and employee recognition will improve capability, performance and innovation. The research study accordingly has a realistic and methodological significance in terms of achieving and improving quality efficiency and sustaining continuous improvement in providing energy in South Africa.

TE-08.2 [R] Evaluating Quality of Service in the Hotel Website with Intuitionistic Fuzzy PROMETHEE II Approach

Gino K Yang; Hungkuang University, Taiwan
Kuo-Chen Hung; Hungkuang University, Taiwan

Website quality will affect the willingness and subsequent behavior of consumers to use the website. But the timeliness and convenience cannot meet consumer demand which much hotel information provided in the website, and cannot enhance consumers browsing and residence time to achieve the aim for enhancing the willingness to buy. Especially in the globalizing competition era, to face the multi-demand of customers, the hotel industry does not have a consistent standard way for assessing website quality and characteristics, and then it is unable to reflect the different customer behaviors and deeper feelings and thoughts. In this project we present an in-depth understanding of customer behavior patterns as a starting point, and try to measure the exclusive hotel architecture website service quality mode, and utilize multi-criteria decision making structure of PROMETHEE approach to assess. To the unavoidable subjective judgments, we will combine the Intuitionistic fuzzy sets and PROMETHEE methods to develop an assessment procedure method of intuitionistic fuzzy PROMETHEE. And in order to provide customers with a more intimate and satisfied service quality, we hope to establish a set of detailed guidelines for assessing the quality of the website in the increasingly important hotel industry.

TE-09 Technology Transfer
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Council Suite
Chair(s) Ichiro Sakata; The University of Tokyo

TE-09.1 [R] Understanding Technological Dynamics of Knowledge Influence between University and Industry

Tzu-Ying Lee; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

To increase the effectiveness of a national innovation system, the linkage between university and industry, as the two important stakeholders, should be enhanced to motivate national level innovation. The objective of this study is to exam the linkage between university and industry by the use of patent citation. The dynamics of influences from university to industry or from industry to university are both analyzed. Also, the influence which varies as a function of industrial type is also investigated. It is observed that the influence from university to industry is increasing, but the influence from industry to university is decreasing. The results obtained in this study can be served as evidence to evaluate how effective knowledge influence can be between university and industry.

TE-09.2 [R] Serendipitous Identification of Fields Derived from Technology Spillovers from Patent Analysis: Case Study of Material Science

Hajime Sasaki; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan
Yuya Kajikawa; Tokyo Institute of Technology, Japan

Some R&D projects generated from technological seeds produce potential applications in other fields. In many industries, huge amounts of public investment are spent continuously over long periods. Advanced technology with high levels of technology are required and achieved. Even in cases with projects that apparently failed, technological and economical spinoff effects are expected from collaterally and often serendipitously developed technologies. A few empirical studies have assessed the extent of serendipitous technological spinoffs quantitatively. This report presents a proposed methodology for predicting technological fields that have plausible and diverse applications in other industries using bibliometrics and network analyses of patent publications. The dataset is extracted from a patent database served by Thomson Reuters. To identify and predict spin-offs will contribute to science and technology policymaking and to the development of potential business partners. We were able to observe the transition of technology transfer between fields with time expanded network. Our results suggest the possibility of using our approach to detect the potential technological and industrial fields where breakthroughs by innovative seeds in

other fields can open new opportunities and directions of development.

TE-09.3 [R] Fuzzy Cognitive Research on Influencing Factors of Technology Innovation: In View of Path Dependence

Jing Hu; China Jiliang University, China
Yong Zhang; China Jiliang University, China
Yilin Wang; Zhongchao Ink Co., Ltd, China

Technology innovation promotes the economic growth of an enterprise. Innovation is not only an adaptive learning and cultural evolvement process but a market error trial process, during which there are a large number of random factors available with obvious unconformity and accumulation. Therefore, there are path dependences during the technology innovation. Based on the path dependence theory, this paper aims to establish a technology innovation evaluation frame and emphasize the important influence effects of path dependence factors on the enterprise technology innovation. The fuzzy cognitive map method is thereby used to identify causal relations among factors and describe the FCM structural diagram for evaluation on the enterprise technology innovation. Meanwhile, a fuzzy feedback system of technology innovation evaluations is hereby established integrating with non-linear Hebbian learning algorithm, and the dependence on expert opinions may be avoided through learning and practice of the cognitive map. Finally, under the assistance of computer software platform, a dynamic simulation on any complex index system is realized accordingly, from which stable conditions can provide path references for an enterprise in carrying out technology innovations and improving the integral efficiency and effect of any realistic technology innovation activity.

TE-10 Educational Issues 3
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Forum Suite
Chair(s) Kem Ramdass; University of South Africa

TE-10.1 [R] Merging Disciplines: An Exploratory Study

Siebert J Benade; University of Pretoria, South Africa

The challenge of most technology-based companies is to plan the next few years in terms of new systems, products and services to be delivered into the market and to decide which technologies to utilize to remain competitive. The basic make/buy question should also be addressed: whether a specific technology should be developed in-house or acquired. It comes down to meaningfully integrating the marketing strategy with the technology strategy of the enterprise. This sounds straight forward enough, also intellectually, but to successfully implement these strategies in real life proves to be extremely challenging. Disciplines such as technology management, asset management, system engineering and engineering management try to expand their footprint and address more (all) of the above-mentioned challenges. This trend consequently creates bigger overlaps amongst the different disciplines. Each discipline typically has its own professional organization(s), body of knowledge (BoK), and associated standards and practices. These developments pose new challenges to academic institutions. Universities should teach fundamentals (not "flavor of the month") that can stand the test of time. Curricula and program architectures should be integrated and not have too many overlaps and/or gaps and, most important, meaningfully prepare students for industry and business. These growing overlaps amongst disciplines cause considerable confusion as different definitions for the same/similar concepts are emerging.

TE-10.2 [R] Technology Management Education for Improving Systems Thinking: Additional Results

Sigal Koral Kordova; Holon Institute of Technology, Israel
Moti Frank; Holon Institute of Technology, Israel
Guy Ribnikov; Elisra Elbit Systems Ltd, Israel

One of the common ways of treating complex tasks and assignments in the world of management and advanced technology is breaking down the problem into components. Apparently, it is a systematic and structured manner, but also a method that ignores the big picture or the whole. The concept that reflects thinking about the issue as a whole and emphasizes the interrelationships among its components, rather than the components themselves, is called systems thinking. The current study deals with the development of systems thinking among students and graduates of technology management. The goals of the study are to identify the factors that influence the development of systems thinking and to find ways to encourage this development. We used a variety of research tools: a questionnaire for assessing the capacity for systems thinking, the Myers-Briggs Type Indicator (MBTI) personality type test and supervisor evaluations. In conclusion, the current study findings show that graduates with certain personality traits can gradually acquire or improve their capacity for systems thinking by receiving appropriate training and through a wide range of work experience, and by holding different job positions over time. Having a wide range of work experience and holding different job positions can help graduates gain knowledge and become familiar with diverse systems and technologies.

TE-10.3 [R] Central Indiana STEM Talent Expansion Program: Student and Faculty Interventions

Stephen P Hundley; Indiana University-Purdue University Indianapolis, United States
Charles Feldhaus; Indiana University-Purdue University Indianapolis, United States
Jeffrey X Watt; Indiana University-Purdue University Indianapolis, United States
Kathleen Marrs; Indiana University-Purdue University Indianapolis, United States
Andrew Gavrin; Indiana University-Purdue University Indianapolis, United States
Howard Mzumara; Indiana University-Purdue University Indianapolis , United States

Funded by a five-year, $2M grant from the National Science Foundation, the Central Indiana STEM Talent Expansion Program (CI-STEP) at Indiana University-Purdue University Indianapolis (IUPUI) is creating a pipeline of students and a campus culture change to increase the number of undergraduates obtaining science, technology, engineering, and mathematics (STEM) degrees. CI-STEP addresses initiatives needed for transforming the undergraduate STEM experience by propagating, expanding, and creating new evidence-based educational innovations in undergraduate STEM education at IUPUI. The primary goal of the project is to employ and assess the impact of several intervention strategies focused on student success, leading to higher numbers of students graduating with STEM degrees. These interventions include: new STEM Summer Bridge Academies; strengthened articulation agreements; peer-mentoring, and academic advising support for community college transfer students; expansion of Peer-led Team Learning, Just-in-Time Teaching, and other faculty-initiated, evidence-based educational opportunities; and development and expansion of career development services and internships for undergraduates. This paper will describe CI-STEP, including the project's purpose and progress-to-date. Specific attention will focus on ways to involve faculty in implementing, adopting, and adapting evidence-based approaches to educating STEM undergraduate students. Successful strategies, conclusions-to-date, lessons learned, and implications for replication, scalability, and sustainability will also be discussed.

TE-11 Entrepreneurship 2
Tuesday, 8/4/2015, 16:00 - 17:30
Room: Executive Suite
Chair(s) James K Chen; Asia University

TE-11.1 [R] Entrepreneurship Research Dynamics (1992-2013): Aim at Entrepreneurial, Innovative Firms and Business Operations

James K Chen; Asia University, Taiwan

This study is aimed at entrepreneurship research dynamics in 1992-2013. Data are based on the online version of the Web of Science (ISI Citation Indexes) and ProQuest Databases from 1992 to 2013 that published articles with titles about entrepreneurship. This study analytically uses the meta-analysis method mining out related entrepreneurship articles, through the bibliometric approach with organized relevant issues, themes, sub-themes, and perspective-based evaluation of the entrepreneurship field. The data shows research

on entrepreneurship performance during the period 1992-2013. The academic research of entrepreneurship continued to slowly increase during 1992-2013, increasing significantly in 2008 and rocketing through the first decade of the 21st century. The results conclude four relevant themes and nineteen sub-themes. The core themes of entrepreneurship are entrepreneur issues, innovative issues, corporative issues, and business operations issues. This research will help researchers realize the panorama of global research entrepreneurship trends, issues, and themes in order to establish further research direction.

TE-11.2 [R] Innovation and Startup Pathways in a University Scope

Jose Manuel M Cardenas; Universidad Catolica San Pablo, Peru
Ignacio Rondon; Universidad Catolica San Pablo, Peru

Entrepreneurship and startup companies are related terms, in the sense that one brings support to the other. The characteristics of a successful startup could be visible in the long term, but how about the way to develop an entrepreneurial person? This study performed a survey within a Peruvian university in order to explain the innovative mindset of the students and even their position about the real needs for performing innovative and disruptive companies (or initiatives). This survey was formerly applied to overall students but the results revealed several inconsistencies. So a new survey was enhanced and applied to senior year students. Results showed that, in the big picture, the students know the innovative and startup pathways and they are able to provide new insights in this theoretical approach.

TE-11.3 [R] Disruptive Innovation and Latecomer's Catching-Up Dilemma: Toward a Demand-side Perspective of Frugal Entrepreneurship

Rufei Ma; Tongji University, China
Kah-Hin Chai; National University of Singapore, Singapore
Chang Chieh Hang; National University of Singapore, Singapore

Different from general start-up with limited initial resources, latecomer firms always face an idiosyncratic catching-up dilemma: strong conflicts between intrinsic pressure of rapid technological catching-up and severe constraints of available technological capability. In the recent past, some entrepreneurial Chinese latecomer firms like Sany and Chery have developed frugal entrepreneurship as a more affordable way of value creation and capture to pursue hitherto unexploited opportunity and to proactively change the rules of the game in emerging economies. How do those latecomer firms solve their catching-up dilemma by frugal entrepreneurship in emerging economies? Based on inductive theory building from multiple cases, we find that the large, fast-growing and diverse market in emerging economies provides unique opportunities for latecomer firms to proactively create market newness through new-feature disruptive innovation and enhanced-feature disruptive innovation. In this way, latecomer firms accumulatively build competitive advantages from comparative cost advantage to cost-based competitive advantage, and to value-based competitive advantage. Overall, this paper makes two contributions: elaborating the demand-side perspective of disruptive innovation within the emerging economies context, and developing the demand-side perspective of frugal entrepreneurship to explain the mechanisms underlying the competitive market driving process of entrepreneurial latecomer firms, which have been neglected in the literature.

WA-00 PLENARY - 3

DATE: WEDNESDAY, 8/5/2015
TIME: 08:30 - 10:00
ROOM: PAVILION
CHAIR(S): ROBERT HARMON, PORTLAND STATE UNIVERSITY

WA-00.1 [K] Straying Slowly: STI in Developing Economies

Youngrak Choi; Ministry of Science and Technology, Ethiopia

Over the last 50 years, numerous research projects and policy recommendations have been made for Science, Technology, and Innovation (STI) in developing economies. However, only a few countries have emerged as achieving sufficiently capable status until now. Why do such gaps happen between discourse and reality? This presentation aims to examine this question with a brief review of predominant perspectives on STI such as Big Push, Import Substitution Industrialization, Appropriate Technology, Manufacturing Capabilities, Post East Asian Model, and Resource-led Development. Then, major features of STI in developing economies will be discussed: largely untapped latent potential; lagged behind and stagnant; no benefit and useful solution for society; neglected and isolated island from the world community. These may be caused by neglecting concerns of the gaps and also looking in wrong places in their quest of scholars across the globe. After that, constraints and bottlenecks hindering STI progress are examined to suggest a new framework; low equilibrium trap, no strong enterprise and no supportive university, limited investment capital, difficulty in priority setting and resource concentration, poor policy execution capability, risk-aversion attitude, inability to adapt technologies to raise productivity, and so on. Finally, some mandatory policy recommendations for global joint initiatives are addressed. Undoubtedly, STI can play an essential role as a critical growth engine of wealth creation for improvements of welfare and for progression of social systems in these economies.

