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PICMET '17

PICMET

Dear PICMET Guests:

We are pleased to welcome you to the PICMET '17 Conference.

The general theme of PICMET '17, "Technology Management for the Interconnected World," brings attention to technological innovations in a world driven by communication networks. The theme is woven into the keynote speeches and several papers, but the Conference is not limited to it. Every aspect of technology management is addressed in the presentations.

There are eight keynote speeches:

Monday:
Dr. James M. Utterback, M.I.T.; "Landmarks in our Understanding of the Management of Engineering and Technology"

Dr. Karl H. Vesper, University of Washington; "Three Underexploited Opportunity Directions for Technology Management"

Tuesday:
Dr. Alan L. Porter; Georgia Institute of Technology; "'Tech Emergence' Indicators – To Inform Management of Technology"

Dr. Guruduth S. Banavar, Viome; "The New Era of AI"

Wednesday:
Dr. Robert A. Burgelman, Stanford University; "Becoming Hewlett Packard: Why Strategic Leadership Matters"

Mr. Scott Roth, Jama Software; "The Rise of Smart, Connected Products and the Challenge to Build Them"

Thursday:
Dr. Dietmar Theis, Technical University of Munich; "Industry 4.0 – Chances and Challenges of the Digital Transformation"

Mr. John R. McDougall, Hon Col (ret), B.Sc. (Alberta) 1967, P.Eng., CD, CStJ, C.Dir., FCAE, FEC, FGC (Hon), Fellow PICMET; "Lessons Learned from International Innovation"

PICMET '17 received 547 submissions. After a double-blind refereeing process, 243 papers are included in the conference. The referees were from around the world. The authors represent more than 100 academic institutions, industrial corporations and government agencies in 24 countries.

The PICMET '17 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 41 sections, listed below, in alphabetical order. Each section contains several papers on the topic.

- **Artificial Intelligence for Technology Management**
- **Big data for Technology Management**
- **Collaborations for Technology Management**
- **Commercialization of Technology**
- **Competitiveness in Technology Management**
- **Cultural Issues in Technology Management**
- **Decision Making**
- **Disruptive Technologies**
- **E-Business**
- **Strategic Management of Technology**
- **Educational Issues**
- **Emerging Technologies**
- **Enterprise Management**
- **Entrepreneurship/Intrapreneurship**
- **Global Issues**
- **Indicators of Technical Emergence**
- **Information/Communication Technology**
- **Innovation Management**
- **Intellectual Property**
- **Leadership**
- **Knowledge Management**
- **Manufacturing Management**
- **New Product Development**
- **Project/Program Management**
- **Quality Management**
- **R&D Management**
- **Resilience of Systems**
- **Resource Management**
- **Science and Technology Communication**
- **Science and Technology Policy**
- **Social Innovation**

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- **Social Media**
- **Supply Chain Management**
- **Technological Changes**
- **Technology Adoption**
- **Technology Assessment and Evaluation**
- **Technology Management in the Energy Sector**
- **Technology Management in the Health Sector**
- **Technology Management in the Service Sector**
- **Technology Planning and Forecasting**
- **Technology Roadmapping**

Many colleagues, worldwide, contributed to the success of the PICMET ’17 Conference.

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

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

Ann White, as the Executive Director Emeritus, edited the *Bulletin* and prepared the front-end materials; Liono Setiowijoso designed, maintained and managed the information systems and PICMET web site under the guidance of PICMET CIO Bob Martin, and formatted the papers for the Proceedings; Caroline Mudavadi, as the Executive Assistant, provided support throughout the planning and registration process; Byung Sung Yoon, as the Executive Director of PICMET and Conference Coordinator, coordinated the overall planning for the conference. Sule Balkan managed finances as PICMET’s treasurer; Mark Ahn coordinated external activities. Timothy Anderson was the Director of Technical Activities, Kiyoshi Niwa and Dilek Cetindamar Kozanoglu were the Co-Directors of International Activities, and Charles Weber was the Director of Awards. Byung-Sung Yoon and Songphon Munkongsujarit coordinated the on-site activities; Pei Zhang managed the documentation together with Hakan Kutgun; Ahmed Alibage prepared the signage; and Jeff Birndorf developed graphic arts for the conference. Nathasit Gerdsri chaired the Student Paper Award Committee, whose members Hongyi Chen, Jonathan Ho and Nazrul Islam evaluated more than 30 papers nominated for the award. Hakan Kutgun developed and managed the PICMET page on LinkedIn.

Timothy Anderson, Tugrul Daim, Kiyoshi Niwa, Dilek Cetindamar Kozanoglu, Harm-Jan Steenhuis and Gary Perman conducted the review process for the papers as the Associate Editors; 126 colleagues from around the world constituted the Panel of Reviewers. They each reviewed up to 10 papers submitted to PICMET ’17. Each paper was reviewed by two or more reviewers to assure high quality. Tim Anderson did the scheduling of the accepted papers for presentation at the conference. Joao Lavoie, Husam Barham, Edwin Garces, Rafaa Khalifa, Sadaf Salek, Amir Shaygan, Chih-Jen Yu and Pei Zhang were the Editorial Assistants to check and verify that the finalized papers included all the revisions recommended by the reviewers.

Elizabeth Aubrey and Sherri Young of IEEE worked with PICMET from the beginning to the end of the conference planning effort. Their professionalism and 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 and supporters of PICMET ’17 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, Portland State University Foundation, Portland State University - Office of Information Technology, EPSON, Search Technology/Vantage Point, FreeGeek Technology Refurbisher, and WHOVA Event Management.

We believe the PICMET ’17 *Bulletin* and *Proceedings* contain some of the best knowledge available on Technology Management for addressing the challenges and opportunities in the interconnected world. We hope they will contribute to the success of technology managers and emerging technology managers, worldwide.

~ Dundar F. Kocaoglu, President and CEO

PICMET '17

DEDICATION

PICMET '17 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.

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IEEE - Technology Engineering Management Society,
INFORMS – Technology, Innovation Management and Entrepreneurship Section

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PANEL OF REVIEWERS

Papers submitted to PICMET conferences are subjected to a double-blind review process. Each paper included in the PICMET ’17 conference was reviewed by two or more members of the Panel of Reviewers to assure a very high quality. The panel had 155 members from around the world. They are listed below in alphabetical order by last name.

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Marthinus Pretorius
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Kem Ramdass
Jamie Rogers
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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.

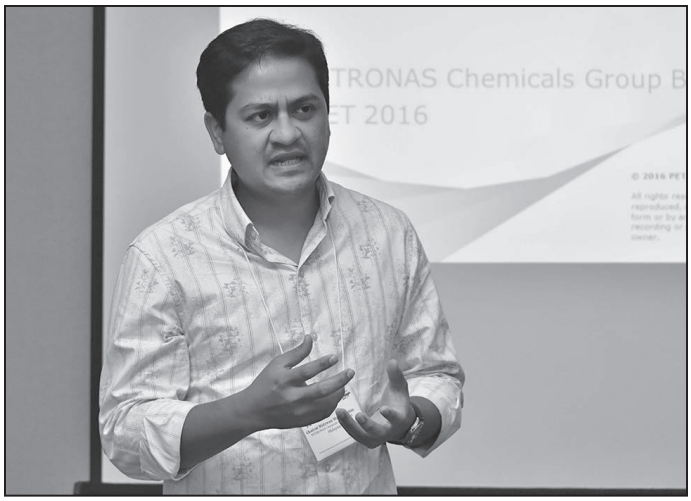
1991
Dr. Andrew S. Grove, CEO of Intel, USA

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 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

2015
Mr. John R. McDougall, President, National Research Council, Canada

2016
Mr. Shinjiro Iwata, Advisor to Hitachi Ltd., 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

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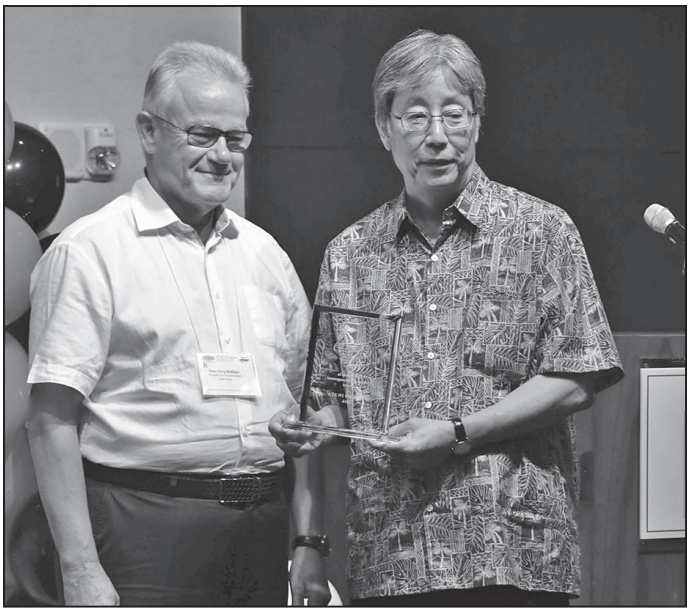


2006
Dr. Frederick Betz, Former Program Officer, NSF
Dr. Fariborz Maseeh, Founder and President, The Massiah Foundation
Dr. T. Nejat Veziroglu, Director, Clean Energy Research Institute, University of Miami

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

2015
Dr. Steven Eppinger, Professor of Management Science and Innovation, Massachusetts Institute of Technology, USA
Dr. Alan L. Porter, Professor Emeritus, Georgia Institute of Technology; and Director of R&D for Search Technology, Inc., USA

2016
Dr. Jay Lee, Ohio Eminent Scholar, L.W. Scott Alter Chair, and Distinguished University Professor, University of Cincinnati, USA

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 the research conducted and supervised, research results published in refereed journals, and research grants received from funding agencies or industry.

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.

PICMET '17

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
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

2015
Dr. Oliver Yu, President and CEO, The STARS Group; Executive in Residence, Lucas College of Business, San Jose State University, California, USA

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, 2016. 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 certificate for the student, as well as a certificate 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
Kosuke Kato

ADVISOR & CO-AUTHOR
Professor Kazuhiko Itaya

UNIVERSITY
Tokyo University of Agriculture and Technology, Japan

PAPER TITLE
"Exploring Effective Factors for the Generation of Innovative Ideas and Technologies in Functional Food R&D"

ABSTRACT

Functional foods are promising products with physiological effects that may provide health benefits. Innovative concepts and technologies that derive from individual creativity and serendipitous findings are indispensable in order to make good sales and achieve a share in the growing functional food market. However, there have been few reports discussing manufacturers in the food industry adapting any kind of a management system for promoting creativity and serendipity. In this paper, we demonstrate the analogy of the R&D processes between functional foods and drugs to point out the important role of serendipity in functional food R&D. To achieve our goal of constructing an effective management system for idea generation in the functional food sector, we conducted survey analysis of 114 R&D researchers and engineers at 74 companies in the sector using a questionnaire on idea generation. Through factorial analysis, we extracted the novel factors underlying idea generation in functional food R&D. We would like to show how these factors may promote creativity and serendipity.

SHARE THE PICMET EXPERIENCE

THE PICMET EXPERIENCE

Joining the world's leading technology management experts from academic institutions, industrial corporations and government agencies for discussions on cutting-edge topics.

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 '17 AWARDEES

Mr. Scott Roth
Chief Executive Officer, Jama Software, USA

As CEO, Mr. Scott Roth sets the strategic vision for the company. Prior to joining Jama, Mr. Roth served as Executive Vice President & General Manager of the Email Optimization business unit for data solutions provider Return Path, where he led a global team of more than 250 employees spanning product management, engineering, sales, services, channel and marketing. Scott brings more than 15 years of SaaS business-building experience including roles with Salesforce.com, ExactTarget and Webtrends. At ExactTarget, Scott helped the organization achieve more than 50 percent annual growth, expand into Europe, Asia and Latin America and complete a successful IPO on the New York Stock Exchange prior to its $2.5B acquisition by Salesforce.com.

Dr. Karl Hampton Vesper
Foster School of Business, University of Washington, Seattle, USA

Dr. Karl Vesper is an emeritus from the University of Washington, where he held full professorships in: (1) Management, where he started the entrepreneurship course in 1970, (2) Mechanical Engineering, where he taught machine design, and (3) Marine Studies, where he taught ocean systems design. His most recent formal academic appointment was in 2011 as Visiting Regents Chairholder in Entrepreneurship at Texas Tech University. Characterized in 1979 by *Business Week* as the "generally recognized dean of entrepreneurial studies," he subsequently became first holder of the Roger Babson Professorship in Entrepreneurship at Babson College and of the Carma Professorship in Entrepreneurship at the University of Calgary, as well as

second holder of the Schoen Professorship in Entrepreneurship at Baylor University and a Fulbright Distinguished Scholar at Trinity College, Dublin. Subsequently in 2001-2002, he was appointed as Visiting Professor in Bioengineering in the Jacobs School of Engineering at the University of California, San Diego, and later a Visiting Professor in Entrepreneurship at the University of Hawaii, Hilo. His academic interest in entrepreneurship began shortly after completing an Air Force officer tour as Flight Test Engineer at Edwards AFB, California, in 1957.

He also worked industrially as Assistant to the President of a high-performance electromotive products company, and as business manager of an oceanographic consulting and instrument manufacturing company where he helped raise venture capital. He holds BS, MS, and PhD degrees in Engineering from Stanford and an MBA from Harvard. His hobbies include motorcycles, snowboarding, surfing, and learning from his grandchildren.

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 '17 AWARDEES

Dr. Guruduth S. Banavar
Chief Technology Officer (CTO), Viome, Inc.

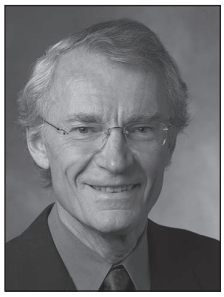
Dr. Guru Banavar believes in applying deep technology innovations to solve major problems that humanity faces, especially in healthcare and education. He is known for his work on Watson AI, Smarter Cities, Services Innovation, Mobile Computing, and Distributed Systems.

He is currently developing AI systems at Viome, a wellness company that offers unprecedented visibility into the biological ecosystem inside each of us and delivers ongoing recommendations to improve wellness with a personalized diet and lifestyle plan. Until recently, he was a senior technology executive at IBM responsible for advancing Watson AI technologies and solutions, and was a member of CEO Ginni Rometty's top executive team.

Dr. Banavar is a recognized thought leader who has spoken on the Nobel, Aspen, Milken, and Turing stages. His work has been featured in major international media including the New York Times, Economist, Wall Street Journal, and NPR. He received a national innovation award from the President of India, and has served on NY Governor Cuomo's commission for state resiliency. Dr. Banavar has served on various industry and academic boards, and was an elected member of the IBM Academy of Technology. He has published extensively and holds more than 25 US patents.

Dr. Robert A. Burgelman
Edmund W. Littlefield Professor of Management, Stanford University, USA

Dr. Robert A. Burgelman is the Edmund W. Littlefield Professor of Management of the Stanford University Graduate School of Business where he has taught since 1981. He obtained a Licenciate degree in Applied Economics from Antwerp University (Belgium), and an MA in Sociology and a Ph.D. in Management of Organizations from Columbia University, where he studied with doctoral fellowships from the Ford Foundation (US) and ICM (Belgium). His research has focused on the role of strategy-making in firm evolution. In particular, he has studied the strategy-making processes involved in how companies enter into new businesses and exit from existing ones to secure continued adaptation. In 2003 he received an honorary doctorate from the Copenhagen Business School for his contributions to the study of corporate innovation and entrepreneurship. Dr. Burgelman has been on the faculty of Antwerp University, New York University, Harvard Business School (as a Marvin Bower Fellow), and Cambridge University (as a Visiting Professor of Marketing Strategy and Innovation at the Judge Business School). He has been elected a Fellow of the Strategic Management Society and a Fellow of the Academy of Management.



He has published many articles in leading academic and professional journals, as well as some 150 case studies of companies and organizations in many different industries. His books include *Inside Corporate Innovation: Strategy, Structure, and Managerial Skills* (Free Press, 1986), *Research of Technological Innovation, Management and Policy* (JIA Press, Elsevier; Volume 4, 1989; Volume 5, 1993; Volume 6, 1997; and Volume 7, 2001), *Strategy is Destiny: How Strategy-Making Shapes a Company's Future* (Free Press, 2002), *Strategic Dynamics: Concepts and Cases* (McGraw-Hill, 2006), *Strategic Management of Technology and Innovation* (5th edition, McGraw-Hill-Irwin, 2009), and *Becoming Hewlett Packard: Why Strategic Leadership Matters* (Oxford University Press, forthcoming). Dr. Burgelman has served as an Associate Editor of the *Strategic Entrepreneurship Journal*, 2007-2014. He has served as the Executive Director of the Stanford Executive Program (SEP) during 1996-2015, and has taught executive programs and led senior and top management seminars for major companies worldwide. He has also served on boards of directors and boards of advisors of several private companies.

General Information

CONFERENCE FOCUS

We are living in a world in which wearable technologies are enabling communication between individuals and service providers, self-driving cars are communicating with the transportation system, vehicle-to-vehicle communication is enabling smart decision making about the traffic conditions, a shared economy is providing vehicle and house sharing, and digital networks are enabling politicians to have instant communication with their constituents. This is the interconnected world driven by technology. The enormous opportunities that this interconnectedness brings to us also create enormous risks and challenges. We have to address a plethora of issues in the ethical, legal, social, political, regulatory and security domains. It is the responsibility of technology management to make technology work for the benefit of humankind by providing effective, efficient and safe solutions to societal problems.

PICMET '17 emphasizes the role of technology management in the interconnected world.

WHO SHOULD ATTEND

Following the PICMET tradition, this high-impact conference 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 '17 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 '17 program consists of

- Ph.D. Colloquium, "Getting Your PhD… and Beyond," Sunday, July 9, 13:00 - 17:00, in Salon A
- Plenary sessions by global leaders from industrial corporations, academic institutions and government agencies, Monday – Thursday; 08:30 – 10:00 in Salons E & F
- Two special meetings:
  1. Country Representatives Lunch Meeting for the current PICMET Country Representatives and those who are interested in becoming Country Representatives, Wednesday, July 12; 12:00 –14:00 in Mt. Hood Room on the 2nd Floor
  2. PICMET '17 debriefing and PICMET '18 Planning Session for everybody who would like to discuss strategies for future PICMET conferences, Thursday, July 13; 14:00 – 15:30 in Salon A
- 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

PUBLICATIONS

There will be two publications at PICMET '17:

- 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 '17 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 sessions and social events.*

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

**The one-day registration fee does not include the evening social events. The PhD Colloquium and site visit*

General Information

are not included in the registration fee. Tickets for these events may be purchased at the registration desk.

SESSION AND PAPER DESIGNATIONS

All technical sessions including plenaries and break-outs are at Lower Level-1 of the Marriott Hotel.

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: Salons E & F 01: Salon A 02: Salon B 03: Salon C 04: Salon D 05: Salon E 06: Salon F 07: Salon G 08: Salon H 09: Salon I 10: Portland Room 11: Eugene Room

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 Salon E.

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

Salem Room is designated as the Authors' Room. The authors can work there with their laptops anytime they wish to do so.

There will be a computer, a projector and a screen in every break-out room. You can bring your presentation slides on a USB drive and use the computer provided. If you would like to use your own laptop, please be advised that you will need to bring the adapters that will fit into the VGA standard connection as all of our projectors will have the standard VGA port. Also, please make sure that you have an adapter to connect to USA electric port if your connection port is different. You can get more information and tips at http://www.usatourist.com/english/traveltips/electric-power-tips.html.

WIRELESS ACCESS

Wireless access will be available in designated areas.

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.

Downtown Portland and the Willamette River

AIRPORT TRANSPORTATION

The pickup area for taxis and town cars is located at 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 about 11 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 SW Morrison St./SW 3rd Ave. stop in downtown Portland (the first stop after the train turns right onto SW Morrison St. – it takes approximately 45 minutes to arrive there from the airport), walk 7 blocks south on either 1st, 2nd or 3rd Avenue, turn left on SW Columbia Street, then turn right on SW Naito Parkway. The address of the Portland Marriott Downtown Waterfront hotel is 1401 SW Naito Parkway. A map of the MAX train lines can be found at https://trimet.org/maps/img/railsystem.png. Tickets are $2.50 and must be purchased at the ticket machine inside the airport on the baggage claim level close to the MAX line. Keep your fare ticket handy in case a fare inspector boards the train.

CLIMATE

The temperature in Portland generally varies between 56oF (13o C) in the evening to 80 o F (27o 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 Portland Marriott Downtown Waterfront hotel.

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 local events and destinations while you are visiting. For a complete list of all that Oregon has to offer, visit www.travelportland.com.

PORTLAND EVENTS

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, July 6th, 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.

City of Roses

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 Avenue, Portland, Oregon; 12:00-13:00; free)*

Oregon Zoo Summer Concerts

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 Sunday, July 16, Aimee Mann will perform. *(Oregon Zoo, 4001 SW Canyon Road, Portland, Oregon; for schedule and ticket prices visit www.zooconcerts.com)*

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 Hall & SW Montgomery, Portland, Oregon; 08:30 - 14:00; Saturdays only)*

Portland Farmers Market at the Square
Every Monday, from June 5th through September 25th, 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 Pioneer Courthouse Square ("Portland's Living Room") home each Monday selling the freshest summer fruits, vegetables, flowers and hot food items. *(Mondays, 10:00-14:00; Pioneer Courthouse Square, 700 SW 6th Ave., Portland, Oregon)*

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. *(2 SW Naito Parkway, Portland, Oregon; Saturdays 10:00-17:00; Sundays 11:00-16:30; www.portlandsaturdaymarket.com)*

Portland Timbers Soccer
Major League Soccer team the Portland Timbers will host Real Salt Lake on July 19th at Providence Park. *(Providence Park, 1844 SW Morrison, Portland, Oregon; for schedule and ticket information visit www.portlandtimbers.com)*

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.

Food Cart Pods
With more than 600 tiny kitchens and counting, Portland's food-cart scene is legendary. The flavorful proliferation has drawn raves from *Bon Appétit* magazine

Food Cart Pod

and CNN (which declared Portland home to the world's best street food). Unlike other cities' mobile food trucks, most Portland carts stay put in groups dubbed "pods," making it a snap to sample several at a time. Downtown Portland pod locations include Alder Street, Fifth Avenue, Third Avenue, and Portland State University. *(visit*

City of Roses

https://www.travelportland.com/article/food-cart-pods/ for exact locations)

Lan Su 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 collaboration 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 has something new to offer - by the minute, by the hour, and with the seasons. *(239 NW Everett Street, Portland, Oregon; hours: 10:00—19:00; admission, $10; www.lansugarden.org/)*

Lan Su Chinese Garden

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; 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; 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; phone: 503 226-2811; for hours and admission charge visit www.portlandartmuseum.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. Join the award-winning,

City of Roses

Powell's City of Books

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., Portland, Oregon)*

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. 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"). After the train ride, hop on and off the Washington Park shuttle, which is free and loops around to Park attractions. Read on for more information about these attractions. *(http://explorewashingtonpark.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)*

The 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, 611 SW Kingston Avenue, Portland, Oregon; for hours and admission price visit www.japanesegarden.com)*

City of Roses

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, Portland, Oregon; 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., Portland, Oregon; http://www.hoytarboretum.org/)*

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 Avenue, Portland, Oregon)*

International Rose Test Garden

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 SE Water Avenue, OMSI Submarine Dock, Portland, Oregon; www.willamettejet.com)*

Downtown Portland

SHOPPING

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

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

Nordstrom department store is adjacent to Pioneer Square, and specialty shops are scattered throughout downtown Portland.

Northwest/Nob Hill
This district's main streets (Northwest 23rd and 21st Av-

enues) 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)*

Bridgeport Village Outdoor Shopping Mall

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 NW 257th Way, Troutdale, Oregon; http://shopcolumbiagorgeoutlets.com/)*

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 Road, Portland, Oregon; www.shopwashingtonsquare.com)*

Woodburn Premium Outlets, Oregon's largest outlet center, features 114 shops including Adidas, Banana Republic Factory Store, Calvin Klein, Eddie Bauer, J. Crew, and Polo Ralph Lauren Factory Store to name a few. *(I-5 South at the Woodburn/Hwy 214 exit; 1001 North Arney Road, Woodburn, Oregon; http://www.factoryoutletstores.info/oregon/woodburn-company-stores.html)*

IEEE - TEMS RECEPTION

IEEE-TECHNOLOGY ENGINEERING MANAGEMENT SOCIETY (TEMS) ICE-CREAM SOCIAL

Sponsored by the Oregon IEEE Technology and Engineering Management Society

DATE: WEDNESDAY, JULY 12
TIME: 18:00 - 19:30
ROOM: SALON A, PORTLAND MARRIOTT HOTEL
TOPIC: TECHNOLOGY MANAGEMENT IN PORTLAND SOFTWARE COMPANIES

Panelists:

- Paul Menig (Moderator) - CEO of Tech-I-M Business Accelerants™
- Jay Haladay - former Founder and CEO of ViewPoint Construction Software
- Serge Leef - VP New Ventures at Mentor
- Scott Roth, CEO, Jama Software
- Siva Narendra, CEO Tyfone

This panel will look at strategically managing software technology from birth to seed round through Venture Capital to IPO to merger/acquisition. Come listen as these Portland technology luminaries provide answers to your questions and more.

Technology is pervasive, from food tech to clean tech, from information tech to financial tech. Computers and software are at the heart of what fuels technology in all

areas, whether it is in the final product as in an intelligent assistant with speakers, used in the development of hardware items such as computer aided design software for automotive and aerospace vehicles, or used to research a biological product such as a new genetically modified food.

There is no fee for this event. It is open to all PICMET attendees.

SOCIAL EVENTS

To facilitate the informal interaction of the participants, several social events have been scheduled during PICMET '17.

RECEPTION/BUFFET

DATE: SUNDAY, JULY 9
TIME: 19:00—22:00
ROOM: SALON E (LOWER LEVEL 1), PORTLAND MARRIOTT HOTEL
DRESS: INFORMAL

Meet other conference attendees, renew old acquaintances, and begin new friendships and collaborations at this opening reception/buffet in Salon E. Included in the regular registration fee.*

PORTLANDIA DINNER

DATE: MONDAY, JULY 10
TIME: 19:00-22:00
ROOM: MT. HOOD (2ND FLOOR), PORTLAND MARRIOTT HOTEL
DRESS: INFORMAL

Enjoy a savory buffet of Northwest cuisine with local and international dishes that have made Portland famous as the "city for foodies" while you mingle and network with colleagues. Included in the regular registration fee.*

AWARDS BANQUET

DATE: TUESDAY, JULY 11
CASH BAR: 18:30—19:00 (IN THE BALLROOM LOBBY – LOWER LEVEL 1)
BANQUET: 19:00—22:00
ROOM: SALONS E&F (LOWER LEVEL 1), PORTLAND MARRIOTT HOTEL
DRESS: BUSINESS ATTIRE

This is the premier social event of the conference. The PICMET '17 Leadership in Technology Management, Medal of Excellence, and Outstanding Student Paper will be presented at the banquet. Included in the registration fee.*

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

SITE VISIT

A site visit to the following company is offered during PICMET '17. Seating is limited, so sign up early. The registration fee is $50.

The time below includes travel time. The return time is approximate and will depend on traffic.

Site visit attendees will meet in the Main Lobby on the first floor of the Portland Marriott Downtown Waterfront hotel and will be guided to the bus by a PICMET Volunteer.

AUTODESK, INC

DATE: WEDNESDAY, JULY 12
TIME: 14:00 - 17:00

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Specialties
3D design software and technology, digital prototyping, sustainable design software, media and entertainment, consumer software, PLM, cloud, and mobile.

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TECHNICAL PROGRAM

PROGRAM OVERVIEW

The PICMET '17 technical program consists of 127 sessions including 4 plenaries, 2 special sessions, 2 panel discussions, and 119 paper sessions.

The plenaries are scheduled from 08:30 to 10:00 every morning, Monday, July 10, through Thursday, July 13, in Salons E & F. They are described in the "Plenaries" section of this Bulletin.

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 '17 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 88 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 '17.

DAILY SCHEDULE

MONDAY, JULY 10, 2017

	00 Salon E-F	01 Salon A	02 Salon B	03 Salon C	04 Salon D	05 Salon E	06 Salon F	07 Salon G	08 Salon H	09 Salon I	10 Portland	11 Eugene
MA 08:30-10:00	Plenary - 1											
MB 10:30-12:00		Innovation Management-1	Technology Planning and Forecasting-1	Strategic Management of Technology-1		Resilience of Systems-1	Big Data for Technology Management-1		New Product Development-1	Quality Management-1		Commercialization of Technology-1
MC 12:00-14:00	**LUNCH**											
MD 14:00-15:30				Technology Roadmapping-1	Technology Adoption-1	Enterprise Management-1	R&D Management-1	E-Business-1	New Product Development-2	Resource Management-1	Artificial Intelligence for Technology Management-1	Global Issues in Technology Management-1
ME 16:00-17:30		Innovation Management-2	Technology Assessment and Evaluation-1	Technology Roadmapping-2		Cultural Issues in Technology Management-1	R&D Management-2	E-Business-2	New Product Development-3	Resource Management-2	Manufacturing Management-1	Global Issues in Technology Management-2

DAILY SCHEDULE

TUESDAY, JULY 11, 2017

	00 Salon E-F	01 Salon A	02 Salon B	03 Salon C	04 Salon D	05 Salon E	06 Salon F	07 Salon G	08 Salon H	09 Salon I	10 Portland	11 Eugene
TA 08:30-10:00	Plenary - 2											
TB 10:30-12:00		Innovation Management-2	Technology Adoption-2	Disruptive Technologies-1	Technological Changes-1	Meet the Editors Panel Session	Science and Technology Policy-1	Knowledge Management-1	Collaborations for Technology Management-1	Indicators of Technical Emergence -1		Decision Making-1
TC 12:00-14:00	**LUNCH**											
TD 14:00-15:30		Innovation Management-4	Information/ Communication Technology-1	Strategic Management of Technology-2	Technology Management in the Health Sector-1		Big Data for Technology Management-2	Knowledge Management-2	Social Media-1	Indicators of Technical Emergence - 2	Manufacturing Management-2	Decision Making-2
TE 16:00-17:30		Innovation Management-5	Entrepreneurship/ Intrapreneurship-1	Competitiveness in Technology Management-1	Technology Management in the Health Sector-2	Collaborations for Technology Management-2	Leadership-1		Social Media-2	Indicators of Technical Emergence-3	Social Innovation-1	Decision Making-3

DAILY SCHEDULE

WEDNESDAY, JULY 12, 2017

	00 Salon E-F	01 Salon A	02 Salon B	03 Salon C	04 Salon D	05 Salon E	06 Salon F	07 Salon G	08 Salon H	09 Salon I	10 Portland
WA 08:30-10:00	Plenary - 3										
WB 10:30-12:00		Innovation Management-6	Entrepreneurship/ Intrapreneurship-2	Strategic Management of Technology-3	Technology Management in the Energy Sector-1	Intellectual Property-1	Science and Technology Policy-2	Project/Program Management-1	Educational Issues-1	Indicators of Technical Emergence-4	Knowledge Management-3
WC 12:00-14:00	**LUNCH**										
WD 14:00-15:30		Innovation Management-7	Entrepreneurship/ Intrapreneurship-3		Technology Management in the Energy Sector-2	Intellectual Property-2	Science and Technology Policy-3	Project/Program Management-2		Emerging Technologies-1	Manufacturing Management-3
WE 16:00-17:30		Innovation Management-8	Entrepreneurship/ Intrapreneurship-4			Intellectual Property-3	Trends in Technological Emergence Indicators	Project/Program Management-3		Emerging Technologies-2	

DAILY SCHEDULE

THURSDAY, JULY 13, 2017

	00 Salon E-F	01 Salon A	02 Salon B	03 Salon C	04 Salon D
HA 08:30-10:00	Plenary - 4				
HB 10:30-12:00		Innovation Management-9	Technology Management in the Service Sector-1	Supply Chain Management-1	Intellectual Property-4
HC 12:00-14:00			**LUNCH**		
HD 14:00-15:30		PICMET '17 Debrief and Future PICMET Planning			

SCHEDULE OF SESSIONS

SCHEDULE OF SESSIONS BY DATE

MONDAY, JULY 10, 2017

Session	Number	Day	Time	Room	Session Title
MA	00	Monday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 1”
MB	01	Monday	10:30 - 12:00	Salon A	“Innovation Management-1”
MB	02	Monday	10:30 - 12:00	Salon B	“Technology Planning and Forecasting-1”
MB	03	Monday	10:30 - 12:00	Salon C	“Strategic Management of Technology-1”
MB	05	Monday	10:30 - 12:00	Salon E	“Resilience of Systems-1”
MB	06	Monday	10:30 - 12:00	Salon F	“Big Data for Technology Management-1”
MB	08	Monday	10:30 - 12:00	Salon H	“New Product Development-1”
MB	09	Monday	10:30 - 12:00	Salon I	“Quality Management-1”
MB	11	Monday	10:30 - 12:00	Eugene	“Commercialization of Technology-1”
MD	03	Monday	14:00 - 15:30	Salon C	“Technology Roadmapping-1”
MD	04	Monday	14:00 - 15:30	Salon D	“Technology Adoption-1”
MD	05	Monday	14:00 - 15:30	Salon E	“Enterprise Management-1”
MD	06	Monday	14:00 - 15:30	Salon F	“R&D Management-1”
MD	07	Monday	14:00 - 15:30	Salon G	“E-Business-1”
MD	08	Monday	14:00 - 15:30	Salon H	“New Product Development-2”
MD	09	Monday	14:00 - 15:30	Salon I	“Resource Management-1”
MD	10	Monday	14:00 - 15:30	Portland	“Artificial Intelligence for Technology Management-1”
MD	11	Monday	14:00 - 15:30	Eugene	“Global Issues in Technology Management-1”
ME	01	Monday	16:00 - 17:30	Salon A	“Innovation Management-2”
ME	02	Monday	16:00 - 17:30	Salon B	“Technology Assesment and Evaluation-1”
ME	03	Monday	16:00 - 17:30	Salon C	“Technology Roadmapping-2”
ME	05	Monday	16:00 - 17:30	Salon E	“Cultural Issues in Technology Management-1”
ME	06	Monday	16:00 - 17:30	Salon F	“R&D Management-2”
ME	07	Monday	16:00 - 17:30	Salon G	“E-Business-2”
ME	08	Monday	16:00 - 17:30	Salon H	“New Product Development-3”
ME	09	Monday	16:00 - 17:30	Salon I	“Resource Management-2”
ME	10	Monday	16:00 - 17:30	Portland	“Manufacturing Management-1”
ME	11	Monday	16:00 - 17:30	Eugene	“Global Issues in Technology Management-2”

TUESDAY, JULY 11, 2017

TA	00	Tuesday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 2”
TB	01	Tuesday	10:30 - 12:00	Salon A	“Innovation Management-3”
TB	02	Tuesday	10:30 - 12:00	Salon B	“Technology Adoption-2”
TB	03	Tuesday	10:30 - 12:00	Salon C	“Disruptive Technologies-1”
TB	04	Tuesday	10:30 - 12:00	Salon D	“Technological Changes-1”
TB	05	Tuesday	10:30 - 12:00	Salon E	PANEL: “Meet the Editors Panel Session”

SCHEDULE OF SESSIONS

TB	06	Tuesday	10:30 - 12:00	Salon F	“Science and Technology Policy-1”
TB	07	Tuesday	10:30 - 12:00	Salon G	“Knowledge Management-1”
TB	08	Tuesday	10:30 - 12:00	Salon H	“Collaborations for Technology Management-1”
TB	09	Tuesday	10:30 - 12:00	Salon I	“Indicators of Technical Emergence -1”
TB	11	Tuesday	10:30 - 12:00	Eugene	“Decision Making-1”
TD	01	Tuesday	14:00 - 15:30	Salon A	“Innovation Management-4”
TD	02	Tuesday	14:00 - 15:30	Salon B	“Information/Communication Technology-1”
TD	03	Tuesday	14:00 - 15:30	Salon C	“Strategic Management of Technology-2”
TD	04	Tuesday	14:00 - 15:30	Salon D	“Technology Management in the Health Sector-1”
TD	06	Tuesday	14:00 - 15:30	Salon F	“Big Data for Technology Management-2”
TD	07	Tuesday	14:00 - 15:30	Salon G	“Knowledge Management-2”
TD	08	Tuesday	14:00 - 15:30	Salon H	“Social Media-1”
TD	09	Tuesday	14:00 - 15:30	Salon I	“Indicators of Technical Emergence - 2”
TD	10	Tuesday	14:00 - 15:30	Portland	“Manufacturing Management-2”
TD	11	Tuesday	14:00 - 15:30	Eugene	“Decision Making-2”
TE	01	Tuesday	16:00 - 17:30	Salon A	“Innovation Management-5”
TE	02	Tuesday	16:00 - 17:30	Salon B	“Entrepreneurship/ Intrapreneurship-1”
TE	03	Tuesday	16:00 - 17:30	Salon C	“Competitiveness in Technology Management-1”
TE	04	Tuesday	16:00 - 17:30	Salon D	“Technology Management in the Health Sector-2”
TE	05	Tuesday	16:00 - 17:30	Salon E	“Collaborations for Technology Management-2”
TE	06	Tuesday	16:00 - 17:30	Salon F	“Leadership-1”
TE	08	Tuesday	16:00 - 17:30	Salon H	“Social Media-2”
TE	09	Tuesday	16:00 - 17:30	Salon I	“Indicators of Technical Emergence-3”
TE	10	Tuesday	16:00 - 17:30	Portland	“Social Innovation-1”
TE	11	Tuesday	16:00 - 17:30	Eugene	“Decision Making-3”