WA-00.2 [K] Governance of Emerging Technologies in Developing Countries

Hamid Reza Amirinia; INOTEX, Iran

Emerging technologies have become the greatest agent of change in the modern world and perhaps in shaping the future. Positive technological breakthroughs from emerging technologies promise innovative solutions to the most pressing global challenges of our time, from resource scarcity to global environmental change. They are currently associated with high economic expectations and major opportunities for public welfare. However, in developing countries, due to a lack of appropriate investment, outdated regulatory frameworks and gaps in public awareness and legitimization process, many of these promising technologies are constrained from achieving their potential. Governments should deal with these technologies in an active way, intervene to develop them toward sustainability and to provide a competitive environment for their diffusion. For this intervention, governments should choose suitable frameworks to govern the technology development process compatible with societal circumstances. Iran's growth in the field of nanotechnology has been remarkable. In 2000 Iran was ranked as the world's 59th country in terms of science generation, for which an important index is the number of ISI papers published in various well known international peer-reviewed journals. However, it only took a decade for Iran's nanotechnology to achieve 8th rank in 2013. Since 2004 Iran has had the highest rate of growth among leading countries of the world in this field. Upon realizing the significant influence of nanotechnology on Iran's future economy, extensive activities were initiated in 2000. This presentation will explain Iran's policies and strategies in dealing with nanotechnology over the last 15 years in the context of the Technological Innovation System approach.

WB-01 Innovation Management 7
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Pavilion East
Chair(s) Nathasit Gerdsri; Mahidol University

WB-01.1 [R] From Catching-up to Constructing Indigenous Technological Capability Chains: Complex System Innovation in Developing Country

Fei Yuan; Tokyo Institute of Technology, Japan
Kumiko Miyazaki; Tokyo Institute of Technology, Japan

Based on the intractable issue of building technological capability for many developing countries, there has been extensive research done on the technological catching-up process. However, most of the literature is generally focusing on the investigation based on external features of the technology system. This paper proposes a framework of technological capability chains (TCCs) to link the building up of technological capabilities and industrial upgrading, which explores the internal structure of complex technology system with different innovative technological knowledge parts. We explore how a latecomer enterprise of

developing countries catch up and then build up the indigenous technological capability chains as a strategic asset and deployment of core competence. The empirical focus is the EV (electric vehicle) industry, with an emphasis on a typical catching-up country - China. We set our investigation by means of in-depth interviews and a multi-case study on the leading Chinese firms engaged in EV. Our study has revealed a number of factors affecting TCCs construction. Those findings also help develop a conceptual model of technological capability building up for a complex system, which could be a starting point for further research on emerging industries. The findings of this paper are more relevant to large catching-up countries such as India, Brazil, Mexico, and Indonesia where indigenous technological capabilities could serve as an important source of innovation for a large domestic market.

WB-01.2 [R] The Implementation of Open Innovation: A Case Study of Managerial Levels in a Centenary Public Research Institute

Ana Paula F Paes Leme; University of Sao Paulo, Brazil
Luciana A Teixeira; University of Sao Paulo, Brazil
Roberto Sbragia; University of Sao Paulo, Brazil
Paulo T Nascimento; University of Sao Paulo, Brazil

Despite the more than ten years since the Open Innovation concept was presented for the first time, companies still demonstrate some difficulties in its implementation. The main challenge refers to the change process from a closed to an open model. Understanding how these companies adopt the open innovation in practice, which involves identifying the organizational adjustments necessary for such, is the aim of this project. This goal was achieved with a case study at Butantan Institute, a centenary public institution, one of the leading producers of immunobiological products in Brazil. The organizational adaptations were discussed in four managerial levels (networks, organizational structures, assessment process and knowledge management systems) at different stages of the change process (unfreezing, moving and institutionalization), and in three levels of the Open Innovation - OI (inside-out, outside-in and coupled). In the Open Innovation implementation, the management foundations that were taken into account revealed different speed of development and the institutionalization was started through the establishment of a dedicated organizational structure, the Technology Transfer Office [TTO]. Having a structure dedicated to innovation management has also enabled to advance subsequently in the coupled innovation. Changes in others managerial levels were also identified and discussed at length.

WB-01.3 [R] Creating Value in Global Innovation Networks: A Study of Smartphone Industry

Chung-Shing Lee; Pacific Lutheran University, United States
Jonathan C Ho; Yuan Ze University, Taiwan
Chien-Feng Hsu; Yuan Ze University, Taiwan

The development and growth of industries in the developing and newly industrialized countries, such as Taiwan and South Korea, has been solely emphasizing a cost-leadership strategy. Although such capital-intensive, volume-driven and cost-down strategies have been successful measured by industrial and economic growth, the amount of value created and captured in the global value chain and innovation networks is insignificant. Recently, companies in South Korea such as Samsung, Hyundai, LG, and Kia, and Taiwanese firms such as HTC and Asus, have been able to create and capture extra value through innovation and branding strategies to differentiate their products in the global marketplace. This research applies Lee and Ho's global industry value creation framework to study the value creation strategies in both developed and newly industrialized countries. We examine the value creation strategies of three smartphone companies in South Korea, Taiwan, and the United States, and evaluate the effectiveness of each company's ability to capture value in the global innovation network. Several managerial and policy implications will also be discussed.

WB-01.4 [R] Matching Partners for Open Innovation Practice

Nisit Manotungvorapun; Mahidol University, Thailand
Nathasit Gerdsri; Mahidol Univeristy, Thailand

Open innovation has received considerable interest from academics and practitioners over the past decade. Nowadays, many firms pursuing open innovation are facing challenges and difficulties in selecting the right partners to work with. Having mismatched partners, even though they are technically capable, can lead to the unsmooth interaction and the failure in innovation performance. Hence, this article aims to address this managerial challenge by proposing an approach for assessing the matching quality of candidate partners who wish to engage in an open innovation project.

WB-02 Commercialization of Tech 2
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Pavilion West
Chair(s) Timothy Anderson; Portland State University

WB-02.1 [R] How to Manage the Industry-University Collaborative Relationship to Improve the Innovation Performance

Fei Li; Zhejiang University, China
Xiaodong Zou; Zhejiang University, China
Jin Chen; Tsinghua University, China
Huaizhong Shao; Zhejiang University, China
Wei Yao; Zhejiang University, China

Based on the context about the industry-university collaboration practice, this paper analyzed a mass of literatures and proposed a theoretical concept of industry-university (IU) collaborative relationship from the perspective of inter-organization relationship management. Through the statistical analysis on the 177 samples of target firms, the paper did an empirical research on how to manage the IU collaborative relationship to improve the innovation performance. This research has three important findings. First, the IU collaborative relationship model could explain the mechanism of industry-university collaboration innovation well. Second, the academic engagement relationship plays a leading role in the process of collaboration innovation. Third, the ambidextrous relationship model would help the enterprise to get much better innovation performance.

WB-02.2 [R] Research Project Valuation and Commercialization Strategy

Chih-Hung Hsieh; Yuan-Ze University, Taiwan

This study aimed to provide a hybrid method of assessing the importance of public research projects and determining strategy in the early stage of commercialization. The author uses an empirical case of the Industrial Technology Research Institute (ITRI) to test the method. As the result of his analysis, the author categorized ITRI's projects into four groups according to benefits and risk factors extracted from a factor analysis, and for each group of projects the author offers possible strategies for further commercialization. The method can highlight change in the meaning and strategic grouping of a project. Furthermore, it can be used for long-term strategic planning, e.g., strategic foresight and corporate foresight.

WB-02.3 [R] Supporting Sustainable Technology Cluster Development: A Performance Measurement Problem

Elizabeth Gibson; Portland State University, United States

Managers require metrics to measure organizational performance. However, metrics used by organizations that support technology cluster development are poorly understood in the literature. The most frequently referenced indicator for cluster development is regional economic and jobs data. These macro level indicators are not sufficient to measure the performance inside the cluster, leaving champions and policy makers to struggle with ad-hoc trial and error experimentation. The difficulty in defining and developing a performance measurement system is addressed. This paper lays the groundwork for improved approaches towards measuring the performance of technology cluster initiatives.

WB-02.4 [R] Knowledge Transfer in a Large Technology Company: Identification of Key Factor Affecting Broker's Knowledge Approval

Asahi Ito; Japan Advanced Institute of Science and Technology, Japan

Kunio Shirahada; Japan Advanced Institute of Science and Technology, Japan

Knowledge is typically created within one unit of a company and then transferred through contact persons ("knowledge brokers") to the other units. There are four main types of participants in the knowledge transfer process: sender, broker, broker's boss, and the other unit members. Transferring knowledge and promoting its utilization to all members in a hierarchical organization is not easy. A key element in effective knowledge transfer identified in a previous work is that the broker's knowledge approval (KA) has a positive impact on knowledge utilization by other members. In this study, several factors in creating KA were hypothesized. They were then tested by holding safety-training courses in a large Japanese technology company and surveying the 36 trainees (knowledge brokers) to ascertain their attitudes related to the hypothesize factors. Multiple regression analysis showed that the sender's KA was the factor that contributed most to the broker's KA. The findings were used to identify methods to improve the effectiveness of knowledge transfer in a large company from the perspective of a knowledge broker.

WB-03 R&D Management 1
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Broadway-1
Chair(s) Songphon Munkongsujarit; National Science and Technology Development Agency

WB-03.1 [R] Organizational Implementation of Product Architecture Development

Guenther Schuh; RWTH Aachen, Germany
Martin Sommer; RWTH Aachen University, Germany
Stefan Rudolf; RWTH Aachen, Germany

Increasing product variety and high cost pressure are significant challenges for manufacturing companies. One approach to face the dilemma between economies of scale and scope is the development of product architectures. This implicates new challenges for both development process and organization. Defined processes and roles are necessary to support product architecture development. A recent survey by our chair states that structured organizational implementation is a success factor when developing product architectures. Nevertheless, most companies do not adapt development organization and processes to the requirements of product architecture development, resulting in undetermined development goals and responsibilities. This paper aims at presenting a processual and organizational framework for product architecture development based on degrees of freedom. Degrees of freedoms are defined to differentiate between normative, generic and company specific conditions in product architecture development. Normative elements define the mandatory organizational and processual framework for efficient product architecture development. Generic conditions reflect process tasks and activities in the product architecture development that are comparable to product development. Company specific conditions describe possible variations in the organizational and processual implementation. The developed framework can be used to ensure processual and organizational implementation to support product architecture development.

WB-03.2 [R] Requirements Degradation for the Creation of a First Prototype

Jeremy J Green; University of Johannesburg, South Africa
Annlize Marnewick; University of Johannesburg, South Africa
Jan-Harm Pretorius; University of Johannesburg, South Africa

The requirements engineering process is typically executed, irrespective of the process model chosen, for the final commercially viable system. The system requirements generated are for a system deployed and used in its final form and function. However, the first prototype that is generated is typically representative of a minimum viable technology, and represents a degraded set of the initial system requirements specification. Typically, a first prototype is used as a technology demonstrator, and its failure or success will determine the continuation of the project, with success triggering the allocation of additional financial and personal resources. This paper explores techniques for requirements degradation that can be used to form the system requirements specification for the first prototype. A requirements engineering methodology is proposed based upon a survey of literature. It takes into consideration the characteristics of the project, i.e., a market driven, technology implementation research project with limited budget and a flexible timeline executed in an academic environment. The techniques must take into cognizance the main risk items, and core requirements, that need to be demonstrated in the minimum viable technology to secure the future of the project. The degradation cannot undermine or jeopardize the future success of the commercially viable system in determining the subset of requirements for the minimum viable technology.

WB-04 S&T Policy 1
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Broadway-2
Chair(s) Deok Soon Yim; International Innopolis Research Center

WB-04.1 [A] Revisit the Concept and Usefulness of Science and Technology Park and Implication for the Regional Innovation Policy: Cases of Seoul and Gyeonggi Province in Korea

Deok S Yim; Science and Technology Policy Institute, Korea, South
Hwang H Cho; Science and Technology Policy Research Institute, Korea, South
Eunhee Kim; Chonnan National University, Korea, South

Science and Technology Park (STP) has been regarded as one of the most effective policy tools to promote innovation activities in the region. However, there are both success and failure cases around the world. In this paper, existing research arguments are reviewed with the case study of two representative STPs in the city of Seoul and Gyeonggi province in Korea. As the existing literature reveals, many success factors are found such as location, university-industry-research institute linkage, management capabilities of the governing organization, etc. It also shows that the amount of governmental support for STP may not be that effective if it is not accompanied with the effort to create an internal/external network of STP and a friendly environment for the start-ups.

WB-04.2 [R] Evolution of Science, Technology and Innovation Policy in Asia: Case of China, South Korea, Japan and Taiwan

Pei-Chun Lee; Taiwan Research Institute, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

During the past decades, it has been gradually recognized that science, technology and innovation (STI) can provide solutions to macro level science and technology (S&T) problems. To foster STI that enables socioeconomic growth, it is widely regarded as necessary means to build institutional capacity for optimizing governance of STI. Therefore, many countries seek to integrate STI policies as part of their national development strategies. Science, technology and innovation policy has been increasingly designed and implemented at supra- and sub-national levels. In this paper, we draw on the emergence of STI policy in Asia and provide a framework for illustrating the evolution of Asian STI policy and, finally and most generally, demonstrate how important it is to understand the interplay of industry, academic research and governmental policy practice in Asian STI policy. This paper makes three contributions: first, it delivers a comprehensive picture of the current landscape of STI policy in Asia, as the evolution of STI policy and major focused policy challenges nowadays has not been discussed in any great detail so far. This serves, second, to illustrate co-evolution of STI policy and technological development in Asia. Thirdly, the paper highlights the Asian perspective of the STI policymaking mechanism.

WB-04.3 [R] Measurement of Scientific Research Performance at the Universidad De Sonora, Mexico

Paula C Isiordia-Lachica; Universidad de Sonora, Mexico
Ricardo RodrÃguez-Carvajal; Universidad de Sonora, Mexico
Geenisis Angulo; Universidad de Sonora, Mexico
Karen ChÃ¡vez; Universidad de Sonora, Mexico

Marcelino Barboza-Flores; Universidad de Sonora, Mexico

Research and citation performance was thoroughly surveyed at the Universidad de Sonora (UNISON), the largest state public university in Sonora, Mexico. Bibliometric analysis for 2000-2009 indicated that the faculty published 812 peer-reviewed journal articles indexed in Scopus and Web of Science. These were cited 8033 times, meaning an average of 10 citations per paper, 691 (85% of the articles) accounted for all the citations. A high number of foreign researcher coauthors indicated a strong international collaboration, with the USA representing the majority. International co-authorship produced higher citation rates. Results determined the most cited publications, most productive faculty members, and most productive research fields. These findings are important for planning research activities and policies at the Universidad de Sonora.

WB-05 TUTORIAL: Managing Technology Push Through Marketing Testbeds
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Broadway-3
Speaker(s) Rainer P Hasenauer; WU-Wien
Charles M Weber; Portland State University

This tutorial aims for a deeper understanding of how technology readiness level (TRL) / market readiness level (MRL) are put into practice; the relationship between TRL/MRL and the technology acceptance model (TAM); and the relationship between TAM and marketability criteria. Questions to be discussed are: how to specify TRL and its sub-models (Integration Readiness, Manufacturing Readiness, IPR Readiness) for specific innovative products' TRL; how to specify MRL and its sub-models (Supply Readiness, Demand Readiness, Customer Readiness, Product Readiness) to determine the market readiness for specific innovative products' MRL; and discussion by selected examples of high tech innovative products.

WB-07 Technology Roadmapping 1
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Studio Suite
Chair(s) Tugrul U Daim; Portland State University

WB-07.1 [R] Analysis of the Intellectual Structure and Evolution of Technology Roadmapping Literature

Petrus T Letaba; University of Pretoria, South Africa
Marthinus W Pretorius; University of Pretoria, South Africa
Leon Pretorius; University of Pretoria, South Africa

The technology roadmapping field has evolved over time from the first and second generation technology roadmaps to the current third generation roadmaps. As a strategy and policy formulation tool, technology roadmaps proved to be useful in facilitating learning and consensus across the firm or across the industry. Similarly, technology roadmaps have been used as a process to operationalize the strategies by mapping the details of future research and development programs, technological capability development programs and manufacturing capability development initiatives. Practitioners and scholars alike are seeking new ways on integration of this technology market planning tool with other business processes while on the other hand, there are efforts for their customization according to the needs of managers or policy makers. This paper maps trends in technology roadmapping and technology roadmap literature through an analysis of life cycle pattern on scientific contributions from this field. A gap exists for quantitative tracking of evolutionary patterns in terms of the three technology roadmapping generations.

WB-07.2 [R] A Framework for Improving the Roadmapping Performance

Maicon G Oliveira; Federal University of Alfenas, Brazil
Andre L Fleury; University of Sao Paulo, Brazil

Roadmapping has evolved over the last years and it is currently an established managerial approach. It has demonstrated potential to support the development of strategies and plans concerning product and technology innovations for businesses and industrial sectors. Plenty of knowledge with regard to the best practices for implementing the roadmapping approach has been reported; however, they are mainly focused on the roadmapping implementation. In fact, there is little information available focused at enhancing the roadmapping performance to an upper level in organizations that have already mastered its implementation. To this end, this paper proposes a framework to improve the roadmapping performance based on its most core result, the roadmap. The framework uses three indicators of roadmapping performance: information gathering, layers integration and forecasting. These indicators work as references for examining roadmaps created in the organization, clarifying eventual limitations in the implemented process. Aiming at enriching the roadmapping performance, the framework recommends different methods and tools to tackle the aforementioned indicators. Examples of published roadmaps are used to analyze the potential of the proposed framework as a roadmapping improvement tool.

WB-07.3 [A] Synchronization Process of R&D and Product Plan: Analysis with Case Example of Mobile Phone Development by Technology Roadmapping Tool

Yoichiro Igarashi; Fujitsu Laboratories Ltd., Japan

This paper discusses processes in technology management that coordinate progress workflows conducted on different timescales and with different requirements, particularly for fundamental research and development (R&D) and product planning. Strategies to survive the turbulent market of the information and communication technology (ICT) industry are becoming more challenging than ever. To address this situation, this paper discusses a solution mechanism based on the previously proposed "synchronization process (SP)" reference model, which defines a set of knowledge and decisions in each department from the perspective of top executives. This paper reveals how the SP operates from the perspective of R&D teams and their knowledge. A technology roadmapping (TRM) tool is introduced as an analysis tool, and it is applied to two case themes from the development history of mobile phones at Fujitsu. The highlights in the findings are that the competitive technologies for long-life products survive because they are based on the virtual (implicit) requests originating from both parties: business units and R&D teams, and such requests lead to the formation of "virtual teams" in the official project. These teams operate even if the formation is incomplete.

WB-07.4 [R] Comparing Impacts on Organizations Participating in On-going Industry-Level Technology Roadmapping Versus One-time Roadmapping Efforts

Austin Cheney; Eastern Illinois University, United States
Kenneth R Pence; Vanderbilt University, United States
David M Dilts; Dilts + Partners, LLC, United States

Through application of collective action and stakeholder theories, examination of theoretical and analytical studies of technological planning and technology roadmapping, and collection and analysis of survey data from organizational participants in six different industry technology roadmapping exercises, a theoretical model predicting factors that influence the impact on organizations participating in the creation of an industry-level technology roadmap (ITR) was developed and evaluated. The model includes: 1) motivations for organizations to participate in the development of an ITR, 2) industry-related motivations for developing a roadmap, 3) stakeholder-based structure and processes used to create the roadmap, 4) characteristics of the roadmap document, 5) industry clockspeed (pace of change), and 6) organizational impacts from ITR development (e.g. technology planning, pace of innovation, collaborative activities and partnering, implementation of new technologies, etc.). A survey instrument was administered to participants (N=128) involved with six different industry technology roadmapping exercises: concrete, electronics, forest products, magnesium, metal casting, and powder metallurgy industries. This paper summarizes the feedback from ITR development organizational participants regarding six open-ended questions, and makes some conclusions about what characteristics determine whether a roadmap experiences future iterations or is left as a one-time exercise in an industry.

SESSIONS

WB-08 E-Business
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Directors Suite
Chair(s) Louwrence Erasmus; CSIR

WB-08.1 [R] Current Status of Smart Systems and Case Studies of Privacy Protection Platform for Smart City in Japan

Yutaka Mizuno; Nagoya Institute of Technology, Japan
Nobutaka Odake; Nagoya Institute of Technology, Japan

This paper is to clarify the current status of smart systems and discuss the progressive formation of the privacy protection ecosystem for smart cities in Japan. The authors surveyed representative smart city projects, promotion groups, and several privacy protection platforms as case studies. As a result, the authors obtained the following three findings. First, Smart Grids and Smart Intelligent Transport Systems have been progressing steadily. Second, several proof of concept in privacy protection platforms have started recently. Third, these privacy protection platforms are classified into two types: a centralized model and a distributed model. Therefore, it is important for the progressive formation of privacy protection platforms in smart cities not only to integrate the centralized model and the distributed model with a hybrid model based on the structure of Multi-sided Markets and Freemium business model, but also to examine a trust framework of privacy property to formulate its secured services at a low price, before full-scale smart systems come into use.

WB-08.2 [A] New Generations of Estonian eGovernment Components

Ahto Kalja; Tallinn University of Technology, Estonia
Tarmo Robal; Tallinn University of Technology, Estonia
Uuno Vallner; Ministry of Economic Affairs and Communications, Estonia

The development of Estonian eGovernment components started approximately 15 years ago. In this article, we discuss our experience regarding how the main components of Estonian eGovernment such as public key infrastructure, data exchange layer and governmental portal have developed and changed within this period. The Estonian ID-card is the best representative of our public key infrastructure technology. The project X-Road realizes the idea of connecting all government information systems over the Internet. The governmental portal is the largest eServices provider in Estonia. All these systems are quite different from the first versions that appeared at the beginning of the century.

WB-09 Strategic Mgmt of Tech 1
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Council Suite
Chair(s) Yuya Kajikawa; Tokyo Institute of Technology

WB-09.1 [A] Tesla Motors, Inc.: Pioneer towards a New Strategic Approach in the Automobile Industry along the Open Source Movement?

Manuel Moritz; Helmut-Schmidt-University, Germany
Tobias Redlich; Helmut-Schmidt-University, Germany
Pascal Krenz; Helmut-Schmidt-University, Germany
Sonja Buxbaum-Conradi; Helmut-Schmidt-University, Germany
Jens P. Wulfsberg; Helmut-Schmidt-University, Germany

In many industries, we observe a paradigm shift from traditional value creation towards co-creation and open production approaches. The boundaries of companies dissolve and many more players (suppliers, customers, community members, etc.) are integrated into the value creation process. This also implies the share of knowledge to set industry-wide standards and to advance new technologies. Tesla Motors, Inc. recently announced that it would give away all of their patents to anyone who in good faith wants to use them. They say their aim was to foster the advancement of electric vehicles to compete with conventional vehicles and give the zero-emission mobility a push. Nevertheless, what about the traditional automobile industry with its big players where even the slightest growth in market share is crucial and the intellectual property (IP) of a company is kept secret like the Holy Grail as it ensures competitive advantages? Based on a Tesla case study our research focusses on product-, company- , market- and industry-specific factors that might enable even small players to start an industry-wide revolution by applying strategic aspects of openness in their business model.

WB-09.2 [R] Designing the Coherent Ecosystem: Review of the Ecosystem Concept in Strategic Management

Masaharu Tsujimoto; Tokyo Institute of Technology, Japan
Yuya Kajikawa; Tokyo Institute of Technology, Japan
Junichi Tomita; Toyo University, Japan
Yoichi Matsumoto; Kobe University, Japan

In the strategic management field, the ecosystem concept is increasing significance. This paper provides an overview of 90 previous studies on the ecosystem concept published in leading academic journals in strategic management field and clarifies the four major research streams. The first perspective is the industrial ecosystem perspective, which is based on the concept of industrial ecology. The second perspective is the business ecosystem perspective. This perspective is based on the theory of organizational boundaries. In the business ecosystem perspective, some influential scholars emphasize platform management, which represents the third perspective, the platform management perspective. The fourth perspective is the multi-actor network perspective, which contributes to the dynamic behavioral relationship analysis based on social network theory. This perspective expands the range of analysis to include various actors in addition to private companies. As a result of the review, this study presented the integrated map of the previous works. Furthermore, this paper proposed original ecosystem concept, definition, and scheme for designing or re-designing coherent ecosystem. The coherency is the core concept for the evolution and expansion of the ecosystem.

WB-09.3 [R] International Flows of Japanese and World's Researchers

Shino Iwami; The University of Tokyo, Japan
Junichiro Mori; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

As a social issue in Japan, Japanese have fewer movements all over the world due to their single-tracked personnel system. It is difficult for students to study abroad because they get a disadvantage to find a job. Researchers are scared to lose their job once they step away from local routines, even for valid reasons. On the other hand, many Japanese Nobel laureates have studied abroad or stay out of Japan. The following hypothesis is led: highly talented researchers need to have experiences to live abroad. The USA is an academic giant that has large shares of papers in every domain, so it is easy to assume that a researcher would be stimulated by staying there. However, where are other academic hubs in the world? The first purpose of this research is to trace movements of highly talented Japanese researchers, comparing them with average highly talented researchers. The second purpose is to identify academic hubs for Japanese and the World. The methodology of this research is to trace movements of top researchers on the map. Their locations are retrieved from affiliation addresses on the Web of Science. These analyses will prove how frequently international research exchanges need, and they provide candidate locations to study abroad.

WB-11 Entrepreneurship 3
Wednesday, 8/5/2015, 10:30 - 12:00
Room: Executive Suite
Chair(s) James K Chen; Asia University

WB-11.1 [R] A Test of a Design Process Scale

Yorgos Marinakis; University of Twente, Netherlands
Rainer Harms; University of Twente, Netherlands
Steven Walsh; University of New Mexico, United States

Design is a type of innovation that focuses on creating new products and service meanings.

Models of the design process are important because they can help firms manage their product and service design processes to obtain competitive advantage. Empirically based models of the design process are particularly valuable because they help us avoid cognitive biases when constructing the models and because they can lead to new theory development. Yet such empirically based models are relatively small in number and not utilized outside of their original studies. Using the first two stages of Ravasi and Stigliani's model of the design process, which was based on a review of 125 articles and 20 books published between 1989 and 2011, we constructed a scale comprising four sets of redundant reflective measures. We then surveyed 131 design firms internationally with those measures. We then fit the scale to the survey results by using Confirmatory Factory Analysis. Using a variety of goodness of fit statistics, we found that a large portion of the scale fit the data.

WB-11.2 [R] An Empirical Study on the Factors Affecting Academic Technology Entrepreneurship in South Korea

Junmo Kim; Korea core Industrial Technology Investment, Korea, South
Youngkwan Kwon; Korea Fair Trade Mediation Agency, Korea, South

Technology entrepreneurship has been considered by universities and public research institutes as a novel growth engine for economic development within the context of a knowledge-based economy. However, there have been persistent concerns about it being at the paradigm of the "Creative Economy" in Korea where related domestic research is lacking. This study investigates the effects of entrepreneurial environments of domestic institutions as well as the capabilities of individual scientists with entrepreneurial intention who belong to these institutions. We conducted a structural equation modeling (SEM) analysis based on the survey data gathered from scientists who belong to domestic universities and public institutions. The results of the analysis are as follows: (1) Entrepreneurial intention constitutes individual scientists' attitude, behavior control, and norm. (2) Commercial capability of individual scientists positively and significantly affects behavior control, while organizational culture positively and significantly affects attitude, behavior control, and norm at the same time. (3) Technical capability has negative and significant effects on the attitude of scientists. (4) The policy of the organizations through organizational culture indirectly affects the above three factors that constitute the entrepreneurial intention. This study highlights the formation of positive entrepreneurial culture within universities and public research organizations by means of reorganizing promotional policies for technology entrepreneurship and emphasizing its importance.