WEDNESDAY, JULY 12, 2017

WA	00	Wednesday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 3”
WB	01	Wednesday	10:30 - 12:00	Salon A	“Innovation Management-6”
WB	02	Wednesday	10:30 - 12:00	Salon B	“Entrepreneurship/ Intrapreneurship-2”
WB	03	Wednesday	10:30 - 12:00	Salon C	“Strategic Management of Technology-3”
WB	04	Wednesday	10:30 - 12:00	Salon D	“Technology Management in the Energy Sector-1”
WB	05	Wednesday	10:30 - 12:00	Salon E	“Intellectual Property-1”
WB	06	Wednesday	10:30 - 12:00	Salon F	“Science and Technology Policy-2”
WB	07	Wednesday	10:30 - 12:00	Salon G	“Project/Program Management-1”
WB	08	Wednesday	10:30 - 12:00	Salon H	“Educational Issues-1”
WB	09	Wednesday	10:30 - 12:00	Salon I	“Indicators of Technical Emergence-4”
WB	10	Wednesday	10:30 - 12:00	Portland	“Knowledge Management-3”
WD	01	Wednesday	14:00 - 15:30	Salon A	“Innovation Management-7”

Schedule of Sessions

WD	02	Wednesday	14:00 - 15:30	Salon B	“Entrepreneurship/ Intrapreneurship-3”
WD	04	Wednesday	14:00 - 15:30	Salon D	“Technology Management in the Energy Sector-2”
WD	05	Wednesday	14:00 - 15:30	Salon E	“Intellectual Property-2”
WD	06	Wednesday	14:00 - 15:30	Salon F	“Science and Technology Policy-3”
WD	07	Wednesday	14:00 - 15:30	Salon G	“Project/Program Management-2”
WD	09	Wednesday	14:00 - 15:30	Salon I	“Emerging Technologies-1”
WD	10	Wednesday	14:00 - 15:30	Portland	“Manufacturing Management-3”
WE	01	Wednesday	16:00 - 17:30	Salon A	“Innovation Management-8”
WE	02	Wednesday	16:00 - 17:30	Salon B	“Entrepreneurship/ Intrapreneurship-4”
WE	05	Wednesday	16:00 - 17:30	Salon E	“Intellectual Property-3”
WE	06	Wednesday	16:00 - 17:30	Salon F	PANEL: “Trends in Technological Emergence Indicators”
WE	07	Wednesday	16:00 - 17:30	Salon G	“Project/Program Management-3”
WE	09	Wednesday	16:00 - 17:30	Salon I	“Emerging Technologies-2”

THURSDAY, JULY 13, 2017

HA	00	Thursday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 4”
HB	01	Thursday	10:30 - 12:00	Salon A	“Innovation Management-9”
HB	02	Thursday	10:30 - 12:00	Salon B	“Technology Management in the Service Sector-1”
HB	03	Thursday	10:30 - 12:00	Salon C	“Supply Chain Management-1”
HB	04	Thursday	10:30 - 12:00	Salon D	“Intellectual Property-4”
HD	01	Thursday	14:00 - 15:30	Salon A	PANEL: “PICMET ’17 Debrief and Future PICMET Planning”

SCHEDULE OF SESSIONS

SCHEDULE OF SESSIONS BY ROOM

Session Number		Day	Time	Room	Session Title
MA	00	Monday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 1”
TA	00	Tuesday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 2”
WA	00	Wednesday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 3”
HA	00	Thursday	08:30 - 10:00	Salon E-F	PLENARY: “Plenary - 4”
MB	01	Monday	10:30 - 12:00	Salon A	“Innovation Management-1”
ME	01	Monday	16:00 - 17:30	Salon A	“Innovation Management-2”
TB	01	Tuesday	10:30 - 12:00	Salon A	“Innovation Management-3”
TD	01	Tuesday	14:00 - 15:30	Salon A	“Innovation Management-4”
TE	01	Tuesday	16:00 - 17:30	Salon A	“Innovation Management-5”
WB	01	Wednesday	10:30 - 12:00	Salon A	“Innovation Management-6”
WD	01	Wednesday	14:00 - 15:30	Salon A	“Innovation Management-7”
WE	01	Wednesday	16:00 - 17:30	Salon A	“Innovation Management-8”
HB	01	Thursday	10:30 - 12:00	Salon A	“Innovation Management-9”
HD	01	Thursday	14:00 - 15:30	Salon A	PANEL: “PICMET ’17 Debrief and Future PICMET Planning”
MB	02	Monday	10:30 - 12:00	Salon B	“Technology Planning and Forecasting-1”
ME	02	Monday	16:00 - 17:30	Salon B	“Technology Assesment and Evaluation-1”
TB	02	Tuesday	10:30 - 12:00	Salon B	“Technology Adoption-2”
TD	02	Tuesday	14:00 - 15:30	Salon B	“Information/Communication Technology-1”
TE	02	Tuesday	16:00 - 17:30	Salon B	“Entrepreneurship/ Intrapreneurship-1”
WB	02	Wednesday	10:30 - 12:00	Salon B	“Entrepreneurship/ Intrapreneurship-2”
WD	02	Wednesday	14:00 - 15:30	Salon B	“Entrepreneurship/ Intrapreneurship-3”
WE	02	Wednesday	16:00 - 17:30	Salon B	“Entrepreneurship/ Intrapreneurship-4”
HB	02	Thursday	10:30 - 12:00	Salon B	“Technology Management in the Service Sector-1”
MB	03	Monday	10:30 - 12:00	Salon C	“Strategic Management of Technology-1”
MD	03	Monday	14:00 - 15:30	Salon C	“Technology Roadmapping-1”
ME	03	Monday	16:00 - 17:30	Salon C	“Technology Roadmapping-2”
TB	03	Tuesday	10:30 - 12:00	Salon C	“Disruptive Technologies-1”
TD	03	Tuesday	14:00 - 15:30	Salon C	“Strategic Management of Technology-2”
TE	03	Tuesday	16:00 - 17:30	Salon C	“Competitiveness in Technology Management-1”
WB	03	Wednesday	10:30 - 12:00	Salon C	“Strategic Management of Technology-3”
HB	03	Thursday	10:30 - 12:00	Salon C	“Supply Chain Management-1”
MD	04	Monday	14:00 - 15:30	Salon D	“Technology Adoption-1”
TB	04	Tuesday	10:30 - 12:00	Salon D	“Technological Changes-1”
TD	04	Tuesday	14:00 - 15:30	Salon D	“Technology Management in the Health Sector-1”
TE	04	Tuesday	16:00 - 17:30	Salon D	“Technology Management in the Health Sector-2”

Schedule of Sessions

WB	04	Wednesday	10:30 - 12:00	Salon D	“Technology Management in the Energy Sector-1”
WD	04	Wednesday	14:00 - 15:30	Salon D	“Technology Management in the Energy Sector-2”
HB	04	Thursday	10:30 - 12:00	Salon D	“Intellectual Property-4”
MB	05	Monday	10:30 - 12:00	Salon E	“Resilience of Systems-1”
MD	05	Monday	14:00 - 15:30	Salon E	“Enterprise Management-1”
ME	05	Monday	16:00 - 17:30	Salon E	“Cultural Issues in Technology Management-1”
TB	05	Tuesday	10:30 - 12:00	Salon E	PANEL: “Meet the Editors Panel Session”
TE	05	Tuesday	16:00 - 17:30	Salon E	“Collaborations for Technology Management-2”
WB	05	Wednesday	10:30 - 12:00	Salon E	“Intellectual Property-1”
WD	05	Wednesday	14:00 - 15:30	Salon E	“Intellectual Property-2”
WE	05	Wednesday	16:00 - 17:30	Salon E	“Intellectual Property-3”
MB	06	Monday	10:30 - 12:00	Salon F	“Big Data for Technology Management-1”
MD	06	Monday	14:00 - 15:30	Salon F	“R&D Management-1”
ME	06	Monday	16:00 - 17:30	Salon F	“R&D Management-2”
TB	06	Tuesday	10:30 - 12:00	Salon F	“Science and Technology Policy-1”
TD	06	Tuesday	14:00 - 15:30	Salon F	“Big Data for Technology Management-2”
TE	06	Tuesday	16:00 - 17:30	Salon F	“Leadership-1”
WB	06	Wednesday	10:30 - 12:00	Salon F	“Science and Technology Policy-2”
WD	06	Wednesday	14:00 - 15:30	Salon F	“Science and Technology Policy-3”
WE	06	Wednesday	16:00 - 17:30	Salon F	PANEL: “Trends in Technological Emergence Indicators”
MD	07	Monday	14:00 - 15:30	Salon G	“E-Business-1”
ME	07	Monday	16:00 - 17:30	Salon G	“E-Business-2”
TB	07	Tuesday	10:30 - 12:00	Salon G	“Knowledge Management-1”
TD	07	Tuesday	14:00 - 15:30	Salon G	“Knowledge Management-2”
WB	07	Wednesday	10:30 - 12:00	Salon G	“Project/Program Management-1”
WD	07	Wednesday	14:00 - 15:30	Salon G	“Project/Program Management-2”
WE	07	Wednesday	16:00 - 17:30	Salon G	“Project/Program Management-3”
MB	08	Monday	10:30 - 12:00	Salon H	“New Product Development-1”
MD	08	Monday	14:00 - 15:30	Salon H	“New Product Development-2”
ME	08	Monday	16:00 - 17:30	Salon H	“New Product Development-3”
TB	08	Tuesday	10:30 - 12:00	Salon H	“Collaborations for Technology Management-1”
TD	08	Tuesday	14:00 - 15:30	Salon H	“Social Media-1”
TE	08	Tuesday	16:00 - 17:30	Salon H	“Social Media-2”
WB	08	Wednesday	10:30 - 12:00	Salon H	“Educational Issues-1”
MB	09	Monday	10:30 - 12:00	Salon I	“Quality Management-1”
MD	09	Monday	14:00 - 15:30	Salon I	“Resource Management-1”
ME	09	Monday	16:00 - 17:30	Salon I	“Resource Management-2”
TB	09	Tuesday	10:30 - 12:00	Salon I	“Indicators of Technical Emergence -1”

Schedule of Sessions

TD	09	Tuesday	14:00 - 15:30	Salon I	“Indicators of Technical Emergence - 2”
TE	09	Tuesday	16:00 - 17:30	Salon I	“Indicators of Technical Emergence-3”
WB	09	Wednesday	10:30 - 12:00	Salon I	“Indicators of Technical Emergence-4”
WD	09	Wednesday	14:00 - 15:30	Salon I	“Emerging Technologies-1”
WE	09	Wednesday	16:00 - 17:30	Salon I	“Emerging Technologies-2”
MD	10	Monday	14:00 - 15:30	Portland	“Artificial Intelligence for Technology Management-1”
ME	10	Monday	16:00 - 17:30	Portland	“Manufacturing Management-1”
TD	10	Tuesday	14:00 - 15:30	Portland	“Manufacturing Management-2”
TE	10	Tuesday	16:00 - 17:30	Portland	“Social Innovation-1”
WB	10	Wednesday	10:30 - 12:00	Portland	“Knowledge Management-3”
WD	10	Wednesday	14:00 - 15:30	Portland	“Manufacturing Management-3”
MB	11	Monday	10:30 - 12:00	Eugene	“Commercialization of Technology-1”
MD	11	Monday	14:00 - 15:30	Eugene	“Global Issues in Technology Management-1”
ME	11	Monday	16:00 - 17:30	Eugene	“Global Issues in Technology Management-2”
TB	11	Tuesday	10:30 - 12:00	Eugene	“Decision Making-1”
TD	11	Tuesday	14:00 - 15:30	Eugene	“Decision Making-2”
TE	11	Tuesday	16:00 - 17:30	Eugene	“Decision Making-3”

PERSONAL SCHEDULE

	Sunday July 9, 2017	Monday July 10, 2017	Tuesday July 11, 2017	Wednesday July 12, 2017	Thursday July 13, 2017
08:00 – 08:30 Bright Start (Breakfast)					
08:30 – 10:00 (A)		Plenary - 1 (Salon E-F)	Plenary - 2 (Salon E-F)	Plenary - 3 (Salon E-F)	Plenary - 4 (Salon E-F)
10:00 – 10:30 Coffee Break					
10:30 – 12:00 (B)					
12:00 – 14:00 Lunch Break					
14:00 – 15:30 (D)					PICMET '18 Planning Session (Salon A)
15:30 – 16:00 Coffee Break					
16:00 – 17:30 (E)					
19:00 – 22:00	Welcome Reception (Salon E)	Dinner (Mt. Hood)	Awards Banquet (Salon E-F)		

SPECIAL SESSIONS

COUNTRY REPRESENTATIVES MEETING

DATE: WEDNESDAY, JULY 12
TIME: 12:00-14:00
ROOM: MT. HOOD ROOM (2ND FLOOR)

PICMET has 131 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-Directors of International Activities, Dr. Kiyoshi Niwa, Professor Emeritus, The University of Tokyo, and Dr. Dilek Cetindamar Kozanoglu, Professor, Sabanci University, invite 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 '17 DEBRIEFING & '18 PLANNING SESSION

DATE: THURSDAY, JULY 13
TIME: 14:00-15:30
ROOM: SALON A

This session will provide an opportunity to give feedback on PICMET '17 and to get involved in the planning for the PICMET '18 Conference. PICMET '18 will be held August 19-23, 2018, at the Waikiki Beach Marriott Resort & Spa, Hawaii, USA.

PLENARIES

PLENARY SESSION—1

DATE: MONDAY, JULY 10
TIME: 08:30-10:00
ROOM: OREGON BALLROOM

Session Chair: Dr. Charles M. Weber, Portland State University, USA

KEYNOTE-1

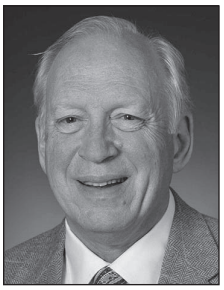
Dr. James M. Utterback, Professor Emeritus of Management and Innovation, MIT, Cambridge, Massachusetts, USA

"Landmarks in our Understanding of the Management of Engineering and Technology"

As our appreciation of the contributions of science, technology and engineering to our societies and economies grows, so does the value of our efforts here toward building the field of innovation science into a disciplined, cumulative and enduring effort.

Over at least the past 50 years, hundreds of scholars have contributed important research, articles, and books that address the "discipline of innovation science." Contributors have been diverse; they come from fields such as economics, history, management, sociology, political science, science and engineering, geography, population ecology, and law. Few universities though define the area in the form of a department or discipline.

This talk will review a few of, in my judgment, the landmark attempts of past decades by governments, the military, leaders of industry and engineering societies, and of academics with different perspectives to understand the ecology, processes and impacts of technological change and the ways in which it might be shaped and managed.



Professor James M. Utterback is David J. McGrath jr (1959) Professor of Management and Innovation at the MIT Sloan School of Management and Professor of Engineering Systems in the School of Engineering at the Massachusetts Institute of Technology. Since receiving the Ph.D. in 1968 from the MIT Sloan School of Management, Prof. Utterback has held faculty positions at Indiana University, the Harvard Business School, and Chalmers Technical University as well as MIT. From 1983 through 1989, he served as Director of Industrial Liaison at MIT. His research has focused on the process of technological innovation in firms in the United States and in other countries. He is author of Mastering the Dynamics of Innovation*, published by Harvard Business School Press in 1994, and of* Design-Inspired Innovation*, published by World Scientific Press in 2006. Recent publications include contributions to* Management Science, Research Policy, Strategic Management Journal, Technological Forecasting and Social Change, The Sloan Management Review, *the* Journal of Engineering and Technology Management *and* Nature Nanotechnology*.*

Professor Utterback's teaching focus is on understanding the dynamics of product and process development, emerging and disruptive technologies, and the varied roles of firms as predators and prey when new technologies emerge. His current research focuses on the sustained growth of newly formed design and technology-based firms in the United States, Sweden, Italy and the United Kingdom and on emerging firms at the confluence of bio and nano-technology world-wide.

Professor Utterback is one of the founders of the Management of Technology Program (now called the Sloan Fellows in Innovation and Global Leadership), which was the first area of study at MIT that awarded degrees jointly from the Schools of Management and Engineering. He is also one of the founders of the Leaders for Manufacturing Program (now Leaders for Global Operations) and the Systems Design and Management Program, which award dual degrees in engineering and in management. Professor Utterback is a foreign member of the Royal Swedish Academy of Engineering Sciences and a Life Fellow of Clare Hall at the University of Cambridge. He received the D.Sc. (Hon) from Chalmers University in Gothenburg, Sweden, in 1997, and an honorary doctorate from KU Leuven in Belgium in 2012. Jim was elected a Fellow in the American Association for the Advancement of Science in 2013.

KEYNOTE-2

Dr. Karl Hampton Vesper, Foster School of Business, University of Washington, Seattle, USA

"Three Underexploited Opportunity Directions for Technology Management"

Three contrasting directions for scholarly pioneering relevant to technology management proposed are: (1) developing engineering cases with more information about personalities and idiosyncrasies of individual engineers, (2) offering an interdisciplinary engineering-systems-design project course that would attract, among others, underrepresented ethnicities regardless of their majors,

PLENARIES

and (3) pursuing entrepreneurship research aimed toward more practical value for entrepreneurs, via student projects that analyze venture plan competition winners as a step toward building a computerized database of shared venture experience accessible for teaching, research, and consultation. This different method for academic research, if it works for entrepreneurship should logically also apply to other fields such as psychology and economics.

Dr. Karl Vesper is an emeritus from the University of Washington, where he held full professorships in: (1) Management, where he started the entrepreneurship course in 1970, (2) Mechanical Engineering, where he taught machine design, and (3) Marine Studies, where he taught ocean systems design. His most recent formal academic appointment was in 2011 as Visiting Regents Chairholder in Entrepreneurship at Texas Tech University. Characterized in 1979 by Business Week as the "generally recognized dean of entrepreneurial studies," he subsequently became first holder of the Roger Babson Professorship in Entrepreneurship at Babson College and of the Carma Professorship in Entrepreneurship at the University of Calgary, as well as second holder of the Schoen Professorship in Entrepreneurship at Baylor University and a Fulbright Distinguished Scholar at Trinity College, Dublin. Subsequently in 2001-2002, he was appointed as Visiting Professor in Bioengineering in the Jacobs School of Engineering at the University of California, San Diego, and later a Visiting Professor in Entrepreneurship at the University of Hawaii, Hilo. His academic interest in entrepreneurship began shortly after completing an Air Force officer tour as Flight Test Engineer at Edwards AFB, California, in 1957. He also worked industrially as Assistant to the President of a high-performance electromotive products company, and as business manager of an oceanographic consulting and instrument manufacturing company where he helped raise venture capital. He holds BS, MS, and PhD degrees in Engineering from Stanford and an MBA from Harvard. His hobbies include motorcycles, snowboarding, surfing, and learning from his grandchildren.

PLENARY SESSION—2

DATE: TUESDAY, JULY 11
TIME: 08:30-10:00
ROOM: OREGON BALLROOM

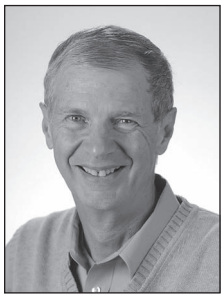
Session Chair: Dr. Timothy R. Anderson, Portland State University, USA

KEYNOTE-1

Dr. Alan L. Porter, Professor Emeritus of Industrial & Systems Engineering, and of Public Policy, Georgia Institute of Technology, USA

"'Tech Emergence' Indicators - To Inform Management of Technology"

Based on the principle that MOT has great potential to gain from exploiting data resources more, Dr. Porter will spotlight "Tech Mining" possibilities. In particular, he will focus on the ways that tech emergence indicators can add value in MOT decision processes. This serves as lead-in to the four-session PICMET track on emergence indicators.



Dr. Alan L. 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, GA (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.*

KEYNOTE-2

Dr. Guruduth S. Banavar, Chief Technology Officer (CTO), Viome, Inc.

"The New Era of AI"

The resurgence of AI is changing every aspect of our lives. Many new kinds of data are becoming available in every field, making possible new insights and approaches that were unthinkable a few years ago. In this talk, I will provide a broad overview of the capabilities of AI platforms that is making this revolution possible, and dive deeply into a few specific AI applications that are showing great promise. In particular, I will discuss how AI can help us understand the biological ecosystem inside each of us, and improve our health and wellness.

PLENARIES

Dr. Guru Banavar believes in applying deep technology innovations to solve major problems that humanity faces, especially in healthcare and education. He is known for his work on Watson AI, Smarter Cities, Services Innovation, Mobile Computing, and Distributed Systems.

He is currently developing AI systems at Viome, a wellness company that offers unprecedented visibility into the biological ecosystem inside each of us and delivers ongoing recommendations to improve wellness with a personalized diet and lifestyle plan. Until recently, he was a senior technology executive at IBM responsible for advancing Watson AI technologies and solutions, and was a member of CEO Ginni Rometty's top executive team.

Dr. Banavar is a recognized thought leader who has spoken on the Nobel, Aspen, Milken, and Turing stages. His work has been featured in major international media including the New York Times, Economist, Wall Street Journal, and NPR. He received a national innovation award from the President of India, and has served on NY Governor Cuomo's commission for state resiliency. Dr. Banavar has served on various industry and academic boards, and was an elected member of the IBM Academy of Technology. He has published extensively and holds more than 25 US patents.

PLENARY SESSION—3

DATE: WEDNESDAY, JULY 12
TIME: 08:30—10:00
ROOM: OREGON BALLROOM

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

KEYNOTE-1

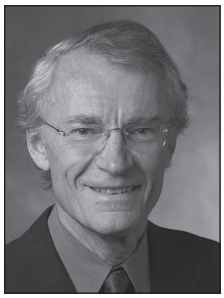
Dr. Robert A. Burgelman, Edmund W. Littlefield Professor of Management of the Stanford University, USA

"Becoming Hewlett Packard: Why Strategic Leadership Matters"

Bill Hewlett and Dave Packard invented the model of the Silicon Valley start-up and set in motion a process of corporate becoming that made it possible for HP to transform itself six times over the 77 years since its founding in the face of sweeping technological changes that felled most of its competitors over the years. Today, HP is in the throes of a seventh transformation to secure its continued survival by splitting in two independent companies: HP Inc. and Hewlett Packard Enterprise.

This keynote address will discuss the differential contribution of HP's successive CEOs in sustaining the company's integral process of "corporate becoming," an open-ended ongoing process for which there is no grand ex ante plan possible and which unfolds through a series of transformations in the course of the strategic evolution of long-lived companies. A comprehensive strategic leadership framework is used to explain the role of the CEO: (1) defining and executing the key tasks of strategic leadership, and (2) developing four key elements of the company's strategic leadership capability.

Dr. Robert A. Burgelman is the Edmund W. Littlefield Professor of Management of the Stanford University Graduate School of Business where he has taught since 1981. He obtained a Licenciate degree in Applied Economics from Antwerp University (Belgium), and an MA in Sociology and a Ph.D. in Management of Organizations from Columbia University, where he studied with doctoral fellowships from the Ford Foundation (US) and ICM (Belgium). His research has focused on the role of strategy-making in



firm evolution. In particular, he has studied the strategy-making processes involved in how companies enter into new businesses and exit from existing ones to secure continued adaptation. In 2003 he received an honorary doctorate from the Copenhagen Business School for his contributions to the study of corporate innovation and entrepreneurship. Dr. Burgelman has been on the faculty of Antwerp University, New York University, Harvard Business School (as a Marvin Bower Fellow), and Cambridge University (as a Visiting Professor of Marketing Strategy and Innovation at the Judge Business School). He has been elected a Fellow of the Strategic Management Society and a Fellow of the Academy of Management. He has published many articles in leading academic and professional journals, as well as some 150 case studies of companies and organizations in many different industries. His books include Inside Corporate Innovation: Strategy, Structure, and Managerial Skills *(Free Press, 1986),* Research of Technological Innovation, Management and Policy *(JIA Press, Elsevier; Volume 4, 1989; Volume 5, 1993; Volume 6, 1997; and Volume 7, 2001),* Strategy is Destiny: How Strategy-Making Shapes a Company's Future *(Free Press, 2002),* Strategic Dynam-

PLENARIES

ics: Concepts and Cases *(McGraw-Hill, 2006),* Strategic Management of Technology and Innovation *(5th edition, McGraw-Hill-Irwin, 2009), and* Becoming Hewlett Packard: Why Strategic Leadership Matters *(Oxford University Press, forthcoming). Professor Burgelman has served as an Associate Editor of the* Strategic Entrepreneurship Journal*, 2007-2014. He has served as the Executive Director of the Stanford Executive Program (SEP) during 1996-2015, and has taught executive programs and led senior and top management seminars for major companies worldwide. He has also served on boards of directors and boards of advisors of several private companies.*

KEYNOTE-2

Mr. Scott Roth, Chief Executive Officer, Jama Software, USA

"The Rise of Smart, Connected Products and the Challenge to Build Them"

The rise of the development of connected devices is impacting how we travel, how we live in our homes, and the jobs we have. Demand for smart, connected products is growing, and product developers face significant challenges in developing and sustaining successful products. As CEO of Jama Software, Mr. Roth is on the frontlines of product development working with a range of companies from startups to establishment Fortune 100s, and he sees firsthand the immense challenges and opportunities faced by those bringing products to market. Nearly everything about product development is changing, and companies must adapt to these pressures. During his talk, Scott will share new research about digital product design and discuss:

- How companies can standardize or optimize their current processes
- Designing new technology that is safe as complexity increases and products become more connected
- Keys to getting to market faster, with fewer product failures

As CEO, Mr. Scott Roth sets the strategic vision for the company. Prior to joining Jama, Mr. Roth served as Executive Vice President & General Manager of the Email Optimization business unit for data solutions provider Return Path, where he led a global team of more than 250 employees spanning product management, engineering, sales, services, channel and marketing. Scott brings more than 15 years of SaaS business-building experience including roles with Salesforce.com, ExactTarget and Webtrends. At ExactTarget, Scott helped the organization achieve more than 50 percent annual growth, expand into Europe, Asia and Latin America and complete a successful IPO on the New York Stock Exchange prior to its $2.5B acquisition by Salesforce.com.

PLENARY SESSION—4

DATE: THURSDAY, JULY 13
TIME: 08:30-10:00
ROOM: OREGON BALLROOM

Session Chair: Dr. Dilek Cetindamar Kozanoglu, Sabanci University, Turkey

KEYNOTE-1

Dr. Dietmar Theis, Honorary Professor at the Technical University of Munich, Faculty of Electrical Engineering, Institute for Physics of Electrotechnology, Germany

"Industry 4.0 – Chances and Challenges of the Digital Transformation"

A profound digital transformation is now underway in the world´s leading industrial and manufacturing companies. They are digitizing essential functions within their vertical operation processes and along their horizontal value chains. The new product portfolios are enhanced with digital functionalities and innovative data-based services are generated. At the end of these transformative processes we will see the emergence of truly digital enterprises, working together with customers and suppliers in industrial digital ecosystems.

The term Industry 4.0 was coined in Germany to emphasize the computerization of manufacturing, the core of this vision being built on the (Industrial) Internet of Things, IoT, the ubiquitous interlinking and networking of persons, things and machines. While Industry 1.0 refers to water/steam power, Industry 2.0 to electric power, and Industry 3.0 to computer power, Industry 4.0 stands for the most recent revolution – the Internet of Things power.

The talk will highlight developments in Industry 4.0 from a German/European perspective, include a glance at global future trends, and will put some emphasis on people, social aspects and ethics in the context of digital transformation.

Dr. Dietmar Theis is an Honorary Professor at the Technical University of Munich, Faculty of Electrical Engineer-

PLENARIES

ing, Institute for Physics of Electrotechnology, where he has been teaching since 1994. He obtained a master´s degree (Diplom) in Physics from the Technical University Berlin and a doctoral degree in Solid State Physics from the same University. For his PhD work he was awarded with the Scheel-Prize of the German Physical Society.

In 1977 Dr. Theis joined Siemens' Research Laboratories (Corporate Technology) where he worked on optoelectronics, light emitting diodes, flat panel displays and power semiconductors, publishing more than 40 technical papers. Since 1995 he was responsible for internal R&D marketing communication, R&D policy and government relations and university liaisons. He edited the Siemens' R&D journal Pictures of the Future and was involved in the company´s technical foresight activities. Dr. Theis was elected as a member of the Engineering Academy of the Czech Republic in 2006 and served as an R&D advisor to the CEO and the Head of the Supervisory Board of Siemens.

In 2008 Dr. Theis retired from Siemens and now continues his professional life as a consultant to a number of European scientific and engineering associations, as lecturer and as a mentor in the internationalization program of the European Industrial Research Association, EIRMA. He contributes to European Foresight Projects and acts as an R&D advisor to companies.

KEYNOTE-2

Mr. John R. McDougall, Hon Col (ret), B.Sc. (Alberta) 1967, P.Eng., CD, CStJ, C.Dir., FCAE, FEC, FGC (Hon), Fellow PICMET

"Lessons Learned from International Innovation"

A study completed in June of 2017 of 16 countries at various stages of development in various regions of the world has exposed fascinating similarities and differences between them in terms of innovation policies and practices. What can we learn from such an analysis? How can we use the findings to improve our own approaches to technology management and innovation whether we work in government, academia, research organizations or business?

This presentation will address key questions faced everywhere around the world and share the key findings which emerged.

1. Is there a "right level" of overall research and innovation funding?
2. Do countries need an industrial strategy to be successful?
3. How should funding be allocated between basic and applied research?
4. Should public funding support needs-driven research?
5. Is innovation most successful when driven top down or bottom up?

6 Is excellence the best basis for funding?

7. Is collaboration necessary for success?
8. What elements lead to a successful cluster?

Mr. John McDougall has 50 years of experience in 75 countries in the natural resource, IT, manufacturing, consulting, real estate and investment industries as well as research and development and academia. He retired from Canada's National Research Council after six years as President, a position he accepted after 12 years as CEO of the Alberta Research Council. He was the inaugural Chair in Management for Engineers at the University of Alberta from 1991-97, and he initiated Innoventures Canada Inc. in 2006 to bring together Canada's leading research and technology organizations providing technology development, demonstration and deployment services as centers of excellence for commercialization and research.

In the private sector, after eight years with a multinational, he managed and founded firms in real estate, investment and development, frontier exploration and logistics, project management, technology development, economics and economic development, financial and business planning, data processing and custom software development and natural gas brokerage. He has also served as an outside director or advisor to several public and private firms.

Mr. McDougall is an active volunteer in business, professional and not-for-profit organizations where holding leadership positions in local, national and international organizations such as The Edmonton Chamber of Commerce and World Trade Centre, Capital Care Foundation, Engineers Canada, St. John's Ambulance, Eureka and the G8 Heads of Research Organizations. He has also served on dozens of academic and government committees and agencies.

He has received medals and recognition including the 2015 PICMET award for Leadership in Technology Management, Honorary membership in the Mexican College of Civil Engineers and the Queen's Jubilee Medal.

PANELS

MEET THE EDITORS

DATE: TUESDAY, JULY 11
TIME: 10:30-12:00
ROOM: SALON E

PANELISTS: Dilek Cetindamar Kozanoglu, Sabanci University; Marina Dabic, Nottingham Trent University; Tugrul U. Daim, Portland State University; Nazrul Islam, University of Exeter; Marthinus Pretorius, University of Pretoria; Steven T. Walsh, University of New Mexico

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.

Editorial leadership from the following journals are expected:

- *International Journal of Energy Technology and Policy*
- *International Journal of Innovation and Technology Management*
- *International Journal of Technoentrepreneurship*
- *International Journal of Transition and Innovation Systems*
- *Technological Forecasting and Social Change*
- *Technovation*

TRENDS IN TECHNOLOGICAL EMERGENCE INDICATORS

DATE: WEDNESDAY, JULY 12
TIME: 16:00-17:3
ROOM: SALON F

PANELISTS: Ying Guo, Beijing Institute of Technology; Ying Huang, Beijing Institute of Technology; Nils Newman, Search Technology; Alan Porter, Georgia Institute of Technology; Arho Suominen, VTT Technical Research Centre of Finland

This panel session will conclude the Indicators of Technological Emergence track to discuss insights from across the presentations at PICMET and discuss trends for future research and applications.

PhD Colloquium

GETTING YOUR PHD… AND BEYOND

Critical Stages and Career Paths for the PhD Student

DATE: SUNDAY, JULY 9
TIME: 13:00-17:00
ROOM: SALON A
REGIST: $35

Session Chair: Dr. Nasir Sheikh, Assistant Professor, SUNY (State University of New York), Korea

SPEAKERS:

Dr. Steven Walsh, Distinguished and Regents Professor, University of New Mexico, USA

Dr. Nitin Mayande, Sr. Data Scientist, NIKE, USA

Dr. Judith Estep, Portfolio Manager, BPA (Bonneville Power Administration), USA

Through guest lectures by the editors and an interactive workshop, the session gives Ph.D. candidates an excellent opportunity to learn how to successfully defend their Ph.D. viva voce and how to become confident in searching for jobs in academia and industry after obtaining a Ph.D. degree. In addition, the Ph.D. candidates will be able to meet peers and colleagues, share experiences, and network with scholars from different continents.

The invited speakers and the participants will share experiences in the following areas:

- Critical stages in the Ph.D. process and how to successfully master them
- The Ph.D. process and career paths in different continents
- Coping with possible problems while pursuing a Ph.D.
- Entering the job market – academia or industry? (tips/tools for job searching)
- How to get your Ph.D. research published

The colloquium consists of two sessions. The editors and peers will share their experiences on the above topics in the first session. The second session will be an interactive follow-up workshop to tackle topics in which the participants are most interested.

This is an excellent opportunity for PhD students, recent graduates and early career researchers to network and discuss Ph.D. process, challenges and opportunities, and career options for a Ph.D. in Engineering and Technology Management.

Issues involved in getting the Ph.D. degree, publishing in academic journals, finding a job and building a career will be included in the discussions.

The speakers will present their views and share their experiences on careers in academia, industry and government agencies.

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

Refreshments will be served.

For more information, please contact Nasir Sheikh: nasir.sheikh@sunykorea.ac.kr

SESSIONS

MA-00 PLENARY - 1

DATE: MONDAY, 7/10/2017
TIME: 08:30 - 10:00
ROOM: SALON E-F
CHAIR: CHARLES M WEBER; PORTLAND STATE UNIVERSITY

MA-00.1 [K] Landmarks in our Understanding of the Management of Engineering and Technology

James M Utterback; Massachusetts Institute of Technology, United States

As our appreciation of the contributions of science, technology and engineering to our societies and economies grows, so does the value of our efforts here toward building the field of innovation science into a disciplined, cumulative and enduring effort. Over at least the past 50 years, hundreds of scholars have contributed important research, articles, and books that address the "discipline of innovation science." Contributors have been diverse; they come from fields such as economics, history, management, sociology, political science, science and engineering, geography, population ecology, and law. Few universities though define the area in the form of a department or discipline. This talk will review a few of, in my judgment, the landmark attempts of past decades by governments, the military, leaders of industry and engineering societies, and of academics with different perspectives to understand the ecology, processes and impacts of technological change and the ways in which it might be shaped and managed.

MA-00.2 [K] Three Underexploited Opportunity Directions for Technology Management

Karl Hampton Vesper; University of Washington, United States

Three contrasting directions for scholarly pioneering relevant to technology management proposed are: (1) developing engineering cases with more information about personalities and idiosyncrasies of individual engineers, (2) offering an interdisciplinary engineering-systems-design project course that would attract, among others, underrepresented ethnicities regardless of their majors, and (3) pursuing entrepreneurship research aimed toward more practical value for entrepreneurs, via student projects that analyze venture plan competition winners as a step toward building a computerized database of shared venture experience accessible for teaching, research, and consultation. This different method for academic research, if it works for entrepreneurship should logically also apply to other fields such as psychology and economics.

MB-01 Innovation Management-1

Monday, 7/10/2017, 10:30 - 12:00
Room: Salon A
Chair(s) Mark J Ahn; Portland State University

MB-01.1 [R] An Analysis on the Role of Organizational Innovation for Enhancing Firms' Innovation Performance

Do Bum Chung; KISTI, Korea, South
Byungil Kim; Andong National University, Korea, South

It is increasingly becoming important for firms to innovate, because technological developments are changing quickly and environmental uncertainties are increasing. A firm needs to achieve innovation to maintain sustainable competitive advantage, unlike other firms. The type of innovations is largely divided into product innovation, process innovation, organizational innovation, and marketing innovation; however, consideration of causal relationships is lacking. Therefore, this study investigates the relationships among four innovations to enhance firms' innovation performance through Korean Innovation Survey (KIS) data of the Science and Technology Policy Institute (STEPI). Especially, firms will have to perform organizational innovation before other innovations as it changes their internal routines. The results show that organizational innovation is positively associated with innovation performance (process innovation and marketing innovation), except for product innovation. This study confirms causal relationships among four innovations, and we suggest the importance of organizational innovation. Firms have to consider the role of organizational innovation when they perform innovation activities in the future.

MB-01.2 [R] A Study on the Environmental Regulations and Innovation: The Case of the European REACH Regulation

Kenji Nagasato; Hitotsubashi University, Japan

Concerning the relationship between environmental regulations and innovation, the Porter hypothesis is known as "properly designed environmental regulations induce innovation in enterprises, resulting in an increase in the improvement and benefit competitiveness." It had been carried out in various studies for a long time, and one research topic is, "What kind of environmental regulations can cause innovation?" In this study, the author discusses the relationship between environmental regulation and innovation on this topic using the case study of European chemical regulations, called REACH regulation. It is said to environmental regulations of stakeholder participation, so the interaction of REACH regulations and corporate innovation is discussed. In general, "Restrictions on hurdle is high, but there is no alternative and society requires the product." In this case, there is a high possibility to induce innovation. The "stakeholders can participate in policy processes regulating" and in the present case, it was indicated that it is difficult to induce a revolutionary innovation.