WD-01 Innovation Management 8

Wednesday, 8/5/2015, 14:00 - 15:30
Room: Pavilion East
Chair(s) Hongyi Chen; University of Minnesota

WD-01.1 [R] Pattern Search in Terms of Growth and Profitability of Funded Start-Up SMEs Based on Their Technology

So Young Sohn; Yonsei University, Korea, South
Jiwon Kim; Yonsei University, Korea, South

Small- and medium-sized enterprises (SMEs) struggle to achieve lasting growth. Many governments provide financial support for new technology based SMEs by employing a technology credit scoring system. The main purpose of this paper is to investigate whether firm's R&D characteristics and types of industry are related to short-term growth and profitability of the start-up SMEs which have received the fund based on their technology. Using a decision tree analysis, we hierarchically examine associated factors on successful technology financing for start-up SMEs. Our study is expected to contribute to the establishment of strategies for the improvement of technical start-up SMEs.

WD-01.2 [R] Secondary Innovation in Emerging Industry: A Case Study

Guannan Xu; Beijing University of Posts and Telecommunicatios, China
Jiakun Wang; Beijing University of Posts and Telecommunicatios, China
Yuchen Wu; Peking University, China
Yuan Zhou; Tsinghua University, China

Different from primary innovation, secondary innovation is a typical innovation mode in developing countries, which starts from technology introduction and imitation and focuses on technology catching up. Based on the traditional theory of secondary innovation, this paper examines the technology innovation mode in an emerging industry in a developing country, and looks for new characters of the innovation mode in the new technology age. Through an in-depth case study of a flat panel display manufacturing company in China, this paper elaborates the environment, strategy and capability evolution in its technology development process, especially from the perspective of innovation ecosystem. Further, this paper probes into how to leverage late comers' advantage in an emerging industry, and puts forward some suggestions for firms in developing countries to improve their competences in the secondary innovation process.

WD-01.3 [R] Innovation in Knowledge Intensive Business Services (KIBS) in Mexico

Leonel Corona-Trevino; National University of Mexico UNAM, Mexico

There is a growing economic role of knowledge intensive business services (KIBS), as they have become engines of economic growth and high quality job creation. However, Mexico has focused mainly on technological innovation, disregarding service innovation and its relationship to technology infrastructure. In the first section of this paper, at the national level, an international comparison is made between Mexico and the USA in terms of employment, value added and productivity including the knowledge and technology intensive sectors. For this purpose, national data is aggregated in two sets: goods and services. Services are divided into traditional, intensive knowledge and innovation centered. We divide goods into manufacturing, which comprises low, medium and high technology, and the remaining goods sectors, mining and construction, are included in low tech industries while agriculture is dealt with separately. The second part of the paper is a micro level study, surveying 35 firms identified as KIBS in order to make a preliminary characterization and look at the types of innovation they are involved in. There is a need for an innovation policy that includes services at the macro level considering Mexican's relatively weak economic structure in high technology goods and innovative and knowledge service sectors.

WD-01.4 [A] Increasing the Value of Innovation - Consulting Services in the Technology Age

Sofia Zafeiropoulou; NYU Polytechnic School of Engineering, United States
Joseph Nadan; NYU Polytechnic School of Engineering, United States

We describe the design and implementation of a new study based on Mind Genomics, and then use the results to provide data to increase the value of Innovation-Consulting Services ("ICS"). We present how an IdeaMap? survey of ICS consumers mined their knowledge and professional experience, as well as the jobs they wanted to get done. It enables the ICS supplier to focus on the services most desired by their consumer. Standard surveys only reveal what the consumer wants; surprisingly, this method additionally provides information on what the ICS consumer does not yet know they want. Standard surveys test each individual ICS element (i.e., aspect, attribute or characteristic that could possibly enhance the value of ICS generated work-products) independent of every other ICS element. The IdeaMap? method is more powerful because it examines how groups of ICS elements that "move together" may be segmented. The study tested 20 ICS elements organized into a framework of four categories (ICS Benefits, Consultant Profile, Consultant Prior Experience, Innovation Methods and Tools). Every recipient was asked to "value" 30 vignette screens with two-to-four ICS elements on each. The 10-minute survey was sent to 351 C-level or above professionals in a wide range of industries.

WD-02 Technology Forecasting 1

Wednesday, 8/5/2015, 14:00 - 15:30
Room: Pavilion West
Chair(s) Tugrul U Daim; Portland State University

WD-02.1 [R] Technology Forecasting: Focusing on Main System or Aggregation of Subsystems

Gizem Intepe; Istanbul Technical University, Turkey
Tufan Koc; Istanbul Technical University, Turkey

A complex product system consists of numerous subsystems organized in a hierarchical fashion. In literature there exists a tendency in measuring the life cycle of main system by using parameters which characterize the performance of that main technology. This may lead to problems in investment decisions for technology renewal since the forecast of main system technology lifecycle is associated but does not fully represent its subsystems lifecycle. This paper intends to clarify this problem with a case study by showing while the main system is in its midlife, some of the subsystems are approaching their limits and require urgent radical investment. As a case study refrigerator system is used and the relevant life cycles are obtained using growth curves as a technology forecasting tool. The findings are discussed and suggestions for the need of a multiple level of analysis are given in the discussion section.

WD-02.2 [A] New Approach for Analyzing Industrial Dynamics and Its Application to the Tire Industry

Kaoru Suzuki; Hitotsubashi University, Japan

For a company to survive in a business environment that is changing rapidly, it must recognize in advance and adapt to the changes in its own industry circumstances. This study shows the analytical process that should be considered in order to recognize at an early stage the change in business environment a company will face in the near future. This analytical approach provides a clue about how to identify the change in business environment and is effective for formulating a future business strategy. The author formulated the hypothesis that an inter-industry boundary change is caused by the homogenization of properties of boundary spanners across two industries, and this boundary change affects the business activities of related industries, including their own companies. This hypothesis was described based on the concept of the social cognitive model. The author used the film industry as an example and explained that the dramatic industrial change in the film industry was caused by the homogenization of properties of boundary spanners between the camera and personal computer industries. The author also identified the impact of the mobile phone industry, based on the boundary change between the mobile phone and personal computer industries.

WD-02.3 [R] A Technology Forecasting Method for Capabilities of a System of Systems

Vesa K Kuikka; Finnish Defence Research Agency, Finland
Juha-Pekka Nikkarila; Finnish Defence Research Agency, Finland
Marko Suojanen; Finnish Defence Research Agency, Finland

We introduce a method for modeling the impact of future technologies and systems on capability areas. In this study, we define capability as the probability of a successful operation. The effects of technology developments are forecasted for three military capability areas (protection, situational awareness and engagement). Expert opinions from a questionnaire were used as capability estimates for the capability areas. Some general results can be obtained from capability areas data, for example, the common-known S-curve development phases can be recognized. The proposed model is based on the idea of system of systems, and the usability of the modeling method is demonstrated with two systems (satellites and UAVs) and three scenarios. We show how to calculate the impact of a system on capability areas by decomposing the capability areas into system level capabilities. The results of the system level model are interpreted with examples of relationships between scenario descriptions and calculated system capability values. By changing system resources, e.g., training, personnel or number of systems, system capability values are changing accordingly. In this way, the model can be regarded as a tool for capability management.

WD-02.4 [R] Forecasting OLED TV Technology Using Bibliometrics and Fisher-Pry Diffusion Model

Yonghee Cho; Portland State University, United States
Tugrul U Daim; Portland State University, United States
Paul Sklar; Energy Trust of Oregon, United States

The market of flat panel displays is experiencing rapid growth with the advancement of digital technologies in broadcasting service. The next challenge of LCD is OLED in the TV market. The study investigates the trends in advanced or emerging technologies by determining their technology diffusion rates due to the lack of experiential data. With the development of information and communication technology, one of the recent methods to assist in technology forecasting is data mining in bibliometric or textual data from various sources such as patents, journals, and research awards. The information extracted from diverse sources can be employed in technology diffusion models such as Fisher-Pry where emerging technologies substitute older ones. The study uses Web of Science and Compendex for bibliometric analysis to forecast the growth of next-generation OLED technologies based on the analogous growth of LCD technologies.

WD-03 R&D Management 2

Wednesday, 8/5/2015, 14:00 - 15:30
Room: Broadway-1
Chair(s) Judith Estep; Bonneville Power Administration

WD-03.1 [A] Theoretical Study of the Quantitative Analysis for the R&D Process Based on the Modified Ising Model: Cyclic Olefin Polymer of Zeon Corporation Case Study

Hideki Hayashida; Osaka University, Japan
Hiroki Funashima; Osaka University, Japan
Hiroshi Katayama-Yoshida; Osaka University, Japan

In this paper a quantitative model of process management is introduced for the continuous period focusing on the process until end of new business development from starting early research stage after idea creation. Much research has been done as a microscopic approach to understand the R&D management for many years. Studies focused on specific aspects of R&D to understand clearly things such as organization, leadership, process management, etc. It is quite difficult to overview the whole progress of R&D status. But to visualize the R&D status, we can manage better as MOT. We studied by focusing on the interaction among factors, which is affected by R&D management. We achieved by establishing the unique mathematical physics model by applying the modified Ising model, which is a physical transition model in previous studies, PICMET '14. In this study, we indicate the implementation of this model by using the open business case and the visualization of the R&D status from the result of the simulation. We selected COP (Cyclic Olefin Polymer) material development and new business development case of Zeon Corporation. From the analysis of the visualization of the simulation result, we indicate the mathematical physics model is effective to understand the perspective R&D status.

WD-03.2 [R] Development of a Technology Transfer Score to Inform the Selection of a Research Proposal

Judith A Estep; Bonneville Power Administration, United States

Against a backdrop of changing US energy strategies, which includes increased research investments in clean energy, the utility industry needs to respond to unprecedented technology challenges. These challenges include an aging infrastructure, a growing population, and aggressive energy efficiency targets. The utility industry is investing in research to identify solutions. However, it's not enough to just develop a technology that solves an energy related problem. In order for a solution to be effective and have an impact, the technology needs to be applied - without the technology transfer component, energy strategies cannot be realized. Therefore, there is a need to understand the difficulties associated with technology transfer. This research will focus the development of a technology transfer score (TTS) that can be used to inform the selection of a research proposal. The paper includes a comprehensive literature review, development of the TT score decision model, and implementation of the score through a pilot demonstration. This research will provide

valuable information to the energy industry. Knowledge is power - by identifying those attributes which contribute to successful technology transfers, the industry could take a proactive approach by ensuring that those elements are implemented and effective in their organizations. While the focus of this research is on the utility industry, the model can easily be applied to any organization that solicits technology research proposals.

WD-04 S&T Policy 2
Wednesday, 8/5/2015, 14:00 - 15:30
Room: Broadway-2
Chair(s) Yuya Kajikawa; Tokyo Institute of Technology

WD-04.1 [R] 'State-of-the-art' of 'State-of-the-art': Extracting Science-Social Issues Interface

Yasutomo Takano; Tokyo Institute of Technology, Japan
Mizutomo Takeuchi; Tokyo Institute of Technology, Japan
Yuya Kajikawa; Tokyo Institute of Technology, Japan

Science and technology have contributed to solving various social issues like vaccines for preventing disease and the Internet for exchanging information. It is important for technology intelligence to comprehend social issues and candidates of technologies for solving them from a vast stream of information flow. However, as the amount of information has exploded, it has become quite difficult to grasp the current status of advancement of scientific research and technologies. In this study, we proposed and demonstrated that "state-of-the-art (SOTA)" was an effective term for extracting the interface between science and social issues. First, in order to test the effectiveness of the proposed approach, papers from sustainability fields were collected. Those papers were divided into three types: SOTA papers, review papers and the others. Then, some characteristics of those types of papers were surveyed. We analyzed what kinds of impacts the term had, the possibility of comprehensiveness of usage. The results showed that paper of SOTA was the technically characteristic term when researchers and practitioner set their direction.

WD-04.2 [R] A New Typology and Transition of Innovation Policy Instruments in China: Evidences from the New Energy Vehicle Industry

Lei Xu; Tsinghua University, China
Cui Huang; Tsinghua University, China
Zhang Li; Tsinghua University, China
Jun Su; Tsinghua University, China

Among several typologies of innovation policy instruments, the most frequently used one is technology-push versus demand-pull. But this typology has some drawbacks. This paper proposes new typologies which classify innovation policy instruments into government-led versus market-led, and product-oriented versus user-oriented. We posit that the innovation policy instruments of China have transited from government-led to market-led, and from focusing on product-oriented solely to focusing on both product-oriented and user-oriented. In order to testify the proposition, we analyze 54 main policy documents of the new energy vehicle industry in China quantitatively by coding and counting applied policy instruments from 1999 to 2014, and the empirical result supports the proposition.

WD-05 TUTORIAL: Scalable Strategic Planning
Wednesday, 8/5/2015, 14:00 - 15:30
Room: Broadway-3
Speaker(s) Paul Menig; Tech-I-M, LLC

Every business needs an information-driven business plan. For a startup looking for funds from family and friends, it need not be very detailed. If, however, the intent is for a small business to get funds from a non-profit such as Mercy Corp., a reasonable plan is needed. For an entrepreneur with a growth idea who is approaching angel investors, the plan needs to be more substantial. If a small and medium size business is seeking a loan from a bank, an even better plan is needed. If the business is a multinational company with hundreds of thousands of employees, the strategic plan is a huge effort. Thus, there is a need for a scalable approach to business and strategic planning, especially to help start-ups and tightly held businesses in the $50 million and up category. This presentation provides insights from decades in the large corporate world, combined with several years of consulting for small businesses and volunteer activities with SCORE and the Oregon Entrepreneur's Network. A framework is proposed for a scalable strategic planning process.

WD-06 Tech Mining 1
Wednesday, 8/5/2015, 14:00 - 15:30
Room: Broadway-4
Chair(s) Alan L Porter; Search Technology, Inc.

WD-06.1 [R] Multiple Science Data-Oriented Technology Roadmapping Method

Yi Zhang; University of Technology Sydney, Australia
Hongshu Chen; University of Technology Sydney, Australia
Guangquan Zhang; University of Technology Sydney, Australia
Donghua Zhu; Beijing Institute of Technology, China
Jie Lu; University of Technology Sydney, Australia

Since its first engagement with industry decades ago, technology roadmapping (TRM) is taking a more and more important role for technical intelligence in current R&D planning and innovation tracking. Important topics for both science policy and engineering management researchers involves with the approaches that refer to the real-world problems, explore value-added information from the complex data sets, fuse the analytic results and expert knowledge effectively and reasonably, and demonstrate to the decision makers visually and understandably. Moreover, the growing variety of science data sources in the Big Data Age increases these challenges and opportunities. Addressing these concerns, this paper proposes a TRM composing method with a clustering-based topic identification model, a multiple science data sources integration model, and a semi-automated fuzzy set-based TRM composing model with expert aid. We focus on a case study on computer science related R&D. Empirical data from the United States National Science Foundation Award data (innovative research ideas and proposals) and Derwent Innovation Index data source (patents emphasizing technical products) provide vantage points at two stages of the R&D process. The understanding gained will assist in the description of computer science macro-trends for R&D decision makers.

WD-06.2 [R] Unsupervised Learning Based Patent Landscapes Using Full-Text Patent Data

Arho Suominen; VTT Technical Research Centre of Finland, Finland
Hannes Toivanen; VTT Technical Research Centre of Finland, Finland

The complexity technologies require that companies have in-depth knowledge of the nature and effect of knowledge - its depth and breadth. Companies need to master expanding technological knowledge bases creating tensions for MOT. We examine how big data in patent landscaping creates insights into MOT. Using big data to manage Competitive Technical Intelligence, companies can foster new forms of adaptive learning processes in MOT. This, however, requires that managers augment human judgment with machine-learning tools, prompting challenges to management traditions. We demonstrate how unsupervised learning creates insight into MOT by identifying topical knowledge foci and showing the dynamics of knowledge domains among companies. Using unsupervised learning and network analysis, we show how a semantic analysis leads to the identification of opportunities in complex environments. We illustrate this using a case in globally operating telecommunication companies using a full-text copy of USPTO-database with approximately 6 million patents' data. Our results show the landscape of the companies and the underlying knowledge embedded in the companies. We discuss how managers can evaluate their technological knowledge against competitors, balancing current needs with the adoption of new knowledge. We further discuss how a semantic analysis can lead to the discovery of latent patterns and identification of opportunities.

WD-06.3 [R] Deeper into Innovation Forecasting

Scott W Cunningham; Delft University of Technology, Netherlands

Recent work questions whether publication and patenting time series actually follow the familiar S-shaped growth curve. Evidence suggests that most fields of scientific activity undergo dramatic bursts of growth, growing by two orders of magnitude in a matter of a year. Scientific activity in research fields may be measured by appropriately selected keyword phrases. The dynamics of publication suggest temporary, higher order positive feedback loops. These may involve the intellectual migration of scientists to nearby fields of interest, or it may involve other community-related benefits created by having a suitable group of likeminded researchers at hand. Unfortunately, given standard publication by year counts we cannot be certain what the governing dynamics of the system actually entail. In this paper we supplement standard innovation forecasting measures with additional richer details including numbers of unique authors over time, use of novel vocabulary, and citation patterns. This is used to prove, or disprove, a number of competing hypotheses about the emergence of new scientific fields. Recommendations are provided for using these extended indicator systems for innovation forecasting.

WD-06.4 [R] Tracing Technology Evolution Pathways by Combining Patent Citation Analysis and Tech Mining

Ying Huang; Beijing Institute of Technology, China
Yi Zhang; University of Technology Sydney, Australia
Jing Ma; Beijing Institute of Technology, China
Alan L. Porter; Georgia Institute of Technology, United States
Xuefeng Wang; Beijing Institute of Technology, China

Because of the flexibility and complexity of Newly Emerging Science and Technologies (NESTs), traditional statistical analysis fails to capture technology evolution in detail. Generating competitive technical intelligence supports industrial, governmental, and academic decisions to guide future development trends.

Patents are one of the most important NESTs data sources and are pertinent to developmental paths. This paper draws upon text analyses, augmented by expert knowledge, to identify key NESTs sub-domains and component technologies. We then complement those analyses with patent citation analyses to help track developmental progressions. We identify key sub-domain patents, associated with particular component technology trajectories, then extract pivotal patents via citation analyses. We compose evolutionary pathways by combining citation and topical intelligence obtained through term clumping.

We demonstrate our approach with empirical analysis of Dye-Sensitized Solar Cells (DSSCs). This study informs NESTs management by spotting prime opportunities for innovation.

WD-07 Competitiveness in TM 1
Wednesday, 8/5/2015, 14:00 - 15:30
Room: Studio Suite
Chair(s) Charles M Weber; Portland State University

WD-07.1 [R] The Strategy of Openness in Industrial Production

Tobias Redlich; Helmut-Schmidt-Universitat, Germany
Stefanie Wulf; Helmut-Schmidt-Universitat, Germany
Manuel Moritz; Helmut-Schmidt-Universitat, Germany
Sonja Buxbaum-Conradi; Helmut-Schmidt-Universitat, Germany
Pascal Krenz; Helmut-Schmidt-Universitat, Germany
Jens P. Wulfsberg; Helmut-Schmidt-Universitat, Germany

Flexibility and adaptability of production systems are still some of the most discussed characteristics of production systems within the traditional manufacturing industry. Because of increasing complexity and dynamics within the corporate environment, some approaches to optimize these traditional characteristics are no longer sufficient to achieve competitive advantages. The ongoing paradigm shift from traditional industrial production to a system of value co-creation forces manufacturers to redefine their role and position within a more open value creation process. Companies have to add principles of openness to previous strategic success factors. In the future, the competitiveness of a company will rather be determined by the ability to cooperate with different actors in heterogeneous global networks. Moreover, we have to be aware that the traditional factory as the central production facility will be dissolving more and more. A new strategic approach for those companies might be what we call the Strategy of Openness.

WD-07.2 [R] Clustering of Small and Medium-Sized Enterprises as a Strategy for Their Competitiveness

Bahar Sennaroglu; Marmara University, Turkey

Economies in the world are supporting small- and medium-sized enterprises (SMEs) due to increasing unemployment rates. But increasing costs of inputs for production of goods and services are barriers to competitiveness and growth of SMEs. Clustering of SMEs is an appropriate strategy to overcome these limitations, since it enables cost reductions of inputs through collaborative contracts with suppliers and gains competitive advantages in the marketplace. Although it is an appropriate strategy, clustering is a difficult process for SMEs. This paper explains competitive advantages of clustering of SMEs and describes a clustering process for procurement. Clustering makes it possible for SMEs to benefit from economies of scale and high quality levels available to large enterprises, and hence achieves sustainable competitiveness. Sustainable competitiveness of SMEs is the key to their growth and their investments in technology and R&D.

WD-07.3 [R] Internal or External Knowledge: Which is More Important for the Performance of National Laboratories in Technology Latecomer Countries?

Pattravadee Ploykitikoon; NECTEC, Thailand
Charles M Weber; Portland State University, United States

The national laboratories in countries that are latecomers to advanced technological development are considered a significant source of scientific knowledge and technology for local industries that the national government deems strategic and for developing the country's infrastructure. This knowledge comes from both inside and outside the national laboratories. We investigate the relative impact of internal and external sources of knowledge on the performance of the national laboratories of a rapidly developing country, whose stated missions are 1) satisfying the needs of targeted local technology users; 2) commercialization of technology; and 3) developing a long-term R&D capability for the country. We conduct a survey-based study, which covers 208 recently completed R&D projects that span three industries: biotechnology; electronics and computers; materials and nano-materials. Our study finds that, regardless of mission, knowledge from external sources impacts performance more significantly than internal knowledge does. The impact on performance is greatest when knowledge from internal and external sources is used in conjunction. We consequently make the case for an open innovation policy for the national laboratories in technology latecomer countries and for implementing practices that enhance the capacity to absorb knowledge that flows into the national laboratories from external sources.

WD-09 Strategic Mgmt of Tech 2
Wednesday, 8/5/2015, 14:00 - 15:30
Room: Council Suite
Chair(s) Hsin-Ning Su; National Chung Hsing University

WD-09.1 [R] System Convergence in the Crafting and Execution of a Services Directed Strategy: A Technology Perspective

Richard V Weeks; University of Pretoria, South Africa
Siebert Benade; University of Pretoria, South Africa

The focus of this paper is directed at gaining an insight into services strategy formulation and implementation, with specific reference to the integration of the diverse systems involved. These systems were identified in a previous paper presented at the 2014 PICMET conference entitled "Servitization: An Integrated strategic and operational systems frame-

work." A key difficulty encountered in practice is that as the future unfolds, these various systems are subject to constant change, both at an individual as well as at an interactive level, a reality that renders strategy creation and execution extremely complex. The convergent, emergent systemic effects and the uncertainty and unpredictably it engenders expose fundamental difficulties associated with traditional strategic management practice, based on underlying scientific management principles. The research study entails a multidisciplinary literature review to determine if a complex adaptive systems approach may not be more effective in practice, a key finding emerging from the study being that this is in fact the case. The value of the research study is that the findings emanating from the literature review could inform future management practice.

WD-09.2 [R] Assessment of IP Management in Agricultural Biotechnology Industry: Insight from a Case Study

Hebron C Chang; National Chung Hsing University, Taiwan
Hisn-Ning Su; National Chung Hsing University, Taiwan

Since 1997, M Inc. faced litigations against non-contracted and contracted farmers about the issues of IP infringement and contract breach. M Inc.'s IP strategies include licensing, royalties, violation reports, investigations, settlement agreement and lawsuits. Organic farmer associations (OSGATA) sued M Inc. for IP invalidity because of misuse, double patenting and IP unenforceability since 2011. M Inc. won OSGATA the litigation after a Supreme Court ruling in 2014. After impacts of GMO issues in these cases, it is encouraged that M Inc. (and other related industries) would establish new non-technological and technological strategies, that is, to donate upcoming expired patents to the public and to develop new products based on "Breeding Biotechnology," which is friendly to human health and the environment. It is foreseen that the transformation of IP managerial in the agricultural biotechnology industry following the case of M. Inc. will achieve a win-win situation for both sides, the agricultural biotechnology industry and the public.

WD-09.3 [R] A Study on the Sales Performance of Automobiles: A Case Study of the US Market

Her-Her Tsai; National Central University, Taiwan
Min-Jhih Cheng; National Central University, Taiwan
Shiu-Wan Hung; National Central University, Taiwan
Dong-Sing He; National Defense University, Taiwan
Lin-Wei Hu; National Central University, Taiwan

This study employed data envelopment analysis and the Malmquist productivity index (MPI) to measure the sales performance of automobiles in the United States market. Our results indicate the mean efficiency value of pickups was higher than those of SUVs, minivans, and sedans/hatchbacks. The efficiency values of cars costing less than USD 20,000 were relatively low. In terms of changes in productivity, our results reveal that although the overall sales performance of the automobile market increased during the study period, the relevant technologies did not improve, but rather regressed.

WE-01 Innovation Management 9
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Pavilion East
Chair(s) Hongyi Chen; University of Minnesota

WE-01.1 [R] Application of Catalytic Effect to Create Innovation

Mariko Shiromura; Japan University of Economics, Japan
Hiroshi Suzuki; Japan University of Economics, Japan

There exist a lot of incremental innovations to solve superficial problems. Breakthrough type innovation, however, is expected to solve latent problems. Consequently, it realizes a safe and wealthy society and competitive economy. Incremental innovation is realized by summation of several solutions in a conventional fixed dimension. The authors think that breakthrough type innovation is realized by expanding this dimension to missing dimension. A bladeless electric fan, a smart-phone, and cloud computing are the examples that a new business model was born in a different dimension from the conventional one. The authors propose a method to create this new dimension by the chemical model of catalytic effect. As an example, the innovation caused by smart meter is described. It is simply replacement of an analog meter to digital within telecommunication in a fixed dimension to realized AMR (Automated Meter Reading). However, smart grid is applied as catalyst, smart meter get the opportunity of AMI. This creates breakthrough type innovation in electric power industry. The authors give some examples of catalytic effect producing new dimension such as smart phone, smart grid, etc.

WE-01.2 [R] Investigating Map of Digital Humanity Research Sponsored by Taiwan Government

Hsin-Ning Su; National Chung Hsing University, Taiwan
Pei-Chun Lee; Taiwan Research Institute, Taiwan
Ching-Wen Kang; National Chung Hsing University, Taiwan
Chien-Cheng Chen; National Chung Hsing University, Taiwan

This study investigates the structure of the Digital humanity research community by quantitatively analyzing Digital humanity research projects funded by Taiwan government in the past 30 years. Taiwan's Digital humanity research networks composed by research community and knowledge distribution are quantitatively investigated by the use of network theory and Taiwan's Digital humanity research map is created to obtain the purpose of two-dimensional visualization. The three-dimensional networks and two-dimensional knowledge maps on the basis of the Taiwan's Digital humanity research projects can be depicted differently by choosing different information as network actor, e.g., institute department or keyword, to reflect Digital humanity research structures in macro, meso, and micro-levels, respectively. Digital humanity research projects are retrieved from GRB (Government Research Bulletin) database which archives research projects sponsored by Taiwan government. A total of 883 projects conducted by 117 institutes are retrieved in this study, and a total of 2045 keywords are identified from the 883 projects for network construction. The obtained results can be used by the government to evaluate how to allocate research funding to the field of Digital humanity.