MB-01.3 [R] A Framework for Understanding Convergence-based Innovation: A Study of Canadian Ventures

Prescott C Ensign; Wilfrid Laurier University, Canada

Many entrepreneurs, venture capitalists, researchers, and policy makers view multidisciplinary convergence-based innovation as a primary source of competitive advantage in the globalized world of the 21st century. Convergence-based innovation is the integration of specialized knowledge from two or more fields or disciplines. The premise is that this type of innovation can lead to greater discovery and creativity which can result in new areas of knowledge, products with longer staying power, and more significant social benefits. This paper focuses on the development of a theoretical framework for understanding the entrepreneurial activity of convergence-based innovation. This framework is described as having three dimensions: content, process, and context. We report the findings in several of our research studies to provide further understanding of these three dimensions. The intent of this paper is to provide both descriptive and prescriptive perspectives that will be beneficial to those managing the entrepreneurial activities of knowledge creation and innovation - whether in small start-up high-tech firms or multi-national corporations. This can also assist faculty and researchers seeking to educate the next generation to live and work in an open-platform cross-disciplinary world.

MB-01.4 [R] Technological Collaboration Characteristics of Global IC Manufacturing Based on Patent Analysis

Zhe Yan; Beijing Institute of Technology, China
Yun Liu; Beijing Institute of Technology, China
Yijie Cheng; Beijing Institute of Technology, China
Xuanting Ye; Beijing Institute of Technology, China

With the development of industrial globalization, there are many international technological collaboration in the integrated circuit (IC) manufacturing industry. This research explores the international technological collaboration characteristics of the IC manufacturing industry from 2004 to 2013 by constructing a technical classification system, developing a patent retrieval strategy, and downloading and preprocessing patents from the European Patent Office (EPO). To fully grasp the international technological collaboration of this industry, we analyze four aspects - collaboration pattern, collaboration network, collaboration institution, and collaboration impact - by utilizing patent association analysis and social network analysis. Findings include the following: first, with regard to technological innovation and international collaboration innovation, the United States, the United Kingdom, India,

and Singapore are more successful, while Germany and Taiwan have great potential for future development; second, Asia and Europe have already formed clusters in topic association map and cooperative network, respectively, but the consistency and convergence of cooperative research orientation hinder further improvement of the nodes inside the cluster; last but not least, we put forward some suggestions for China to enhance its international collaboration level. The analysis can also be used to propose suggestions for other countries/regions, and the framework presented in this paper could be applied to examine other industrial international technological collaboration.

MB-02 Technology Planning and Forecasting-1
Monday, 7/10/2017, 10:30 - 12:00
Room: Salon B
Chair(s) Markus Gunther; Bielefeld University

MB-02.1 [R] Internet of Things Technology Diffusion Forecasts

Yorgos Marinakis; University of Twente, Netherlands
Steven T Walsh; University of New Mexico, United States
Rainer Harms; University of Twente, Netherlands

Prognosticators and pundits are forecasting an explosion over the next decade in the number of sensors connected to wired and wireless networks, also referred to as the Internet of Things. The challenge is that these sensor forecasts are being made without taking into account the infrastructure required to manufacture and operate the sensors. Financial forecasts of individual infrastructure components have been made, but they give point forecasts rather than diffusion curves. It is also often not clear what models these forecasters are using, as they are often in proprietary reports. The present study provides sensor and sensor infrastructure technology component diffusion forecasts using a sigmoidal model of product diffusion. A plurality of technology diffusion curves was computed, one for each sensor infrastructure component technology. To identify the potential lack of availability of a component or a set of components, the forecast curves were then examined for temporal commonalities and differences. Thus this study provides a method for forecasting an emerging technology.

MB-02.2 [R] Cross-Over Between Scenario Analysis and Agent-Based Market Simulation for Technology Planning

Markus Gunther; Bielefeld University, Germany
Lars Lupke; Bielefeld University, Germany
Christian Stummer; Bielefeld University, Germany

Many firms resort to scenario analysis as a tool for supporting strategic technology planning. For this purpose, alternative future scenarios are set up and contrasted with potential courses of action that take into account, for instance, new product features, measures for market introduction, or novel business models. Typically, the fitting between these scenarios and potential (action) portfolios is based on estimations. Enriching this rather limited valuation with outcomes from (agent-based) market simulations may therefore serve as a valuable means for decision support, because simulation results provide much more in-depth information such as product diffusion curves based on the new technologies for each combination of scenario and (action) portfolio over the course of time. The simulation can account for the relevant stakeholders (e.g., consumers) by modeling them as agents with heterogeneous preferences and behaviors. The prospective market development then emerges from the agents' actions and interactions (e.g., their word-of-mouth communication or purchases). We will describe such an agent-based model and discuss its contribution to technology planning by means of application examples based on real-world data.

MB-02.3 [R] Development of R&D Technology Rating Model in the Defense Area

Youjin Jung; Defense Agency for Technology and Quality, Korea, South
Joonyoung Kim; Defense Agency for Technology and Quality, Korea, South

This research presents the development of an R&D technology rating model that is applicable to the defense area. Technology profitability index and technology evaluation index are the main components of the model. Technology profitability index is derived using multiple regression analysis to forecast revenue from technology transfers. Technology evaluation index is developed using the hierarchical analysis with expert opinion. The weighted average of technology profitability index and technology evaluation index is used to derive a technology rating. If the defense R&D technology rating model applied in practice, it can contribute to efficient R&D budget allocation. Also, it helps the vitalization of transfer of technology in the defense R&D sector.

MB-03 Strategic Management of Technology-1
Monday, 7/10/2017, 10:30 - 12:00
Room: Salon C
Chair(s) Caren Weinberg; Ruppin Academic Center

MB-03.1 [A] Open Innovation Through Interconnection Between Small and Medium-Sized Enterprises and Large Enterprises

Takashi Iwamoto; Keio University, Japan
Atsuko Yasuda; B plus I Inc., Japan

In Japan, where economic growth is stagnant, it is necessary to implement a new growth model for the manufacturing industry to grow again. In this regard, exploitation of small and medium-sized enterprises (SMEs) with high and niche R&D and/or manufacturing capabilities in the form of open innovation is a key. Although previous researches showed open innovation had become implemented more widely than 10 years ago, in Japan, open innovation involving SMEs has not been widely adopted so far. In fact, there are several hurdles to overcome to realize open innovation with Japanese SMEs, such as difficulties to access their implicit information, which is typically disclosed only to trusted parties, and lack of network of local coordinators, including local bankers and personnel of local industry development organizations, who have access to SMEs' technical information in their small territories. Therefore, it is necessary to organize a network of these local specialists to search for a broad range of SMEs. Recently, several companies have been trying to connect SMEs across Japan and large enterprises (LEs). In this paper, the business model of one of such companies was analyzed, and the importance of the platform integrating information and communication technology (ICT) and manpower, which connects local coordinators with implicit knowledge of SMEs and LEs, is discussed.

MB-03.2 [R] The Role of Strategic Orientation in Business Innovation

Chung-Shing Lee; Pacific Lutheran University, United States
Leong Chan; Pacific Lutheran University, United States
David E McNabb; Pacific Lutheran University, United States

Focusing on technology-driven industries, this paper describes a model by which it is possible to identify and evaluate business strategies according to a matrix of four generic strategy categories. The model may assist in assuring that business functional strategies fit the requirement of the adopted business orientation. The model is illustrated by our interpretation of past and present strategies followed by leading firms in a variety of industries. We identify four generic categories of business strategic orientations: strategies designed to reallocate earnings or acquire greater market share, strategies that expand the profit pool by implementing innovations, strategies designed to re-adjust competitive positions in a declining market, or strategies designed to capitalize on "the next big thing." Examples of high-tech companies with one or more of these strategic orientations are provided. The framework presented in this article contributes to research in strategic management, and supports managers in making business decisions for high-tech companies.

MB-03.3 [R] Configuration Options for Corporate Incubators: Development of a Description Model Using the Morphological Analysis Method

Gunther Schuh; RWTH Aachen University, Germany
Felix S Lau; Fraunhofer Institute for Production Technology, Germany

Richard Zimmermann; Fraunhofer Institute for Production Technology, Germany
Florian Vogt; Fraunhofer Institute for Production Technology, Germany

Innovation is a catalyst for growth and competitiveness. Relying on conventional R&D activities to manage innovation, companies often fail at providing the necessary rates of innovation and developing truly radical innovations. To circumvent these problems, corporate incubators are designed to provide a separate development environment to accelerate innovation by integrating startups or providing internal project teams with resources, autonomy and work space. There are many options for designing a corporate incubator and aligning it to the company's strategic goals. However, no comprehensive models for the description of configuration options have been developed to date, resulting in a lack of knowledge in research and high failure rates in practice. The paper's objective is to close the knowledge gap by providing a validated, qualitative description model. For this purpose, morphological analysis is used to develop the model while the design parameters are derived drawing on an extensive analysis of literature and current business practice.

MB-03.4 [R] Dynamic Network Analysis of Inter-firm R&D Cooperation Based on Internet Information: A Case Study of Google

Feifei Wu; Beijing University of Technology, China
Qian Li; Beijing University of Technology, China
Xin Li; Beijing University of Technology, China
Lucheng Huang; Beijing University of Technology, China
Xiaoli Wang; Beijing University of Technology, China

With the implementation of China's innovative national development strategy, R&D cooperation has become an important way to enhance technological innovation capability of enterprises. Inter-firm R&D cooperation promotes enterprises to obtain complementary knowledge and ability, and has an important impact on technological innovation and development of enterprises. However, as a result of the variability of enterprise strategies and external environment, inter-firm R&D cooperation network presents the dynamic change. The purpose of this paper is to examine the evolutionary dynamics of inter-firm R&D cooperation network. This paper takes Google as a focal firm, using Internet information to construct and R&D cooperation network. Then we use dynamic network analysis to explore the characteristics of network structure including time, scale, pattern and technology. Firstly, clustering of partners with the same cooperative content in three different stages. Secondly, we try to take standard industrial classification to conduct industrial division of cooperative enterprises. Thirdly, the establishment time of the cooperative enterprise is analyzed statistically. Finally, we summarize and analyze the overall evolutionary features of Google R&D cooperative network according to the research. The results suggest that Google R&D cooperation is based on its technological innovation advantages, the R&D cooperation between Google and Google partners enable both of them to take advantage of complementary capabilities, facilitate product development and technology integration for an enhanced market share. In addition, at the different stages of development of Google, the selection of cooperative enterprises is changing and it reflects that there is a certain cooperation standard when Google initially chooses a partner.

MB-05 Resilience of Systems-1

Monday, 7/10/2017, 10:30 - 12:00
Room: Salon E
Chair(s) Paul Rohmeyer; Stevens Institute of Technology

MB-05.1 [A] Capability Effectiveness Testing for Architectural Resiliency in Financial Systems

Paul Rohmeyer; Stevens Institute of Technology, United States
Tal Ben Zvi; Stevens Institute of Technology, United States
Donald Lombardi; Stevens Institute of Technology, United States
Alan Maltz; Stevens Institute of Technology, United States

Increasing interconnectivity in financial institutions and markets along with complex, interdependent architectures present unique enterprise risks. While technological advances continuously improve the reliability and trustworthiness of individual technological system components, the complex, collaborative architectures relied on by most financial organizations present substantial challenges that span technology, personnel, and process dimensions. As systems and threat environments grow in sophistication, approaches to security testing and evaluation must evolve as well. Traditional approaches to cyber security testing may still be useful to evaluate basic architectural components; however, new techniques are needed to enable the enterprise to construct simulation exercises that model real-world threat conditions and test the resiliency of all architectural components, including personnel and process dimensions. Organizations must not only establish capabilities to recognize breach attempts, but take decisive response action under conditions of uncertainty and stress. Techniques to evaluate resilient enterprise architectures sometimes underemphasize the threats surrounding human dimensions. This paper examines emerging risk considerations presented by increased connectivity among financial services enterprises. It explores new requirements for testing and evaluation of enterprise resiliency as well as organizational detection and response capabilities. The paper considers industry and other external environmental factors driving the need to develop comprehensive evaluation approaches to evaluate the effectiveness of enterprise capabilities in order to embed capability effectiveness assessments within enterprise risk management practices. Limitations of current cyber testing approaches in simulating the emerging cyber threat environment are identified, and the value of realistic, time-bound drills and tests that mimic the stress of real-world cyber events are explored.

MB-05.2 [R] The Role of Resilience in Regional Innovation System

Pei-Chun Lee; Feng Chia University, Taiwan
Ryan Hamamoto; Feng Chia University, Taiwan

It has been recognized that regional innovation systems (RIS) policies can contribute to the adaptation of regional economies and therefore their economic resilience. As changes in international competition and shifts in consumer demand transform conditions, a resilient economy is considered to be successful if it can withstand these inevitable adaptations over time. For socio-ecological systems, resilience requires the amount of change that a system undergoes while retaining its structure and functions, the degree to which it can reorganize, and the degree to which it can create and sustain the capacity to learn and adapt. Policymakers are beginning to take interest in the concept of resilience as they explore the factors that influence the internal development of a region by seeking to understand the external factors that affect the ability of a region to respond to change. With this understanding, more effective policy formulation and the establishment of appropriate governance structures are made possible to effectively accommodate and facilitate change. To advance our theoretical understanding of the importance of resilience in regional innovation systems, which usually comprises economic and intangible value, this study provides theoretical analysis and a holistic review of resilience and RIS research. This paper makes two major contributions: First, it delivers a comprehensive review of resilience in economic theory and innovation studies, as the measurement of resilience has yet to be explored in this context in great detail. Second, it illustrates the critical role of resilience in RIS.

MB-05.3 [A] The Four Factors of Workplace Resilience

Larry A Mallak; Western Michigan University, United States

An interconnected world places high expectations on individuals. Working effectively to meet these expectations requires resilience, among other attributes. Thus, resilience has entered into the realm of organizational and engineering management. However, there are considerable differences among the several definitions and research streams concerning resilience. This paper uses case studies and empirical data to inform the study of workplace resilience. Much of the resilience research to date has focused on patients and individuals under the care of clinical professionals for the treatment of post-traumatic stress disorder (PTSD), adolescent mental health, and coping skills. Recently, interest in studying resilience in the workplace has necessitated the need for models and instruments validated with the general workforce population. One instrument - the Workplace Resilience Instrument (WRI)

- has been developed and validated with several segments of the U.S. workforce. The WRI produced four factors: Active Problem-Solving, Team Efficacy, Confident Sense-Making, and Bricolage. These four factors provide insight to the effective functioning of individuals within engineering management organizations and have implications for organizational performance. The meaning and implications of these four resilience factors are shared using case studies, examples, and findings from the research to date.

MB-06 Big Data for Technology Management-1
Monday, 7/10/2017, 10:30 - 12:00
Room: Salon F
Chair(s) Mike Freiling; Portland State University

MB-06.1 [R] Big Data in Product Development: Need for a Data Strategy

Julian Wilberg; Technical University of Munich, Germany
Isabell Triep; Technical University of Munich, Germany
Christoph Hollauer; Technical University of Munich, Germany
Mayada Omer; Technical University of Munich, Germany

Products nowadays do not only consist of mechanical and electrical components but also of connectivity components. Connected products set up a feedback-loop and provide manufacturers with use phase data. Such data enables manufacturers to better understand how products are used, which could help to design products that better fit the actual use. The number of connected devices will increase, but there is little knowledge about problems that engineering companies face when using data analytics for product development. The literature review and the experience gained through case studies highlight that inexperienced companies especially run into problems at the planning phase even before data analytics can start. The findings emphasize that companies need to invest time to develop a data strategy beforehand. However, an analysis of existing process models for data initiatives reveals that only little support is provided for the systematic development of a data strategy. Therefore, this paper derives a framework for a process model that supports companies in developing a data strategy for product development. The paper ends with suggestions for future research.

MB-06.2 [R] Achieving Competitive Advantage Through Big Data: A Literature Review

Husam Barham; Portland State University, United States

With the accelerated advances in information technology that affected every aspect of the modern, quick-paced life, and the huge influx of data being stored about almost everything we do, we are struggling to catch up and make sense of what is going on around us. Big data offers a viable way to understand the modern world and to transform this influx of data into usable information and insights that allow for better decision making, and in the case of businesses, to achieve competitive advantage over competitors as big data promises to provide the means for making the right decision at the right time based on faster, more accurate, more efficient, and more effective aggregation and analysis of internal and external sources of data, in ways that are unparalleled in human history. This paper reviews literature to find out in what ways can big data add value to firms, what are the challenges in implementing big data, and why big data projects tend to fail. Finally, based on the literature review findings, the paper discusses whether big data can really generate competitive advantage against competitors by analyzing the findings under the resource-based view of the firm theory.

MB-06.3 [R] Assessing the Value of Data: An Approach to Evaluate the Technology Driven Benefits of Smart Product Data

Gunther Schuh; Fraunhofer Institute for Production Technology IPT, Germany
Ramon Kreutzer; Fraunhofer Institut for Production Technology IPT, Germany
Marc Patzwald; Fraunhofer Institut for Production Technology IPT, Germany

Data-centered and customer-oriented business models shape the digitalization to be the central social, economic and technological development of current knowledge societies. A great share of these new business models is enabled by smart product field data, which is generated during the product's phase of utilization. To capture the diluting value and commodification of mechanical products, companies within the manufacturing industry as the providers of smart products have to position themselves strategically against new competitors, e.g., from the IT sector, to avoid being victim to the "digital Darwinism." A growing number of manufacturing companies have already started to see the revenue and differentiation potential of smart product data as a competitive advantage. Similar to other intangible assets, a comprehensive understanding of the quality, scope and value of smart product field data is a basic prerequisite for its monetization. However, so far the majority of companies are lacking this basic understanding for the value of their smart product data, thus not being able to lever its potentials. Hence, this paper develops a model, which supports manufacturing companies in assessing if a generic set of field data generated by a smart product is able to provide value added for the user. In the model itself, field data of smart products as well as "digitally enabled functionalities" will be examined extensively. Subsequently, generic sets of field data as carriers of information will be mapped regarding their suitability for enabling functionalities, which represent a demand of information.

MB-08 New Product Development-1
Monday, 7/10/2017, 10:30 - 12:00
Room: Salon H
Chair(s) Antonie M de Klerk; University of Pretoria

MB-08.1 [R] Comparative Analysis of Idea Generating Processes in Emerging and Developed Countries; Indonesia, Malaysia, and Japan

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

In recent years, researchers have focused on innovations launched from emerging countries. Although several cases of innovative products developed in emerging countries have been reported, there are few studies investigating differences in the idea generating process in emerging and developed countries. The main purpose of this study is to investigate those differences by adopting an exploratory approach pursued through a series of idea generation experiments. The experiments were conducted using as subjects graduate school students in two emerging countries, Indonesia and Malaysia, and one developed county, Japan. To simulate a realistic new product development process, the experiment consisted of three parts: the participants developing ideas, experts evaluating the ideas, and then participants analyzing the process over several group discussions so that the points may be discerned in the development process where there are differences between emerging countries and developed countries. Differences on both idea characteristics and selection criteria were found. First, the Indonesian and Malaysian participants proposed feasible ideas having lower investment risk than did Japanese participants. Second, the participants from the two emerging countries selected ideas with greater confidence than did the Japanese participants. Third, the former groups made decisions on their ideas without referring to experts' evaluations in contrast to the latter group.

MB-08.2 [R] Improving the Effectiveness of Fuzzy Front End Management: Expanding Stage-Gate Methodologies through Agile

Aruna Bhatia; Portland State University, United States
Juchun Cheng; Portland State University, United States
Sadaf Salek; Portland State University, United States
Vidhi Chokshi; Portland State University, United States
Antonie Jetter; Portland State University, United States

More now than ever before, product development has become more challenging and complex with all the globalization around business today. Understanding the requirements of unfamiliar markets can be very challenging for organizations trying to speed up their innovations. Also, with the advent of globalization there is pressure on everyone to perform better and roll out new products in the market. The fuzzy front-end process is a very dynamic and

unstructured process. By taking advantage of the key characteristics of Agile and Stage-Gate model, an Integrated Agile Stage-Gate Hybrid model was developed which could help in improving the effectiveness of the fuzzy front-end process. The goal of this research is to improve the effectiveness of the fuzzy front end innovation process by expanding Stage-Gate methodologies through Agile. In order to do this, a literature review was done to understand and review various Stage-Gate approaches, focusing on the problems of the Stage-Gate model and solutions provided by the succeeding frameworks. The key contribution of the research is an assessment of different Stage-Gate models which have been developed over the years focusing on their problems and the solutions given by Agile to resolve these problems. Recommendations are made in the end accordingly.

MB-09 Quality Management-1
Monday, 7/10/2017, 10:30 - 12:00
Room: Salon I
Chair(s) Hajime Sasaki; The University of Tokyo

MB-09.1 [R] Expanding the Definition of Quality Costs Beyond the Conformance and Nonconformance Dichotomy

Armando Elizondo-Noriega; Texas Tech University, United States
Mario G Beruvides; Texas Tech University, United States
David Guemes-Castorena; Tecnologico de Monterrey, Mexico

Satisfying customer's needs is the main goal in both quality and innovation management. However, the relationship between innovation management and quality management is not fully understood in the quality literature. One way to understand this complex relationship is via cost of quality (COQ) studies. COQ is the sum of conformance and nonconformance costs, but the conformance-nonconformance dichotomy seems to be ambiguous and arbitrarily defined. The ambiguity in the conformance and nonconformance terminology prevents observing the relationship between innovation and quality management. In the current work that ambiguity is demonstrated via the analysis of a paradox between properly managing and reducing product returns in consumer electronics. Also, the inhibition mechanism preventing the ability to observe the abovementioned relationship is made visible. It is critical and necessary to redefine the COQ not only on conformance and nonconformance terms, but also on a holistically and consistent basis to aid in quality policy making process.

MB-09.2 [R] A Historical Analysis of the Evolution of the Economics of Quality: The Cost of Quality Revisited

Armando Elizondo-Noriega; Texas Tech University, United States
Mario G Beruvides; Texas Tech University, United States
David Guemes-Castorena; Tecnologico de Monterrey, Mexico

The current work aims to shed light on the evolution of the economics of quality, also known as the cost of quality (COQ), via a historical analysis of the succession of different historical and scientific developments in the field. A timeline analysis makes visible the critical shifts in the development of the COQ theory and its implications to current industrial and technological challenges. In the same vein, the analysis of technical developments gives grounds to question the prevailing COQ paradigm, i.e., besides obtaining the COQ's evolution profile, the analysis shows the current COQ paradigm lacks lean manufacturing elements such as pull demand strategies. The current theory may unintentionally omit relevant information regarding the interaction between supply (supplier) and demand (customer), which in turn reduces current COQ model's predictability. This problem is identified as a possible paradigm paralysis in the future development of the state of the art in COQ.

MB-09.3 [R] The Application of Quality Function Deployment to Smartwatches

An wun Lee; National Chiao Tung University, Taiwan
Grace T.R. Lin; National Chiao Tung University, Taiwan
Wen-Hsun Kuo; National Chiao Tung University, Taiwan
Shin-Jye Lee; Yunnan University, China

Consumers are confused about the benefits of using Smartwatches due to the various insignificant functionalities that are included in the devices, as well as the unclear value propositions promoted by Smartwatch manufacturers. In order to improve the quality of products and to provide features that can satisfy consumers' needs, the expectations of consumers need to be understood by technicians. This paper recommends the use of Quality Function Deployment (QFD), a method that integrates consumers' dynamic requirements with product designs, which can be represented via a House of Quality (HoQ) matrix diagram. Here, the unmet and uncovered needs of consumers vis-a-vis the Smartwatch are analyzed extensively through the employment of a questionnaire-based survey. The opinions of consumers and technicians are then examined, and an HoQ is constructed to evaluate the relationship between the Smartwatch's design attributes and its technical attributes. Finally, the attributes that need to be improved are listed in a suggested order of priority.

MB-09.4 [R] Prediction of Business Partners Using an n-Gram-Based Approach that Combines a Network Model and Linear Model of a Supply Chain

Hajime Sasaki; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

Supply chains are viewed as networks of both goods and services, and knowledge and information. Their knowledge will be potential resources for new business relationship with hidden partners; however, many companies find it difficult to develop new opportunities. A recommendation of a potential partner is helpful for regional revitalization. Research into supply chains has shifted from a linear model to a network model. A network model using graph theory can topologically explain a supply chain, whereas, in a linear model, there are some differences with the real world because of a lack of information. In this study, we propose a prediction model for a new business partnership with predictors extracted from network and linear approaches used in combination for the prediction of performance and interpretability. Our dataset consisted of a network of 327,012 transactions among 131,192 companies in Northeast Japan, which was retrieved from supplier-customer relationship data provided by Teikoku Databank, Ltd. Network centralities were extracted as topological features from the network of each company. Trigram relationships were also extracted from the network motif so that the logistic flow to a company from its supplier could be used to predict customers as business partners. The results showed that the performance of the proposed model was excellent, with a high contribution of probability extracted from the trigram relationships. From this perspective, we found that the information of logistics flows is a critical factor for predicting a potential partner, even in a network model.

MB-11 Commercialization of Technology-1
Monday, 7/10/2017, 10:30 - 12:00
Room: Eugene
Chair(s) Phil Y Yang; National Taichung University of Education

MB-11.1 [R] A Multilevel Analysis of Research Excellence and Research Commercialization in Entrepreneurial Universities

Phil Y Yang; National Taichung University of Education, Taiwan

This paper develops the notion of research ambidexterity in the context of the entrepreneurial universities. The putative multilevel relationships between university's antecedents, departmental/individual research ambidexterity and commercial performance are examined. On the basis of a postal questionnaire survey, a dataset of 634 faculty members, 99 departments, and six universities is collected. The results of regressions suggest that both levels of research ambidexterity facilitate departmental and individual commercial performance, respectively. Moreover, there exist multilevel positive relationships between university organizational flexibility, departmental research ambidexterity, and individual research ambidexterity and opportunity exploitation. The paper concludes that the development of research ambidexterity in entrepreneurial universities should be considered as multilevel relationships between universities, departments and individuals.

MB-11.2 [R] Discovery and Dynamic Prediction of User's Interest Based on

ARIMA

Xuejian Ren; Beijing Institute of Technology, China
Xiang Chen; Beijing Institute of Technology, China

User's interest is changing over time in online social networks. How to make use of the user's historical data to forecast the user's interest in the future and then to make some individual recommendations with higher accuracy has become a particularly important research problem. To solve this problem, we propose an interesting model based on auto regressive integrated moving average (ARIMA) to discover the user's preference dynamically and combine the collaborative filtering (CF) to recommend user's preference hashtags. In order to verify our method, we choose the real-world data from Sina Microblog which is the biggest social network in China in two years as the experiment data set. More specifically, the data is divided into 24 periods by month average and extract interesting themes by Sina-users Latent Dirichlet Allocation (LDA) of every period. Then, we compute the users' similarity based on Cosine similarity. Thus, we can get the time series of the user's interest for dynamic prediction by ARIMA. As shown in the experiment results, our designed method can not only predict the user's preference dynamically and more accurately than the previous work, but also can improve the sparsity slightly by making use of the content of Sina Microblog and user's hashtag.

MD-03 Technology Roadmapping-1

Monday, 7/10/2017, 14:00 - 15:30
Room: Salon C
Chair(s) Clive Kerr; University of Cambridge

MD-03.1 [R] Developing a Strategic Roadmap for Policy and Decision Making: Case Study of ICT and Disaster Risk Reduction in Public Safety Networks

Nasir J Sheikh; The State University of New York (SUNY), Korea, Korea, South

Globally, disaster risk management (DRM) and disaster risk reduction (DRR) are recognized as key areas of concern and planning and are embedded in multiple United Nations Sustainable Development Goals (SDGs). The scope is broad and varied. To communicate and coordinate the efforts to realize the goals and policies, a strategic roadmap can be an effective method. However, roadmaps tend to include only general and broad goals, guidelines, and priorities. This can lead to confusion for the policy implementers and practitioners. To avoid this, the roadmap can include multiple layers that translate the policy roadmap elements to specific practical elements to implement policy. This is accomplished by combining roadmapping with the house of quality (HoQ) method. HoQ uses a planning matrix to bridge the relationships. HoQ is used in complex production environments such as automotive but is novel to DRR. One important aspect of DRR is information and communications technologies (ICT) and includes public safety and emergency networks such as FirstNet and SafeNet. ICT for DRR may be defined as the ICT services, applications, infrastructure, systems, and technologies for disaster prevention, mitigation, preparedness, response, and recovery and may include regional and international communications networks. This research provides an initial roadmap framework of ICT for DRR.

MD-03.2 [R] Analysis on Evolution and Frontier Research of Selective Catalyst Reduction Technology for Diesel Engine Based on Bibliometrics

Lucheng Huang; Beijing University of Technology, China
Xiaoli Wang; Beijing University of Technology, China
Feifei Wu; Beijing University of Technology, China
Qian Li; Beijing University of Technology, China

Diesel engines are widely used in medium and heavy vehicles because of higher dynamic performance and lower oil consumption. However, the problems of pollution from diesel exhaust emissions begin to stand out. Selective catalytic reduction technology is one of the main methods of emission treatment of diesel-engine applications. This paper uses the literature retrieved from the Web of Science as the data source. With the information visualization software Citespace, the paper explores the development trend of the selective catalyst reduction technology for diesel engines. Through keywords burst detection to determine hot words of frontier topics; and building heterogeneous clustering network of keywords and co-citation literatures to reveal the frontier framework. Finally, retrieving innovative literatures based on frontier knowledge and co-citation literature clusters; then refining frontier topics of the selective catalyst reduction (SCR) technology. The results show that current research on SCR technology for diesel engines is focused on the load performance and denitrification efficiency of copper supported on different carriers. The research on enhancing the resistance to H2O and anti-SO2 of SCR catalyst at low temperature is also the focus of SCR technology study. Besides, it is also actively exploring the optimization and improvement of control strategy for SCR after-treatment system.

MD-03.3 [A] Building a Medical Product Development Industry in an Emerging Economy

Jeff Hamilton; Rangsit University, Thailand
Ronald Vatananan-Thesenvitz; IKI-SEA - Bangkok University, Thailand

Thailand has an overburdened healthcare system, which is at risk of failing due to the fact that it has one of the fastest growing aging populations in the region. The facts that Thailand has fewer financial resources and a doctor patient ration of 1:2,700 only magnify the problems of the local healthcare system. One way Thailand could offset some of this burden would be to reduce the overall costs of the healthcare system by creating a medical product development industry. At present, the country imports over 90% of its hospital equipment and over 65% of its general medical supplies. Thailand, for the most part, has been a third-tier original equipment manufacturer (OEM) that makes parts of products for other manufacturers and has little or no place with these companies as an R&D partner. Therefore, the Thai government supports various initiatives that are aimed at moving the country's medical product development industry up the value chain from OEM to ODM (original design manufacturer) by creating fully developed Thai products under Thai brands for export around the world. Successfully enhancing Thailand's position in the value chain will involve combining several related conceptual tasks into one coherent policy program for the medical device industry. This paper expands on a government project conducted in 2016 to scan existing government units and private enterprises tasked with driving R&D efforts in medical product development. Based on the results, a first-cut strategic roadmap was developed to demonstrate how Thailand's medical product industry could move from OEM to ODM by 2030.

MD-04Technology Adoption-1

Monday, 7/10/2017, 14:00 - 15:30
Room: Salon D
Chair(s) Charles M Weber; Portland State University

MD-04.1 [R] Adoption Criteria Evaluation of Activity Tracking Wristbands for University Students

Amir Shaygan; Portland State University, United States
Dilek Ozdemir Gungor; Izmir Katip Celebi, Turkey
Hakan Kutgun; Portland State University, United States
Ali Daneshi; Portland State University, United States

Information and communication technologies (ICTs) are reshaping our world. Companies keep launching their innovations in different industries. Some of these technologies have well-defined customer targets such as chronic patients, whereas some are candidates to become mainstream products. Activity tracking wristbands are a good example of mainstream candidate products. These devices are mainly designed to monitor activities and other health related measures on a continuous basis, but their functions are limited to neither fitness nor health tracking. First of all, the information provided by these devices and the way they are provided - which is directly related to their technology - play significant roles in the adoption decision. Moreover, as consumers need to keep them on their wrist constantly, its design plays a critical role. Being effective from hedonic aspect is important as well. Last but not least, cost criterion should always be taken into account in the adop-

tion decision. Due to the multi-dimensional adoption of these devices, it is crucial to understand how people evaluate these dimensions and understand the value they put on each of these criteria. In this paper, the aim is to understand the important levels of these dimensions and their sub-criteria for university students using hierarchical decision model (HDM).

MD-04.2 [A] Requirements-Based Matching Approach to Configurate Cyber-Physical Systems for SMEs

Felix Jordan; FIR Institute for Industrial Management, Germany
Anne Bernardy; FIR Institute for Industrial Management, Germany
Max Stroh; FIR Institute for Industrial Management, Germany
Johannes Horeis; FIR Institute for Industrial Management, Germany
Volker Stich; FIR Institute for Industrial Management, Germany

This paper addresses the challenge of modelling individual cyber-physical systems (CPS) for small and medium-sized enterprises (SMEs) in manufacturing industries. CPS are key technology building blocks for the implementation of Industrie 4.0. Especially for SMEs the increase of production efficiency and reduction of manufacturing costs through CPS offer potential to maintain their competitiveness and innovation capacity. Although SMEs perceive the potential of CPS, they often lack financial and human resources to acquire the necessary CPS-competencies as well as an overview of all the currently available technological solutions. To overcome this issue a matching platform will offer SMEs support in finding suitable CPS-components by letting them express their functional and technical requirements. The matching logic is based on a set of morphologies that encompasses the functional and requirement spectrum of CPS-components. The matching algorithm analyses the input for congruence of requirements and available technologies and suggests suitable technology combinations. This paper describes the methodology of the matching platform, and introduces the research work to define and to develop the technology morphologies. The presented results facilitate the selection and configuration of CPS for SMEs.

MD-04.3 [R] Assessing the Sentiment of Social Expectations of Robotic Technologies

Cristian Mejia; Tokyo Institute of Technology, Japan
Yuya Kajikawa; Tokyo Institute of Technology, Japan

The robotics market, both for service and industry, has been rapidly growing in recent years, and it is expected to continue in the same way. However, despite the positive forecast, some specific robotic technologies have not found a smooth path to society. In this paper, we investigate the relation between society and robotics by conducting a comprehensive analysis of papers and news articles from 1976 to 2015 with the purpose of elucidating the role of society's sentiment and attention towards robotics research and development. We could identify three peaks of inflated social attention, corresponding to industrial robots (1978-1990); and a first (1999-2006) and second wave (2010-2015) of service robotics. Then, the sentiment analysis technique is applied on the corpus of news to discover patterns of negative or positive expectations, to finally link these expectations to specific technologies in the citation network of papers. This study points towards the development of a bibliometric indicator of social impact of technology.

MD-05 Enterprise Management-1
Monday, 7/10/2017, 14:00 - 15:30
Room: Salon E
Chair(s) Jonathan C Ho; Yuan-Ze University

MD-05.1 [R] Concept of Innovation Transfer from Corporate Incubators

Gunther Schuh; RWTH Aachen University, Germany
Florian Vogt; Fraunhofer Institue for Production Technology IPT, Germany
Felix Lau; Fraunhofer Institute for Production Technology IPT, Germany
Philipp Bickendorf; Fraunhofer-Institute for Production Technology IPT, Germany

Due to the increase of disruptive innovations and accelerating product lifecycles, focusing on only incremental innovation is not enough to ensure long-term corporate growth. However, deadlocked internal structures and the day-to-day business prevent companies from reaching their full innovation potential. To escape the dilemma, companies are increasingly counting on corporate incubators for the development of radical innovations. Outside existing structures, project teams, external expertise or the integration of start-ups accelerate the innovation process. However, the long-term corporate strategy leads to the fact that most of the innovations from corporate incubators are reintegrated into the parent company. A successful transfer of external innovations is therefore a central challenge, which is so far described insufficiently in the literature by mainly focusing on the Not Invented Here Syndrome. To implement a successful transfer from a corporate incubator, a defined strategy considering the situational context is required. Especially the transfer object and the characteristics of the corporate incubator are decisive. The aim of the paper is therefore to display the problems of a transfer of innovations from corporate incubators to the parent company and to introduce a concept for a solution model of a situation-specific transfer process.

MD-05.2 [R] Technology Management Practices of CTOs in Emerging Economy India

Ajit Kumar; NITIE, Mumbai, India
Mukundan R; NITIE, India
Karuna Jain; NITIE, India

Emerging economies have mostly been dependent on developed economies for advanced technology and industry practices. In the developing country India, many initiatives are taken to catch up with fast pacing technological development. The industry is responding with the development of the new position of technology leaders like CTO, CIO and CDO, each focusing on their practices in the technology management domain. In the era of the fourth industrial revolution, technology leaders are attempting to enhance efficiency and cater business opportunities of the vast market of India. We investigate the change in their role by profiling them using the NLP-based technique to understand the gap between academician's knowledge and practitioner's view. The findings suggest that role of technology leaders is evolving and gaining importance in the top management team. Also, their technology management practices dynamically vary as per the need of the organization.

MD-05.3 [R] Profit Sharing Strategy, Employee Commitment and Intention of Stay

Ching-Hsiu Chi; Yuan-Ze University, Taiwan
Jonathan C Ho; Yuan-Ze University, Taiwan

Profit-sharing strategy (PSS) has been identified as one of the key elements affecting employee work attitude and behavior as well as performance. In this paper, the aim is to study how the adoption of profit-sharing strategy is related to commitment and intention of stay. This article analyzes the correlation between the adoption of profit-sharing strategy (PSS) and employee intention of stay and how it is mediated by employee commitment. Overall, there is a positive correlation between the adoption of profit-sharing strategy and employee intention of stay. The data was collected from employees from different industries in Taiwan. Survey data is from over 262 employees in different companies in Taiwan. In studying the relationship among profit-sharing strategy, commitment and intention of stay, we found strong correlations between profit-sharing strategy and intention to stay, mediated by commitment. Employee commitment and intention of stay will be affected by profit-sharing strategy.