WE-01.3 [R] Stakeholders Influence in the Innovation Process of the Automotive Industry: An Exploratory Case Study

Cesar A. C. Bento; Universidade Federal do ABC, Brazil
Victor Vinha; Universidade Federal do ABC, Brazil
Vanderli C Prieto; Federal University of ABC, Brazil

In 1986 in Brazil, the Program for Motor Vehicle Air Pollution Control was created (PROCONVE), which has the main objective of reducing the emission of pollutants. The last phase of the program, called PROCONVE 7 (P7), became valid for the fleet of buses and trucks produced from early 2012. To comply with the new limits, which, compared with the first phase of this program (PROCONVE P1), demanded a 96.3% reduction in particulates and 87.3% of nitrogen oxide (NOx), it was necessary to make engine modifications, to develop new systems for gas treatment and the use of diesel with low sulfur content. It was a significant moment, with the development of a high degree of complex innovations, such as the Exhaust Gas Recirculation (EGR) technology and also Selective Catalytic Reduction (SCR). All participants involved could be affected by or impact the company, and could threaten or contribute to the project's success. This document identifies the stakeholders involved in this project and also analyzes how they influenced it and the level of collaboration and threat of each of them. The data was collected through semi structured interviews and questionnaires applied to the teams involved in all phases of the project.

WE-01.4 [R] Actors' Engagement in Sustainable Hydrogen Energy Innovation: A Comparative Analysis

Nazrul Islam; University of Abertay Dundee, United Kingdom
Yuya Kajikawa; Tokyo Institute of Technology, Japan

Hydrogen energy is currently a major focus of a sustainable energy future across the world. Following a period of high expectations, prospects for a transition to hydrogen are now

often presented in terms of the relative (short term) merits of hybrid and battery-electric verses hydrogen fuel cell vehicles. Whilst in the longer term aspects of these competing technologies may prove synergistic, a more fundamental problem remains: Which hydrogen production technologies and methods have foremost relevance to hydrogen energy innovation? How do actors engage themselves to produce and deliver sustainable hydrogen and how effective are they? This research is commissioned in order to evaluate whether technology push or market pull is in effect, and to contrast challenges and drivers for hydrogen energy innovations. In this respect this study presents a comparative analysis between the UK and Japan.

WE-03 R&D Management 3
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Broadway-1
Chair(s) Songphon Munkongsujarit; National Science and Technology Development Agency

WE-03.1 [A] Visualization of Knowledge Integration in a Japanese Cutting-Edge Research Institution: A Multi-level Bibliometric Perspective

Alfonso Avila-Robinson; Kyoto University, Japan

The complexity of the problems facing society, such as health care, mobility, or environment, call for solutions cutting across different disciplines. This lies at the heart of interdisciplinary research. Interdisciplinarity has been strongly promoted worldwide over the recent years. For the case of Japan, a prominent example is the WPI (World Premier International Research Center) initiative. The integration of unrelated or distant bodies of knowledge - also regarded as knowledge integration, fusion, confluence, or convergence - is an essential factor for interdisciplinary research. This study aims at quantitatively and visually capturing knowledge integration in a cutting-edge WPI research institution in Japan. By combining different existing approaches into one integrated framework, fuller, more holistic, insights into the knowledge integration efforts can be gained. Three levels of analysis are proposed: macro, meso, and micro; each of them targeting knowledge integration at different granularities. For each of these levels, different bibliometric-based and visualization approaches are used: global research maps, science overlays, and research landscapes, respectively. The results of these analyses will not only provide key insights into the way knowledge integration efforts can be assessed in cutting-edge research institutions, but also they are expected to serve as a spearheading effort for the conduction of further "technology intelligence" studies.

WE-03.2 [R] R&D, Innovation and Business Performance: A Case Study in a Medium Size Brazilian Agroindustry

Camila B Mourad; University of Sao Paulo, Brazil
Carlos L Perim Jr.; Guarany Industria e Comercio Ltda, Brazil
Carlos Roberto F Bara; Insper, Brazil
Roberto Sbragia; University of Sao Paulo, Brazil

Brazil is one of the top performing countries regarding agriculture production and thus, there is fierce competition among national and international industries in the machine and equipment market. Against all the odds, Guarany, a medium-sized national company, is developing, producing and selling sprayers in Brazil and exporting to over 60 countries. This 90-year old company has, since its foundation, consistently invested in R&D and patent protection. Thus, this study tries to evaluate how the intensity of R&D may be associated with Guarany's performance. To do so, we interviewed the Board of Directors and compared their feelings with a quantitative analysis of internal indicators over a 10-year period. With reliable internal information, such as detailed balance sheet, R&D, applied patents, and hours effectively worked in production, a comprehensive case study was conducted. Qualitative perceptions and statistical tests reveal that Guarany is reaping the benefits in sales, gross margin, new product sales, cost reductions, and productivity gains, due to its R&D and patents oriented business model. In an emerging country such as Brazil, where the culture of R&D and patent protection are relatively scarce, Guarany could be considered as a benchmark.

WE-03.3 [R] Strategic Alignment in a Consortium: A Case of the Thai Seed Industry

Songphon Munkongsujarit; National Science and Technology Development Agency, Thailand
Sabin Srivannaboon; Chulalongkorn University, Thailand

This paper examines the case of a Thai seed consortium in which industry, university and government jointly collaborate. Some key success factors of the consortium formation and operations are identified, including the building of trust and relationships among members, the focus on the core competency of the organization, the focus on the customer, the adequacy of resources, the passion of key personnel, and the "coopetition" nature of the business. We also present the linkages between the missions of consortium members and the strategic plan of the seed consortium through the alignment matrix. Overall business improvement at the national level, as a result of the alignment, can be seen from the significant increase in the growth rate of export value of the Thai seed industry after the strategic plan of the seed consortium was put in place.

WE-04 S&T Policy 3
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Broadway-2
Chair(s) Nasir Sheikh, State University of New York

WE-04.1 [R] Top Researcher Change by Governmental Support in Japan

Kazuya Tanaka; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

Fundamental R&D development needs public support. Now the Japanese government is focusing on financial support for top researchers to promote their research. Our research is trying to reveal how this kind of financial support works for them from a quantitative and qualitative perspective. "Funding Program for World-Leading Innovative R&D on Science and Technology" (FIRST Program) is a recent large support program in Japan. The program offers a very unique system to advance world-leading research carried out in a wide spectrum of fields in both university and industry leading near-future industrial applications. We use this program as a model case to reveal quantitative and qualitative change of top researchers in R&D development and also the output by this kind of governmental support.

WE-04.2 [R] Manpower Demand Forecasting of Strategic Emerging Industry in China: Based on Grey System Methodology

Wei Yao; Zhejiang University, China
Yuxiang Li; Zhejiang University, China

In 2011, the State government of China pinpointed seven industries as Strategic Emerging Industries (SEI). This paper predicts the manpower demand of China's seven strategic emerging industries by using grey prediction model, taking time series data (from 2009-2012) of 346 Chinese main-board listed companies from CSMAR. The results show that the total manpower demand of Chinese strategic emerging industries will reach 1,516,792 in 2015, and the number will increase to 2,779,007 in 2020.

WE-05 TUTORIAL: Technology Scorecarding
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Broadway-3
Speaker(s) Birgit J Oberer; Kadir Has University
Alptekin Erkollar; ETCOP

Many organizations that resist change are missing growing opportunities; global business interactions are easier to conduct with new technologies; and people become more dynamic in a global work environment. Empowered customers, coupled with increasing economic, product, and market change, force organizations to become customer-focused,

outcome-oriented business partners who must think about technology systems as business drivers and revenue catalysts. In this tutorial, a multidimensional technology evaluation scorecard template is introduced that enables a requirements analysis for managing innovation incentives and technology strategies within an organization. The developed multidimensional technology evaluation scorecard covers all the main strategic success factors from a management perspective and, in particular, relies on the qualitative factors of innovation management, determines the quality and dynamics deficits of technology strategies, and may provide clues for knowing which factors that should receive special attention. Today, many organizations change the way that they do business in order to keep up with a technologically evolving economy; people become more dynamic with the changing business environment and technological innovations. The work environment is designed by the growing technology, and the temporal and geographical boundaries need to be overcome. Traditional evaluation approaches of information technology focus mainly on metrics of the operational level, such as cost measures (cost per transaction, cost per ticket, cost per megabyte used), and availability measures (cycle time, first pass yields, mean time to repair). Although these kinds of metrics are beneficial for decision makers, they are less relevant for business leaders, who focus on achieving strategic business outcomes. IT focusing metrics often are considered isolated from the rest of the company's targets and not aligned to the company strategy, leading to different problems, such as a significant gap between perception about the value and the contribution of technology to the organization's strategy and a lack of alignment between business targets and IT measures, all of them causing opportunity costs. To cover activities on innovation and technology management and establish performance measurement structures, one instrument offering a systematic approach is the balanced scorecard.

WE-06 Tech Mining 2
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Broadway-4
Chair(s) Alan L Porter; Search Technology, Inc.

WE-06.1 [R] Modeling Technological Topic Changes in Patent Claims

Hongshu Chen; University of Technology Sydney, Australia
Yi Zhang; University of Technology Sydney, Australia
Guangquan Zhang; University of Technology Sydney, Australia
Donghua Zhu; Beijing Institute of Technology, China
Jie Lu; University of Technology Sydney, Australia

Patent claims usually embody the most essential terms and the core technological scope to define the protection of an invention, which makes them the ideal resource for patent content and topic change analysis. However, manually conducting content analysis on massive technical terms is very time consuming and laborious. Even with the help of traditional text mining techniques, it is still difficult to model topic changes over time, because single keywords alone are usually too general or ambiguous to represent a concept. Moreover, term frequency which used to define a topic cannot separate polysemous words that are actually describing a different theme. To address this issue, this research proposes a topic change identification approach based on Latent Dirichlet Allocation to model and analyze topic changes with minimal human intervention. After textual data cleaning, underlying semantic topics hidden in large archives of patent claims are revealed automatically. Concepts are defined by probability distributions over words instead of term frequency, so that polysemy is allowed. A case study using patents published in the United States Patent and Trademark Office (USPTO) from 2009 to 2013 with Australia as their assignee country is presented to demonstrate the validity of the proposed topic change identification approach. The experimental result shows that the proposed approach can be used as an automatic tool to provide machine-identified topic changes for more efficient and effective R&D management assistance.

WE-06.2 [R] Innovation and Design Process Ontology

Cherie Courseault Trumbach; University of New Orleans, United States
Christopher McKesson; University of British Columbia, Canada
Parisa Ghandehari; University of New Orleans, United States
Lawrence DeCan; University of New Orleans, United States
Owen Eslinger; US Army Engr. Research and Development Center, United States

Many domain-specific ontologies exist. These ontologies are used in text mining processes to better understand text that is available within the specific domain. Example domains include specific business areas such as marketing or functional areas such as particular types of operations within the intelligence community. This paper makes a step toward developing a broad ontology for the innovation and design process as a domain. Such an ontology can be used to better understand the discussion that takes places in the design and development of new innovations and can be used to better understand the influences on that development. In many cases, the success, failure, or final direction of a new innovation may not rest upon its technical merits but on the non-technical influences during the design and development process such as political influences. This paper uses examples within the shipbuilding domain in order to take steps toward building an Innovation and Design Process Ontology that can be applied to the Technology Delivery System (TDS) framework as a means of capturing and understanding the influences on the delivery system.

WE-06.3 [R] Identifying Target for Technology Mergers and Acquisitions Using Patent Information and Semantic Analysis

Lu Huang; Beijing Institute of Technology, China
Lining Shang; Beijing Institute of Technology, China
Kangrui Wang; Beijing Institute of Technology, China
Alan Porter; Georgia Institute of Technology, United States
Yi Zhang; University of Technology Sydney, Australia

Technology plays an increasingly important role in today's enterprise competition. Technology mergers and acquisitions (Tech M&A), as an effective way to acquire external technology resources rapidly, have attracted attention from researchers because of their potential realization of value through synergy. A big challenge that faces corporate managers and government policy makers is how to identify the appropriate target to support effective technology integration. In this study, we develop a model of target selection of Tech M&A from the perspective of technology relatedness and R&D capability. We present the results relating to M&A in the field of cloud computing in China.

WE-07 Competitiveness in TM 2
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Studio Suite
Chair(s) Louwrence Erasmus; CSIR

WE-07.1 [R] An Integrated ISM-DEMATEL Model for Evaluation of Technological Innovation Capabilities' Impact on the Competitiveness of Small & Medium Size Enterprises (SMEs)

Zeinab Ashtianipour; Qazvin Islamic Azad University, Iran
Hessam Zandhessami; Qazvin Islamic Azad University, Iran

One of the most important factors that influences firms to improve competitiveness and achieve competitive advantage is the utilization of technological innovation capabilities (TICs). In this paper, the impacts of the various aspects of these capabilities are evaluated and prioritized. After reviewing the literature, the capabilities have been categorized into six dimensions, and different aspects of competitiveness have been identified. Using Interpretive Structural Modelling (ISM), the interaction amongst the factors is extracted. Cause and effect equations of the Multiple Attribute Decision-making approach are used to determine the relative rate of the effects of TICs on competitiveness. The results obtained from the DEMATEL algorithm and ISM are analyzed and compared and the rates of influences are evaluated. Finally, combining both of the aforementioned methods, an integrated ISM-DEMATEL model is devised through which the factors are prioritized while the importance, intensity and effect of each factor are quantitatively calculated. The findings indicate that "R&D" has the highest influence on competitiveness of SMEs, and "profitability" and "quality" have the highest scores among the affected factors.

WE-07.2 [A] Evaluation of the Vehicle After-Sales Services Offered in South Africa by Competing Brands

Khutso I Mashigo; University of Pretoria, South Africa
Richard V Weeks; University of Pretoria, South Africa
Louwrence Erasmus; CSIR, South Africa

The South African automotive industry is the third largest sector in the national economy, This industry employs a significant number of people and it accounts for about 7.6% of the country's GDP. It operates in a highly competitive and dynamic environment that is growing at a tremendous rate due to international competition and changing demands of the customers. Furthermore, new competitors are countinuously entering the market introducing new competing brands which make it even more difficult for different brands to be competitive and profitable. A combination of a literature review and narrative enquiry was used in this study, that is qualitative and non-statistical in nature. The objective is to evaluate strengths and weaknesses of the servitization strategies adopted by competing brands in the after-sales service industry in South Africa to understand factors that give the competing brands a competitive advantage. The research study particularly focuses on views from a passenger-car dealership perspective.

WE-08 Convergence of Tech
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Directors Suite
Chair(s) Martin G Moehrle; Universität Bremen

WE-08.1 [R] Market Convergence in the Field of Stationary Energy Storage Systems

Nathalie Sick; Helmholtz Institute Muenster, Germany
Nina Preschitschek; University of Bonn, Germany
Stefanie Broering; University of Bonn, Germany
Jens Leker; University of Muenster, Germany

In order to develop and market powerful stationary energy storage systems, competences of different industries like the battery, chemical, energy, and electronics sector are necessary, which may lead to a convergence of these formerly distinct industries. Therefore, the purpose of this study is to anticipate industry convergence in the area of stationary energy storage by analyzing market convergence. A potential market convergence can be indicated by collaborative activities such as strategic alliances, joint ventures or mergers and acquisitions. As a main source of information on such activities, we use the full text database Nexis to conduct a search in English news sources referring to collaborations on stationary energy storage systems. As a result, we find signs for an ongoing market convergence, whereby a detailed analysis of collaborations in this field reveals that the mainly involved industries are the battery, electronics and energy industry sectors. In this context, the dominance of cross-industry collaborations indicates that competences from a variety of industries are needed to develop and introduce new solutions for stationary energy storage. Our analyses and findings contribute to the convergence research field by extending the currently scarce body of empirical literature on market convergence and by validating a recently developed analytical framework to anticipate and assess the status of market convergence.

WE-08.2 [R] Measuring Technological Convergence in the Field of Smart Grids: A Semantic Patent Analysis Approach Using Textual Corpora of Technologies

Frank Passing; Volkswagen Group Research, Germany
Martin G. Moehrle; University of Bremen, Germany

In the light of a fast and decisive impact of technological convergence, an early warning system for monitoring convergence is crucial for strategic tasks in companies. Investigations have shown that especially patent data is a vital information source for the analysis of measuring technological convergence. Although academics have paid much attention to classification and citation analyses, these approaches have shortcomings in terms of, e.g., delays and misclassifications. To overcome these shortcomings, this paper will present a novel approach for measuring technological convergence by semantic similarity of patents using textual corpora of technologies. By the case of smart grids we demonstrate the feasibility of our semantic measurement approach. Focusing on patent data from the USPTO, the results show clear evidence of some converging technologies and a proof of concept for our novel monitoring concept. For academics this approach offers new opportunities for analyzing convergence processes by means of semantic similarities. For practitioners, however, it serves as an early and reliable assessment instrument for strategic tasks like forming partnerships or evaluating the business environment.

WE-08.3 [R] Korean Experiences and Lessons Learned from Standardization Framework Activities

Byoung Nam Lee; ETRI, Korea, South
Wung Park; ETRI, Korea, South
Juyoung Park; ETRI, Korea, South
Hyoung Jun Kim; ETRI, Korea, South

In the ICT area, we are facing emerging domains of standardization such as Smart Cities, Big data, Internet of Things, Cloud computing, Smart Machines, 3D Scanning & Printing, and many other forthcoming emerging domains. The key commonality of these emerging domains involves the characteristics of complex systems. The emerging areas are influenced by multi-facets of a complex sphere. To deal with emerging domains in standardization, Korea Agency for Technology and Standards (KATS) has led standardization framework activities in Korea. From the above activities, we have learned that following issues should be carefully considered to deal with the complex characteristics of the emerging domains: Treatment on Horizontal vs. Vertical Domains, Value proposition, Unambiguous and Useful Guide, Participants (stakeholders and experts), Verification and Validation.

WE-09 Strategic Mgmt of Tech 3
Wednesday, 8/5/2015, 16:00 - 17:30
Room: Council Suite
Chair(s) Charles M Weber; Portland State University

WE-09.1 [A] Managing Technology Push through Marketing Testbeds: The Case of the Hi-Tech Center in Vienna, Austria

Rainer Hasenauer; Vienna HiTECH and WU Wien, Austria
Charles M Weber; Portland State University, United States
Peter Filo; University of Economics, Bratislava, Slovak Republic
Jozef Orgonas; University of Economics, Bratislava, Slovak Republic

The "technology push" approach to technology development rests on the assumption that if you make it, they will come. This assumption carries significant market risk. The technology may miss its intended market window, or the market that was anticipated at the inception of technology development no longer exists at the time of market release. This paper discusses how the Hi-Tech Center in Vienna, Austria, a multi-national collaborative effort between industry and universities in Central Europe, helps its clients manage technology push by deploying the marketing testbed approach. After identifying lead users for a client's technology, it characterizes and determines optimal market entry dates and windows of opportunity; readiness for and resistance to adoption; technology acceptance and marketability; and best practices for market entry. The Hi-Tech Center learned the following overarching lesson from engaging with six clients in six different industries: marketing testbeds comprise an effective toolkit for managing technology push, primarily because they act as a link between the technology readiness level and the market readiness level. Thus, they provide early insight into the customer's willingness to pay, the degree of fit between key features of the technology and marketability criteria, and, by extension, potential return on investment.

WE-09.2 [R] Strategic Marketing and Innovation Performance of Indian MSMEs

R Srinivasan; Indian Institute of Science, India
Lohith C.P; Indian Institute of Science, India

Rajeshwar S Kadadevaramath; Siddaganga Institute of Technology, India
S Shrisha; Karnataka State Planning Commission, India

Micro small and medium enterprises (MSMEs) is an integral part of the Indian industrial sector. The distinctive features of MSMEs are less capital investment and high labor absorption, which has created unprecedented importance to this sector. As per the Development Commissioner of MSME, the sector has the credit of being the second highest in employment in India, which stands next to the agricultural sector. The MSMEs are very much needed in efficiently allocating the enormous labor supply and scarce capital by implementing labor intensive production processes. Associated with these high growth rates, MSMEs are also facing a number of problems like sub-optimal scale of operation, technological obsolescence, supply chain inefficiencies, increasing domestic and global competition, fund shortages, change in manufacturing and marketing strategies, and a turbulent and uncertain market scenario. To survive with such issues and compete with large and global enterprises, MSMEs need to adopt innovative approaches in their regular business operations. Among the manufacturing sectors, we find that they are unable to focus themselves in the present competition. This paper presents a brief literature of work done in MSMEs, innovation and strategic marketing with reference to Indian manufacturing firms.

WE-09.3 [R] Opportunities for Strategic Alignment of IT to Business with the Adoption of Cloud Computing: Case Studies in Large Organizations

Eduardo Z Milian; Sao Paulo University, Brazil
Mauro M Spinola; Sao Paulo University, Brazil
Marcelo Schneck P Pessoa; Sao Paulo University, Brazil

This paper shows the adoption of cloud computing (CC) as a tool to promote strategic alignment of Information Technology (IT) to business. Using elements from literature on CC as the benefits brought by its adoption and on strategic alignment of information technology to business, the article reveals how the emerging technology of CC has the ability both to influence and enable new business strategies, such as opening new market opportunities for organizations. Through a multiple case study were identified as the adoption of CC was able both to support and shape business strategies, but also to promote integration between infrastructure and processes business and IT infrastructure and processes. Opportunities for strategic alignment could be observed with the CC adoption to meet a specific need of one company and also as a result of a more general strategy of the organization adopting it as a model for services delivery.

HA-00 PLENARY - 4

DATE: THURSDAY, 8/6/2015
TIME: 8:30 - 10:00
ROOM: PAVILION
CHAIR(S): TIMOTHY ANDERSON; PORTLAND STATE UNIVERSITY

HA-00.1 [K] Innovation in Canada

John McDougall; National Research Council, Canada

Historically, research and the arts were often viewed from a similar perspective - as "things advanced economies did" and there was minimal accountability from investments in research. Following massive global investments in research, expectations for impacts are rising around the world and people are beginning to question the appropriate shape of public investment across the entire ST&I horizon. Canada too has made major investments in knowledge generation and, as a result, punches above its weight in publications and citations. However, raw knowledge is a tradable good, and like any other resource, in the absence of value added through innovation, is a relatively low value commodity and thus, is not sufficient to create a competitive economy. Monetizing knowledge through innovation underpins globally competitive economies - by contributing to productivity through development and commercial application of technologies, products and services. Canadian business expenditures in research and development (R&D) lag behind many countries. Furthermore, Canada faces chronic challenges in effectively moving knowledge developed in higher education institutions to companies that have the ability to absorb it and translate it into commercially viable products. This presentation will outline the actions being taken to improve Canada's innovation performance.

HA-00.2 [K] The Architecture of Engineering

Steven Eppinger; Massachusetts Institute of Technology, United States

Our work with the design structure matrix (DSM) started by using the method as a research tool to model the performance of engineering projects. However, we immediately recognized DSM to be a powerful method to explore and explain the deep structure of complex technical projects across a range of industries. Today, we can use DSM to represent the architecture of complex engineering systems, the architecture of large engineering processes, and the architecture of networked engineering organizations. In this keynote presentation, I will review some of the key DSM research results and the ways in which the method is used today to manage complex technical projects. I will also offer thoughts on the frontiers in engineering management that may be addressed using DSM modeling and some reflections on why it takes more than 20 years to bring a practical new method into common practice.

HB-01 Manufacturing Management 1
Thursday, 8/6/2015, 10:30 - 12:00
Room: Pavilion East
Chair(s) Kem Ramdass; University of South Africa

HB-01.1 [R] Key Leadership Factors towards Business Process Improvement: A Managerial Focus

Kem Ramdass; University of South Africa, South Africa

Complex systems require leaders that are able to deliver the highest quality products and services. Therefore, it is critical that organizations hire the right leaders, who possess the right skills in the right roles. The shortage of leaders and leadership skills is creating a challenge for the embattled clothing and textile industry over the past four decades. Competition is forcing organizations to focus their energy on "core competencies." The clothing and textile sector is witnessing changes in technology, diversification of labor, and managerial implications while competing on the global market. Managerial competencies are essential in a dynamic working environment where collaboration and team effort are vital for organizational progress. The South African manufacturing industry is plagued with inefficiency, and productivity and is at its worst level with a 1.35% growth rate. The industry's ability to generate sustainable and productive employment varies according to geographical locations. The aim of this article is to highlight the lack of managerial and leadership competencies in the implementation of business improvement strategies that can be implemented at manufacturers to improve the productivity levels while trying to save jobs in the industry. An extensive review of literature was undertaken to identify leadership competencies applicable to the South African context. Six leadership competencies were identified and were validated by expert opinion. Both qualitative and quantitative data was used in the survey.

HB-01.2 [R] Integrating 5S Principles with Process Improvement: A Case Study

Kem Ramdass; University of South Africa, South Africa

Lean manufacturing may be applied predominantly in the manufacturing environment; however, it is aptly applicable to the service industry as well. 5S may be considered as a tool of lean as it reduces waste and adds value to the process. It may be combined with other tools such as Kanban, Kaizen, total preventive maintenance, and total quality management in addressing pertinent issues in the workplace. Thus managers face increased pressure to improve performance within their organizations. Performance management is the "buzzword," including national and international competition. In order to accomplish this objective with a decreasing workforce, managers are empowering employees to take

responsibility on productivity and performance. By creating a workplace that is conducive to achieve this performance, in consideration of health and safety, work design and productivity, the implementation of the 5-S principles can become one of the sustainable competitive advantages in industry. The objective of the study is to highlight that many organizations, both manufacturing and service, lose millions of rands in the form of waste on a regular basis. Therefore, integrating these principles into a plant's culture can cut a worker's compensation costs, reduce lost time, improve productivity and quality and strengthen labor-management relations. The objective of this paper is to highlight that 5S principles are fundamental to the workplace and to indicate that the monetary value of waste across the spectrum is insurmountable. In order to achieve this, a case study methodology was used as it was the most applicable method of collecting data. The best way to make the 5-S principles an integral part of plant culture is to develop a plant-wide program. The study provides an overview of workplace challenges experienced. It is the researcher's intention to emphasize the importance of these basic principles and their associated benefits for all stakeholders through an exploratory research design.

HB-01.3 [R] The Effects of Disruption on Different Types of Tile Manufacturing Industry-layouts: An Empirical Investigation on Tile Manufacturing Industry

John M Ikome; Tshwane University of Technology, South Africa
Sesan Peter Ayodeji; Tshwane University of Technology, South Africa
Grace Kanakana; Tshwane University of Technology, South Africa

Almost all manufacturing facilities need to use production scheduling systems to increase productivity and reduce production costs. Most manufacturing industries invest a huge amount of money to manufacture and supply products on time in order to meet customers' demands and objectives, but due to unforeseen disruptions, these objectives are difficult to achieve. In real life, production operations are subject to a large number of unexpected disruptions that may invalidate an original schedule. This work considered effects of disruption on different types of industry-layouts that have seldom been used in manufacturing industries, namely: fixed, product, production and process industry-layouts. Questionnaires were used for data collection from a number of companies in Cameroon and reliably theory, simulation software's were using to analyze the data. The study reveals that disruptions varies per industry-layout and the leading sources of disruptions are machine breakdown, power failure, employee absenteeism and material shortage. It is concluded that disruption of one type may not greatly affect productivity of a certain industry-layout, whilst similar disruptions can have devastating effects on another type, and also, the impacts of disruption are dependent on the industry-layouts.

HB-01.4 [A] Managing Supplier Transitions: Development and Performance through Work Transfer

Veekit O'Charoen; The Boeing Company, United States
Jeoffrey H Bispham; The Boeing Company, United States

The dynamics of the aerospace production environment today requires companies to effectively utilize all available resources to remain competitive. The cost and quality of hardware offered in the market is a key element, not only of the capabilities of each supplier, but also the supplier network providing aircraft components to the enterprise. To remain competitive, major aerospace industries are increasingly implementing supplier development programs to maintain capable and high performing supplier bases. This case study presents a concept of outplant engineering's role and the effort to improve performance of a supplier from a manufacturing and tooling perspective. The experiences from this case study suggest that early engagement is the most important supplier development prerequisite before undertaking operational work transfer activities such as technical and capacity capabilities. There will always be emergent support requests in the initial production phase of new hardware. Collaborative inter-organizational communication is identified as an important supporting factor in transforming an organization's effort to develop performance improvement capabilities with the supply chain.