MD-06 R&D Management-1
Monday, 7/10/2017, 14:00 - 15:30
Room: Salon F
Chair(s) Naoshi Uchihira; Japan Advanced Institute of Science and Technology

MD-06.1 [R] The Role of Bridge Managers in Global R&D Projects

Naoshi Uchihira; Japan Advanced Institute of Science and Technology, Japan

Nawarerk Chalarak; Japan Advanced Institute of Science and Technology, Japan
Srigowtham Arunagiri; Indian Institute of Science, India

In the current competitive global business environment, global collaboration in an ecosystem becomes very important to strengthen a company's core competencies. We classify global resources into three types: knowledge resources, manufacturing resources, and deployment resources. There are several types of global knowledge resources, including offshore outsourcing in research and development (R&D), collaborative R&D, mergers and acquisitions, connect and develop activities, and licensing. This study focuses on offshore R&D, where R&D bridge managers play an important role. We clarify the role of R&D bridge managers through a case study of offshore R&D outsourcing by Japanese companies to their R&D centers in India. Although there are several studies about global R&D management from an organization's viewpoint and several studies about bridge system engineers in offshore software development, little research has been conducted on bridge managers in R&D. In this study, the roles of R&D bridge managers are characterized by a comparison between bridge system engineers and R&D bridge managers.

MD-06.2 [R] Servitization Education for Technical Personnel: Concept and Its Effect on R&D Output

Kunio Shirahada; Japan Advanced Institute of Science and Technology, Japan
Naoki Takahashi; EIZO, Japan

Manufacturing companies are recognizing the importance of integrating service-based value in technology-based businesses for sustainable corporate success. However, unlike large manufacturing companies, most other companies have limited technological and human resources. We need to consider servitization when resources are limited. The authors have developed a practical approach to servitization and verified its effectiveness in a middle sized Japanese manufacturing company through action research. As a result, we found a successful case that is based on resource integration among several companies. Through the analysis of how engineers can produce innovative results under limited resources, this study will demonstrate how servitized engineers changed their view on technology and what they did to achieve innovative results, thereby showing what will be needed in servitization education for technical personnel.

MD-06.3 [R] Identifying Technology Advancements and Their Linkages in the Field of Robotics Research

Toshihiro Kose; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

Robots have been developed and merged various sophisticated technologies such as mechanical engineering, control systems, electronics, and software for about half a century, and have played a significant role in automation of manufacturing industries and substantial improvement of productivity. Artificial intelligence (AI) has also been developed rapidly and is expected to apply to various fields including robot technologies. The recent rapid advancement of information and communication technology (ICT) and emergence of the Internet of Things and artificial intelligence (AI) are expected to make robots more intelligent as well as more autonomous, and to contribute to healthcare, construction, logistics, agriculture, and other service sectors. The purpose of this paper is to detect trends of technology advancements and their linkages between the field of robotics research and that of AI, and to identify the main areas where the robot has contributed to scientific sectors and has made impacts by applying a citation network analysis.

MD-07 E-Business-1
Monday, 7/10/2017, 14:00 - 15:30
Room: Salon G
Chair(s) Ahto Kalja; Tallinn University of Technology

MD-07.1 [A] Administration of the State Information System of the Estonian eGovernment

Ahto Kalja; Tallinn University of Technology, Estonia
Tarmo Robal; Tallinn University of Technology, Estonia
Triin Gailan; Information System Authority, Estonia

The developing of Estonian eGovernment components started approximately at the beginning of the century. In this article, we discuss our experience of how the main components of Estonian eGovernment are managed in this period. The administration system RIHA is developed for realizing this management. The objective of the RIHA is to guarantee the transparency of the administration of the state information system, planning for information administration and supporting the interoperability of databases of the state, local governments and persons in private law performing public duties.

MD-07.2 [R] A Study of Impact of Instant Messaging on Job Performance through Employee Empowerment

Chih-Yin Wu; National Sun Yat-sen University, Taiwan
Hue-Mei Liang; National Sun Yat-sen University, Taiwan
Su Mei Chiu; National Sun Yat-sen University, Taiwan
Chih-Hung Yuan; National Sun Yat-sen University, Taiwan

This electronic document is a "live" template and already defines the components of your paper (title, text, heads, etc.) in its style sheet. The Internet has revolutionized the way we communicate. In particular, instant messaging (IM) as a social media platform can meet the demands of omnipresent communication, and hence constantly using IM has become a routine activity of most people. Through constantly receiving organizational ingredients with IM, employees may feel equipped with more job related knowledge, closely connected with the organization and authorized in decision making. There have been few studies that directly discussed the use of IM at work in view of employee empowerment; therefore, this study is aimed to provide some insight into this issue to show how the employee could feel empowered. This study is to explore the impact of employees' usage of IM as a communication tool on employee behavior from the perspective of "employee empowerment" with the following purposes: (1) the IM usage with the relationship of "job satisfaction", "job performance" and "organizational commitment" (2) the impact of the IM usage on employee empowerment (3) with the relationship of "IM usage" and "empowerment", "job satisfaction", "job performance" as well as "organizational commitment."

MD-08 New Product Development-2
Monday, 7/10/2017, 14:00 - 15:30
Room: Salon H
Chair(s) Kazuo Hatakeyama; UNISOCIESC

MD-08.1 [R] Product Models in Mechatronic Design

Dominik Weidmann; Technical University of Munich, Germany
Moritz Isemann; Technical University of Munich, Germany
Peter Kandlbinder; Technical University of Munich, Germany
Christoph Hollauer; Technical University of Munich, Germany
Niklas Kattner; Technical University of Munich, Germany
Lucia Becerril; Technical University of Munich, Germany
Udo Lindemann; Technical University of Munich, Germany

Mechatronic engineering is characterized by interaction of the three disciplines mechanical, electrical and software engineering. The ongoing shift in mechatronics towards a growing importance of information technology leads to increasing discipline interfaces and increasing product complexity. Here, product models are an important artefact to face these challenges and to coordinate the interdisciplinary development of mechatronic products. This contribution analyzes product models in mechatronic design with special focus on their interdisciplinary character. The study and the results are based on a literature analysis. A selected collection of 55 industry-relevant product models is analyzed and categorized according to previously defined criteria. Statistical analyses of this data set are conducted to gain interesting insights about the state of the art of product models in mechatronics. First findings show a distinct overlapping in models between disciplines in certain areas. The models of different disciplines are compared among each other and analyzed according to

the categorization criteria. In future research this data base and the findings are used to develop a method to systematically identify companies' currently used models and adapt their model portfolio regarding their future processes and products.

MD-08.2 [R] Design Capabilities in Software Innovation Settings

Felipe Zapata Roldan; University of Bridgeport, United States

The border between tangible and digital products is getting more diffuse, and the design methodologies are converging to a more comprehensive and holistic approach in that sense. The output of these novel innovation processes is often a digital entity like an app or a physical object. For users and consumers, it is important to keep a fluid interface between hardware and software, assuring a proper and effective user experience (UX) during all user interaction (UI). This work uses review-centric research to identify from theory a set of innovation and technological capabilities used in the product design stage of software development, and explores which of them are common to the tangible product design. The capabilities were grouped in three dimensions: organizational (human and strategy), structural (technology and knowledge management) and relationships (partnerships and transfer). Agile methodologies, rapid application development (RAD), scrum frameworks, lean development, Unified Modeling Language (UML), and other software industry tools were used as examples of design capability resources alongside new product development (NPD) and its product design and strategy generation tools for project development in tangible/non-tangible products like QFD, Stage-Gate, TRIZ, etc. A model of a common product development cycle for both tangible and software products is displayed showing their similarity and how they connect.

MD-08.3 [R] Improving the Conceptual Design at the Technological Innovation of Product

Jose C Alvarez Merino; Universidad Peruana de Ciencias Aplicadas, Peru
Kazuo Hatakeyama; UNISOCIESC, Brazil

The core of technological product innovation is in the conceptual design, which needs to be addressed in a convergent way to supplement the lack of technological trajectory, lack of resources for testing and laboratories, and encourage networking of researchers. That is the case of countries with less technological development where the scarcity of resources is obvious. This article proposes a methodology for conceptual design, based on the use of test results from existing data, and the matrix of contradictions of the inventive methodology TRIZ. This methodology is then applied to the conceptual design of an adsorption refrigeration system using exhaust gas of automotive vehicles, affording a new conceptual design.

MD-08.4 [R] Determining the Application Suitability of Agile Methods for Highly Interdependent Products

Gunther Schuh; RWTH Aachen University, Germany
Michael Riesener; RWTH Aachen University, Germany
Frederic Diels; RWTH Aachen University, Germany

Meeting heterogeneous customer requirements in short product life cycles with a variety of product functions is a significant challenge for manufacturing companies nowadays. So far, some of the requirements remain unknown until late stages of the product development project, which makes it more difficult to generate the right product features. This is mainly caused by volatilely changing customer expectations. One promising approach to address these challenges is the application of agile methods from the software industry to the development of physical products. Nevertheless, most companies are not able to adapt this approach and therefore adhere to plan-driven development methods. This is due to a lack of profound knowledge in transferring agile methods to the development of highly interdependent physical products. This paper aims at the presentation of a methodology, which determines the application suitability of agile methods for the development of highly interdependent products. Therefore, the type and degree of interdependencies between individual product scopes are analyzed. Based on this investigation and the application of Agile Indicators, an evaluation of development scopes regarding their suitability for agile development is derived. The developed methodology can be used to ensure the right degree of agility in physical product development. The applicability of the proposed methodology is shown with the practical case of a small manufacturer of electric cars.

MD-09 Resource Management-1
Monday, 7/10/2017, 14:00 - 15:30
Room: Salon I
Chair(s) Timothy R Anderson; Portland State University

MD-09.1 [R] Analysis of the Impact of a Small Hydropower Generation Project on the Local Economy: The Case of Gokase Town, Miyazaki Prefecture

Yaeko Mitsumori; Osaka University, Japan

Since the Fukushima Daiichi nuclear disaster that occurred in the wake of the Great East Japan Earthquake, the use of renewable energy has become one of the major pillars of Japan's energy strategy. The Japanese government has therefore introduced a feed-in tariff policy for renewable energy in order to promote its use. Among the various types of renewable energy, one type that has attracted much attention is small hydropower because it generates low environmental impact, offers high-energy efficiency, has an abundance of potential sites, and can operate for long periods. In many cases, small hydropower generation is used for the "local production for local consumption," and thus local communities often take the initiative to promote plans for establishing small hydropower plants. This study selected a community development project utilizing small hydropower plants in Gokase Town in Miyazaki Prefecture. Applying an analytical method, this study measures the economic and social impacts of the small hydropower plant project in the town.

MD-09.2 [R] Impacts to Productivity in the Painting Trades

William Ibbs; Univ. of Cal. Berkeley - Ibbs Consulting Group, United States
Gerald H Williams, Jr.; Construction Research, LLC, United States
Timothy R Anderson; Portland State University, United States

The "painting trades" include commercial and industrial painters and drywall finishers, which are normally represented by the same labor union for collective bargaining purposes. They are also members of the same construction trade organization, the Finishing Contractors Association (FCA). Labor is the greatest variable cost of performance for these trades and so, labor productivity is a critical concern of these trade contractors. The FCA funded this research to better understand the factors which impact labor productivity and to what degree. The FCA collected data on 140 commercial painting projects, 56 industrial painting projects, and 147 drywall finishing projects. Fifteen productivity variables were derived from a review of the literature and in discussions with an expert panel of industry executives, selected by the FCA executive director. The data was collected by the FCA using an online survey sent to FCA member contractors. Correlation matrices and single linear regression analyses were performed on the data, which revealed the majority of the variables were negatively correlated with labor productivity and were statistically significant at very high levels.

MD-10 Artificial Intelligence for Technology Management-1
Monday, 7/10/2017, 14:00 - 15:30
Room: Portland
Chair(s) Mike Freiling; Portland State University

MD-10.1 [A] Comparison of Intelligent Classification Techniques by Practicing a Specific Technology Audit

Ali Berkol; Baskent University, Turkey
Gozde Kara; Middle East Technical University, Turkey
Abdurrahman Turk; Turkish Military Academy, Turkey

Technology audit activities are carried out for assessment of firms' technological requirements, capacity or management capability. The aim of these assessments is to define the

weaknesses of firms and develop actions in order to improve firms' technological capacity and/or technology management capability. Generally these activities are implemented with survey questionnaires. These questionnaires can be filled by managers of firms or can be implemented as an interview by independent experts. However, evaluating surveys and preparing useful comments related to results can consume lots of time and also contain lots of biases/subjectivity. In accordance to ease the decision-making process and provide more verified/accurate results, we develop a methodology based on an Artificial Neural Network (ANN) algorithm which is aimed to behave like a decision maker. And in this study, we use a synthetic data set which is prepared for assessment of technology management capability of selected 70 Turkish firms.

MD-10.3 [R] Common Sense Reasoning for Knowledge Integration

Mike Freiling; Portland State University, United States
Daniel Sagalowicz; Portland State University, United States

Recently, the field of artificial intelligence has made significant advances in building deep models of complex tasks. One area, however, that seems to have lagged behind is the domain of "common sense reasoning." Much common sense reasoning research has defined the term in a way that requires deep models of everyday phenomena, making progress difficult. Common sense reasoning does not in itself need to be a deep process. It can be limited to a single task - integrating the knowledge provided by other models and information sources, focusing only on the dominant conditions identified by each model. To remedy these shortcomings, we propose an approach based on an architecture that we refer to as CS+CM, for "Common Sense Plus Constituent Models." In a CS+CM architecture, the common sense (CS) layer plays an integration role that only requires limited inferential capabilities. In addition, we propose concrete limits to representational and inferential capabilities, and identify the structural requirements for deeper models to support integration at the common sense layer. We illustrate this approach with examples in diverse areas of capital investment, team selection, and behavioral finance.

MD-11 Global Issues in Technology Management-1
Monday, 7/10/2017, 14:00 - 15:30
Room: Eugene
Chair(s) Tsung-Han Ke; National Chi Nan University

MD-11.1 [R] The Time Trend of the Impact of Foreign Direct Investment on Labor Market: The Moderation Effect of Production Technology

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

Foreign direct investment plays a major role in international production. Studies that have suggested the impact of international production on the wage rate of labor market often have different results and argument. Under the trend of globalization, the purpose of this study will investigate the impact of foreign direct investment on the employee compensation of agriculture, industry and services sectors. Past literatures have also indicated that there exists positive correlation between international production and production technology, and there exists a connection between production technology and labor wage. Thus, this study investigates the moderation effect of production technology between foreign direct investment and employee compensation. The dataset consists of the members of Organisation for Economic Co-operation and Development (OECD) countries, and the period is from 2000 to 2014. The empirical analysis uses structural equation modeling (SEM) to explore the relationship of foreign direct investment, employee compensation, and production technology, where the factor of production technology is classified into the development of science and technology, and the accumulation of human capital to compare the effect of exogenous technology and endogenous technology. The main goals of this study are to resolve the trend of the influence level of employee compensation, and the trend of the effect of production technology.

MD-11.2 [R] Comparative Analysis of English and Chinese Publications in Cloud Computing: A Research Profiling

Yijie Cheng; Beijing Institute of Technology, China
Yun Liu; Beijing Institute of Technology, China
Wei Wang; Beijing Institute of Technology, China
Xuanting Ye; Beijing Institute of Technology, China

This paper made a research profiling analysis of English and Chinese publications in the cloud computing field at four levels, namely, the general publication, high-yield groups, scientific collaboration and research content. Some interesting and meaningful results are found: (1) the prosperity of English publications of cloud computing research influences the development of Chinese publications to a certain extent; (2) the first Chinese paper named "Cloud computing: a method to realize conceptual computing" was published in 2003, which may be shown that China's scholars take one step ahead of abroad; (3) Chinese scholars who published English cloud computing papers and those who published Chinese papers belong to different groups; (4) scientific research output of Chinese western regions in the cloud computing field is not as weak as people usually think; (5) there are signs that the current focus of cloud computing research is shifting from the technology itself to socioeconomic issues. The results of this study provide a better understanding of development tendency, influential groups, topical issues and other important factors as a basis for directing individual research activities, efficiently extending research networks and selecting appropriate publication channels in the area of cloud computing research.

MD-11.3 [R] The Evolution of China's 3D Printing Technology Policy from the View of Policy Tool

Junhuan Huo; Beijing Institute of Technology, China
Jingru Yin; Beijing Institute of Technology, China
Jian Zhang; Central University of Finance and Economics, China
Yun Liu; Beijing Institute of Technology, China
Xuanting Ye; Beijing Institute of Technology, China

At present, China's 3D printing industry has come into the period of "outbreak", where the market growth is accelerated and the relevant technological progress is remarkable. But 3D printing enterprises are difficult to survival and development for completely relying on the market. For an emerging industry, China's government taking what kind of 3D printing policy in different stages is essential for future development of 3D printing. This paper explores the evolution of China's 3D printing policy from the perspective of policy tools, which include the technology supply side, demand-driven side and environment regulation side. The paper finds that China's government attached more and more importance to the 3D printing industry, and the policies continue to be refined and strengthened. On the basis of the aforesaid analysis, the paper puts forward some policy suggestions on how to promote the development environment of China's 3D printing industry.

MD-11.4 [R] The Evolution of Structure and Characteristics of International Collaborative Network of Publications about 3D Printing Technology

Jingru Yin; Beijing Institute of Technology, China
Junhuan Huo; Beijing Institute of Technology, China
Jian Zhang; Central University of Finance and Economics, China
Yun Liu; Beijing Institute of Technology, China
Xuanting Ye; Beijing Institute of Technology, China

The development of 3D printing technology has attracted worldwide concern, and most countries have funded it actively in technology research and development. Based on the publications data from the Web of Science, the paper conducts a systematic analysis on the international collaborative network of publications about 3D printing technology from the perspective of institutions. By using the social network analysis methods such as density, average path length, clustering coefficient, collaborative network centrality and collaborative strength to analyze the evolution of its structure and characteristics, the paper finds that more and more institutions from different countries joined the international collaborative network gradually, and there are significant differences in the structure and characteristics

of the international collaborative network of the institutions in different stages.

ME-01 Innovation Management-2
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon A
Chair(s) Felix Lau; Fraunhofer Institute for Production Technology IPT

ME-01.1 [R] Preparing for the On-Demand Economics: The Cases of a Leading Open Innovation Platform in China

Jiang Huang; Tsinghua University, China
Jin Chen; Tsinghua Univerisity, China

The purpose of this study is to offer a more microlevel and holistic framework of how firms can integrate knowledge from both inside and outside of the firm, and transfer the knowledge into products or services with the cooperation of internal employees and external actors. Specifically, this study aims to replace the traditional linear model of innovation into an interactive hourglass model of innovation. As such, the open and user innovation perspective is adopted to explain how the new innovation model is constituted and how it works. The theoretical framework is illustrated with the key processes and several embedded cases from Haier, who, by successfully using both full-time employees and spanners, together with vast resources from the global scale, thrive in the fierce home appliance market.

ME-01.2 [R] Research on the External Environmental Impact Factors of P2P Lending Industry's Regional Differences in China

Tingyu Zheng; Beijing Institute of Technology, China
Tao Wang; Beijing Institute of Technology, China
Zhiyun Ma; Beijing Institute of Technology, China

Recently, the Internet Finance is developing at a high speed as the fusion and innovation product of the financial industry and Internet industry. However, the financial ecology and policy environment is different in each region of China. As a result, the development of Internet Finance in different areas of China has presented obvious regional differences. As an important form of Internet Finance, the development of P2P (peer-to-peer) lending also presents regional differences. Related research has been mainly focused on the risks, legal supervision and development status of P2P lending. There is a lack of research on the track of development, regional differences and impacts of P2P lending. In this paper, it is based on each area's comprehensive development index of P2P lending in 2014 from "www.WDZJ.com". Through the measurement and calculation of economic environment index, credit environment index, financial environment index, legal environment index and education level and regression analysis of these indexes, it is found that all these five indexes have indirectly caused the regional differences as the external environmental factors in different aspects. Furthermore, economic environment index, credit environment index and financial environment index have been identified as direct external environmental impact factors and its mechanism have been also studied.

ME-01.3 [R] Influencing Factors Analysis of 3D Printing Technology Diffusion Across Industries

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

With the rapid development of technology, the growing number of technology diffusion not only appears among different technology sectors, but also appears among different industry sectors. It shows high level of complexity. The influencing factors of technology diffusion are complicated and gradually become a hot academic research field. We take the 3D printing technology as the research object, using patent citation data computing industry association strength and building the VAR model that includes the factors of technology diffusion degree, R&D investment, R&D organization, R&D staff, and market capacity. By collecting data from related statistical yearbook, we conduct Granger causality test, impulse response and variance decomposition analysis to the above model. The empirical results show that volatility of the technology diffusion is influenced by itself and R&D investment, R&D organization, R&D staff, and market capacity. This effect is of certain continuity, but the influences of different factors on the technology diffusion have great difference.

ME-02 Technology Assesment and Evaluation-1
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon B
Chair(s) Markus Gunther; Bielefeld University

ME-02.1 [R] Database Valuation: How to Determine the Economic Lifetime and Contribution of DB Assets?

Tae-Eung Sung; KISTI, Korea, South
Seung-Pyo Jun; KISTI, Korea, South
San Choi; KISTI, Korea, South
Hyun-Woo Park; KISTI, Korea, South

Regardless of the increasing interest in practical uses of technology valuation, there exists no valuation model for measuring appropriate values of database assets. Cost approach, which involves the calculation of input cost such as software database, can be utilized for calculating the establishing expenses of databases, but we need to propose an optimal valuation model to properly reflect future business profitability and standardize how to estimate and apply to primary variables associated. In this study, we look into how to determine the economic life expectancy of database assets based on durable period of five years and the contribution of database assets to the entire business value created through the business model therein. Since there has been no valuation model to date to lead to an objective market value of database assets, it is expected that the database valuation framework proposed herein would be significantly useful when various data-driven business models are involved.

ME-02.2 [R] Measuring 'Start-Up Readiness' of Scientific Research-Based Start-Ups Using Analysis of Citation Networks: Case Study of CRISPR-Cas9

Tomotaka Goji; The University of Tokyo, Japan
Takanari Matsuda; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

Recent experiences related to scientific research-based start-ups that launched initial public offerings (IPOs) without maturity of functional technologies and intellectual property suggest that the concept of "start-up readiness" can be defined as an earlier-applied criterion than "technology readiness." This study was conducted to show that emergence of a scientific research domain and its central researchers signal "start-up readiness." We analyzed the centralities of researchers, whether these researchers are start-up founders, and the timing of their founding and venture capital funding. This case study explored the biotechnology research field of genome editing, CRISPR-Cas9, which has generated start-ups that completed IPOs in 2016. We constructed cited-and-citing author networks based on paper citation networks, calculated centralities for each author, checked if authors of high centralities are founders, and chronologically compared the centralities and the start-ups' founding and venture capital funding. Results show that authors with higher combined centralities have higher rates of being founders, with potential to let their start-ups raise initial VC funding, similarly to the number of citations, a conventional bibliometric index. Furthermore, the centralities can serve as better indexes of scientists' potential to become founders, reflecting their "start-up readiness," because the centralities might encompass a wider range of potential founders.

ME-02.3 [R] Research on Preceding-Evaluation in Key Technology Projects of Enterprise

Jinyi Gu; Beijing Institute of Technology, China
Yun Liu; Beijing Institute of Technology, China
Zhe Yan; Beijing Institute of Technology, China
Fangjuan Yang; Beijing Institute of Technology, China
Xiaomei Ding; Guojin Gold Group Co.Ltd, China

Evaluation in key technology project is an important part of science and technology management, and plays a significant role in the development of science and technology. The preceding evaluation of science and technology projects in China still belongs to the starting stage. According to the characteristics of the key technology research projects, in this paper, an evaluation criteria system of key technology project for enterprise was put forward from the following perspectives: enterprise strategy and objectives, market, R&D, finance, circumstances, environment and ecology. After comprehensive evaluation, we used the Delphi method and AHP to calculate the composite evaluation index. To some extent, the evaluation can monitor the risk which may arise from the processes of implementing these technology items. It is also conductive to making scientific and reasonable decisions by managers and then improving the efficiency of resource allocation.

ME-03 Technology Roadmapping-2
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon C
Chair(s) Ronald Vatananan-Thesenvitz; IKI-SEA - Bangkok University

ME-03.1 [R] Roadmapping as a Platform for Developing Management Toolkits: A Collaborative Design Approach with the LEGO Group

Clive Kerr; University of Cambridge, United Kingdom
Robert Phaal; University of Cambridge, United Kingdom
Kasper Thams; The LEGO Group, Denmark

Roadmapping holds a unique position in industrially-relevant management tools: it can act as an integrative central hub to which other tools easily connect. Unfortunately, this type of application is generally not considered. Therefore, we are championing roadmapping as a platform for developing management toolkits. This positions roadmapping as a foundational building block when integrating a set of tools which are configured to address a range of corporate challenges and activities. To illustrate the premise of "roadmapping as a toolkit platform" and provide a proof-of-concept, this paper will report on a collaborative research engagement between the University of Cambridge and the LEGO Group, which prototyped a management toolkit underpinned by roadmapping.

ME-03.2 [R] Benchmarking of Technology Roadmapping Process in Energy Sector: A Literature Review

Chih-Jen Yu; Portland State University, United States
Tugrul U Daim; Portland State University, United States

Technology roadmapping (TRM) has been recognized as an effective and flexible technology planning tool to assist a company, industry, or nations to lay out their strategic technology needs and align their vision and strategic objectives. Technology roadmaps have been developed into various types and formats, by means of generic or customized processes, to suit specific organizational requirement in different industry settings such as the energy sector. However, evaluating the effectiveness of the roadmapping process remains a critical issue for roadmap updating and improvement. This paper proposes a benchmark approach based on a literature review to help develop a comparative model with required checklists.

ME-03.3 [R] Co-Evolution of Technologies, Key Components and Institutions in the Case of Smart Houses in Japan

Kumiko Miyazaki; Tokyo Institute of Technology, Japan
Jin Tiecheng; Tokyo Institute of Technology, Japan
Kentarou Nishida; Tokyo University, Japan

Smart houses aim to offer an innovative solution to provide a level of smartness that has not existed, such as home energy management or automation. Various devices must be connected to function as a whole integrated system, so that standards become an important issue. An analysis is made of the co-evolution of technologies, key components and institutions in the case of smart houses. We aim to address the questions: 1) How has the technological accumulation process of HEMS (Home Energy Management System), the key component of smart houses, taken place? 2) How have the strategies towards smart houses evolved for a leading smart house maker? 3) How have the institutions such as government policy and standards related to smart houses evolved in Japan? Interviews were carried out with leading personnel in industry, government and other institutions related to smart houses and HEMS such as NEC, Sekisui HEIM and METI. Patents were utilized as the main data source for the quantitative analysis of HEMS. By investigating the technology space, we visualized the process of technological evolution of HEMS by identifying distinctive stages of technological development. The key players are identified and correspondingly the process of each player's technological accumulation process is investigated. The evolution of smart houses has shown that they have reached the 3rd stage of innovation model of smart house.

ME-05 Cultural Issues in Technology Management-1
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon E
Chair(s) Dilek Cetindamar; Sabanci University

ME-05.1 [R] Impact of International Postures on Willingness to Communicate During International Exchanges Using Skype

Yoshihiro Tabira; Panasonic, Japan
Satoru Goto; Toyo Gakuen University, Japan

Internet and Web-based communication tools, such as the Skype platform offered by Microsoft, enable us to communicate with other people worldwide at low cost. This provides a good opportunity for nonnative English educators to cultivate children's English skills. While most Japanese schools provide access to the Internet, Internet- and Web-based communication tools are underexploited; e.g., only a few teachers have registered Skype accounts. To introduce a new study program in a school, teachers should prove its benefits in advance. However, scales to evaluate skills obtained from these programs have not been developed. Thus, we attempt to develop a scale to perform this work. First, we developed a scale based on international postures. Second, we performed an empirical test using Skype to measure the scale in junior high school and high school environments. This study shows the results of the empirical test and discusses its contribution to the diffusion of information and communication technology in the educational industry

ME-05.2 [A] Science Culture Index Construction for Innovation Center Cities: Beijing as a Case Study

Xuan Liu; National Academy of Innovation Strategy, CAST, China
Hui Luo; National Academy of Innovation Strategy, China
Xiang Li; National Academy for Innovation Strategy, China

Science culture makes a crucial contribution to the city as an innovation center. Firstly, science culture could result in a friendly economy context for innovation, related to the finance and the marketing of the city, involving consumers, jobs, innovation clusters and infrastructures. Secondly, an active science culture provides a positive social environment to cultivate innovative talents concerned with civic scientific literacy, public attitude towards innovation, and more engagement of the public in innovation activities. Beijing just released the latest strategy on building the innovation capability and the picture to become a world-leading innovation center by the end of 2020, which means a matching science culture environment is imperative. In this paper, we provide a critical appraisal of the Science Culture Index for an innovation center city such as Beijing by explicitly combining innovation performance indicators and public understanding of science (PUS) indicators in a composite index. With this framework, more discussion was put forward on how to build an urban culture conducive to innovation. The research findings were based on empirical analysis of the 8th national survey of civic scientific literacy in China and the latest innovation performance indicators in the same year.

ME-05.3 [A] VR/AR Technologies' Cross Boundary Contribution to Cultural Inheritance

Yu Song; North China University of Technology, China

Jixin Zhao; North China University of Technology, China
Tomoatsu Shibata; Tohoku University, Japan

In recent years, the introduction of VR/AR technologies has drawn great attention from all over the world. Such technologies have been applied to multiple fields, including automotive telematics and culture creatives. As part of the culture industry, cultural inheritance may also be significantly stimulated by technology integration, including regional and international culture renaissance as well as education of culture. In the Internet age, cultural communication and globalization have formed a global market with great potential, for both material and intangible cultures. The situation for culture inheritance might also be greatly improved by the help of such frontier technologies. This paper will pay particular attention to the changes that VR/AR technologies could potentially make to traditional culture inheritance cause, especially from the aspect of cross industry open innovation in the Internet-age. We will try to investigate VR/AR's applications and the upcoming contributions to cultural inheritance. This research is based on the investigations of a series of evidences in China, together with a complementary case from Japan. Mainly, the changes to the macro environment and industry structure will be discussed, which are concluded and generalized based on all cases.

ME-06 R&D Management-2
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon F
Chair(s) Kunio Shirahada; Japan Advanced Institute of Science and Technology

ME-06.1 [R] Manage Interdisciplinarity Based on Requirements Traceability

Dominik Weidmann; Technical University of Munich, Germany
Udo Lindemann; Technical University of Munich, Germany

Mechatronic products have become increasingly complex. A core aspect is that the involved disciplines are highly interdependent. Hence, the interdisciplinary coordination of discipline-spanning interfaces is a core issue for successful development. This contribution addresses the need for a better coordination in interdisciplinary development projects. Therefore, this contribution seizes a structured method to coordinate interdisciplinary issues, based on requirements traceability. The core aspect of the method is the connection of development artifacts in a graph-based model: Products, functions, components, requirements, the organizational structure and their links are visualized. A set of rules is implemented to analyze the system in order to derive coordination needs and affected objects and stakeholders. This method is successfully implemented into a software tool. The interdisciplinary coordination should be supported by analyses that quickly identify and visualize connections among these elements. For a further proof of feasibility, the tool was successfully applied in a semi-academic context. This evaluation case reveals further potential in the field of automated model generation.

ME-06.2 [R] PLS-Based Multi-Group Analysis for Knowledge Management in the Life Insurance Industry

Li-Su Huang; National Taichung University of Science and Tech., Taiwan
Mohammed Quaddus; Curtin University, Australia
Anna Rowe; Curtin University, Australia
Cheng-Po Lai; Nanhua University, Taiwan

Organizations implement KM with the assumption that KM will enhance organizational competitive advantages. However, little research has been conducted on their relationships in the life insurance industry, which involves knowledge-intensive activities. Therefore, this paper aims to examine the antecedents of KM adoption, employees' perceptions on KM, their effects of KM practice and the impact of KM practice on organizational performance. A research model was first proposed combining the literature and results from a qualitative field study. We then developed a questionnaire based on the model and conducted an empirical pilot study to revise the research instrument. Finally, the main survey was conducted in the life insurance industry in Taiwan. The main survey data were analyzed utilizing partial least squares (PLS) and PLS-based multi-group analysis (MGA) techniques.

ME-06.3 [R] R&D Mode Decision in a Strategic Context of Openness: An Empirical Test of SMEs in China

Yanting Guo; Zhejiang University, China
Gang Zheng; Zhejiang University, China

Mainly driven by the long-term discussion about the importance of research and development (R&D) activities, previous research has devoted considerable efforts in investigating different R&D modes while the findings are far from conclusive. Given the rapid progress of the "open innovation" paradigm, much less is known about whether and how the open search strategy, both in breadth and depth, influences firms' R&D activities and performance. This is an interesting but underexplored question especially for small and medium enterprises (SMEs) from developing countries like China who are often limited by knowledge and other resource. Based on survey data of 554 Chinese manufacturing SMEs, this study extends recent research by emphasizing and investigating the SMEs' differences in openness as strategic context. While internal R&D is found to be positively associated with performance in searching broadly and deeply, cooperative R&D is found to have a stronger effect on performance only when SMEs conduct a broader search.

ME-07 E-Business-2
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon G
Chair(s) Ahto Kalja; Tallinn University of Technology

ME-07.1 [R] The Interactive Effects of Product Categories and Channel Types on Perceived Risk, Customer Experience and Transaction Cost

Jonathan C Ho; Yuan Ze University, Taiwan
Ting-Yu Wei; Yuan Ze University, Taiwan

With the growth of online business, many brick and mortar retailers, from department stores, warehouse retailors, to supermarkets have been developing their web-based channels. However, how retailors are deploying numerous varieties of products in the two different channels demands management consideration. This research is designed to examine the effects of product categories on consumer perceptions that have significant differences between the two channels. Applying two-dimensional factorial experimental design, consumer perceptions on perceived risk, customer experience, and transaction cost in the two channels were examined. The results show that the channel types have impact on perceived risk, customer experience and transaction cost. The interactive effect of product category and channel type was found significant on customer experience and transaction cost. These research results provide retailers information in deploying their products in the two types of channels that should be able to target the right market segments for appropriate product categories.

ME-07.2 [R] A Case Study of an Organizational Continuum of a Technological Platform in a Japanese Accounting Cloud Service

Yutaka Mizuno; Nagoya Institute of Technology, Japan
Nobutaka Odake; Nagoya Institute of Technology, Japan

The purpose of this study is to clarify an organizational continuum of a technological platform development in a Japanese accounting cloud service. The authors continuously have been studying an accounting cloud service, which adopts two-sided markets structure and freemium business model on a core and periphery platform with modular designs. As the results of our case study, the authors obtain three findings. First, the Japanese accounting cloud service, which runs its business with regional banks in retail banking, has been exploiting its platform into partners' customers. Second, the accounting cloud service has been building up from a supply-chain platform to an industrial platform in retail banking in four years since its entrepreneurship. Third, the accounting cloud service has been transforming its cloud-to-cloud service connections from weak-tied interfaces developed by other companies to its own strong-tied interfaces. Therefore, starting-up cloud service

providers should not only utilize weak-tied interfaces to invite two-sides onto its platform to establish a structural hole within its two-sided markets structure, but also should develop its own strong-tied interfaces and indirect ties to tighten upon its two-sided markets structure to realize values buried in its cloud ecosystem.

ME-07.3 [R] Does Offline Drive Online?: A Study of Interconnected Effects of Technology Attributes in Self-Service Systems

Chun-Hua Hsiao; Kainan University, Taiwan

The introduction of self-service technology (SST) has provided a direct interface for service delivery. Ever since the introduction of this user-friendly kiosk, 7-Eleven ibon has gained popularity among customers. In the meantime, with the explosion of the Internet, many firms are attempting to incorporate this mobile wireless technology into their service systems. We propose a model, referred to as the integration of self-service technology (i.e., the ibon kiosk) and mobile wireless technology (i.e., the ibon app), to test the interrelationship between technological influence processes (i.e., system service quality and perceived convenience/ubiquity) and their impact on offline/online behavioral intention. In addition, the impacts of SST satisfaction and technological attributes on the adoption of the application will also be examined. The results are expected to show that technological attributes will have impacts on both online and offline service systems, and offline service systems may increase the adoption intention of online service systems.

ME-08 New Product Development-3
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon H
Chair(s) Antonie M de Klerk; University of Pretoria

ME-08.1 [R] Statistical Analysis of Cross-Field Inventions Made in Interconnected World

Masayuki Hirose; IMPP, Hitotsubashi University, Japan

One recent development attracting interest is the movement of technologies into new sectors from existing businesses, going beyond the distinction between industries. Fujifilm, for example, entered the cosmetics field by paying attention to the similarity between film and skin composed of collagen. Nike developed new running shoes having the same suspension concept like the technologies applied for racing cars. Certainly the interconnected world is gradually expanded with the decrease of a potential barrier between industrial fields. The effectiveness of such cross-industrial innovations has been highly evaluated as one of concepts which can trigger a breakthrough idea of new product development. Then, can inventions combining technical features from different technical fields have, as a matter of course, more possibility of becoming a patent than those resulting from the combination of technical features within the same technical fields? In this study, the author explores the effectiveness of such cross-field inventions by statistical analysis of Japanese patent applications. The analysis reveals that there are technical fields showing a significant difference between cross-field inventions and others. This study provides the implications for R&D managers who are seeking joint R&D partners, new and useful application of their core technologies or considering fusion with technologies in different fields.

ME-08.2 [R] Analysing New Product Development Projects Incorporating Real Options: A Basic Model and Case Study

Christian E Nissen; University of Pretoria, South Africa
Leon Pretorius; University of Pretoria, South Africa
Antonie M De Klerk; University of Pretoria, South Africa

This study explores the implementation of real option analysis (ROA) theory in valuing new product development (NPD) projects. A literature survey conducted as part of the research process revealed that traditional discounted cash flow (DCF) techniques used in valuing investments are deterministic and assume that all future outcomes are fixed. However, there is always uncertainty and fluctuation in the business environment that would change the initially perceived value of a project. Managerial flexibility is therefore needed to influence and gain maximum value from a potential investment. ROA can mitigate some of the problems of traditional DCF models and provide a comprehensive view of the potential investment's value and future potential. A combined DCF and ROA model was identified and validated through a case study. The case study analyzed the investment in the development of a roof support product used in the South African underground mining environment. A 7-year period consisting of the initial development phase of the product along with investment required in creating production capacity as well as 5 years of forecasted sales was analyzed. A scenario analysis was conducted as part of the simulation research method wherein uncertainties that could influence the investment's decision were analyzed and decisional criteria prescribed for each scenario. This study concluded that ROA together with existing DCF models could improve the valuation and decision-making process of investing in NPD projects.

ME-08.3 [R] Goal System Management for Use-Oriented Product-Service Systems

Julian Wilberg; Technical University of Munich, Germany
Felix Heitzer; Technical University of Munich, Germany
Christoph Hollauer; Technical University of Munich, Germany
Mayada Omer; Technical University of Munich, Germany

Companies are currently undergoing a transition and becoming product-service system (PSS) providers. Developing PSS leads to new challenges because companies need to extract service- and product-related goals and requirements from customer expectations. Companies need to derive and manage a transdisciplinary set of goals (product- and service-related). The literature review of this paper revealed that existing procedure models for goal system management do not address the PSS-specific challenges (e.g., customer integration) adequately. Thus, this paper introduces a theoretical procedure model for an improved development and management of PSS-related goal systems. Furthermore, the derived method box provides PSS providers with additional tool support to tackle the challenges related to managing PSS goals.

ME-09 Resource Management-2
Monday, 7/10/2017, 16:00 - 17:30
Room: Salon I
Chair(s) Gerald H Williams, Jr.; Construction Research, LLC

ME-09.1 [R] Evaluating the Effect of Centralized Administration on Health Care Performances Using Discrete-Event Simulation

Chen Zhang; School of Technology and Health, KTH, Sweden
Hamza Hanchi; School of Technology and Health, KTH, Sweden
Sebastiaan Meijer; School of Technology and Health, KTH, Sweden

Patient flow management is increasingly motivated by the request to improve system performance. The improvements to local departments are expected with minimal negative effects on the upstream and downstream departments which are integral parts of the care pathway. Although it is widely debated that hospital buildings are expensively constructed and operated, we observe a lack of efforts on the logistical efficiency of care provision within facilities in hospitals, especially in developing areas. This asks for more research attention towards the knowledge gap between health care supply and demand. Our work presented a simulation-based approach to study the impact of centralized administrative works by evaluating waiting times of services and resource utilizations. A discrete-event simulation (DES) model was constructed in reference to a hospital complex in Jiangsu, China. The results showed that the centralized administration benefited patients regarding a reduced total length of stay and waiting times of administration; however, reorganizing administration also influenced waiting times of medical services and resource utilizations of different types of facilities. Neglecting administration in the care pathway might yield to unclear knowledge of their impacts. This article can also support the inclusion of simulation in the strategic planning phase of health care projects.

ME-09.2 [R] International Trade Relations of Products for Wind Energy Production: A Study from the Dynamic Social Network Analysis (DSNA)

Fernanda G Basso; Sao Paulo University, Brazil
Geciane Silveira Porto; Sao Paulo University, Brazil
Sergio Kannebley Junior; Sao Paulo University, Brazil

The objectives of this work are to check the international trade relations of the top 20 countries that sell products related to the production of wind energy and which are the main products in international trade in this sector. The motivation for the analysis of this energy matrix stems from the need of more consistent public policies for production, because the logistics necessary to reach the end consumer, as this energy source needs to be installed in places with good intensity winds, and later transported to the consumer market. Initially they selected 23 products that make up the equipment for building towers and the production and processing of wind energy. Using the data in COMTRADE, it was the countries that sell the products chosen in order to establish the main countries. Later, he collected the data from 2006 to 2015, from the HS codes. Secondly the export data of the 23 products were grouped to check the major global players in the sale and purchase of these products then added to the annual sales of each country for each product in order to see which are prevalent in each country. Data were analyzed using the Social Network Analysis (SNA) with the aid of Gephi software. For graphical presentation of the data is used dynamic networks that allow the visualization of the change in exports over the period studied. It is observed that trade relations between the US, Canada and Mexico are the most expressive of the network, but you must also highlight Japan, Germany and France and in recent years the strengthening of Denmark in this market. Four products stand out, which say about the wind turbine blades and towers; consoles for a voltage not exceeding 1000V, instrument control for automatic adjustment and gear boxes and other speed.

ME-09.3 [A] Application of Business Process Reengineering as a Process Improvement Tool: A Case Study

David J Kruger; University of South Africa, South Africa

The environment in which organizations function at present is characterized by precipitous variation and development. In consequence, if they are to remain competitive, organizations must constantly improve their processes and systems. The improvements referred to must relate mainly to the effective and efficient utilization of scarce resources within the organization, and cause a shift in organizational priorities. The shift from product centredness to customer centredness makes change inevitable. Globally, organizations are eagerly seeking innovative philosophies and theories that will help them achieve growth, competitiveness and productivity. Business process reengineering (BPR) is recognized as a methodology which could be beneficial in attaining the goals. Developed during the 1990s, BPR is a derivative of other Japanese methodologies such as just in time and process focus. Its hallmark is the sweeping restructuring of processes, transformation of alignment and streamlining of processes within an organization. The aim of the paper is to identify a specific application which could facilitate improvements to the processes of a selected organization. The correct application of the BPR methodology would result in effective and efficient processes.

ME-10 Manufacturing Management-1

Monday, 7/10/2017, 16:00 - 17:30
Room: Portland
Chair(s) Manuel Ebi; RWTH Aachen University

ME-10.1 [R] Cost-Orientated Product Variant Evaluation Using Similarity Analysis

Gunther Schuh; RWTH Aachen University, Germany
Michael Riesener; RWTH Aachen University, Germany
Manuel Ebi; RWTH Aachen University, Germany

Engineer-to-order companies in the field of mechanical engineering are particularly facing the challenge of providing customized products at competitive prices while the market is increasingly fragmented into small niches. Striving to fulfill this demand, companies underestimate the negative financial effect of a higher product variety. Therefore, complexity costs for new product variants with small volumes are often only roughly estimated. This leaves a severe risk for cross-subsidization of exotic variants and a loss in the company's competitive market position. Previous research does not provide a holistic approach that considers the integration of complexity costs related to a new variant and the existing variants in the offer process. This paper introduces a methodology facing these challenges. Adjustments of product configurations during the configuration process are analyzed and taken into account in order to increase the transparency during this work-flow. Complexity costs of new customer specific product variants can be determined at an early stage of the offer process. By using similarity analysis, they are clustered and distributed to the causative department. Customers can thus be managed through the offer process, and the pricing of the product can be optimized as the complexity costs are considered as well.

ME-10.2 [R] Performance Drivers in Global Production Networks

Gunther Schuh; WZL RWTH Aachen University, Germany
Jan-Philipp Prote; WZL RWTH Aachen University, Germany
Bastian Fraenken; WZL RWTH Aachen University, Germany
Margarete Stoewer; WZL RWTH Aachen University , Germany
Manuel Ebi; WZL RWTH Aachen University, Germany

Today's manufacturing companies produce goods in globally dispersed production sites in order to profit from differences in factor costs and access new markets. Due to a rising competition on global markets, companies need to operate their production sites on a maximum level of performance in terms of efficiency, flexibility, quality and cycle times. The globally dispersed production sites differ in many aspects, which have an influence on their performance. The technological equipment, the size of the site or the complexity of the site's product portfolio can be mentioned exemplarily. Currently, companies are not able to assess which factors have an impact on their sites' performance. Beyond that they are missing an approach to identify at which point these factors have a significant impact on the performance. Overall cause and effect relationships between performance drivers and production site performances are still unexplored. The knowledge of these relations would enable companies to derive design guidelines for the configuration of their production networks. Therefore, the aim of this paper is to develop a method to evaluate the impact of performance drivers in global production networks. The approach should enable companies to identify significant corridors of influencing factors of manufacturing sites.

ME-10.3 [R] Challenges in Processing Digital and Physical Parts in Additive Manufacturing: An Exploration

Dominik Morar; University of Stuttgart, Germany
Hans-Georg Kemper; University of Stuttgart, Germany
Heiner Lasi; Ferdinand-Steinbeis-Institut, Germany

Additive manufacturing (AM) - 3D printing for the purpose of industrial production - is known for enabling individualization and freedom of design. Furthermore, AM enables digital transformation in production through its highly digitized process, which often is simplified as directly printing a physical part from CAD data. The objective of this paper is to identify and describe requirements on information systems based on the physical and digital objects of the AM process. Since AM is an uprising manufacturing technology, an exploratory research design is chosen based on semi-structured interviews in German enterprises. Firstly, the digital attributes of an AM part that are crucial to product quality need to be defined. Besides the geometry of an AM part, data from different AM process phases are crucial - e.g., production parameters. Secondly, identification of parts and their virtual representations in different steps of the AM process becomes more relevant. In particular, multiple parts are often arranged in one build job for AM processing but should be traced individually. Thirdly, there is demand to digitally manage diverse manufacturing conditions of AM parts, since a part could be produced by several build jobs on different machines. Fourthly, the integration of AM into existing structures is a key challenge to manufacturers. These requirements will be addressed by an approach based on the Industry 4.0 reference

architecture.

ME-11 Global Issues in Technology Management-2
Monday, 7/10/2017, 16:00 - 17:30
Room: Eugene
Chair(s) Peixiao Qi; China Research Inst. for Science Popularization

ME-11.1 [R] The Mobility of Researchers Between China and the US

Yuanxi Huang; China Association for Science and Technology, China
Linjia Zhao; China Association for Science and Technology, China
Yinqiu Wang; China Association for Science and Technology, China

The mobility of researchers helps knowledge transmission and collaboration in the process of globalization, and is becoming a major policy objective in recent years. Research system and the individual researcher can benefit from mobility. As a developing country, China is trying to do more to learn from developed countries, including academic exchange. The US is the world's largest talent magnet. It is meaningful to study the researcher mobility between China and the US. Based on Scopus author data, the researchers are divided into 3 groups on the perspective of China, which are outflow group, transitory group and inflow group. According to a set of 728421 active researchers in this study, China has a net total inflow of researchers from the US in the period of 1996 to 2015. Different classes of researchers performances differently in production quantity and quality. The Brain Inflow produced most paper among all the researchers; the Transitory Brain Mobility has highest quality production among the 3 groups. The production quality of Brain Outflow is much better than the Brain Inflow. The characteristic of researcher movement between the two countries and its impacts should be better understood to help talent development.

ME-11.2 [R] Evaluation on Development Index for National Science Popularization Capacity of China

Nian Zheng; China Research Inst. for Science Popularization, China
Peixiao Qi; China Research Inst. for Science Popularization, China
Gang Wang; China Research Inst. for Science Popularization, China

National science popularization capacity (NSPC) is a comprehensive strength by which a country provides science popularization products and services for the public. Science and technology innovation and science popularization are two wings to achieve innovation development. To evaluate NSPC is to significantly promote the public scientific literacy. This paper analyzed China's science popularization capacity from 2006-2014 based on six aspects - science popularization personnel, fund, infrastructure, science education environment, science popularization works communication, and science popularization activity - using standard ratio methodology based on the data from China Science Popularization Statistics and China Statistical Yearbook. The findings are as follows: the 2014 development index for national science popularization capacity (DINSPC) is 2.03 times that of 2006, whose effect is significant; and science popularization infrastructure and science education environment are two most important factors to promote NSPC, science popularization works communication and activities are two constraint factors. In addition, improving national science popularization capacity has a significant pulling effect to greatly promote the civic scientific literacy.

ME-11.3 [R] Science Communication and Culture in Rural China: A Case Study of Xiachen Village in Zhejiang Province

Lihui Wang; China Research Institute for Sci. Popularization, China
Nian Zheng; China Research Institute for Sci. Popularization, China

The study of the public's attitude towards science and technology has been a substantive feature of science communication, and with the rapid development of science and technology, the characteristics of science as a kind of culture has become increasingly evident. In order to investigate Chinese rural residents' attitude towards science and technology, we conducted a survey through questionnaire in Xiachen village of Zhejiang Province, with a series of face-to-face interviews of 15 people. The findings of this study are: 1) almost all respondents agree with a positive opinion of science and scientist; 2) more than 40 percent of residents believe in fortune-telling, face reading and fengshui, especially a certain percentage of old people who have religious practices; 3) for rural residents, science and technology is a part of life and a method of making living. Based on the above conclusions and interviews, this study also gives some suggestions on science communication in Chinese rural areas.

TA-00 PLENARY - 2

DATE: TUESDAY, 7/11/2017
TIME: 08:30 - 10:00
ROOM: SALON E-F
CHAIR: TIMOTHY ANDERSON; PORTLAND STATE UNIVERSITY

TA-00.1 [K] 'Tech Emergence' Indicators - To Inform Management of Technology

Alan Porter; Georgia Institute of Technology, United States

Based on the principle that MOT has great potential to gain from exploiting data resources more, Dr. Porter will spotlight "Tech Mining" possibilities. In particular, he will focus on the ways that tech emergence indicators can add value in MOT decision processes. This serves as lead-in to the four-session PICMET track on emergence indicators.

TA-00.2 [K] The New Era of AI

Guruduth S Banavar; Viome, United States

The resurgence of AI is changing every aspect of our lives. Many new kinds of data are becoming available in every field, making possible new insights and approaches that were unthinkable a few years ago. In this talk, I will provide a broad overview of the capabilities of AI platforms that is making this revolution possible, and dive deeply into a few specific AI applications that are showing great promise. In particular, I will discuss how AI can help us understand the biological ecosystem inside each of us, and improve our health and wellness.

TB-01 Innovation Management-3
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon A
Chair(s) Marthinus J Du Plessis; University of Pretoria

TB-01.1 [R] How Technological Diversification Affects Innovation Performance: Evidence from Chinese Manufacturing Listed Firms

Yubing He; Fuzhou University, China
Yanhua Shen; Fuzhou University, China

The relationship between technological diversification (TD) and innovation performance has been among the most intensely debated questions in the field of technological innovation management, both from a theoretical and empirical viewpoint. However, little evidence has been found in related literature about how latecomers could enhance innovation performance by means of diversified technology search. This paper analyzes the impact of technological diversification on innovation performance at the firm level based on the argument that TD consists of two types: unrelated technological diversification (UTD) and related technological diversification (RTD), both of which have a different impact on innovation. The paper conducts an empirical study in a sample of 201 Chinese manufacturing listed firms for the period of 2006 and 2014 on the relationship between the unrelated technological diversification or related technological diversification and firm innovation performance, Moreover, the moderating effect of absorptive capacity in the relationship between TD and

innovation performance is also examined.

TB-01.2 [R] Diffusion of Innovation Management Practices in Manufacturing Industry in Brazil

Ruy Quadros; UNICAMP - State University of Campinas, Brazil
Edmundo Inacio Jr.; UNICAMP - State University of Campinas, Brazil
Ione Egler; CGEE - Centro de Gestao e Estudos Estrategicos, Brazil
Andre Tavares; Innovarelab, Brazil
Rubia C Quintao; CGEE - Center for Management and Strategic Studies, Brazil
Daniel Monaco; Innovarelab, Brazil
Glicia Vieira; UFES - Federal University of Espirito Santo, Brazil

The paper addresses the building of innovation management capabilities at the firm level in emerging economies by investigating the adoption of innovation management practices in Brazilian manufacturing firms. Innovation management practices in this paper encompass innovation strategy design, innovation management processes and tools and innovation networking practices. The paper investigates how Brazilian subsidiaries of multinational corporations which carry out R&D and innovation activities compare to firms controlled by Brazilian nationals in terms of diffusion of innovation management practices. In order to investigate empirically these issues, a survey of an intentional sample of 65 Brazilian firms was carried out in 2015. The survey comprised the application of an electronic structured questionnaire supported by visits and extensive interviews aimed at collecting evidence. Findings indicate that subsidiaries of multinational corporations in Brazil have presented a higher rate of diffusion of innovation management practices and developed more capabilities than their local competitors. Nevertheless, Brazilian national firms have shown a higher profile in the adoption of practices related to technology intelligence and networking with Brazilian public research institutions. Amongst factors explaining such differences and nuances, firms' marketing and technology strategies and the span of their R&D function scope stand out.

TB-01.3 [R] A Relation Between Informal Communication in Innovation and Open Innovation Climate in an R&D Organization

Sineenat T Watanavisit; National Electronics and Computer Tech. Center, Thailand

This paper is proposed and aimed to examine a relation between an informal communication in innovation and open innovation climate in a research and development (R&D) organization in Thailand. The main research strategies are (1) a quantitative analysis of the relation between informal communication in innovation and innovation and flexibility which is one of three dimensions of open innovation climate; and (2) a case study of an R&D organization in electronics and computer technology in Thailand. Data have been collected from an online questionnaire which was sent to target respondents which are 250 researchers working for the R&D organization. Forty respondents completed and returned the survey. Results from the paper will provide implications to other R&D organizations in Thailand for designing innovation communication activity or planning an innovation communication strategy for creating an open innovation climate.

TB-02 Technology Adoption-2
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon B
Chair(s) Stephen Ruth; George Mason University

TB-02.1 [A] Future Problems for the Sharing Economy: Five Potential Challenges to Growth and Progress

Stephen Ruth; George Mason University, United States

This paper briefly reviews some of the technical and economic issues that have led to the dramatic growth in the sharing economy and then suggests challenges which might cause serious disruptions, both short and long term. At the end of 2016 this sector had never looked better, with double and occasionally triple digit annual growth the norm. Other market segments, like retail and consumer goods and media/entertainment, are growing too. Yet this growth is already showing vulnerability to serious concerns, which can be grouped into five categories: fragility of the part-time work force; uncertainty of long-term consumer inducements; increased risk of potential government intervention; taxation equity complexities; and the possibilities of zero or negative growth long-term. Each will be discussed briefly, concluding with a recommended agenda for action.

TB-02.2 [R] Operation of Radio Frequency Identification Technology to Control Cattle Movements

Diamondra Helinoro Razaivaovololoniaina; University of Antananarivo, Madagascar
Tigana Mandimby; University of Antananarivo, Madagascar
Elise Raveloson; University of Antananarivo, Madagascar
Bosco J Bezaka; University of Antananarivo, Madagascar

Beef theft is a well-known social problem in Madagascar. Traceability management tools are still not effective so far. This research aims to contribute in the fight against this scourge. It focuses on the implementation of a mobile identification system and the development of a software called Omby to carry out systematic controls of cattle movements. Radio frequency identification or RFID technology and new technology of information and communication or NTICs were adopted for the traceability system. The application is written in C++ language and is developed with the programming and interface creating tool QTcreator 1.2.1. An Arduino Mega 2560 card was used to make the mobile control system. This application allows one to scan and to generate the ID number of a cattle from an existing database. The system created by this new technology facilitates the fight against oxen theft due to the real-time availability of the oxen localization as well as the information concerning them. It will contribute to reduce social and economic conflicts due to oxen theft, and accordingly, reduce the human loss caused by confrontation. Also, it will contribute to improve animal health.

TB-03 Disruptive Technologies-1
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon C
Chair(s) Matti A Sommarberg; Tampere University of Technology

TB-03.1 [R] Perspective of the 3D Printing Technology Applied on Medical Resource Integration and Service Innovation Business Model

James K Chen; Asia University, Taiwan
Hanna T Do; Asia University, Taiwan

Clinical data shows that many oral cancers, car accidents and major accidental injuries cause organs and limbs to be partially or completely removed due to incomplete physical appearance surgery. This not only causes inconvenience to life, but also directly affects patients' psychology and influences their job opportunities in the community. In the past, patients have been treated through Medical Equipment Company using the artificial prostheses or artificial organs. However, it did not give a sufficient result, which were a waste of time and money. Fortunately, nowadays, 3D printing technology provides opportunity for patients to solve their problems quickly with low financial burden. Indeed, 3D printing technology was introduced by Nagoya Municipal Industrial Research Institute in 1982. Later, the industry applied this technology in prototype manufacturing and/or a convenient mold. Only a few years ago, 3D printing technology application started to be used in the healthcare industry. This research creates one evaluation system of a hospital/organization purchasing 3D printing that includes domain evaluation, criteria, and sub-criteria factors through AHP method processing. Analysis includes four evaluation domains: novelty, importance, uncertainty, and complexity. The result shows that "uncertainty" (D3) domain is the best factor among four domains by AHP framework. "Artificial limb-model" is the first object on 3D printing in the current market. The result states that the 3D printing technology can be applied on medical models and innovation service of the business model.

TB-03.2 [R] Mechanisms of Disruptive Technological Change: Case Studies in Transformation of Traditional Industries

Matti Sommarberg; Tampere University of Technology, Finland
Saku J Makinen; Tampere University of Technology, Finland

The purpose of the manuscript is to use grounded theory building method to investigate three industry contexts that show disruptive innovations based in digital technologies that change the dynamics in industry competition. Specifically, we investigate the mechanisms of disruption in these cases and seek common features of change. Our analysis builds on mechanisms as detecting actors, their properties, and start- and end-states of the system under change and activities of the actors that bring about the change. Our analysis shows common themes that are exhibited throughout all the cases. One of these mechanisms is de-coupling of traditional value chain activities. These de-coupling mechanisms are driven by the formation of innovation ecosystems rather than traditional value chains. This is further accelerated by the emergence of platforms and digital technologies at large. We propose, based on our results, some fundamental mechanisms that are driving industry transformation due to digitalization. We also discuss managerial and theoretical implications of our results in detail.

TB-03.3 [R] Impact of Product Architecture on Disruptive Innovation: Case Study of Sharp Corporation and Its Acquisition by Hon Hai

Yukihiko Nakata; Ritsumeikan Asia Pacific University, Japan

This single-case study examines Sharp Corporation to uncover why sound companies fail when they confront changes in markets and technology. Although Sharp successfully established a vertically integrated production factory to produce LCD-TVs, the company ultimately failed and was acquired by Taiwan's Hon Hai. The case study shows that Sharp's fatal failures were excessive investment in its Sakai factory and improperly assessing the disruptive technological innovation presented by a "recommended module" for China smartphones. This case study shows that the change in product architecture from integral to modular triggered disruptive innovation and Sharp's rapid decline.

TB-03.4 [R] New Strategic Thinking Required in Promoting Innovation of Disruptive Technology

Zheng Li; National Academy of Innovation Strategy, CAST, China
Hui Luo; National Academy of Innovation Strategy, CAST, China
Ting Xia; National Academy of Innovation Strategy, CAST, China
Cao Ruan; National Academy of Innovation Strategy, CAST, China

Many countries, both technology-advanced ones and those that are developing, have been paying close attention to new technologies potentially about to be disruptive, and forecasting disruptive technologies and their possible impacts on societies. This paper reviewed the inductive studies of disruptive technologies, and the analysis of the features and potential advantages of converging and integrated thinking used in technology management in terms of allocation of national resources of science and technology. The conclusion is that novel sciences and disruptive technologies are more likely to be produced through multidisciplinary and integrated basic research.

TB-04 Technological Changes-1
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon D
Chair(s) Kumiko Miyazaki; Tokyo Institute of Technology

TB-04.1 [R] Adapting Technological Capabilities for World Digital Business: The Case of Netflix

Santiago Ruiz Navas; Tokyo Institute of Technology, Japan
Kumiko Miyazaki; Tokyo Institute of Technology, Japan

Technological capabilities are tied to the strategy of a company supported by the concepts of path dependence and absorptive capacities, and they describe the fields that help the company to achieve its strategical objectives. This paper's objective is to analyze Netflix's change in technological fields through time and compare these changes with two strategic moments, when it started to provide VOD service and the decision to go global. Two research questions are proposed: 1) Which are Netflix's technological capabilities in time, 2) How the technological capabilities change in the two strategical moments, Netflix's start of providing VOD service in 2007 and its decision to provide services abroad in 2010. Longitudinal systematic descriptive analysis of Netflix's patents IPC codes is done in order to get some insights of Netflix's change of technological capabilities in time. Three changes in Netflix technological capabilities were detected, 2000 - 2006 as an IT-based retailer, when it started to provide VOD service in 2007-2009 it had a technological focus on TV digital processing and parallel processing, and as last 2010-2013 when they announced to start providing international VOD service, their patents' focus was TV digital processing, data processing systems and communication infrastructure.

TB-04.2 [A] Cross-Disciplinary Survey on 'Data Science' Field Development: Historical Analysis from 1600s-2000s

Etsuko Tane; The University of Tokyo, Japan

For the last several decades, the rapid development of information technology and computer performance accelerates generation, transportation and accumulation of digital data, and it came to be called "Big Data." In this context, researchers and companies are eager to utilize the data to create new values or manage a wide range of issues, and much focus is being placed on "data science" to extract useful information (knowledge) from digital data. Data science has been developed from several independent fields such as mathematics/operations research, computer science, data engineering, visualization and statistics since the 1800s. In addition, artificial intelligence converges on this stream in recent years. On the other hand, the national projects have been established to utilize data for society with concerns surrounding the security and privacy. In this paper, through detailed analysis on the history of this field, processes of development and integration among related fields are discussed as well as comparative aspects between Japan and the United States. This paper also includes a brief discussion of future directions.

TB-04.3 [R] Endowment Structure,Technological Innovation and Industrial Structure Upgrading

Yunfang Wang; Beijing Institute of Technology, China
Xu Bai; Beijing Institute of Technology, China
Yijie Cheng; Beijing Institute of Technology, China

This study estimates the effect of technological innovation on industrial structure upgrading and the adjusting effect of endowment structure on the effectiveness of technology innovation. Analysis are applied on a panel data covering the period from 2005 to 2014 for 31 provinces in China. We found that technological innovation has statistically significant positive impacts on industrial structure upgrading. We also document that this effect is positively moderated by endowment structure. That is to say, endowment structure significantly enhances the promotional role of technology innovation on industrial structure upgrading. That is to say, compared with labor-intensive endowment structure areas, the promoting effect of technology innovation on industrial structure upgrading is greater in capital-intensive endowment regions, and the adjusting effect of endowment structure on the effectiveness of technology innovation is also greater.

TB-04.4 [R] Performance Metrics in Engineering Change Management: Towards a Methodology to Investigate the Efficiency of Handling Engineering Changes

Niklas Kattner; Technical University of Munich, Germany
Udo Lindemann; Technical University of Munich, Germany

The efficient management of engineering changes highly influences the success of an engineering design project. Additionally, the increasing complexity, the faster development cycles and the growing competition in many industries turn the focus in engineering science to the engineering change management and its improvement. Although the research activity increased steadily in recent years, the literature lacks a broad understanding of

performance metrics either to analyze the structural implications of the applied engineering change management process or to measure its efficiency in its implementation. Therefore, the paper presents a first draft of a procedure to support the project management in investigating its engineering change management. Consequently, a method is introduced which defines and details the steps necessary for the analysis. Hence, performance criteria are developed to leverage the performance measurement. In addition to criteria developed in advance for the investigation, historical data of change orders is used to take company-specific change characteristics into account. By utilizing the given data, patterns within the engineering change data can be found to further improve the quality of the performance criteria. Finally, the application is enabled by introducing a way to implement the criteria and conduct a performance analysis.

TB-05 PANEL: Meet the Editors Panel Session
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon E
Panelist(s) Dilek Cetindamar; Sabanci University
Marina Dabic; Nottingham Trent University
Tugrul U Daim; Portland State University
Nazrul Islam; The University of Exeter Business School
Tinus M.W. Pretorius; University of Pretoria
Steven T Walsh; University of New Mexico

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.

Editorial leadership from the following journals are expected:

- *International Journal of Energy Technology and Policy*
- *International Journal of Innovation and Technology Management*
- *International Journal of Technoentrepreneurship*
- *International Journal of Transition and Innovation Systems*
- *Technological Forecasting and Social Change*
- *Technovation*

TB-06 Science and Technology Policy-1
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon F
Chair(s) Nasir J Sheikh; The State University of New York (SUNY), Korea

TB-06.1 [R] Identifying Influencers of Corporate Performance in Interfirm Networks

Taro Oka; The University of Tokyo, Japan
Hajime Sasaki; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

The recent volatility of the business environment has increased the importance of firms that could foster innovation and influence other firms to bring competitive advantage to their surrounding regions. Therefore, it is becoming increasingly important for policy makers to identify such firms to maximize the effects of subsidies aimed at stimulating the regional economy. The purpose of this research is to build practical prediction models of influencers of corporate performance by extracting features of firms that have impact on surrounding firms' corporate performances. Firms are defined as influencers of corporate performance when increases in the revenue of surrounding firms were observed in the fiscal year after their own revenue increased. Interfirm relationships of firms located in Aichi prefecture that Teikoku Databank, Ltd. possesses are used as the target of this research. Interfirm networks are formed to calculate network indices such as network centralities and participation coefficient. Those network indices are used as features for building prediction models classifying the influencers. As a result, the f score over 0.7 was realized. Network index such as betweenness centrality contributed significantly on the prediction models. This paper contributes to explaining the implication of the index in propagation of corporate performance within an interfirm network.

TB-06.2 [R] Assessment of Arms Import Policies: Literature Review

Sungjin Kim; The State University of New York (SUNY), Korea, Korea, South
Nasir J Sheikh; The State University of New York (SUNY), Korea, Korea, South

Arms transfer policies are generally not aligned between supplier and recipient nations. Hence they involve complex and protracted negotiations and decision making. Decision modeling has been established as an effective method of resolution for such complex scenarios; however, this is a novel approach in arms transfer policy making. In this paper, import policies of recipients are investigated as a required phase for developing a holistic decision model for each side. The objective is to identify policy criteria. For a comprehensive assessment of the arms import policies, a literature review is conducted in multidisciplinary fields of study such as political science, economics, and military science. The results indicate that some topics are field-specific while others, such as diffusions, offsets, and economic considerations, are common to multiple disciplines. Hence, a multiple-perspectives approach is applied to include technological, economic, political, industrial, and military (TEPIM) in formulating the decision model for recipients. To conclude, the paper suggests a hierarchical decision model (HDM) framework that incorporates the multiple TEPIM perspectives, their associated criteria, and alternatives to be considered by recipients in making an effective arms import policy. Future research will include a validation process with expert panels to better define the decision model.

TB-06.3 [A] A Quantitative Study on the Transformation of Scientific and Technological Achievements Policy in China's Central Subordinated Universities

Nan Zhang; Beijing Institute of Technology, China
Xun Luo; Beijing Institute of Technology, China

The Bayh-Dole Act provides a good learning model for the transformation of scientific and technological achievements. In 2015, China revised "the Law to Promote the Transformation of Scientific and Technological Achievements in People's Republic of China" to try to improve the status of domestic technological transformation. This paper examines the transformation of scientific and technological achievements policy in China's central subordinated universities, divides the policy of each university into four categories, five levels. After detailed analyses about policy text content, comparing with the existing laws and regulations, drawing on the successful experience of Bayh-Dole Act, we put forward relevant policy recommendations that support the policy-making of the authorities.

TB-07 Knowledge Management-1
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon G
Chair(s) Shino Iwami; University of Jyvaskyla

TB-07.1 [R] Experiences from a Discipline in Facilities Planning Applied to Non-Industrial Environments

Gabriel B Barradas; Federal University of Rio de Janeiro, Brazil
Vinicius C Cardoso; Federal University of Rio de Janeiro, Brazil

Facilities planning is a key subject for industrial engineering courses. Usually, we teach students the basics of this discipline through the systematic layout planning (SLP) developed by Muther, and ask them to develop a real-world project at a factory. The problem with this approach is the fact that many of our students are going to work at service companies and we believe the classical facilities planning methods and tools are not ready for this kind of business. Recently, we've been encouraging students to try redesigning the layout of non-industrial facilities, like schools, IT offices and entertainment industry businesses. We have developed an extensive study in the role that facilities play on workers' and users' creativity, and we are teaching this state-of-the-art approach to the students. In this paper,

we present the results of those students' projects, pointing out what's good and bad from this experience, as well as presenting the key concepts for teaching facilities planning that fosters creativity.

TB-07.2 [R] The Automatic Scientometrics Analyzing System

Shino Iwami; University of Jyvaskyla, Finland

Governmental officers and non-IT researchers start to highly demand voluntary works of analyzing quantitative analyses. Additionally, in the international conferences I attended, some researchers are interested in my research about big data analyses. On the other hand, data-based tools made by IT researchers and engineers are not diffused well, because it is difficult for others to interpret the results for the reality. Namely, collaborations between non-IT people and IT people sometimes do not go well. The reason is that human resources of IT-researchers or engineers are insufficient. The purpose of this research is to make an effective analyzing system for scientometrics and bibliometrics used in innovation policy and technology management. Target users are IT users but not IT developers. I am making the Automatic Scientometrics Analyzing System. Its three parts are (1) data collection, (2) analyses, and (3) result presentation. By function separation and modularization, it becomes easy to add new data sources and new methodologies. The results on my presentation server are published automatically at the public place, Microsoft Azure Web service. This system will enable us to produce objective evidences for decision-making effectively.

TB-07.3 [R] Exploring Research Focus Association in Digital Humanities

Hsin-Ning Su; National Chung Hsing University, Taiwan
Yang-Tai Chou; National Chung Hsing University, Taiwan

Digital technology and humanities have been gradually integrated into a new research discipline. The study aims to understand how research that focuses on digital humanities associate with each other as well as identify influential research focuses by the use of association rule mining. A total of 77 papers obtained from the SSCI database was analyzed by association rule mining. The results show that library and digital library, research and digital library, digital humanity and digital library are the most frequent and influential research focuses in this research field. It is suggested that the development trend of digital humanities is based on utilizing resources available in the digital library and conducting research to advance the development of humanities.

TB-08 Collaborations for Technology Management-1
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon H
Chair(s) Leonel Corona-Trevino; National University of Mexico UNAM

TB-08.1 [R] Design Framework of an Ecosystem for Network-Based Innovation

Gunther Schuh; Fraunhofer Institute for Production Technology IPT, Germany
Sebastian Woelk; Fraunhofer Institute for Production Technology IPT, Germany

Innovation for hardware development needs specific constituents like ideas, capital, knowledge, production means, market feedback, organization and brand in order to evolve and succeed. However, companies have limited resources resulting in missing innovation constituents impeding single-handed innovation and restricting the company's innovation capability. In order to overcome limited resources with minimal effort as well as obtain new point of views additionally, companies need to participate in an innovation stimulating environment to get access to needed innovation constituents by collaborating with others. In such an innovation ecosystem, diverse actors and infrastructures fulfill specific roles and contribute all necessary innovation constituents enabling a network-based innovation by collaboration. However, the contributing companies are economically independent of each other and also act opportunistic, making a win-win situation for the innovation participants necessary. The objective of this paper is to illustrate why joint innovation in a network is essential for a company's innovation capability and what deficits in the literature exist in designing such innovation ecosystems. Based on that analysis, a design framework of an ecosystem for network-based innovation focusing on hardware development is introduced.

TB-08.2 [R] Technology Management of Capital Assets and Risks in the Service Sharing Economy: Cases of Uberization of Crowdfunding and Transportation in Mexico

Leonel Corona-Trevino; National University of Mexico UNAM, Mexico

Firms such as AirBnB, Uber, and Blablacar have platforms for connecting owners of underused assets with clients through the Internet, thus allowing people to rent out their spare rooms or book relay rides by acting as matchmakers, allocating resources where they are needed and charging a percentage of the cost in return. This phenomenon could be regarded from the point of view of: 1) Internet technology evolution from a network of computers to a network of people devoted to sharing their knowledge and user experience, coming further, as the Internet of Things (IoT), and 2) as part of the increasing involvement of the user (consumer/client) in production and innovation processes. These approaches allow us to analyze service-user platform firms according to the different kinds of specific assets distribution and risks. The new organization is based on Internet platform tools which integrate information, machinery, energy, science, and customer collaboration. We conclude that there are large profits for those firms based on platforms, as there are not yet any counterbalances through competition, posing the question about whether there is a need for technology management regulation during this phase of the service sharing economy. A selection of 17 service platform firms in Mexico involved in transportation and crowd funding are described on the basis of their business model, the market and the distribution of assets and income.

TB-08.3 [R] Fab Labs Network in Developing Countries: Knowledge Spillover Effects or Managing Technology Development within the Scarcity Economy?

Regiane B Vieira; University of San Caetano do Sul, Brazil
Luis P Bresciani; University of San Caetano do Sul, Brazil
Isabel C Dos Santos; University of San Caetano do Sul, Brazil

This article is aimed at identifying the nature and restrictions observed in the innovating Free Fab Labs in Sao Paulo, Brazil. The use of developed country business models in developing countries is always reason for concern, especially because of the different socioeconomic and industrial development stages. In developed countries, the Fab Labs initiative results from the accumulation of technological knowledge and entrepreneurship. However, in developing countries, which are still very susceptible to political and economic instability, the Free Fab Lab initiative represents a change in paradigm in the way new services are created and in the manufacturing of new products and technology. In opposition to the capitalist logic, of exploration of abundant resources, Fab Labs are based on resource sharing, using the power of creativity and individual talent originated from the concept of knowledge society. This article reports the Free Fab Lab experience in the city of Sao Paulo and is based on a qualitative, exploratory analysis, supported by non-structured interviews with the Fab Labs coordinators. Results point towards a Free Fab Labs vision as an alternative to unemployment, but furthermore and even more importantly, as a potential opportunity, even though still in its embryonic stages, for the new generation of technological entrepreneurs to adopt Fab Labs as a creativity laboratory, whose work is widely based on the concepts of shared economy.