HB-02 Technology Forecasting 2

Thursday, 8/6/2015, 10:30 - 12:00
Room: Pavilion West
Chair(s) Jisun Kim; Bonneville Power Administration

HB-02.1 [R] Knowledge Accumulation and Value of Inventions

Praveena Chandra; University of Sydney, Australia
Andy Dong; University of Sydney, Australia

A challenging task in technology management is the early identification of valuable inventions. Techniques that attempt to do so using patent indicators find that the predictions based on one indicator often do not agree with the predictions made with other indicators. Focusing on technological value, we propose a new metric based upon the concept of knowledge accumulation. Knowledge accumulation accounts for the background knowledge preceding the invention. Prior knowledge underlying an invention should be indicative of technical experience in the sector, which has led to solutions to various technological problems that grow the body of knowledge relevant to the invention. Hence knowledge accumulation may be a suitable indicator of the maturity of the knowledge that contributes to the specific invention. Using a composite patent value and multiple generation citation networks, we compare knowledge accumulation in patents for inventions in the energy harvesting sector over a 100-year observation period. The results indicate that there is a statistically significant correlation between the composite patent value and knowledge accumulation. As the analysis considered both patent applications and granted patents, the results imply that the metric can be used to predict the technological value of technologies that have not yet been patented.

HB-02.2 [R] Applying TRIZ and Bass Model to Forecast Fitness Tracking Devices Technology

Sowmini Sengupta; Intel Corporation, United States
Jisun Kim; Portland State University, United States
Seong Dae Kim; University of Alaska Anchorage, United States

65% of the world's population lives in countries where overweight and obesity kills more people than those who are underweight. Healthcare organizations, private corporations and individuals are investing in proactive health and weight management. Advances in sensor technologies have enabled development of affordable wearable technology devices, the most rapid expansion being fitness trackers which entered the market in 2012. This paper describes the application of a combination of TRIZ and Bass modeling to forecast the technology growth projections for fitness trackers. For the TRIZ modeling, the fitness tracking system was divided into three subsystems and each was analyzed per the technology trends from current literature. The subsystems' combined assessment was then visualized via a radar plot. The analysis showed the technology to be in an emergent state with primary growth in the hardware and software subsystem areas. For the Bass model adoption rate projection, the market size was estimated to be 69% of the US population who are active health trackers. The innovator and imitator parameters were calculated using information from analogous products such as cellular phone, home PC and ultrasound imaging. The Bass model showed the market peaking at eight and saturating in fifteen years.

HB-02.3 [R] Putting Design Thinking into the Patent Deployment Practice of Dimming LED Driver SMEs

Fang-Pei Su; Shu-Te University, Taiwan
Pei-Jie Shih; Wufeng University of Technology, Taiwan
Wen-Goang Yang; Chaoyang University of Technology, Taiwan
Kuei-Kuei Lai; Chaoyang University of Technology, Taiwan
Chien-Yu Lin; National Yunlin University of Science & Technology, Taiwan
Ping-Chun Chang; National Yunlin University of Science & Technology, Taiwan

This research focuses on the use of design thinking and patent information as the basis for a set of operation processes. These will investigate how enterprises can find new business opportunities based on the demands of the market through patent deployment and

technology road-mapping, starting with the establishment of a top management team and an industrial development model to proposing strategic patent deployment patterns. Four aspects of technology road-mapping were then developed to support decisions regarding connecting technologies with the market. The four aspects of the road-mapping include technologies, patents, products, and the market. The research produced six patent deployment models and three feasible patent deployment schemes. The technology road-mapping of the case company was then completed so as to realize the long-term blueprint of connecting technologies with market goals. The results won high praise from the company. This research believes that using SPDT process and patent information at the same time will produce complementary effects, and enhance the objectivity and reliability of the patent deployment. Using just patent information may have limitations because the information only comes from the outside. However, using it together with SPDT can guarantee the extraction of more valuable technological information from internal discussions with the company, and provide patent deployment and technology road-mapping for the company.

HB-03 Productivity Mgmt 2
Thursday, 8/6/2015, 10:30 - 12:00
Room: Broadway-1
Chair(s) David J Kruger; University of South Africa

HB-03.1 [A] Process Integration and Improvement in a Higher Education Institution in South Africa

David J Kruger; University of South Africa, South Africa

Processes utilized in service organizations are justly regarded as crucial resources. Each process utilized in rendering a service appreciably plays a role in the cost of managing the organization. Processes impact on the service levels customers expect and experience from the service provider. Higher education providers are not immune from poor performing and costly processes. The researched institution is as a result, not an exception. Due to the business model of the institution, Open Distance Learning, it is imperative for the organization to have effective and efficient processes to service 350,000 students. Due to failures of critical processes at inopportune moments, management decided that processes should be improved utilizing scientific and systematic improvement tools. The researcher was requested to investigate processes and affect changes that would improve the performance of said processes. Various lean change methodologies were utilized in investigating, mapping and improving processes. Lean methodologies utilized included the Ishikawa diagram, seven service wastes, the five why principle and root cause analysis. The purpose of the study was to create processes fit for purpose, effective integration and acceptance of the improved processes and ensuring processes were effectively engineered. A standard operating procedure was produced for each of the improved processes.

HB-03.2 [R] Improving Library Efficiency to Meet Patron's Needs: A Data Envelopment Analysis Benchmarking Model

Michael Clark; Portland State University, United States

Technological innovation and the information age have increased patrons' expectations of the services and resources that academic libraries provide. Libraries are responding to patrons' needs by providing digital resources and services, and collaborative spaces that invite communication and knowledge sharing. In order to effectively meet patrons' needs, libraries are striving to efficiently manage their human, materials, and fiscal resources. Libraries have traditionally measured efficiency by developing single factor productivity indexes. However, these qualitative methods do not adequately address the efficiency aspect which measures the transformation of resources (inputs) into services (outputs). Data envelopment analysis (DEA) measures the relative efficiencies of a decision making unit with multiple inputs and outputs. The DEA methodology has been applied to libraries over the past 20 years. This paper proposes a DEA evaluation model that faculty, in their advisory and advocacy shared governance roles, can employ to strengthen their libraries. The model is demonstrated by analyzing the efficiency of the Portland State University Branford Price Millar Library to its peer institution libraries for the academic year 2011-2012.

HB-03.3 [A] Q-mark Model Assessment Using CBAM (Cost Benefit Analysis Method)

Jeong-Hyun Park; ETRI, Korea, South
Jin-Sam Kim; ETRI, Korea, South
Ki-Hong Kim; ETRI, Korea, South
Boo-Hyung Lee; KnogJu National University, Korea, South
Chi-Young Park; University of Pennsylvania, United States

This paper presents assessment of processes in Q-mark based on CBAM (cost benefit analysis method). There are 5 main processes with 3 additional processes in Q-mark for quality of R&D projects. Among 8 processes assessment results, test management process and project execution management process are a high priority for quality of R&D projects; otherwise, peer review process and project process management process are low priority. The Q-mark model has been adapted and improved continuously for quality upgrade of R&D projects, and inner and outer customer satisfaction with products.

HB-06 Cultural Issues 1
Thursday, 8/6/2015, 10:30 - 12:00
Room: Broadway-4
Chair(s) Charla C Griffy-Brown; Pepperdine University

HB-06.1 [R] Are Geeks Driving Out the Fashion Industry?

Saori Kitaura; Hitotsubashi University, Japan
Yuichi Washida; Hitotsubashi University, Japan

More consumers have been shifting from mass media to network media such as the Internet. There has been a significant movement towards being engrossed in games or the Internet among people in their teens and 20's. The main target of the fashion industry has been teenagers. Geeks who are absorbed in games or the Internet tend to avoid social interaction in real life, and so they might be not interested in appearance and fashion. Questionnaire surveys were conducted in 2012 to examine the features of geeks and fashionistas. This paper discusses whether the Information and Communication Technology (ICT) generation who live in a virtual society can be destroying a basic and essential role of fashion, as a means of expressing one's social identity. For geeks who have learned different rules of communication, there is no need for them to spend time or money on fashion. There is a possibility that the more developed ICT Networks become, the less relevant the fashion industry will be.

HB-06.2 [R] Personal Style, Culture and Performance Outcomes in Projects: What is the Role of Project Leader Individual Differences?

Zvi H Aronson; Stevens Institute of Technology, United States

We centered the effect of project leader personal style on culture in project-based work. Little is known about dispositional factors of the project leader and how they contribute to culture in projects. The current study, based on a sample of 121 project teams, illustrates that individual differences in the project leader's personal style are related to culture in project-based work. In conjunction, we showed how culture can be used by the leader to trigger performance outcomes in projects. Recommendations to re-consider selection and training for project leaders are provided.

HB-06.3 [R] The Changing Discourse of Technology in Society in the 21st Century: Identifying Themes, Broader Questions and Exploring the Role of Technocratic Ideology

Charla C Griffy-Brown; Pepperdine University, United States

What are the themes and broad questions within these themes that have arisen within the discourse represented by Technology in Society? Is there any connecting ideology or methodology that crosses all of these themes? This study revealed that there were broad questions and themes that emerged in the international journal, Technology in Society, from 2004-2015. Some of these broader thematic questions included: What are the significant

issues to be raised and debated about technology's power to influence human and natural environments? Regarding ethics and values, how will the public understand science and technology as it continues to evolve? A content analysis conducted over the last decade of the journal identified broad categories and themes of interest to scholars. A more in-depth look at these themes, applying a theoretical framework called "epistemic strategies", was used to construct the broader questions within these themes. In addition, this framework highlighted that there was an underlying epistemological ideology that crossed the manuscripts published regardless of their theme. This epistomology is referred to in the philosophy of science domain as "technocratic" ideology and is important to highlight as it impacts decision-making and scholarly thinking. By identifying this trend in broader questions as well as this underlying ideology, this study provides insight into the promise and real constraints of the ongoing study of technology in society.

HD-02 PANEL: PICMET 2016 Planning Session
Thursday, 8/6/2015, 14:00 - 15:30
Room: Pavilion West
Panelist(s) Dundar F Kocaoglu; Portland State University
Tugrul U Daim; Portland State University
Timothy Anderson; Portland State University
Caroline V Mudavadi; Portland State University
Dilek Cetindamar; Sabanci University
Kiyoshi Niwa; Professor Emeritus, The University of Tokyo
Kenny Phan; Portland State University
Liono Setiowijoso; Portland State University
Charles M Weber; Portland State University

This panel session will provide an opportunity to give feedback on PICMET '15 and to get involved in the planning for PICMET '16 and '17 conferences. PICMET '16 will be held September 4-8, 2016, at the Waikiki Beach Marriott Resort & Spa, Hawaii.

HD-03 Productivity Mgmt 1
Thursday, 8/6/2015, 14:00 - 15:30
Room: Broadway-1
Chair(s)

HD-03.1 [R] Gender and Productivity in Biotechnology: Evidence from Mexican Scientists

Humberto Merritt; National Polytechnic Institute (IPN), Mexico

In the innovation literature, it is widely recognized that women face a number of gender related barriers to succeed in scientific careers. Most women seeking to become scientists need to overcome not only professional hurdles but also personal and social obstacles. Nonetheless, in the last few years women have made strides in closing the gender gap, especially in life sciences. In Mexico, biotechnology is one of the few fields where women participate in large numbers. In particular, the School of Biological Sciences of the National Polytechnic Institute (ENCB-IPN) is one of the most prestigious academic colleges in the country, where women have a long tradition of being devoted to teaching and carrying out basic research. In this paper, we seek to identify how scientific activity is driven by gender factors by analyzing the role of Mexican female scientists from ENCB in pushing the knowledge frontier. By drawing in the Espacenet patent database we can identify how women interact with their male colleagues. Empirical findings suggest that most female scientists from ENCB patent in collaboration with male scientists, whereas with only a handful of them patenting alone.

HD-03.2 [R] Analysis of Packaging and Delivery Operation in a Cucumber Packaging Factory Using Lean Six Sigma

Micheal K Adeyeri; Tshwane University of Technology , South Africa
Mukondeleli G Kanakana; Tshwane University of Technology, South Africa

The paper is aimed at analyzing and improving the sorting, packaging and delivery operations at a cucumber packaging industry. The packaging operation of a farm in Mpumalanga, South Africa, has been studied in detail, and possible areas of improvement are proposed. It is a usual practice for farms in South Africa to have a packaging center where farm produce is sorted, packaged and delivered to various customers across the country. Perishable farm produce requires special handling, care and timely delivery to end users or consumers so as to keep to the limit of its shelf life. The farm under consideration has been having a lot of damages as a result of an improper and poor packaging operation. Therefore, the study makes use of Lean Six Sigma tools to analyze and quantify the efficiency of the current packaging system and proffers a better and profitable approach in minimizing waste. The result shows that simple changes in system arrangement and concepts can significantly reduce the damages, increase the number of deliveries and improve system performance measures.

HD-03.3 [R] Effect of Environmental Factors on Labor Productivity in Construction Industry

Mitra Amini; Portland State University, United States
Gerald H. Williams; Construction Research, LLC, United States

The cost of labor on a construction project makes up between 40 and 50% of the cost of production (depending on the trade); therefore, labor productivity as one of the best indicators of production efficiency has always been of great concern for construction project managers. In the construction industry, in particular, contractors and project managers frequently face cost overruns or experience construction claims due to productivity factors impacting labor. Therefore, having a good understanding of productivity impact factors would help managers when performing the cost estimates early on at the planning phase. This paper analyzes the published literature and illustrates the type and negative effects caused by environmental factors (weather, darkness, and noise) on productivity and duration of activities in different construction trades. Although published studies agree on negative impact to labor productivity due to environmental factors, no specific trend could be identified on the relationship between productivity and severity of these factors.

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Hilton Floor Layout