TB-09 Indicators of Technical Emergence -1
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Salon I
Chair(s) Alan L Porter; Search Technology, Inc.

TB-09.1 [R] Exploring the Fundamental Conceptual Units of Technical Emergence

Arho Suominen; VTT Technical Research Centre of Finland, Finland
Nils Newman; Search Technology Inc, United States

The study of emerging technologies is broad and has multiple and often poorly integrated threads. For example, some studies draw from a number of characteristics such as radicalness, growth speed, coherence, impact, uncertainty and ambiguity, while others only look at expected economic benefits. This fractured view of the growth of new technologies has created a hodgepodge of approaches and a dearth of fundamental measures within this research space. Recent efforts at developing a more fundamental measure of technological behavior have yielded "technical emergence" - a simple proposition which seeks to measure the growth of concepts within a community of users by tracking novelty, persistence, community and growth. This fundamental unit induces the possibility to actually measure and, more importantly, test its behavior using repeatable bibliometric techniques. We discuss in detail the conceptual origins and evaluate the concept of technological emergence and relations of indicators to it.

TB-09.2 [R] Technological Emergence Indicators Using Emergence Scoring

Jon Garner; Search Technology, Inc., United States
Stephen Carley; Search Technology, Inc., United States
Alan L Porter; Search Technology, Inc., United States
Nils C Newman; Search Technology, United States

Indicators of technological emergence promise valuable intelligence to those determining R&D priorities. We present an implemented algorithm to calculate emergence scores for topical terms from abstract record sets. We offer a family of emergence indicators deriving from those scores. Primary emergence indicators identify "hot topic" terms, then we use those to generate secondary indicators that reflect organizations, countries, or authors especially active at research frontiers in a target domain. We also flag abstract records (papers or patents) rich in emergent technology content, and we score technological fields on relative degree of emergence. We show illustrative results for example topics - nano-enabled drug delivery, non-linear programming, dye sensitized solar cells, and big data.

TB-09.3 [R] Study on Assessment Model for Emerging Technology Maturity

Wei Wang; Beijing Institute of Technology, China
Yun Liu; Beijing Institute of Technology, China
Shuhan Liu; Beijing Institute of Technology, China

Technology maturity refers to the general availability of individual technology or technology systems in the research and development process. Emerging technology is a kind of technology which is developing or has newly appeared, though the great impact it may have on economic structure or the development in one or several industries, it also shows the uncertainty in marketing, management and other aspects. Thus, the evaluation of technology maturity has become an important part of emerging technology forecasting and technology foresight. By studying the assessment method of technology maturity of weapon equipment which is developed by the Department of Defense of the United States, this paper will present a useful reference to establish an assessment model for technology maturity in an emerging technology area.

TB-11 Decision Making-1
Tuesday, 7/11/2017, 10:30 - 12:00
Room: Eugene
Chair(s) Oliver Yu; San Jose State University

TB-11.1 [R] Computer-aided Detection: Cost Effectiveness Analysis with Learning Model

Ryohei Takahashi; Tokyo Institute of Technology, Japan
Yuya Kajikawa; Tokyo Institute of Technology, Japan

Computer-aided detection (CAD) has been a promising research area over the last two decades in the medical field. CAD usually supports doctors by marking medical images with potential lesions. This technology has performed many remarkable accomplishments in the laboratory and has been used for some medical cases (e.g., breast cancer and colorectal cancer). However, its health-economic impact (i.e., cost-effectiveness) from a societal perspective remains controversial because of the lack of studies. To clarify the cost-effectiveness of CAD, we propose a new methodology, the "learning model," and conduct a simulation based on data reported in previous studies. This model can predict performance improvement due to the accumulation of medical imaging data and the proficiency of CAD for doctors. In this article, we demonstrate the feasibility of our proposed methodology in mammography and computed tomographic colonography CAD. Furthermore, based on the analyzed results, we discuss the potential of CAD.

TB-11.2 [R] Assessing and Improving Consistency of a Pairwise Comparison Matrix in the Analytic Hierarchy Process

Oliver Yu; San Jose State University, United States

A major breakthrough in multi-criteria decision analysis has been the analytic hierarchy process (AHP), with its innovative applications of matrix theory and pioneering concept of consistency in human judgments for pairwise comparisons. However, the criterion for assessing consistency among these judgments in a pairwise comparison matrix of AHP is somewhat cumbersome to apply, and the available procedures for improving the consistency of the matrix focus mainly on the effects rather than the source of the inconsistency: the underlying human judgments. This paper presents a simplified criterion for assessing the consistency of a pairwise comparison matrix. It further develops a systematic procedure for modifying an insufficiently consistent matrix to total consistency based on the degree of confidence the decision-maker places on these judgments, and discusses the implications of this total consistency modification procedure.

TB-11.3 [R] Quantifying Nescience: A Decision Aid for Practicing Managers

Charles M Weber; Portland State University, United States
Rainer Hasenauer; Vienna HiTECH and WU Wien, Austria
Nitin Mayande; Portland State University, United States

Aristotle's dictum scio nescio (I know that I don't know) may serve as a source of enhanced performance for organizations. Awareness of nescience sets the direction for further inquiry, as managers tend to move in the direction that they believe will reduce nescience most. However, nescience is difficult to quantify, so, to date, managers have primarily relied on intuition. Observing business analytics practices in three industries - semiconductor manufacturing, medical diagnostics and social media analytics - suggests that nescience can be measured using metrics from information theory. In semiconductor manufacturing, strategies for problem solving can be explained in terms of Shannon's entropy formula, which indicates the most effective pathway for reducing nescience and identifying the practice with the highest benefit/cost ratio. In medical diagnostics, variants of this formula can be used to reduce nescience to improve the quality of diagnosis. Social media analytics firms reduce nescience to identify loci of influence in online social networks. Nescience is measured by centrality and centralization metrics from information theory. In the aggregate, these observations suggest that metrics for nescience that are based on information theory may serve as a decision aid for practicing managers.

TB-11.4 [R] Attractor-Based Fitness Landscapes for Computational Decision Search

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

Managerial decision making involves searches for alternative courses of action, including searches for technological innovations. A substantial stream of computational work on managerial decision making has been based on search using Kauffman's NK landscape model, which represents fitness or payoff values to a discrete set of binary strings. In this paper, we propose a new method for landscape generation, the method of superposition of attractors, in which the fitness landscape is continuous. We introduce the attractor-

based (AB) fitness landscape model, the core model based on this method, with parameters specifying the number of attractors and the steepness and heights of landscape peaks in the neighborhoods of attractors. We then describe the search using this model, consider issues in implementing the search process, and provide an example of applying the model to studying exploration and exploitation. Next, we compare the AB and NK landscape approaches and identify some advantages and disadvantages of the AB approach relative to the NK approach. Advantages of the AB model include more control over the shape of the fitness landscape, applicability to outcomes not arising from intraorganizational interdependence, and visualization. We then consider customizations and generalizations of the model, including applications to coordinated exploration and resource partitioning processes.

TD-01 Innovation Management-4
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon A
Chair(s) Ruy Quadros; Universidade Estadual de Campinas

TD-01.1 [R] Towards a Better Understanding of the Key Elements Driving the Innovativeness of the Mineral Resources Industry: A Literature Review

Marthinus J Du Plessis; University of Pretoria, South Africa
Marthinus W Pretorius; University of pretoria, South Africa

It is perceived by a wide sphere of stakeholders, including the public, that the mineral resources (MR) industry is slow to adapt to the increasing challenges it faces. Technologies like advanced automation and the "Internet of Things" could already have significantly improved the operating practices and the overall performance of the industry. There is a need for research on how the MR industry can accelerate innovation processes to improve its performance. This paper aims to share insight into the validity of these perceptions, the uniqueness of the challenges the industry faces and to identify the key elements that must be addressed to improve the innovative capacity of the industry. Some industry successes in technology development and innovation are analyzed and lessons from these successes are shared. It is clear from the literature that various informed parties do agree that the MR industry underperforms with relation to innovation. Academic studies, reports from managing consulting firms and environmental, social and corporate governance reports confirm this. The literature study also confirms that there are unique features inherent to this industry constraining innovation. Features such as the static nature of ore deposits that results in relatively fixed mine layouts and exploitation plans, large capital requirements, long-term supply contracts and extended mine development and technology development cycles of up to ten years. The generic elements for successful innovation and its interdependencies are determined and reflected in the paper. The innovation management practices of the MR industry have been studied and the analysis thereof is discussed. A comparison was drawn between generic innovation management elements and the MR industry practices. The gaps were identified and are discussed as the outcome of this paper. This literature study will form the basis of a follow-up study to develop a comprehensive and integrated innovation management framework for the minerals resources industry.

TD-01.2 [R] The ExodUX Framework: Supporting Comprehensive User Experience Design

Simon Kremer; Technical University of Munich, Germany
Alexander Schlimm; Technical University of Munich, Germany
Udo Lindemann; Technical University of Munich, Germany

Designing a positive user experience (UX) with products enables the creation of unique selling propositions. Being strongly driven by cognitive processes rather than mere product properties, UX is difficult to realize successfully. While user experience design (UXD) is a rather young discipline within product development, other disciplines outside engineering design traditionally focus on creating experiences. We aim at transferring knowledge from those disciplines to support the design of fascinating UX with technical products. Our work is based on the ExodUX model (from Experience Oriented Disciplines to User eXperience) consisting of 41 experiences from disciplines outside engineering design (e.g., sports). Our overarching goal is to support UXD based on the ExodUX approach - extending the model to a broader framework. As part of this, we documented concrete design information for all 41 experience triggers in a consistent and applicable way. Furthermore, we present a supplementing process for how to implement gained knowledge of single triggers in a product development project. Finally, we provide situation-specific application methodologies for the whole framework.

TD-02 Information/Communication Technology-1
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon B
Chair(s) Kem Ramdass; University of South Africa

TD-02.1 [R] An Investigation into the Implementation of New Versions of Information Systems Implementation

Kem Ramdass; University of South Africa, South Africa

Companies are constantly being put under pressure to obtain the maximum return on their investments, including the maximum return on their investment in Enterprise Resource Planning system (ERP) systems. Organizations are becoming increasingly aware that information is a valuable company asset, and applied correctly, it can be used as a competitive advantage. The way that information is managed and applied within an organization is becoming increasingly important. This became even more evident since the organization moved from a national company to an international company competing for market share internationally. The methodology adopted in the research is an investigation using a case study analysis to highlight some of the issues affecting the maintenance management systems applied in the organization and includes a review of secondary data including existing literature and documents, relevant research reports and journal articles and unstructured interviews with personnel.

TD-02.2 [A] Ontology Design for Automatic Evaluation of Web User Interface Usability

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

The rapid development of the Internet and associated technologies for content delivery has led to a situation where the Web can be accessed on a multitude of different platforms - from desktop computers, laptops and tablets to smart-phones, which have become a crucial part of our lives, raising the question of usability on this plethora of devices. Testing and validating user experience (UX) throughout the whole development process is costly. However, some of this work done by humans could be executed automatically starting in early development. In this paper we address web user interface (UI) automatic evaluation and in particular discuss the ontology design for capturing knowledge of web usability domain for UI evaluation.

TD-02.3 [R] The Impact of Train Cancellations in South Africa: A Case Study

Kem Ramdass; University of South Africa, South Africa

Transnet Freight Rail (TFR), formally known as Spoornet, is the largest operating division of Transnet LTD. TFR is responsible for the transportation of rail freight along the geographical route of approximately 20 500 kilometer rail network. Approximately 1500 kilometers is involved with heavy haul lines for export coal and export iron ore. Within TFR, the customer care department has been divided into business units (BU's) as follows: Containers and Automotives (CAB), Agriculture and Bulk Liquids (ABL), Mineral Mining and Chrome (MMC), Iron Ore and Manganese (IOM), Steel and Cement (SAC) and Coal (Export/Domestic). In 2014 the strategy of Transnet was to become one of the top five railways in the world. In order to realize this objective, Transnet embarked on the reduction of costs with the implementation of the market demand strategy (MDS). Thus, this study is focused on the reduction of costs through the analysis of train cancellations in the National Command Centre (NCC) which currently cost Transnet in the region of 2.1 billion rands over the past

financial year (2014 - 2015). In order to achieve this, a case study methodology was used as it was the most applicable method of collecting data.

TD-03 Strategic Management of Technology-2
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon C
Chair(s) Bharat Rao; New York University Tandon School of Engineering

TD-03.1 [A] Opening the Door for the New Methodology for Optimizing Functional Material Development in Technology Management Framework II

Hideki Hayashida; Osaka University, Japan
Hiroki Funashima; Kobe University, Japan
Hiroshi Katayama-Yoshida; Osaka University, Japan
Takao Nomakuchi; Wakayama university, Japan

A research study of the R&D management from various kinds of focus and scope has been done for many years. Especially, it has been quite difficult to explain the R&D project status as a quantitative dynamic model. In our previous study, we defined the R&D project as the dynamic model and estimated interactions among internal elements within the company. This interaction plays an important role to express the R&D project status. We applied this model to the specific business case and attempted to express the state of the R&D process using the quantitative physical model as a modified magnetic model. As the result of the model simulation, the modified magnetic model can distinguish the success and failure case. In this paper, from the detailed differential analysis of success case and failure case by the model simulation and the visualization of the R&D project status by the result of this differential analysis, the possibility of the feedback to the improvement points of the current R&D project are suggested. More attention should be paid to the interaction between the quantitative part and qualitative part within the R&D activity.

TD-03.2 [R] A Consideration of Strategy and Innovation for Hyper Smart Society Realization

Hiroshi Kubo; Chiba Institute of Technology, Japan

Various companies must select an innovation model according to their respective strategies to realize a hyper smart society (HSS). Four strategic approaches exist: resources, positioning, gaming, and learning; these respectively correspond to the linear, Klein, hypothesis-testing, and interactive innovation models. Using the Stage Gate method for the linear and Klein models enables a concentration of the appropriate themes and management resources. In doing so, the issues to be overcome, which include selecting themes and developing human resources, can be surmounted by limiting the gatekeeper to one person or applying the Boost Gate method. Conversely, a method similar to the agile method, which involves quickly repeating a short cycle of analysis, design, implementation, and testing, is considered effective with the hypothesis-testing and interactive models.

TD-03.3 [R] Relationships Between MNEs and Domestic Firms Following FDI

MJ. Ni. ilknur Tekin; Bocconi University, Italy

Understanding the relationship and impact of linkages between MNEs and the local domestic firms is essential for the governments of developing countries that are designing policies aimed at generating maximum benefits from FDI by MNEs. A growing body of research has analyzed the direct and indirect effects of FDI on developing countries, some of which date back to as early as 1999. This paper stems from an ongoing field research project with a global research policy organization on exploring the interactions between MNEs, the eco-systems that they sustain and their interactions with the local and regional governments. Given the privacy of the ongoing research data, at this point we provide a simple recollection of the current state of literature on the addressing the relationships among these companies, their eco-system, and the government. We also deliver a closer look into the technology and knowledge spill-overs following FDI, for assessing the current state of benefiting from linkages between MNE and the local domestic firms. Further insights on the field research outputs will become available during the PICMET Conference.

TD-04 Technology Management in the Health Sector-1
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon D
Chair(s) Yoko Ishino; Yamaguchi University

TD-04.1 [R] Lean Manufacturing in The Healthcare Sector

Cory R. A Hallam; The University of Texas at San Antonio, United States
Carolina Contreras; The University of Texas at San Antonio, United States

The term "Lean Healthcare" has been highlighted in literature as an approach to improve quality and operational efficiency within healthcare organizations. As a management philosophy, Lean healthcare seeks to increase patient and stakeholder satisfaction through continuous improvement. As healthcare facilities start the Lean journey, the complexity of their organizational structures represents a challenge that most organizations must overcome to be successful. The changes associated with a Lean transformation not only require planning and consideration among different groups but also needs to accurately identify the needs of users in a new Lean program. Therefore, the aim of this work is to present a comprehensive overview of the main challenges and opportunities highlighted in the literature about the implementation of Lean in the complex healthcare environment using a meta-analytic approach of 24 case studies.

TD-04.2 [R] Bundled Payments: A Rationalist Approach to Overcoming Bounded Rationality Problems In Healthcare Management

Cory R. A Hallam; The University of Texas at San Antonio, United States
William Flannery; The University of Texas at San Antonio, United States
Carolina Contreras; The University of Texas at San Antonio, United States

"Bounded Rationality" is a recognized term that describes many issues in the healthcare sector. People often makes decisions about their healthcare alternatives that are not the most suitable, ranging from failing to select among health insurance options, to selecting low quality and expensive healthcare services. Behavioral economics theory highlights that decision makers are boundedly rational and often do not act rationally when searching for a solution due to the many options they have to choose from. Bundled payments in the healthcare sector have been described as a better alternative over traditional payment models because of the potential to provide the required care that patients need, while optimizing the total treatment costs. With bundled payment the healthcare system seeks to avoid the uncertainty and risks patients may face when selecting the best option for an episode of care. Therefore, the aim of this article is to provide an overview of behavioral economics, review some of its contributions, and analyze how bundled payments may be used in the healthcare sector to reduce problems with bounded rationality.

TD-04.3 [R] Socioeconomic Status and the Utilization of CT and MRI in Taiwan

Ya-Hsin Li; Chung Shan Medical University, Taiwan
Ya-Ting Huang; Chung Shan Medical University, Taiwan

The study is to evaluate computed tomography (CT) and magnetic resonance imaging (MRI) utilization patterns among health care related patients and other patients. Methods: The data for 2011 to 2013 were collected from the National Health Insurance Research Database (NHIRD) published by the National Health Research Institutes in Taiwan. Propensity score matching was used to control the medical professional group and control group based on patients' age and gender. Besides descriptive and bivariate analysis, logistic regression was used to determine the relative factors that influence CT and MRI utilization. Results: Medical professionals have lower CT utilization rate than other patients, but health care related patients used more MRI treatment than normal patients. However, the costs in high technology and overall medical care cost are lower in health related patients group. Patients' characteristics, living environment, family income significantly influenced CT and MRI utilization. Conclusions: The utilization rate of CT and MRI in Taiwan is higher than other countries. We found a pattern of increased CT utilization in patient groups with a lower SES. And health related patients had less CT utilization and more MRI utilization.

TD-04.4 [R] Apply Information and Communications Technology to Improve the Quality of Day Care Center

Jar-Yuan Pai; Chung Shan Medical University, Taiwan
Darren Liu; Des Moines University, United States
I-Hsiang Lin; Nantou Hospital, Taiwan
Hsin-Chuan Lai; Tung's Taichung Metroharbor Hospital, Taiwan

The rapidly growing aging population (65+) in Taiwan has incurred continuing increase in the incidence of chronic disease; hence is elevated the need for long-term care services. This study aims to develop a medical system in a day care center of central Taiwan and evaluate its efficiency in the care processes. The cloud-based medical system used information communication technologies (ICT) including a wireless medical device and a computerized management system. The system also used RFID and connection technologies (WIFI and 4G) to gather data in six domains: Demographic Information, Health Care Service, Data Base Report Exporting, Senior Social Worker Management, Decision Management, and Website Service. To measure the quality of the ICT system, we used the PZB model of five-dimension of service quality: tangibles, reliability, responsiveness, assurance, and empathy. The results showed that both the staff and elderly patients in day care center agree that the system provided better support to the care (p value<0.05). That is, the adoption of ICT system may enhance the efficiency of care and improve the service quality because it cuts down routine paper works and reduces the time to retrieve patient records.

TD-06 Big Data for Technology Management-2
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon F
Chair(s) Yun Liu; Beijing Institute of Technology

TD-06.1 [R] Longitudinal Patent Analysis for Big Data Technology

Bingxiu Gui; Beijing Institute of Technology , China
Yun Liu; Beijing Institute of Technology, China
Xu Bai; Beijing Institute of Technology, China
Jiaojiao Zhang; Beijing Institute of Technology, China

Big data technology has experienced very rapid development over the last decade. This paper aims to trace the latest dynamic and trends in the hot classified fields of big data technology. Firstly, this paper builds the classification system of big data technology. Based on the classification system, this paper uses patent counts to dig out the hot classified fields and finds out the representative hot classified fields. After that, we attempt to grasp the overall situation of big data technology at present through the dynamic collaborate analysis among scientists. Lastly, new directions for big data research and development are proposed.

TD-06.2 [R] Analysis on the Demand of Top Talent Introduction in Big Data and Cloud Computing Field in China Based on 3-F Method

Linjia Zhao; China Association for Science and Technology, China
Yuanxi Huang; China Association for Science and Technology, China
Yinqiu Wang; China Association for Science and Technology, China
Jia Liu; National Academy of Innovation Strategy, CAST, China

Big data and cloud computing, which can help China to implement an innovation-driven development strategy and promote industrial transformation and upgrading, is a new and emerging industrial field in China. Educated, productive and healthy workforces are a necessary factor to develop big data and cloud computing industry, especially top talents are essential. Therefore, a three-step method named 3-F has been introduced to help in describing the distribution of top talents globally and making the decision about whether they are needed in China. The 3-F method relies on calculating the brain gain index to analysis of the top talent introduction demand of a country. Firstly, Focus on the high-frequency keywords of a specific field by retrieving the highly cited papers. Secondly, using those keywords to Find out the top talents of this specific field in the Web of Science. Finally, Figure out the brain gain index to estimate whether a country needs to introduce top talents of a specific field abroad. The result showed that the brain gain index value of China's big data and cloud computing field was 2.61, which means China needs to introduce top talents abroad. Besides P. R. China, those top talents are mainly distributed in the United States, the United Kingdom, Germany, Netherlands and France.

TD-06.3 [R] Building Information Modeling (BIM) Enabled Facilities Management Using Hadoop Architecture

Muhammad Arslan; Universite de Bourgogne, France
Zainab Riaz; Lahore University of Management Sciences, Pakistan
Saba Munawar; National University of Computer & Emerging Science, Pakistan

Protecting the safety of occupants and the environment is a core value within facilities management. Data acquisition systems such as wireless sensor networks can help to monitor facilities to reduce hazards such as fire, water flooding and burglaries. Building information modeling (BIM) is a revolutionary development that is reshaping the architecture engineering and construction (AEC) industry. BIM is both a process and a technology and offers wide solutions for facilities management. In order to monitor and manage facilities data in a BIM-based simulated environment, this work reports on a development of a system that uses BIM software and a wireless sensor technology to develop a proactive safety management system. However, to link BIM data with data values of wireless sensors motes will challenge the traditional approaches to data management, and massive sensor data will contribute to the emerging model of big data. To extract relevant information out from the collected data, a prototype system uses Hadoop architecture for data storage and processing. The results of processing BIM and sensor data in a Hadoop architecture have demonstrated that the proposed system can effectively provide data visualizations to facility managers with the most accurate information needed to make decisions. It also ultimately attempts to reduce safety hazards during the facility management phase of a building.

TD-07 Knowledge Management-2
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon G
Chair(s) Shino Iwami; University of Jyvaskyla

TD-07.1 [R] Automatically Constructing Areas of Expertise Based on R&D Publication Data

Alisa Kongthon; National Electronics & Computer Technology Center, Thailand
Santipong Thaiprayoon; National Electronics & Computer Technology Center, Thailand
Choochart Haruechaiyasak; National Electronics & Computer Technology Center, Thailand
Kanokorn Trakultaweekoon; National Electronics & Computer Technology Center, Thailand

For developing countries such as Thailand where the number of knowledge workers is quite limited, a complete national researcher profile database is essential to locate experts in various fields in order to foster collaborative opportunities. Since the current national researcher database was constructed based upon voluntary responses from researchers to create their profile, we found that the database is incomplete, and particularly the area of expertise field has been empty for a great number of researchers. To solve the problem, we propose several approaches to automatically construct areas of expertise using keywords from R&D publications. The best performance is by using term frequency - inverse document frequency (TF-IDF) with title weighting and keyword merging approach. The evaluating result yields 7% higher performance than the baseline (i.e., term frequency) method.

TD-07.2 [R] Metabolism of Inter-Firm Transactions in Regional Network

Hiroko Yamano; The University of Tokyo, Japan
Hajime Sasaki; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan
Many industrial transaction networks were destroyed or restructured after the Great East Japan earthquake in 2011. Some companies went bankrupt, but most companies somehow survived through the disaster. It was crucial for companies, especially those which had business relations in the affected areas, to know the sustainability of their

transaction networks. The purpose of this study is to understand the companies' resilience, in terms of their transaction metabolism. We obtained data from Teikoku Databank, Ltd., and analyzed 391,430 transactions between companies in the affected Tohoku district from 2010-2014. We took the inter-firm transactions as links, and calculated their lasting rate in each company during the designated period. We examined if the companies with a high rate of long-lasting links were well-equipped for the disaster, and found that link persistence does not always represent the company resilience. We focused on the metabolism of the links in each company, which is defined by the diversity of their lasting rate. Examining the restructuring after the disaster, we concluded the metabolism of the links can be regarded as a new indicator that represents the characteristics of a company in the industry transaction networks.

TD-07.3 [R] Cross-domain Academic Paper Recommendation by Semantic Linkage Approach Using Text Analysis and Recurrent Neural Networks

Kiran Mysore Ravi; The University of Tokyo, India
Junichiro Mori; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

In this digital age, free-flow and exchange of knowledge and information are of paramount importance. This is the prime reason why we decided to tackle cross-domain linkage. Firstly, we build a system which recommends scholarly academic papers based on the content of news articles a user is reading using text analysis techniques. We perform a human expert evaluation to test the system for relevance. Our judges show good agreement with a kappa value of 0.869. To improve the quality of recommendations further, we use an RNN-LSTM model trained on Wikipedia to measure document relevance. We reorder a list of academic papers based on their semantic similarity with the input document using our RNN-LSTM model. Our model achieves a slightly better performance than one of the best document embedding techniques doc2vec (paragraph vector). To the best of our knowledge, ours is the first study linking the domains of news media and academic landscape, and bridging the knowledge gap.

TD-08 Social Media-1
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon H
Chair(s) Olumide Adebayo; University of Bridgeport

TD-08.1 [R] Knowledge Flows and Influence in Online Social Networks: Proposing a Research Agenda

Charles M Weber; Portland State University, United States
Nitin Mayande; Portland State University, United States

Online social networks, which have been defined as aggregated organizations that emerge from the Internet when people carry on public discussions, are increasingly becoming the vehicle of influence in social, political and economic discourse. Yet, despite its increasing importance, the nature of influence in online social networks is not really understood. Practitioners openly admit that they lack the experience to make sense of the phenomenon, and extant theory of influence in networks, which extrapolates from observations of the real world, is demonstrably inadequate when it comes to explaining influence online. The paper introduces a novel approach to analyzing influence online, which is based on the premise that knowledge flows rather than connectivity or position determine loci and regions of influence. The authors propose an exploratory, longitudinal population study of 100 highly diverse online social networks. The study will 1) benchmark a set of metrics for influence in these networks to determine which metrics are best suited for measuring influence in a plethora of contexts; 2) characterize the nature and properties of knowledge flows within each network; and 3) determine how knowledge flows impact the (virtual) spatial and temporal distribution of influence within that network.

TD-08.2 [A] Producing and Communicating an Interactive Popular Science Video for New Media

Mavis Tsai; Shih Hsin University, Taiwan

Science is an important part of human life. It is the application process and the construction of knowledge regarding a phenomenon of nature. Scientific development and technology management are the basis for national development, social progress, and an important indicator of overall competitiveness of a country. Therefore, it relies on education to improve people's scientific literacy. Using media to convey scientific knowledge to the community is one of the best approaches, using diverse channels and platforms to pass on scientific information and knowledge, and thus enhance the public's scientific literacy and help with new technology or innovation diffusion. To communicate scientific information adequately, the mass media need to provide suitable information and channels so the community can acquire new information, and thus innovations can be generated. In addition, new media have become quite important and convenient for a new generation. The purpose of this study is to illustrate ways to plan and produce an interactive short film regarding environmental science or technology issues for new media so as to increase audience learning retention and involvement with regards to scientific topics and to do so at a lower cost and higher efficiency. The researcher picked as an example the issue of ways micro plastics spell big problems for future generations. This application paper indicates methods of achieving collaboration among a group of scientists, journalists and video shooting teams, ways for them to plan and produce an interactive popular science video step-by-step, and means for applying science communication strategies, such as game/toy-based learning, fear appeal, and rationalized appeal strategies for interactive popular science videos production. In this paper, the researcher finished the interactive short film script following these communication strategies and hyper narrative types, demonstrating an example for how to plan the producing and communicating of an interactive popular science video for new media. This study selected scientists who are knowledgeable in the issues surrounding micro plastics to participate in this research and a popular science video-producing process so as to help discover adequate video and animation design strategies for producing lower cost videos which promote scientific knowledge and deal with technological issues regarding micro plastics.

TD-08.3 [R] The Development of Social Commerce Research: A Main Path Analysis of the Literature

Kai-Yu Tang; Ming Chuan University, Taiwan

Recent studies have highlighted that social commerce has become a new type of electronic commerce since consumers' shopping behavior is heavily influenced by social media (e.g., Facebook, Twitter), such as reading comments and feedback on products. It is important to note that the development of social commerce has caught the attention of business practitioners; moreover, it is also essential for researchers to probe into the existing research on the rapid growth of social commerce. As such, the aim of our research review is to identify the core research themes and trends in social commerce. To gain deep insights from the academic research, we present a network-based citation analysis, that is, a main path analysis, to analyze the knowledge dissemination within the social commerce literature. To construct a holistic review of the social commerce research, in this study, we performed multi-keyword queries to search for relevant articles in two major sources of high quality academic journals, namely the Sciences Citation Index (SCI) and the Social Sciences Citation Index (SSCI). The timespan covers original papers and the most up-to-date research. Accordingly, a total of 319 journal articles with 3,753 citations were obtained and used for the main path analysis. Based on the algorithm of the search path link count, the traversal count of knowledge flow within the social commerce research network was calculated. In addition, the result of the top 10 critical main paths (key-routes) was mapped in a directed network graph. This is the very first attempt to profile the most critical developmental trajectories of social commerce research. The pilot results can serve as a research-based platform for scholarly discussion.

TD-08.4 [R] Text and Data Mining of Social Media in Science and Technology Publicity

Haodong Zhang; China Association Science and Technology, China

Shuo Xu; Beijing University of Technology, China
Zheng Wang; China's Ministry of Science and Technology, China
Lijun Zhu; China's Ministry of Science and Technology, China
Hui Luo; China Association Science and Technology, China
Dasheng Deng; China Association Science and Technology, China
Hong Wu; China Association Science and Technology, China

WeChat is a new generation of mobile instant messaging product, which has over 800 million active accounts and supports voice, video, pictures and text messages. China's Ministry of Science and Technology has applied social media to science and technology management. Rui Dong Ruan is one of the official accounts in the WeChat matrix of China's Ministry of Science and Technology. This research proposes an approach which uses Chinese word segmentation and topic model to processing texts of Rui Dong Ruan. The experimental result shows that there is a certain relationship between the content of the articles and the view counts on WeChat, which can make the science and technology propaganda more efficient and effective.

TD-09 Indicators of Technical Emergence - 2
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Salon I
Chair(s) Ying Guo; Beijing Institute of Technology

TD-09.1 [R] Using Machine Learning Approaches to Identify Emergence: Case of Vehicle Related Patent Data

Samira Ranaei; Lappeenranta University of Technology, Finland
Arho Suominen; VTT Technical Research Centre of Finland, Finland

Bibliometric studies have long used simple search strings, publications count, and word counts to track the emergence of technologies. Novel machine learning methods open new possibilities to study bibliometric data and use algorithmic approaches to uncover emergence of a technology. This study looks at the large and complex dataset of vehicle related patents to uncover emergence indicators. By using machine learning methods this study focuses on if, and to what extent, different methods can produce patterns of emergence from the data directly. The data extracted from PATSTAT contains 711,296 granted US patent abstracts between the years 1980 and 2014 resulting from a search for "vehicle," creating a complex dataset of technologies from automotive to medical applications. Using Latent Dirichlet Allocation and Dynamic Topic Modeling, we show different emergence patterns. Finally, we discuss in detail the possibilities of using machine learning approaches to draw emergence dynamics of technologies.

TD-09.2 [R] Delineating Translational Innovation Pathways for Nanomedical Research Using Tech Mining

Jing Ma; Shenzhen University, China
Donghua Zhu; Beijing Institute of Technology, China
Dorothy Farrell; Office of Cancer Nanotechnology Research, NCI, NIH, United States
Michael Chang; Office of Cancer Nanotechnology Research, NCI, NIH, United States
Piotr Grodzinski; Office of Cancer Nanotechnology Research, NCI, NIH, United States
Natalie F Abrams; Office of Cancer Nanotechnology Research, NCI, NIH, United States
Alan L Porter; Georgia Institute of Technology, United States

Clinical translation of technological discoveries from bench to bedside has been a slow and incremental process. Capturing early events in technology development can provide key insights into the nature of biomedical innovation and its bottlenecks. The sheer volume of the available information, however, presents a significant barrier to a systematic assessment of current capabilities. Nanomedicine, which deals with medical applications of nanotechnology, perfectly exemplifies the challenges facing translational research. In this study, we have explored the feasibility of using a streamlined tech mining approach for identification of translational innovation pathways using observable markers found in research literature. The framework contains three sections: 1) extraction of feature terms from titles and abstracts; 2) tagging research articles with translational stages and application markers; and 3) analysis of topical changes, translational phases, and innovation pathways. We applied this strategy to analyze a set of 23,982 PubMed records that involved gold nanostructures (GNSs), which have been extensively studied in a wide range of biomedical applications. The studies were classified based on their intended clinical application, research field, disease, and translational stage. Our results have identified a significant increase in GNSs studies in the areas of cancer, therapeutic applications, and animal testing. Additionally, the tags along with feature terms were used to build innovation pathway maps for three types of biomedical applications: treatment, in vitro detection, or imaging. The framework described in this paper can be useful for academic researchers, funding agencies, as well as pharmaceutical and medical device companies to facilitate assessment of translational readiness and future research planning.

TD-09.3 [R] Discovering Interactions in Big Data Research: A Learning-Enhanced Bibliometric Study

Yi Zhang; University of Technology Sydney, Australia
Ying Huang; Beijing Institute of Technology, China
Alan Porter; Georgia Institute of Technology, United States
Guangquan Zhang; University of Technology Sydney, Australia
Jie Lu; University of Technology Sydney, Australia

As one of the most representative emerging technologies, big data analytics and its related applications are rapidly leading the development of information technologies and are significantly shaping thinking and behavior in today's interconnected world. Exploring the technological evolution of big data research is an effective way to enhance technology management and create value for research and development strategies for both government and industry. This paper uses a learning-enhanced bibliometric study to discover interactions in big data research by detecting and visualizing its evolutionary pathways. Concentrating on a set of 5840 articles derived from Web of Science covering the period between 2000 and 2015, text mining and bibliometric techniques are combined to profile the hotspots in big data research and its core constituents. A learning process is used to enhance the ability to identify the interactive relationships between topics in sequential time slices, revealing technological evolution and death. The outputs include a landscape of interactions within big data research from 2000 to 2015 with a detailed map of the evolutionary pathways of specific technologies. Empirical insights for related studies in science policy, innovation management, and entrepreneurship are also provided.

TD-10 Manufacturing Management-2
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Portland
Chair(s) David J Kruger; University of South Africa

TD-10.1 [A] The Suitability of Lean as an Improvement Tool in a Manufacturing Concern: A Case Study

David J Kruger; University of South Africa, South Africa

Since the Industrial Revolution, enterprises have attempted to identify viable methodologies for improving the manner in which they conduct their business. A number of methodologies have been tried and tested; some were successful, and others less so. The quest to do more with fewer resources has broadened. As a result, when competition has intensified, manufacturers and service providers have acknowledged the negative effect of waste in processes and systems on their profit margins, and the need to eradicate it. Lean manufacturing has been identified as a powerful methodology in finding solutions for improvement problems. It was developed from the Toyota Production System (TPS) and has been refined over time to be applied universally. It has been implemented with varying degrees of success worldwide. The paper illustrates how lean was utilized in a particular organization to improve its processes and ultimately its profit margin; an explanation is given of what was done to ensure the ultimate success of the improvements undertaken in the researched organization. The paper includes a discussion of possible pitfalls.

TD-10.2 [R] Evaluation of the Effects of Activity Deviations onto a Development Project's Target Dimensions

Gunther Schuh; RWTH Aachen University, Germany
Michael Riesener; RWTH Aachen University, Germany
Christian Doelle; RWTH Aachen University, Germany
Soeren Brockmann; RWTH Aachen University, Germany
Manuel Ebi; RWTH Aachen University, Germany

Manufacturing companies in high wage countries strive towards shortened development and innovation cycles at decreased costs in order to strengthen their competitive position. These goals can be achieved by efficient and lean development projects. Approaches aiming at designing efficient development processes such as the value stream analysis only analyze development projects retrospectively as well as periodically and therefore do not continuously improve the efficiency of the respective projects themselves. Furthermore, existing approaches for project management mainly evaluate the target dimensions' time, cost and quality on a superior project level although steering measures have to be implemented on an activity level. Therefore, a concept is needed allowing the determination of an activity's contribution to the time, cost and quality goals of a project. Based on the determined contribution it is possible to assess the effects of a deviation on activity level onto the project goals comparable to a sensitivity analysis allowing a focused implementation of measures. The methodology introduces an approach to partition overall project time, cost and quality goals among the different project activities. In a second step, it is derived how deviations within the target dimensions on activity level can be rated in terms of their effect onto the project comparable. Depending on the effect of the activity-deviation onto the project goals, the implementation of measures is decided. To support this decision, a logic is derived to rate the respective impact of a deviation.

TD-10.3 [R] Energy Management Approach for Optimizing Production Cost of Industrial Enterprise Case of Canapmad

Daudet Evariste Zely; University of Antananarivo, Madagascar
Elise Raveloson; University of Antananarivo, Madagascar
Feno Daniel; University of Toamasina, Madagascar
Diamondra Helinoro Razaivaovololoniaina; University of Antananarivo, Madagascar

The CNAPMAD Company is constituted by several services of production such as the printing house, the workshop of fabricating, tinplate making and unit of drying. From 2004 until 2006, CNAPMAD has noticed a raised variance of load cost at the production cost management level in the company. The purpose of this research is to establish the strategy to optimize the production cost. After applying the method of energy management as: use of efficient equipment like economic lamps, implement politics anti-wasting as well as the compensation of reactive energy from equipment within workshops. This research allowed to analyze the root causes of this additional cost which are mainly the augmentation of electricity price, increasing energy consumption caused by low power factor of equipment, wasting and over capacity of lighting . This research led to optimize expenses that the company may have control in itself. With this CNAPMAD can save at least 20% of their annual electricity current is £2877 save per year including £1760 gain obtained for relief of lighting and £1117 received compensation of reactive energy, so this research contributes to the reduction of production cost and improves the level of performance of the company.

TD-11 Decision Making-2
Tuesday, 7/11/2017, 14:00 - 15:30
Room: Eugene
Chair(s) John Francis Agwa-Ejon; University of Johannesburg

TD-11.1 [A] Decision Making under Uncertainty and Risk: A Retiree's Perspective on Choosing Between Pension Options

Antonie M de Klerk; University of Pretoria, South Africa

For most individuals, successful retirement depends on the availability of sufficient funds in appropriate financial instruments to ensure an acceptable level of income for the remainder of that person's life. This application paper considers the situation faced by a specific individual in a South African context on the point of retirement: either accept a life-time guaranteed fixed pension (life annuity) from his employer or withdraw the capital amount and invest it in a so-called living annuity. The decision appears deceptively simple, but is in fact highly dependent on the uncertainty associated with each of the alternatives. A requisite model is developed to capture the key features of the problem and analyzed to identify the preferred course of action. Given that this is a personal decision, the individual's subjective assessment of uncertainties and risk appetite are captured and used in the analysis. The purpose of the paper is to illustrate the use of decision making tools to inform a complex decision characterized by uncertainty and risk, as is often encountered in technology management, rather than a multi-attribute value function. Based on the analysis, the preferred choice for the decision maker is identified: accept the guaranteed pension. Conclusions and possible improvements to the model are presented. The approach developed in this paper is general and can be directly applied to, for example, decisions in technology management where uncertainty often plays a role.

TD-11.2 [R] Content Analysis using Fuzzy Cognitive Map (FCM)

Yasser Alizadeh; Portland State University, United States
Antonie J Jetter; Portland State University, United States

Cognitive mapping was introduced as a method to model complex systems that reflects how experts or stakeholders understand cause-and-effect relationships. Later, fuzzy cognitive mapping (FCM) combined cognitive mapping with artificial neural networks (ANN), resulting in the unique capacity to capture and use qualitative data to perform quantitative analysis and study system behavior in response to changes of system elements. However, when it comes to building FCM models from qualitative data, particularly from secondary data sources, guidance for modelers is scarce. This article introduces a step by step guideline for building FCM that not only deals with causal relationships but also offers techniques to adjust the inconsistencies, and tune the granularities through parent-child relationships. It also proposes two techniques, isolated graph analysis, and receiver-only-concept analysis to investigate the completeness of the final FCM and hypothesize new connections to fill the gaps.

TD-11.3 [R] Decision Support System to Optimize Cropping Pattern for Arid Agricultural Zones of Pakistan

Muhammad Toseef; Namal College, Pakistan
Malik Jahan Khan; Namal College, Pakistan
Muhammad A Choudhary; Namal College, Pakistan

In the rural areas of Pakistan, the farmers usually follow the pattern of cultivating the common crops which they have been doing since long ago. The agriculture sector has been having a significant contribution in the gross domestic product (GDP) of Pakistan. However, it has declined from 54% to about 30% over the last decade. About 65% of the population of Pakistan has its economic dependence on the agriculture sector. This research work has modelled and developed a decision support system which can assist the farmers plan crops to be cultivated next year resulting in maximum yield. The research focuses on incorporating the factors affecting the crops revenue including market trends, weather conditions, soil nature, funds availability, water availability, etc. The system is capable to formulate this problem of the agriculture sector as an optimization problem and solve it using linear programming approach to facilitate different stakeholders using an easy-to-use application. The decision support system has been built based on data collected from 40 farmers of the region and expert advice from agronomists, breeders and crops specialists. It will be of significant value for the progressive farmers of arid agricultural region.

TE-01 Innovation Management-5
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon A
Chair(s) Oliver Yu; San Jose State University

TE-01.1 [R] Managing Open Innovation: A Case Study of the National Science and Technology Development Agency (NSTDA) in Thailand

Songphon Munkongsujarit; National Science and Technology Development Agency, Thailand
Sabin Srivannaboon; Chulalongkorn University, Thailand

Open innovation is perhaps one of the most interesting topics in technology management, but is not yet well understood by the community at large. As there is no concrete, single standard for open innovation practice, there exist a great many opportunities for researchers and practitioners to find new ways of bridging the gap between value creation and value capture whether they be solutions for external technology or knowledge capital and resources. This research study attempts to explore open innovation through the lens of project management and project portfolio management by using the National Science and Technology Development Agency (NSTDA) in Thailand as a case study. It captures existing processes in open innovation at NSTDA as well as theorizes a framework for open innovation by proposing different layers of collaboration from within the organization's sub-units to external parties in academia and business.

TE-01.2 [R] Service Innovation Management Models: Planned, Iterative and Emergent Innovations

Carla M Kitsuta; UNICAMP, Brazil
Ruy Quadros; Universidade Estadual de Campinas, Brazil

Although service innovations present characteristics that make them different from innovation in goods, the literature presents traditional innovation management models, whose development has been based on the experience of manufacturing industries, as valid and applicable to service companies. Service innovation may take place in multiple dimensions, considering technological and non-technological elements. It may result from planned efforts, but can also emerge from the service practice, which indicates that these models may not be the only way open to service companies. The present article analyzes whether reference models for innovation management, which have influenced new product and service development activities, are suitable and adopted by service companies in the information technology (IT) sector in Brazil. We analyzed data from 10 Brazilian IT service companies supplying software development, systems integration and mobile services development. Findings suggest that traditional reference models for innovation management are suitable to service companies, but three other possibilities were identified. These possibilities relate to the innovation processes discussed by Toivonen (2010) and are identified here as (i) compression rapid application model, (ii) experiential rapid application model and (iii) practice-driven model. Even though innovation management models are not able to capture all diversity present in service sectors, acknowledgement of the different service innovation dimensions and innovation processes allows service companies to improve their understanding, develop competencies, and organize better their innovation efforts.

TE-01.3 [R] How Do Innovation Capabilities of Industrial Cluster Evolve in the Context of E-Commerce?: A Case Study from China

Xiao Chen; Zhejiang University, China
Gang Zheng; Zhejiang University, China

The amount of e-commerce conducted has grown exponentially as the development of the Internet. So far, some studies focus on the impacts of e-commerce on competitiveness on the level of enterprises. However, many researchers pay little attention to this topic on the industrial clusters level. The mechanisms between development of e-commerce and industrial clusters have not been discovered yet. As vital sources of national competitiveness, industrial clusters play a pivotal role in the development of industry. In the context of e-commerce, some clusters can leverage the openness, ease of use, and transactional.

TE-02 Entrepreneurship/ Intrapreneurship-1
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon B
Chair(s) Shino Iwami; The University of Tokyo

TE-02.1 [R] Time-Series Analysis on the Fields of Entrepreneurship Research

Tatsuya Kuroda; The University of Tokyo, Japan
Shino Iwami; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

This research overviews and analyzes the studies on venture businesses, start-ups, or entrepreneurs which play more and more important roles in our societies through the analysis by time-series approach and by individual countries. Firstly, we extracted academic papers including the words "venture," "start-up," or "entrepreneur" in the titles and abstracts from the Web of Science provided by Thomson Reuter's with data from 1991 to 2015. With these search queries we extracted 87,733 papers. Then we conducted citation analysis for these papers using network analysis by each additional five years in the 25 years and checked changes of the keywords contained in main clusters by these terms and by countries. From the result of this analysis, we figured out how the most important articles have been cited in their cluster in this research field over time and found the difference of clusters by countries where they have relatively more shares of papers. Additionally, the share of papers published in Japan totally has come down to only about one percent in this field and less share especially in emerging clusters. On the contrary, China has had more influence on this research field since the beginning of this century.

TE-02.3 [R] Entrepreneurship of Professional Managers in High-Tech Firms to Enhance Service Innovation: Case Study of Hsinchu Science Park and Silicon Valley Park

James K Chen; Asia University, Taiwan
Purevdulam Altantsetseg; Asia University, Taiwan

International Business Machines (IBM) points out that academics and industries have paid a higher attention to "service science" since 1985. With the rotation of the wheel of a service era, many companies have driven from production to service-orientation, and focus on the manufacturing services field. In the past, high-tech companies with leading technologies and unique products were ahead of other companies, but nowadays, this pattern is changed due to the changing market environment, consumption and other factors. In order to attract customers and to continue a leading position in the market, companies are required to have service innovation infrastructure. This study focuses on enhancement of the service innovation goal by professional managers' entrepreneurship for high-tech companies in Hsinchu Science Park and Silicon Valley areas. Initially, in accordance with the purpose of the study, relevant literatures were integrated from domestic and international journals to develop the draft questionnaire. Then, a survey was conducted at Hsinchu Science Park and Silicon Valley by the participation of 12 experts to finalize the content of the questionnaire. Third, the pilot questionnaire survey was sent out to 250 participants (200 in Hsinchu Science Park and 50 in Silicon Valley) through e-mail and internet platform. Finally, statistical software is used to analyze multivariate regression. Findings state that the personality (PersA) of Entrepreneurial Orientation to Service Innovation (InnV) has no significant correlation. The personality (PersB) to InnV has significant correlation. When PersA integrated environment (Env) to InnV generated significant positive correlation; PersB integrated Env to InnV got strong positive correlation. Consequently, environment factor hold on intermediary efficient results. PersA integrated Organizational Factor (OrgV) has significant correlation but only increases a little coefficient value. PersB integrated OrgV have significant correlation but decrease the coefficient value. Consequently, this study demonstrates that OrgV doesn't have an intermediary efficient result. The result of the analysis is useful for decision makings of top managers, when they adopt service innovation in these two science parks. Moreover, results provide a theoretical contribution for academicians for their future academic reports.

TE-03 Competitiveness in Technology Management-1
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon C
Chair(s) Takao Nomakuchi; Wakayama University

SESSIONS

TE-03.1 [R] A Study on the Factors of the Innovator's Dilemma in Japan

Takao Nomakuchi; Wakayama University, Japan
Hideki Hayashida; Osaka University, Japan
Masakazu Takahashi; Yamaguchi University, Japan

Japan's textile industry has been called "the forsaken industry." In the textile industry, while knowing that there is a market by adopting the latest technology, many in management of the textile industry stick to traditional production methods. It is the innovator's dilemma of Japan's textile industry cluster. In this paper, covariance structure analysis is performed on the basis of a questionnaire in order to consider the factors of management behavior related to sticking to traditional production methods. According to the results of the analysis, factors for the innovator's dilemma are verified.

TE-03.2 [R] Exploring the Nanotechnology Landscape for Competitive Advantage Using SAO-Mining

Roel Boekel; Delft University of Technology, Netherlands
Scott W Cunningham; Delft University of Technology, Netherlands
Xuefeng Wang; Beijing Institute of Technology, China

Historically, nanotechnology faces the same challenges of every new, emerging and science-based industry. The transfer of viable knowledge from science to market needs to be better bridged. To enhance this transfer, a methodology is designed which integrates engineering design and subject-action-object (SAO) text mining. The methodology is used to find, select and evaluate appropriate nanotechnologies for solving industrial problems using scientific abstracts. A case study is conducted whereby engineering design methods are used to structure a technical innovation problem in the manufacturing industry. 1.2 million abstracts from nanotechnology related articles are retrieved from the Web of Science and indexed using SAO-parsing of the title and abstract. The performance of this novel methodology is measured using precision and recall, an approach common to the field of information retrieval. The methodology is further evaluated on the basis of structured interviews conducted with two engineering managers. The results demonstrate that the SAO methodology is a valuable assist to innovation and design within the firm. Significant challenges are addressed in this article, e.g., knowledge loss due to SAO-parsing, and also the phenomena of information stickiness.

TE-03.3 [R] The Spatio-Temporal Pattern Evolution of Climate Technology Innovation of China's Potential Strategic Docking Countries

Zhiyun Ma; Beijing Institute of Technology, China
Yun Liu; Beijing Institute of Technology, China
Zhe Yan; Beijing Institute of Technology, China
Xu Bai; Beijing Institute of Technology, China
Xiaomei Ding; Guojin Gold Group Co., Ltd, China

Technology provides effective means for response to the climate change while technology innovation is a headspring and strong driving force for national development. In this paper we examined the spatio-temporal dynamic evolution process, pattern and character of climate technology innovation of China's strategic docking state by evaluation of the invention patents authorization using Theil index method and spatial econometric model. The analysis was conducted and explored on the three levels of time, space and the effect of geographically proximate base on national space unit. The result indicated that the difference in climate technology innovation of different countries is expanding and shows a strong stability high and low level convergence club. The lower the gaps in innovation level of different countries, the higher probability of climate technology transfer and vice versa. There is geographical proximity effect of climate technology innovation, particularly among low innovation countries.

TE-03.4 [R] Research on the Government Agriculture Investment Efficiency under 'China's New Normal'

Xu Bai; Beijing Institute of Technology, China
Yun Liu; Beijing Institute of Technology, China
Jie Y Cheng; Beijing Institute of Technology, China
Zhiyun Ma; Beijing Institute of Technology, China
Zhe Yan; Beijing Institute of Technology, China

This paper analyzes the current situation of China's government investment in agriculture under the new economic norm and uses the VAR model to estimate the equilibrium relationship between total agricultural output value, agricultural and forestry meteorological expenditure, agricultural capital construction expenditure, agricultural science and technology cost and agricultural comprehensive development fund. The results show that the investment of agricultural science and technology has an obvious effect on the total agricultural output value under the new economic norm. The conclusion will provide a reference for the formulation of relevant agricultural investment policies in China.

TE-04 Technology Management in the Health Sector-2

Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon D
Chair(s) Leon Pretorius; University of Pretoria

TE-04.1 [R] Organizational Dynamics of Sustainable eHealth Implementation: A Case Study of eHMIS

Getnet B Fanta; University of Pretoria, South Africa
Leon Pretorius; University of Pretoria, South Africa
Louwrence Erasmus; University of Johannesburg, South Africa

Successful implementation of electronic health (eHealth) is affected by several interrelated factors that go beyond technological elements. Economic, social (human) and environmental (organizational) factors significantly influence the sustainability of eHealth systems. Because of organizational factors, the same eHealth system can exhibit different success level in different healthcare institutions. Organizational culture, structure, resources, work process flow, leadership and management support are the key elements of organizational factors in the process of eHealth implementation. These organizational factors can deter the acceptance of eHealth technology if not carefully considered in the process of eHealth implementations. In this research study, we seek to understand the elements of an organizational factor that influence eHealth implementation and to study their dynamic interactions with technological dimensions. Healthcare organization is a complex system that involves nonlinear interaction among organizational elements that keep changing over time. A conceptual framework developed to describe the organizational dynamic of eHealth implementation illustrates nonlinearity through feedbacks. A case study approach is used to learn the holistic characteristics of organizational factors during the implementation of Electronic Health Management Information System (eHMIS) in Ethiopia. The conceptual framework is tested with data collected from two separate focus group discussion sessions with the implementers and owners of eHMIS. A system dynamics research simulation applied in this study is an appropriate method to enhance the learning process of a complex system. Finally, a causal loop diagram (CLD) of organizational dynamics is developed from the focus group data, literature and eHMIS implementation documents review.

TE-04.2 [R] Exploring Organizational Culture for Information Security in Healthcare Organizations: A Literature Review

Bridget Barnes Page; Portland State University, United States

The healthcare sector has generally been a late adopter of information technology solutions. As a result of the American Recovery and Reinvestment Act of 2009, the Centers for Medicare and Medicaid Services implemented a program whereby financial incentives were made available for eligible healthcare entities and healthcare providers implementing health information technology solutions. These healthcare entities and providers were required to attest to "meaningful use" (e.g., electronic data capture of clinical data, provision of electronic health records to patients) in order to receive the financial incentives. This program, more than any other key driver, has transformed the utilization of health information technology (HIT) in clinical settings. Health IT is now ubiquitous. With the advent of these HIT solutions has come large caches of private and protected health information which must be

guarded from both accidental disclosure and nefarious criminal activity. Compliance monitoring efforts by the Department of Health and Human Service's Office for Civil Rights have increased dramatically in recent years with multi-million dollar fines being levied across the country for security gaps. As a result of this increased risk, many healthcare organization are revisiting their information security position and culture in the age of electronic medical records. This paper will review the current state of that culture.

TE-04.3 [R] Effects of Doctor Networking on Diffusion of New Cancer Therapy

Yoko Ishino; Yamaguchi University, Japan
Ken Kaminishi; Yamaguchi University, Japan

Cancer, which is uncontrolled cell growth in malignant tumors, has been the leading cause of death in Japan since 1981. Therefore, cancer suppression by finding novel drugs or therapies is one of the most important challenges facing the world today. Recently, new drugs including monoclonal antibodies and immune checkpoint inhibitors have been invented. However, the sales of the new drugs do not depend solely on their medical effect. There are many factors affecting the diffusion of a new cancer therapy. In this study, we focused on the attitudes and behaviors of cancer specialists in order to understand improved marketing strategies for new cancer therapies. First, we studied how a specialist decides whether or not to adopt the new therapy, by applying a qualitative comparative analysis to an interview survey of cancer specialists. Secondly, we modeled the behavior of cancer specialists toward a new therapy. Then, we simulated the diffusion of a new therapy using agent-based social simulation. Finally, the findings that can be utilized in marketing strategies were obtained. One of the most interesting findings was that the topology of the network of cancer specialists has a large effect on the diffusion of the new therapy.

TE-05 Collaborations for Technology Management-2

Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon E
Chair(s) Yoshikazu Yamaguchi; Chiba Institute of Technology

TE-05.1 [R] Three-Layer Structure among Technology Transfer, Industry-Academia Collaboration, and Basic Research in Universities

Yoshikazu Yamaguchi; Chiba Institute of Technology, Japan
Jun Fujimoto; Chiba Institute of Technology, Japan
Akira Yamazaki; Chiba Institute of Technology, Japan
Takehiko Koshiyama; Chiba Institute of Technology, Japan

In promoting the creation of innovation, it is imperative that new technological seeds developed by universities are transferred to private companies; in recent years, such awareness has been on the rise. To promote technology transfer, it is important to comprehend its relationship with its influencing factors. We assumed a three-layer structure, meaning that basic research promotes industry-academia collaboration, which in turn promotes technology transfer. This study aims to reveal the quantitative relationship between technology transfer and university activities and indexes, and examine the three-layer structure. Taking Japanese universities as a case study, data on technology transfer including patents and venture companies, industry-academia collaboration including joint research and contract research, and basic research including research papers and grants-in-aid for scientific research were collected and analyzed. Consequently, multiple regression equations, which explain patent applications, patents, patent licenses, income of patent licenses, and venture companies using five, five, two, three, and two explanatory variables, respectively, were derived. Moreover, the three-layer structure was examined considering the multiple regression models and the correlation between the explanatory variables and other influencing factors. We hope the results will help in planning policy measures and also help university managements in promoting technology transfer.

TE-05.2 [R] Organizing Multi-Cross-Industry Innovation Initiatives: The Case of Connected Living

Alexander Kerl; University of Bremen, Germany
Martin G Moehrle; University of Bremen, Germany

Nowadays, companies from various industries realize that their core business lies in converging technological fields. This development is confirmed by the example of interconnected products which are known as "smart" products. Popular instances are smartphones or smart TVs as well as a relatively new branch that is concerned with smart home solutions. As these smart home solutions are typically developed in unique cross-industry innovation networks, which have hardly been explored so far, we derive the following research question: What type of organizational framework supports collaboration in a cross-industry network environment, and what practices are important for collaboration success? Based on this question, we develop an in-depth case study of Connected Living, a highly active German multi-cross-industry innovation network set up as a non-profit organization of more than 50 participating companies. Our paper is structured as follows: first, we describe the organizational model of Connected Living and the development of the network since its foundation in 2008, before showing which key practices are important for collaboration success in this kind of network setting. Our findings highlight the network's heterogeneous composition which involves the integration of existing members' competitors and companies from distant industries, the management's awareness of a workshop fit, the linkage between publicly funded research projects and the emergence of multi-cross-industry innovation initiatives and the proactive public relations activities as being crucial for collaboration success.

TE-05.3 [R] Using Management of Technologies to Avoid Social Conflicts around the Area of Large Scale Mining Project in Madagascar

Olivier Herindrainy Rakotomalala; University of Antananarivo, Madagascar
Elise Raveloson; University of Antananarivo, Madagascar
Andrianaivomalala Ravalison; University of Antananarivo, Madagascar
Etienne Rakotomaria; University of Antananarivo, Madagascar

The emergence of large-scale mining projects is a lever for economic growth for a country ranked among the poorest in the world as Madagascar. The government supported by donors like the World Bank has taken steps to encourage the investors in this regard. But local communities in the area of implementation of the project can be a barrier delaying or even halting the project. This paper aims to study the interactions between a large-scale mining project and its host environment to better understand the dynamics of this system and find ways to anticipate its future. The mathematical theory of graph was used to model the relational transactions between elements of the system formed by the project and its host community. Then we wrote algorithms and queries on visual basic and pyton to implement the model on a computer system. We found that this software can be a ground surveillance system for the mining company to anticipate possible social conflicts and adjust the action to be taken in time to avoid it.

TE-05.4 [R] Collaboration Structure in Nanotechnology R&D: An Analysis of Organizational Dynamics on the Level of Collaboration and Structural Alliances

Nazrul Islam; The University of Exeter Business School, United Kingdom
Stanley Gyoshev; The University of Exeter Business School, United Kingdom
Daniel Amona; The University of Exeter Business School, United Kingdom

Many consider the nanotechnology field as the key enabling technology, general purpose technology, radical or disruptive technology. As a science-based cluster classified by OECD (1997), nanotechnology is a highly R&D-intensive field and is likely to have a greater level of interaction between actors across sectors. Apart from academic actors, governments and regulatory bodies are aware of possible economic impacts of this field and therefore a significant amount of funds has been allocated for the nanotechnology field. In this study, we analyze how the level of collaboration in nanotechnology R&D projects is influenced by various organizational dynamics, funding initiates and legal origins of these entities. Using data from both qualitative and quantitative sources, we examine the collaboration factors that affect collaboration and structural alliances. Our results show that public organizations

are more prone to the levels of collaborative activities but less capable of collaboration on an international scale, while small- and medium-scale enterprises struggle with having collaborative partners. Also, the more networks a nanotechnology firm has in its value chain, the less likely the collaborative structure is enhanced.

TE-06 Leadership-1
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon F
Chair(s) Marthinus W Pretorius; University of Pretoria

TE-06.1 [R] Future Thinking: The Scarce Management Skill

Anthon P Botha; University of Pretoria and TechnoScene, South Africa
Marthinus W Pretorius; University of Pretoria, South Africa

We are all expert strategists for the now. But what about the future? Seeing that the future lies beyond strategy, it is of great concern that so few leaders have the ability to do future thinking. Future thinking is the ability to mind-time travel into the future, experience that imagined future and back-cast to develop strategies in the present to realize the preferred future. Several futurists have expressed concern about the lack of future thinking skills and an interest in the future among business leaders on a global scale. This applies to corporate boards, executive management, policy makers and academics alike. This research is based on interviews, supported by learnings from executive training and consulting in future thinking. We look at future thinking in terms of recognizing emerging and disruptive technology in time, the ability to integrate the understanding of human behavior inside the workspace and in the marketplace and the ability to make sense of the impact of major events. This paper presents a thought model outlining critical reasons for lack of interest in the future and recommendations to instate future thinking among leadership.

TE-06.2 [R] The role of team member personal style differences in project performance: Does the type of innovation matter?

Zvi H Aronson; Stevens Institute of Technology, United States

Teams are progressively becoming primary in the way employees in organizations conduct work. We examined the role of staff personal style differences in project performance for teams working on incremental and radical innovations. Regression results based on 149 teams suggest that, for employees, conscientiousness and agreeableness, predominantly, seem to be beneficial for NPD project performance. Slope tests promote our proposition that for speed, radical NPD might gain from extra open and stable staff. Further, exceedingly agreeable employees do not seem to provide support when new ideas are fostered, since it could be a precursor to group think and less successful innovation. We provide implications for selection and training of employees assigned to work in innovation teams.

TE-06.3 [R] Continuity in Corporate Governance and Its Relationship with the Company's Performance

Iram Aziz; NAMAL, Pakistan
Muhammad A Choudhary; NAMAL, Pakistan

Continuity of corporate governance of Pakistan International Airlines Corporation is analyzed for the duration of 11 years and is compared with the continuity of corporate governance of Emirates. We have generously benefited from MIT Airline Data Project analytics for employee and aircraft productivity and other measures of financial performance of airlines. PIAC operates under the Federal Aviation Division, and according to the PIAC Act 1955, PIAC's board consists of 11 members including one chairman/managing director, eight directors nominated by the federal government and two directors nominated by the shareholders. During the analysis period, 55 individuals have been changed in the PIAC Board. The governance structure of PIAC is compared with that of Emirates. Emirates has eight main positions in its corporate structure and contrary to PIAC, it has retained its governance structure for many years. In the 11 years of analysis, seven board members are continuing while only one person has changed in the whole duration. The analysis shows the continuity/stability of the governance structure has a strong relationship with the corporate performance and firm's profitability.

TE-08 Social Media-2
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon H
Chair(s) Mavis Tsai; Shih Hsin University

TE-08.1 [R] An Analysis of the Service Ecosystem of the Japanese Pay-television Industry from the Perspective of Service Dominant Logic

Shuji Sudo; Japan Advanced Institute of Science and Technology, Japan
Yasunobu Ito; Japan Advanced Institute of Science and Technology, Japan

The purpose of this paper is to analyze the circumstances surrounding the pay-TV industry in Japan. According to the service dominant logic (SDL) theory, the paper considers the industry as a service ecosystem that is a self-adjusting system of components connected by service exchange. The study analyzes and illustrates the ecosystem using information from audience measurements by TV viewing meter and survey, media marketing research, economic statistics, observation of marketing activities and interviews with businesspersons in the industry. This paper argues that it is meaningful to consider the situations surrounding the pay-TV industry as a service ecosystem that consists of various components such as platforms, cables, satellites, channels, productions, TV sets, set top boxes, and family viewers. This consideration has to lead to a better understanding of the situation where each component is mutually nested. The paper concludes that although competitive video on-demand services on the web are expanding gradually, the coverage rate of pay TV remains stable in the Japanese market. The pay-TV ecosystem embraces strength to survive in the market for the moment due to attributes of audience and its prevention system against churn.

TE-08.2 [R] How the Innovation Diffusion of Facebook Changed Internet Usage and Expression of Public Opinion in Taiwan

Mavis Tsai; Shih Hsin University, Taiwan
Yu-Wei Zhang; Shih Hsin University, Taiwan

Taiwan is a country with fairly high Internet and smart phone penetration. By 2014, more than 70 percent of Taiwanese over the age of 15 owned a smart phone. Using Facebook online or via mobile Internet is gradually an accepted innovation for most Taiwanese, especially for the new generation. This study aims to discover whether the innovation diffusion theory and spiral of silence phenomenon worked on Facebook usage and adoption during the 2016 Taiwanese presidential election. In this study, the researcher launched an Internet survey to get a sample with 485 respondents. Also, the researcher interviewed nine respondents who are enthusiastic voters using in-depth interviewing methods to acquire qualitative data. The research results showed us distinguishing characteristics of those Facebook users or adopters, and how they can use their quasi-statistical organ to get an impression of the public opinion climate on Facebook, and how these factors affected or changed their public opinions expression. The 2016 presidential election in Taiwan was an important social or political movement for Taiwanese. The research results showed the innovation diffusion or adoption of Facebook changed the Internet usage and public opinions expression in Taiwan.

TE-09 Indicators of Technical Emergence-3
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Salon I
Chair(s) Nils C Newman; Search Technology

TE-09.1 [R] Twitter Data Mining for the Social Awareness of Emerging Technologies

Xin Li; Beijing University of Technology, China
Qianqian Xie; Beijing University of Technology, China
Lucheng Huang; Beijing University of Technology, China

Yuan Zhou; Tsinghua University, China

With the rapid development of Internet and information technology, social media has been growing fast. A large amount of social awareness data, which represents the public's sensing and response to emerging technologies, is contained in social media such as Twitter. Analyzing and mining the social awareness data to early detect the future trend of emerging technologies and identify the commercial potential of emerging technologies are crucial for government research and development strategic planning, social investment and enterprises practices. For this reason, this paper proposes a method to analyze the social awareness of emerging technologies based on Twitter data mining. Firstly, the natural language processing module in Thomson Data Analyzer is applied to extract the keywords from the tweets. Secondly, the social awareness information is analyzed by applying text mining and social network analysis, and then the social awareness of emerging technologies is mined by using a time-slicing-based awareness information map. Finally, the perovskite solar cells technology is as a case study to analyze the effectiveness and feasibility of the method.

TE-09.2 [R] Validating the Earlier Analyses and Forecasting on Dye-Sensitized Solar Cells (DSSCs)

Ying Huang; Beijing Institute of Technology, China
Alan L Porter; Georgia Institute of Technology, United States
Yi Zhang; University of Technology Sydney, Australia
Ying Guo; Beijing Institute of Technology, China
Donghua Zhu; Beijing Institute of Technology, China

Newly emerging science and technologies (NESTs) bring numerous innovation opportunities and challenges. At the same time, the highly uncertain dynamics of NESTs pose special challenges to traditional technology forecasting tools. Dye-sensitized solar cells (DSSCs), a promising third-generation photovoltaic technology, can add functionality and lower costs, enhancing the value proposition of solar power generation in the early years of the 21st century. We have analyzed DSSCs' R&D activity patterns and trends through a series of studies in the past several years and come to realize the validation analyses is useful to improve the science, technology & innovation (ST&I) policy processes. Yet, rarely do we revisit forecasts or projections to ascertain how well they fared. One of our aim is to check accuracy, to gain some sense of how valid those studies were and whether they proved useful to others in some ways. Additionally, we want to assess the degree to which such future-oriented analyses did or did not make good use of available information. Moreover, we seek indications of what information is key, and how future-oriented technology analyses (FTA) processes can better utilize such information.

TE-09.3 [R] A Method for Analyzing Practicing Managers' Perception on the Disruptive Nature of Digitalization in Machine-Building Industry

Matti Sommarberg; Tampere University of Technology, Finland
Saku J Makinen; Tampere University of Technology, Finland

The purpose of the paper is to demonstrate a technology foresight method where visual analogue scale is used with an experimental survey design to investigate views and perceptions of possible future disruption caused by digitalization in an established machine-building industry. We demonstrate the usability of the method in detecting differences in future worldviews of practicing managers with results highlighting polarized responses with significant clustering among groups. For example, the respondents that were inclined to view that digital technologies are disruptive, i.e., change the paradigm of value creation in machine-building, also viewed that it is more related to service and business models than products and operation. Digitally enabled concepts like open innovation and industrial internet were perceived to be more disruptive drivers than the digital technologies themselves.

TE-10 Social Innovation-1
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Portland
Chair(s) Dilek Cetindamar; Sabanci University

TE-10.1 [R] Emerging Process of Rural-Based Innovation System: A Taiwan Case Study of 'Yilan Experience'

Sheng-Tsung Hou; Feng Chia University, Taiwan

Recent studies of "regional innovation system" (RIS) are mostly on technology-driven clusters, but few are on demand-driven "rural-based RIS." From the perspectives of value co-creation, there are still few discussed on the rural-based RIS by culture and creative motives. To integrate such a theoretical gap, this study grounds on RIS and PPP (public-private partnership) from the qualitative research approach to interpret the case of Yilan, a rural northeastern county in Taiwan, dealing with poverty and financial burden; it has held a flagship local festival since the 1996 International Children's Folklore & Folkgame Festival to transform its value creation into local economic and social development in the following decades. From the case of Yilan, this study examines the value creation amongst stakeholders from different sectors, and thus induct to the process, approaches, and model of rural-based RIS. Finally, this research elaborates the theories through rural-based RIS, and thus contributes the theoretical and practice implications.

TE-10.2 [R] Social Innovation Assessment at the University Level

Dilek Cetindamar; Sabanci University, Turkey
Berna Beyhan; Middle East Technical University, Turkey

Based on a literature review, this paper points out the need for an assessment model that could account for the social aspect of technological innovations generated in universities. Rather than quantitative metrics, using cases seems an appropriate approach to evaluate social innovations at universities to capture the richness of social impact. We further suggest the consideration of gathering information on four dimensions of social innovation to complement the case approach: (1) the categories of beneficiaries who will benefit from social innovations, (2) the geographic location of impact, (3) the type of social innovations in terms of their output, and (4) the social benefit that innovation will bring. This paper ends with a few suggestions for further studies.

TE-10.3 [R] Shaping City Government Through Effective Technology Management: The Changing Role of Public Libraries

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

Governments and communities increasingly rely on well-managed, accessible technology resources to improve their daily lives. Rapidly-advancing innovation and widespread use of electronics now require rapid adaptation of city services to meet the needs of local citizens. A well-known fixture in the array of city services is the public library. Technological advancements have transformed the needs and expectations of traditional library patrons and have shifted priorities towards effectively managing choices in technology the facility should offer. This study will examine the issues, attitudes, and trends shaping services in public government, specifically the public library. Using data gathered from a survey distributed to 92 patrons of a small, suburban library, we explore the relationship between personal variables such as age, gender, race and level of education and the value library patrons place on services and technologies offered (digitized media, internet access, electronic resources, and so forth). This study will assist government and library professionals in achieving a fuller understanding of the technologies that different demographics prioritize and will assist in guiding decision-making processes for technology implementation and management at a local level.

TE-11 Decision Making-3
Tuesday, 7/11/2017, 16:00 - 17:30
Room: Eugene
Chair(s) Antonie M de Klerk; University of Pretoria

TE-11.1 [R] A Fuzzy-AHP-Based Decision Support System for Maintenance Strategy Selection in Facility Management

K.P. Pun; The Hong Kong Polytechnic University, Hong Kong
Y.P. Tsang; The Hong Kong Polytechnic University, Hong Kong
K.L. Choy; The Hong Kong Polytechnic University, Hong Kong
Valerie Tang; The Hong Kong Polytechnic University, Hong Kong
H.Y. Lam; The Hong Kong Polytechnic University, Hong Kong

In facility management, maintenance plays an important role in the sustainable development of buildings, involving safety, technical, economic and environmental aspects. An effective building maintenance strategy is critical in improving equipment reliability and availability, maintaining a comfortable environment, enhancing energy efficiency and minimizing the life-cycle cost of the building. Hence, a company's competitiveness and profitability can be improved significantly if unintended failure can be avoided. However, in the current maintenance process, maintenance knowledge and expertise are usually very subjective while the conventional approach is not sufficiently systematical to explain the judgement and assessment criteria. In addition, even though applications of optimization approaches in the maintenance process have been considered, exploring acceptable reasoning for vague information, such as costs, risk assessment and expert feedback is lacking, in the consideration of different maintenance strategies. Therefore, in this paper, a fuzzy-AHP-based decision support system (FADSS) is proposed for assisting in the multi-criteria decision-making process so as to determine the most cost-effective and efficient maintenance strategy. To evaluate the proposed system, a case study is conducted regarding building facilities maintenance. It is found that, through formulating the most suitable strategy, the work efficiency can be improved, and the maintenance costs can be minimized.

TE-11.2 [R] The Multi-Criteria Decision Making, A Tool for the Promotion of Technological Inter-Connected World through Digital Decision Making

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

The world is dynamic and requires complex decisions to be made in order to resolve the global challenges. One of the tools, which can be used to assist the analyst and expert decision makers, is multi-criteria decision making (MCDM). The dramatic increase in computer power, both wired and wireless connectivity, and availability of big data have affected the way we make decisions. This paper explores how big data and other technological information may be used to influence the MCDM process. A multi-case study, based on complex decisions made, was used to identify the key indicators to access the level of improvements in accuracy and speed as a result of big data in the MCDM process. The paper also examines the barriers to the successful adoption of big data in decision making and suggests reasons why decision makers should be encouraged to adopt the digital technologies in global decision processes. Recommendations were then made on how to best adopt the e-technology and cyber-infrastructure to the MCDM process. The paper concludes by indicating further areas of research and recommends that the users of big data should increase vigilance at all times.

TE-11.3 [R] Scoring vs. Ranking: An Experimental Study of Idea Evaluation Processes

Shijith Kumar Payyadakkath; IE Business School, Spain
Zhijian Cui; IE Business School, Spain
Dilney Goncalves; IE Business School, Spain

Using an online experiment, this study examines the efficacy of two idea evaluation processes: scoring vs. ranking in the context of innovation management. In the scoring process, the evaluators are asked to rate the quality of each idea by assigning it a score (e.g., from 0 to 100) while in the ranking process the evaluator simply orders all ideas according to their perceived qualities. We find that the scoring process has better idea evaluation accuracy than the ranking process. In addition, our results demonstrate that providing additional information in idea presentation or having domain-specific knowledge can improve the evaluation performance of the scoring process but not that of the ranking process. This enables us to make valuable contributions by addressing contemporary issues and challenges in technology enabled product or service innovation processes.

WA-00 PLENARY - 3

DATE: WEDNESDAY, 7/12/2017
TIME: 08:30 - 10:00
ROOM: SALON E-F
CHAIR: KIYOSHI NIWA; THE UNIVERSITY OF TOKYO

WA-00.1 [K] Becoming Hewlett Packard: Why Strategic Leadership Matters

Robert A Burgelman; Stanford University, United States

Bill Hewlett and Dave Packard invented the model of the Silicon Valley start-up and set in motion a process of corporate becoming that made it possible for HP to transform itself six times over the 77 years since its founding in the face of sweeping technological changes that felled most of its competitors over the years. Today, HP is in the throes of a seventh transformation to secure its continued survival by splitting in two independent companies: HP Inc. and Hewlett Packard Enterprise. This keynote address will discuss the differential contribution of HP's successive CEOs in sustaining the company's integral process of "corporate becoming," an open-ended ongoing process for which there is no grand ex ante plan possible and which unfolds through a series of transformations in the course of the strategic evolution of long-lived companies. A comprehensive strategic leadership framework is used to explain the role of the CEO: (1) defining and executing the key tasks of strategic leadership, and (2) developing four key elements of the company's strategic leadership capability.

WA-00.2 [K] The Rise of Smart, Connected Products and the Challenge to Build Them

Scott Roth; Jama Software, United States

The rise of the development of connected devices is impacting how we travel, how we live in our homes, and the jobs we have. Demand for smart, connected products is growing, and product developers face significant challenges in developing and sustaining successful products. As CEO of Jama Software, Mr. Roth is on the frontlines of product development working with a range of companies from startups to establishment Fortune 100s, and he sees first-hand the immense challenges and opportunities faced by those bringing products to market. Nearly everything about product development is changing, and companies must adapt to these pressures. During his talk, Scott will share new research about digital product design and discuss: • How companies can standardize or optimize their current processes • Designing new technology that is safe as complexity increases and products become more connected • Keys to getting to market faster, with fewer product failures

WB-01 Innovation Management-6
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon A
Chair(s) Marina Dabic; Nottingham Trent University

WB-01.1 [R] Contextual Differentiation of Absorptive Capacity: Empirical and Conceptual Development

Marina Dabic; Nottingham Trent University, United Kingdom
Ernest Vlacic; NOVAMINA, Croatia
Tugrul Daim; Portland State University, United States

This paper is focused on the research and operationalization of the absorption capacity in technology driven firms with a particular focus on their technology-based innovation performances, which is widely recognized as a means of achieving and maintaining the firms'

competitive advantage. Although research in the field of absorption capacity was globally initiated more than two and a half decades ago, the same was not at all the case with Eastern European firms. Considering that, the research objective of this paper arises: what is the level of the absorptive capacity in technology driven Croatian firms and how does it catalyze their innovation outputs? Our specific objectives are to measure the integrated level of the absorptive capacity (ACAP) with respect to all its constituent components: assimilation, acquisition, transformation and exploitation. Such an ACAP measured value will be tabulated against the innovation outputs of firms and their business performances. To achieve these objectives a selected population of more than 200 Croatian firms that are dealing in technology development was defined as a sample and asked to fill out the questionnaire. Forty five of them that have fully responded were tested against formulated hypothesis, ultimately proving that the higher level of ACAP is somehow positively driving their innovation performances.

WB-01.2 [A] Innovation Management: A Need-Centered Optimal Joint Investment Approach

Oliver Yu; San Jose State University, United States

With exponential advances in technology innovations, effective management of innovation has become imperative. Existing literature on innovation management has largely focused on managing product, project, and operations or on motivating creativity in the innovation process. This paper presents an alternative integrated and systematic approach that focuses on managing the needs of all major participants of the innovation process - the idea generator, the core team, the supporter, and the adopter - to achieve an optimal joint investment in the development and implementation of a creative idea. Based on this approach, innovation management consists of three key elements: (1) productive creativity that uses the understanding of needs to motivate idea generation that will effectively respond to the needs of the other major participants; (2) impactful marketing that uses the understanding of the needs to effectively communicate and persuade the acceptance of the creative idea by the other major participants; and (3) adaptive organization that uses the understanding of the needs to develop flexible and sustainable structure and culture of the organization to effectively adapt to changes in the environment as well as challenges to the organization as it grows and matures with time. For each key element, the paper outlines the basic concepts, specific tools, and case examples for its successful accomplishment, and explores future areas of research.

WB-01.3 [A] Market Based Innovation for Sustainable Competitive Advantage

Wilson Zehr; Eastern Oregon University, United States

New technology and product-based innovation are important catalysts for new markets. However, as nascent markets mature, imitation becomes rampant, products become more commoditized, and firms must shore-up their value proposition to avoid strictly cost-based (scorched earth) competition. The term used in marketing to describe this is "differentiation." The essence of differentiation is turning the dials of the marketing mix (product, people, price, place, promotion) to create an offering that is the most attractive to current or potential customers. In order to differentiate, the mix must be "different" in a very good way - that means in a way that is both important and valuable. Creating this type of game-changing differentiation requires innovation - creating unique offerings with an unmatched and previously unseen value proposition. This process is called market-based innovation. When market-based innovation is based on the core competencies of an organization, then it can also lead to sustainable competitive advantage. Of course, sustainable competitive advantage is the key to market domination over the long haul. In this paper we will discuss several examples of successful market-based innovations and explore techniques for putting these principles to work in any organization.

WB-02 Entrepreneurship/ Intrapreneurship-2
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon B
Chair(s) Gianluca Zanella; University of Texas at San Antonio

WB-02.1 [R] Culture and Social Capital: Effect on the Growth of Small Medium Enterprise

Gianluca Zanella; University of Texas at San Antonio, United States
Cory R. A Hallam; University of Texas at San Antonio, United States
Carlos Alberto Dorantes; Tecnologico de Monterrey Campus Queretaro, Mexico

We examine the role of intra-firm and inter-firm's social capital of small and medium enterprises, and in particular we focus on micro and small software (MSS) firms. More specifically, we develop a conceptual model of the impact of intra-firm and inter-firm social capital on the performance and evolution of MSS firms. This model aims to explain the great performance differences between MSS firms in different regions of the world. We thus explore the social fabric in which software companies are embedded, affecting their growth and development in the market. Unlike existing theoretical models of social capital, the current theoretical framework proposed in this paper a) decomposes social capital based on the nature of inter-firm and intra-firm social ties, b) includes the firm leaders' uncertainty avoidance as a precursor of the nature of firm social ties, and c) includes the national culture dimension of individualism/collectivism as an important moderator of the effect of intra-firm social ties on firm performance.

WB-02.2 [R] Efficiency Assessment of the Social Capital Capacity on Entrepreneurial Activity: A Perspecive Driven from Social Media

Arash Hajikhani; Lappeenranta University of Technology, Finland

Innovation is the main engine of a sustained economic growth that leads to a vibrant economy. Meanwhile, the large and diverse array of participants and resources are constructing an ecosystem where the synergies contribute to ongoing innovation and flourish in a modern economy. One major dimension of a healthy innovation ecosystem is illustrated in the social-economical aspects of society known as entrepreneurship. Our research concern is to capture the efficiency of social capital capacity towards entrepreneurship-oriented activities in society at large. The approach is to look at the perspective in the form of an input and output where inputs are the governmental efforts for educating human capital in the society and the output is the entrepreneurial-oriented activities and desires. Special focus was given to social network services in order to capture entrepreneurial activity as well as leverage established reports in the benchmarking practices. The level of analysis is country level by looking at a sample of European countries. In order to assess the efficiency of input efforts to be transformed into output, we utilized a non-parametric method dominant in operation research and economics known as data envelopment analysis (DEA). Efficiency measures are calculated which generate a new scale and ranking accordingly, with an emphasis on efficiency rather than proficiency of social capital capacity.

WB-03 Strategic Management of Technology-3
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon C
Chair(s) Caren Weinberg; Ruppin Academic Center

WB-03.1 [R] Growth Strategies for an Indian IT Brand in Europe: The Case of Tata Consultancy Services - Hungary

Bala Mulloth; University of Virginia, United States
Bharat Rao; New York University Tandon School of Engineering, United States

In this business case study, we aim to describe the growth and transformation of Tata Consultancy Services (TCS) in Hungary. TCS was originally an Indian IT company founded in 1968 and part of India's prestigious Tata Group. It was a world leading technology consultancy, IT services and solutions and business process outsourcing organization serving customers located in 51 countries across six continents. TCS' first Global Delivery Center was established in Budapest, Hungary, in February 2001. The aim of this center was to cater the needs of the global services market by providing near-shore services. It was specifically designed to cater to the needs of European companies looking for flex-

ible and agile services such as those provided by Indian IT service providers along with a closer cultural fit. The case describes some of the unique characteristics of the Hungarian Center and the steps that the Tata senior management based in Budapest took to further the growth and development of the Center. Some of the potential teaching objectives of the case include: a) understanding the growth and evolution of the TCS brand; b) fostering innovation and developing new initiatives within a large services global center; c) managing the challenges and opportunities of a technology-based global delivery model, combined with a multi-location strategy.

WB-03.2 [R] Firm vs. Individuals: The Case of an Acquisition of TTPCom and Motorola

Caren Weinberg; Ruppin Academic Center, Israel

For nearly half a century scholars and practitioners have been looking for an integrative theory to expand the success of mergers and acquisitions (M&A). Most research, however, reports that M&A's are invariably unable to live up to their expected value. This research reviewed acquisitions of technology-based firms and identified the most significant factors affecting their desire to follow M&A as an exit strategy as well as its impact and results. The case study presented is one of a number of cases collected from technology startups acquired between 2000 and 2005 in the ICT sector. Using semi-structured interviews, observations and secondary sources, the case provides rich details of the acquisition and its outcomes. The conceptual framework that guided the original study integrated a wide range of theories, including those of strategic management, M&A in general, organizational studies, international business management and technology management. The key finding highlights the importance of the individual verses the firm as a variable both in research as well as when approaching M&A scenarios in industry.

WB-03.3 [R] Study on the Development of Human Resources in Science and Technology in China

Hui Luo; National Academy of Innovation Strategy, CAST, China
Yuanxi Huang; China Association for Science and Technology, China
Linjia Zhao; China Association for Science and Technology, China

Human resources in science and technology (HRST) is an important component of innovative talents. The amount, structure and efficiency of HRST in a country determine the strength of national innovation and potential development in the science and technology field. In China, the amount of HRST reached 81.14 million, ranking the first in the world until the end of 2014. Obviously, the main body of HRST in China is the young people with the average age of 33.73, which means that China has entered the "golden age of HRST bonus" release. The education level of HRST in China is gradually improving, and the proportion of bachelor degree owners in the future will be increasing. Highly educated HRST are mainly gathered in the fields of education, public management, science and technology, and financial. However, there are still some problems of concern in the process of HRST development and utilization in China. They are mostly on the aspects of the relationship between the quality and efficiency, the differences among regions and the lack of global HRST utilization. Suggestions about how China develops its HRST better are discussed, combined with some specific foreign countries' experience in the whole critical thinking process. HRST is the richest and most precious strategic resource. Thus, the more China develops and utilizes its HRST fully, the more the positive impact of HRST can be raised and released. In other words, the full use of HRST could help with China's new drive of participating in international competition, and new vigor to accelerate innovation-driven development strategy and science and technology innovation-centered comprehensive innovation.

WB-04 Technology Management in the Energy Sector-1
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon D
Chair(s) Jan-Harm C Pretorius; University of Johannesburg

WB-04.1 [A] Utilizing IEC61850 Standard and the Generic Object Orientated Substation Event Facility in Modern Protection and Control Devices

Tumelo Motsei; University of Johannesburg, South Africa
Louwrence D Erasmus; University of Johannesburg, South Africa
Jan-Harm Pretorius; University of Johannesburg, South Africa

IEC61850 technology has proved to be the future of communications in the power system protection environment. The numerous benefits of IEC61850 overshadow what the current widely used DNP3 technology has to offer. This paper is concerned with the investigation of the electrical protection communications technology which will be most beneficial to power utilities. In evaluating the two communication design alternatives, IEC61850 and DNP3, the research relied on theory, laboratory experiments, probability models and equipment purchase data. Analytical analysis of the two designs was carried out using a Monte Carlo approach whereby the stochastic weights of the seven evaluation criteria used in this research were presented as inputs to Monte Carlo analysis. The simple additive weighting (SAW) strategy was employed as a deterministic model within Monte Carlo to evaluate the probability of IEC61850 being the most preferred technology over DNP3 or DNP3 over IEC61850 conversely. Three worst-case scenarios of preferences were used during Monte Carlo evaluation. It was found through statistical analysis of the analytically obtained overall results that the probability of DNP3 technology being beneficial over IEC61850 was 0.54 in one of the worst-case scenarios. In the other two worst-case scenarios, the probability of IEC61850 being the most desirable technology was found to be 0.52 and 0.59.

WB-04.2 [R] Residential Customer Satisfaction Performance Assessment Model for Electricity Service for a Power Utility in Brazil

Angela M Catapan; Copel, Brazil
Eduardo K Yamakawa; Institutos Lactec, Brazil
Luciano C Siebert; Lactec, Brazil
Alexandre R Aoki; Lactec, Brazil
Edson P de Lima; Kaizen-do, Brazil

Measuring organizational performance is a necessary condition for improving management systems and the achievement of companies' strategic objectives. To evaluate customer satisfaction has been a challenge for companies since high levels of satisfaction correlate with high levels of performance. Particularly in the provision of public services such as water, sanitation, gas and energy, it can assess the level of consumer satisfaction with power utilities. The design of the performance measurement system model and the respective formulation of its indicators is, therefore, a critical element in the design of the service operations management system. Performance evaluation in utilities' services is strongly connected to customer satisfaction. This work presents a literature review of customer satisfaction and performance evaluation and a set of performance measures to form the customer satisfaction for electric power supply services. The main result is a framework regarding the performance indicators to be monitored for electricity services customer satisfaction, the frequency of measurement, the frequency of review, who is responsible for the measurement and the source of data.

WB-04.3 [R] Evaluating a Potential Dominant Design for Selective Catalytic Reduction of NOx in Light Diesel Vehicle Exhaust Gas

Dumisani Mkhwanazi; University of Pretoria, South Africa
Jasper L Steyn; University of Pretoria, South Africa

The potential was investigated for selective catalytic reduction technology developed by a major catalytic converter manufacturer to become the dominant technology for light diesel vehicle catalytic converters. The dominant design framework was used to analyze the potential for major change in the industry. A new dominant design enhances the market share of the innovating entity, while disrupting the businesses of competitors and suppliers. The technology, developed by Johnson Matthey, replaces platinum group metals with copper and iron as catalysts, without the need to add reducing agents such as urea. It offers significant cost and performance benefits over competing systems in a substantial global market segment. The case study method was used, employing public domain documentation and structured questionnaire interviews of engineers, chemists and technologists of Johnson

Matthey in England, Japan and South Africa. It indicated that the company's selective catalytic reduction technology does offer significant cost and performance benefits over known competing technologies. It has the potential to become the dominant technology in removing NOx from light vehicle diesel engine exhaust gases. Regarding technology management, it was found that the innovation was directed at meeting regulatory imperatives and resulting demand from established customers rather than to achieve a dominant design.

WB-05 Intellectual Property-1
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon E
Chair(s) David Guemes-Castorena; Tecnologico de Monterrey

WB-05.1 [R] A Real Option Based Model for the Valuation of Patent Protected Technological Innovation Projects

Roberto D Hernandez-Garcia; Tecnologico de Monterrey, Mexico
David Guemes-Castorena; Tecnologico de Monterrey, Mexico
Idalia E Ponce-Jaramillo; Tecnologico de Monterrey, Mexico

Decision tree analysis and internal rate of return do not properly take into account uncertainty and flexibility, which are crucial for both valuating a project and the related decision-making process. Usually, uncertainty has been regarded as a factor that needs to be eliminated; nevertheless, real option analysis (ROA) recognizes that it may generate value. Similarly, managerial flexibility is usually not taken into account; however, it is possible and necessary to valuate it, since it allows managers to decide on the investment, or disinvestment, in a project as time unfolds. Despite the advantages of using ROA, it is still not widely used among decision-makers. Consequently, the present research proposes the development of a model based on real options that supports decision-makers in the valuation process of uncertain projects. The model, originally developed by Schwartz and later adapted and modified by Ernst, Legler and Lichtenthaler, is used as a baseline. The objective is to develop a tool (by simplifying the previous models) that can be easily and intuitively used by decision-makers to valuate patent protected technological innovation projects. Accordingly, its main users are expected to be technology transfer offices, which can use it as a tool that supports the decision-making process of investing in risky projects for its further commercialization. The main results of the model are the probability distribution of the project value and the percentage of times that profit are generated, which are critical factors when deciding to invest in a project.

WB-05.2 [R] Early Future Technology: Using Artificial Intelligence to Manage Design-Driven Intellectual Property

Raphael Arar; IBM Research, United States
Ray Strong; IBM Research, United States

This paper addresses an area of the management of innovation characterized by the problem that the time from conception of an idea to its realization as innovation is often unpredictable. We address the question of what to do with intellectual property that is ahead of its time. How can a company make the best use of ideas that may take years to reach economic feasibility? We speculate on a comprehensive solution. In this paper we take two very limited steps toward solving the problem: (1) we provide an ostensive definition, and (2) we offer a speculative description of a solution. We refer to our examples as "early future tech". We provide three case-study ideas that fall into this category: (1) context-aware user interfaces, (2) topic bridging in automated conversation and (3) recommendations based on flexible user profiles. We survey existing techniques for revisiting such ideas and discuss their benefits and limitations. The paper concludes by describing a signpost-based method that the authors speculate will enable automated trend-listeners to alert the asset owner that the intellectual property meets a relevance threshold of business value. This proposed method could effectively reduce the costs of managing the pipeline of early future technology.

WB-05.3 [R] Venture Capital and Patent Activities in China

Ying Guo; Beijing Institute of Technology, China
Li L Zhang; Beijing Institute of Technology, China
Yue Qian; Beijing Institute of Technology, China
Chao Yang; Beijing Institute of Technology, China

Patents signal a start-up's technological and innovative capability. Venture capital (VC) investors can evaluate the true potential and behavior of start-ups through their patents. While VC would have an effect on enterprises' innovation output, the detailed interaction between VC and patent activities in China is different and attractive. This paper explores this relationship on two levels, describing the overall investment of China as descriptive analysis and multi-case study as exploratory analysis. We first got a full-view perspective of VC investment amounts and industry distribution in China. Then we looked at 57 companies in the bio-pharmaceutical industry and divided them into four groups: already in a good track when getting VCs, holding patents when the companies are founded, getting innovation (patents) by mergers and acquisitions, and don't care patents much. By analyzing the interaction between VC and patent activities of four typical companies, we got four characteristics, which could be referenced by both companies and investors in making decisions.

WB-06 Science and Technology Policy-2
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon F
Chair(s) Mark J Ahn; Portland State University

WB-06.1 [R] Working Motivations of Service in Academia

Takashi Onoda; JAIST, Japan
Yasunobu Ito; JAIST, Japan

The Japanese public research establishment plays a significant role of "innovation hubs" in which shared and core facility functions as research infrastructures under the 5th Science and Technology Basic Plan since 2015. The innovation hub emphasizes its functions as services in academia where collaborations between industry and academia have been promoted and core facilities have been shared. Prior research has already highlighted merely service elements which emphasize an efficiency and usability for external users, so they cannot show scientists' and coordinators' subjective and autonomous working motivations and incentives of service in academia because almost all have Ph.D. degrees and aim to contribute to the academic community. This paper demonstrates and challenges how scientists and coordinators who engage in service activities in a shared and core facility have incentives and motivations for the sharing services. Especially, we focus on their epistemic cultures in mental conflicts and its solutions for sharing facility, referring to the ethnographic data and the interviews in the Japanese NMR facility.

WB-06.2 [A] Improvement of R&I Policies and Systems for Enhancing the Life Cycle Planning and Integrated Management of Research Infrastructures in Taiwan

Hai-Chen Lin; STPI, National Applied Research Laboratories, Taiwan
Hui-Fang Li; STPI, National Applied Research Laboratories, Taiwan
David Walther; RSPRC, National Taiwan University, Taiwan

This research is about applying life cycle analysis in evaluations of research and innovation policy, especially for research infrastructures. It focused on gaining insights of management challenges or issues of research infrastructure in Taiwan by using scanning of previous policy documents, interviews and a focus group with stakeholders. The result found that many issues were derived from lacking of life cycle consideration and the integrated management mechanism for research infrastructure. For filling the gaps, some possible improvements for R&I policies and systems were proposed. By using life cycle analysis in our evaluations, it can provide an efficient and systematic framework for exploring and organizing the challenges or issues of research infrastructure. Also, it may help to induce identifying of the root cause from the upstream phase along the life cycle and contributes to designing of proactive actions instead of just reactive ones.

WB-06.3 [R] An Analysis on Characteristics and Impacts of Chinese Highly Cited Researchers' Transnational Mobility

Yun Liu; Beijing Institute of Technology University, China
Fangjuan Yang; Beijing Institute of Technology University, China
Jinyi Gu; Beijing Institute of Technology University, China

In the trend of globalization of science and technology (S&T), there has been a sweeping flow of high-level scientific and technological talent (HSTT). Training and recruiting HSTT is a strategic choice of all countries and regions of the world to gain international competitive advantages. In order to make full play to the role of HSTT in the development of economy and society, China has implemented an open policy and mechanism to press ahead transnational construction of HSTT in an all-round way. This paper focuses on HSTT, which is represented by Chinese highly cited researchers (CHCR). Firstly, this paper summarizes the characteristics of CHCS's transnational mobility from the views of form, stage, direction, scale, frequency and time on curriculum vitae analysis. Secondly, this paper built econometric models to measure the influence of CHCR's transnational mobility on international co-publication and scientific research productivity.

WB-07 Project/Program Management-1
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon G
Chair(s) Leon Pretorius; University of Pretoria

WB-07.1 [R] Engineering Consultant Project Cash Flow Controls: An Empirically-Supported System Dynamics Conceptual Model

Alfred M Chitongo; University of Pretoria, South Africa
Leon Pretorius; University of Pretoria, South Africa

Extant literature shows different measures for business performance of a "for-profit" organization, including both financial performance and non-financial dimensions. Key financial performance measures, evident in existing literature, include: profit; revenue; cash flow; and return on investment, among others. Some previous scholars highlighted that without a healthy cash flow, an organization can fail to sustain itself, even when it records huge profits and high return on investment. This paper explores further the issue of cash flow, as a key financial (and business) performance measure, with a particular focus on controls taken by an engineering consultant during the design stage of project execution when he/she forecasts a project cash flow shortfall. A system dynamics conceptual model of the engineering consultant's project cash flow controls (and their associated unintended and undesirable effects) is formulated, in this paper, from existing literature, mental models of contemporary project managers (from an engineering consulting firm with many infrastructure projects in South Africa), and systems thinking. Results suggest some counterintuitive dynamic hypothesis: controls taken by an engineering consultant (aimed at increasing his/her project cash flow) when he/she forecasts a project cash flow shortfall tend to generate some unintended and counteractive effect - a reduction of the engineering consultant's project cash flow.

WB-07.2 [R] Continual PM Self-Growth Model: Utilizing the PM Competency Evaluation Sheet

Yumiko Miyake; Japan Advanced Institute of Science and Technology, Japan
Naoshi Uchihira; Japan Advanced Institute of Science and Technology, Japan

As business things change rapidly, various issues occur. It is important to resolve these issues by projects. Therefore, it is necessary for an organization to develop a project manager (PM) to be in charge of the projects to achieve success. For PMs, it is not enough to only study project management. Based on the knowledge of project management, it is necessary for a PM to practice projects and gain personal and practice competencies. Therefore, PMs have to have continuous training and practice to gain competencies. Also, it is important for PMs to evaluate their competencies at their optimum time, and set the next goal for the continual growth. Especially, during training to gain the competencies, it is necessary to evaluate the competencies of a PM. As for the human resource development of the PMs, there are not many cases where the self-evaluation and the visualization of competency are combined. This paper proposes "Continual PM Self-Growth Model" with the self-evaluation of the competencies utilizing PM competency evaluation sheet at their optimum time between the outcome of training and the self-study. In this study, the model has been verified by PMs.

WB-08 Educational Issues-1
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon H
Chair(s) Kem Ramdass; University of South Africa

WB-08.1 [R] Work-Integrated Learning: A South African Challenge in a Dynamic Environment

Kem Ramdass; University of South Africa, South Africa

Changes in the global economy have enabled the requirement for flexibility, adaptability and innovation that have led to new education and training demands in order to remain competitive. The most significant demand is the proposed need for a highly skilled labor force that has the ability to employ new knowledge, technologies, improvement methodologies and ultimately add value to existing goods and services in a socially changing environment. Essentially, these skills and capabilities are developed through a broad general higher education system. The clothing industry is a hands-on industry where rapid change has occurred within the past few decades in terms of production, technology and skills application. It has evolved into a multi-faceted industry that is not only concerned with the manufacture of clothing but also the systems of production, distribution, diffusion, reception, adoption and consumption which drive the clothing industry. The objective of this paper is to highlight the importance of work integrated learning in a socially challenging environment through a case study methodology. The link between theory and practice is vital for the progress of technological improvements in industry. Therefore, this study impacts technology management in a colossal way.

WB-08.2 [R] Survey Analysis for Workplace Management of Universities' Research Managers and Administrators

Shin Ito; Tokyo University of Agriculture and Technology, Japan
Toshiya Watanabe; The Univeresity of Tokyo, Japan

Universities and public research institutions play an important role in national innovation systems. Not only researchers but research managers and administrators contribute to innovation management as well. Because of the expertise and the diverse tasks of research managers and administrators, they are required to share their advanced knowledge and skills with each other. Thus, appropriate collaboration among them at their workplace and the organizational design for the collaboration are critical key elements. This study aims to investigate the relationships between organizational design, skills, and performance of research managers and administrators. In order to clarify the research topic, a questionnaire survey for research managers and administrators in Japanese universities and public research institutions was conducted. A total of 401 usable responses were obtained and the results of analysis on them statistically indicate that both organizational design for collaboration and skills have a significant impact on performance. These findings contribute to the development of work process of innovation-oriented universities and institutions.

WB-08.3 [R] The Role of Social Support in Teachers' Intention to Use ICT Tools in Their Classrooms

Naomi Zeitouni; Holon Institute of Technology, Israel
Irena Milstein; Holon Institute of Technology, Israel

Though the advantages of information and communication technology (ICT) in education are unequivocal, the current level of ICT integration in teaching and learning practices is still not enough. The literature stresses the importance of teacher education in this lengthy

process. This study proposes a model to examine the effect of social support provided by workshops on the school teachers' willingness to incorporate ICT into their classroom routines. Survey data was collected from 161 elementary school teachers that participated in a workshop organized by a government agency. Results show that only informational support of the workshop is positively related to the perceived fitness of ICT tools and the teachers' intention to adopt them.

WB-09 Indicators of Technical Emergence-4
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Salon I
Chair(s) Ying Huang; Beijing Institute of Technology

WB-09.1 [R] Patent Network Analysis for Identifying Technological Evolution: A Case Study of China's Artificial Intelligence technologies

Lu Huang; Beijing Institute of Technology, China
Wen Miao; Beijing Institute of Technology, China
Yi Zhang; University of Technology Sydney, China
Huizhu Yu; Beijing Institute of Technology, China
Kangrui Wang; Beijing Institute of Technology, China

The identification of technology evolution is a crucial way to assist in technology management. Since modern technology has become more and more complex and dynamic, general statistical techniques can hardly capture the underlying information of technological interconnection in the process of technology evolution. However, complex network analysis can be considered to be a powerful tool to investigate this issue. At the same time, patent documents containing rich information to indicate technological evolution in sequential time period can be significant data sources. This paper constructs technological networks, based on the core terms derived from patent documents, to present technology distribution. The comparison between the networks of sequential time periods provides a way to understand technological evolution in detail, which can not only help understand the development of selected technologies quickly but also contribute to the research and development (R&D) plan of technology commercialization. A case study on the evolution of China's artificial intelligence technologies is conducted to demonstrate the feasibility of this method.

WB-09.2 [R] Explore the Dynamics of an Emerging Technology Through Research Networks: The Case Study of Triboelectric Nanogenerator

Haoshu Peng; Shanghai Advanced Research Institute, CAS, China
Arho Suominen; VTT Technical Research Centre of Finland, Finland

The decision of researchers to endeavor in a specific field of study is an interesting vantage point to the emergence of a technology. The growth of a research community in size and persistence is an especially important indicator of the vitality for a new field. This study looks at an emerging technology, Triboelectric Nanogenerator, invented in 2012. It is an energy harvesting technology which converts ambient mechanical energy to electricity. It has significant commercialization potential in self-powered systems for personal electronics, environmental monitoring, medical devices and even large-scale power facilities. This study aims to identify the emergence of the technology through research community indicators, analyzing the research network of Triboelectric Nanogenerator. The four-year publication abstract data of TENG studies was extracted from the Web of Science and analyzed using VantagePoint, Python Script and VOSviewer. Based on the analysis, we discuss origin and dynamics of the research network indicators and their usefulness in analyzing emergence through researcher population growth. The findings show the importance of leadership and geographic proximity of the top authors in shaping the community of a new field. Also, co-author numbers vary as more collaboration occurs among researchers with different research interests. Finally, the changing number and structure of funding organizations indicate the impact that government and industry funding has in boosting the development of a new technology. Especially, the support from industry in the early days of an emerging technology may indicate great potential in researchers' enrolment. The findings provide a new perspective to evaluate emerging technologies.

WB-09.3 [R] Typology of Business Models for Adopting Grid-Scale Emerging Storage Technologies

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

Electricity grids are nowadays facing various market and technological challenges that influence their reliability and profitability. As a viable solution to those challenges, energy storage technologies provide multiple service delivery along the electricity grid value chain. In addition to their role for penetration of renewables in future of electricity grid, electricity storage technologies possess a number of societal and environmental benefits, such as reducing carbon footprint and securing regional energy demands. The primary challenge for utilities and regulators, however, is to find a business model that best fits to technology, application, and regional electricity market. We propose a typology of different business models for adopting energy storage technologies among utilities. The business model frameworks are tailored to provide a customized analysis platform for adopting emerging energy storage technologies. For industry looking to adapt new energy storage technologies, such analysis can provide multi-dimension considerations (cost, efficiency, reliability, best practice business operation model, and policy instruments), which can potentially lead to complete view for strategic decision making purposes.

WB-10 Knowledge Management-3
Wednesday, 7/12/2017, 10:30 - 12:00
Room: Portland
Chair(s) Alisa Kongthon; National Electronics & Computer Technology Center

WB-10.1 [R] Roles and Positions of Knowledge Flow of Companies in the Silicone Hydrogel Contact Lens Industry

Fang-Pei Su; Chaoyang University of Technology, Taiwan
Kuei-Kuei Lai; Chaoyang University of Technology, Taiwan
Ming-Chung Yang; National Chin-Yi University of Technology, Taiwan
Chien-Yu Lin; National Yunlin University of Science & Technology, Taiwan
Yunn-Kuen Chang; Chaoyang University of Technology, Taiwan
Chia-Chun Liu; Chaoyang University of Technology, Taiwan

Silicone hydrogel contact lens manufacturers do not only invest in research and development but also absorb the technical knowledge of their competitors. It is an important issue to recognize the position and role on the technological network. This study first combines the in-degree centrality, out-degree centrality, and eigenvector centrality of the patent search network into two variables of activeness and passiveness by principal component analysis. The authors then decide on cluster counts and classify all companies into these clusters by a two-stage analysis. The first stage contains variance ratio criteria and 1-way MANOVA to decide on three clusters and the second-stage groups by Activeness and Passiveness as cluster variables of K-means clustering and tests significance of these three positions by MANOVA. This study finds out that the roles of these three positions are knowledge absorber, knowledge producer and knowledge inertia.

WB-10.2 [R] Knowledge Converter(s) Within Knowledge Flows of Patent Citation Network: Evidence from Patent Lawsuits of Smartphones

Yu-Hsin Chang; Chaoyang University of Technology, Taiwan
Kuei-Kuei Lai; Chaoyang University of Technology, Taiwan
Chien-Yu Lin; Yunlin University of Science and Technology, Taiwan
Wen-Goang Yang; Chaoyang University of Technology, Taiwan
Pei-Jie Shih; WuFeng University, Taiwan
Chia-Chun Liu; Chaoyang University of Technology, Taiwan

Prior studies provided a model to categorize technological companies into Knowledge Absorbers, Knowledge Producers, and Brokers Based on Producing Knowledge, and Brokers Based on Absorbing Knowledge. The model is based on the betweenness centrality of patent citation network and O-I index which is the difference between out-degree centrality and in-degree centrality divided by the sum of them. However, this study has found that the

model might fail when the O-I index approaches zero. If a company's O-I index approaches zero and its betweenness centrality is high, its out-degree centrality and in-degree centrality will be high. The company within this zone produces and absorbs more knowledge. This kind of company is called "Knowledge Converter." The result shows that knowledge converters are key players in the smartphone industry.

WB-10.3 [R] Exploring the Antecedents of Facebook Check-in Service on Sharing Intention

Jung-Jung J Chang; Hsing Wu University, Taiwan
Chun-Hua Hsiao; Kainan University, Taiwan
Chien-Hung Lin ; Kainan University, Taiwan

Facebook is currently considered as one of the largest and fastest growing social networked community on the Internet. Location-based service (LBS), one of the Facebook check-in functions, provides various services of location related and value-added applications. The study explores the antecedents of users' reuse intention and sharing willingness in the context of Facebook check-in usage. To achieve the research purpose, 495 effective questionnaires were collected for analysis by the structural equation modeling technique. The results demonstrate that utilitarian motivations have a stronger relationship with behaviors intention and hedonic motivations have a higher relationship with sharing willingness. Social media providers should ensure the quality of service content. We also find that perceived price value is correlated with both behavior intention and sharing willingness. The study provides an in-depth understanding of consumer behavior in social network environment. The authors also discuss the managerial implications of the empirical results.

WB-10.4 [R] The Study of Classification on Patent Decisions: The Cases from U.S CAFC

Wen Ling Hsu; Chaoyang University of Technology, Taiwan
Yun Ken; National Taiwan University of Science & Technology, Taiwan
Fang-Pei Su; Chaoyang University of Technology, Taiwan

In the business environment of a knowledge-based economy, patents are a key factor that influences the competition and development of the high-tech industry. Taiwanese technology manufacturers, which are vital players in the global market, have been frequently accused by large foreign enterprises of patent infringement. Intellectual property lawsuits in the United States attract wide international attention because of the country's market size and the prestige of its court opinions regarding patent lawsuits. Therefore, this study examined the types of issues involved in various litigations among U.S. patent lawsuits, and expanded complete patent decision networks to investigate key cases and the issue development path. This facilitates the understanding of U.S. court opinions and the preparations for relevant management practices. In addition, the objective of this study was to develop an analysis method by using a law database to collect 1,313 patent decisions issued by the U.S. Court of Appeals for the Federal Circuit between 1997 and 2007. The concept of co-citation in citation analysis was employed to interpret the foci of patent decision litigations in recent years. Following classification, the litigation issues were confirmed by U.S. patent attorneys to ensure that the classification method and logic used in this study possess practical validity. The purpose of this study is to provide future patent decision researchers with a systematic perspective and focused reading so that they can efficiently select the most appropriate patent decision classification method.

WD-01 Innovation Management-7
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Salon A
Chair(s) Kazuhiko Itaya; Tokyo University of Agriculture and Technology

WD-01.1 [R] Function of Ba of Meta-Engineering for Creating Innovation

Yasutoshi Komatsu; Watanabe Co. Ltd., Japan
Hiroshi Suzuki; Japan University of Economics, Japan

The authors have proposed the MECI cycle as a fundamental process for realizing innovation. The MECI cycle is founded on Ba (roughly meaning "field"). The Ba concept was proposed by Nonaka and Konno as a context shared among Ba participants, and by Carlson and Wilmot as an innovation team. The function of Ba they described is limited to interactions or communications among participants, however, even though Ba has diverse functions. The authors regard Ba as classifiable into three categories: Ba of catalysis, Ba of group working and Ba of networks. Different types of Ba influence innovation in different ways. In Ba of catalysis two ideas react through a catalytic effect of Ba to create a new idea for innovation. In Ba of the group working, participants share their context and commitment, and are coupled tightly by communication. Everyday discussion fosters a sense of unity, which strongly promotes development. In Ba of networks, many participants exchange their information every day using the internet. They are loosely coupled by communication. Their innovation can be truly democratized. Results suggest that innovations created in the Ba of networks will be dominant in future efforts.

WD-01.2 [R] Ambidexterity of Innovative Capability and Economic Performance

Ssu-Hua Chen; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

The economic performance of countries is defined as an assessment for a country of its success in global markets related to its knowledge base, innovative capabilities and overall market strength. Technological diversification is considered as one of the factors of economic growth. Therefore, the article investigates the extent to which technological diversification affects economic development and how capabilities approach economic performance of a country. Technological diversification is a phenomenon that extends a firm's technology base into a wide range of technology fields. Whereas previous studies have provided insights into the connection between technological diversification and firms' performance, little is known about the influence of technological diversification on countries' innovative performance and trends. The purpose of the paper is to examine the relationship among technological diversification and economic performance at country level. A heuristic framework for depicting how a country's capability interacts with its economic growth is proposed in this study to contribute to technology and innovation management.

WD-02 Entrepreneurship/ Intrapreneurship-3
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Salon B
Chair(s) Gianluca Zanella; University of Texas at San Antonio

WD-02.1 [R] Technological Opportunity Detection and SMEs

Dante B Castro Solano; Tecnologico de Monterrey, Queretaro Campus, Mexico
Cory R. A Hallam; University of Texas at San Antonio, United States
Gianluca Zanella; University of Texas at San Antonio, United States

Technological entrepreneurship is associated with innovation, economic development, and great return on investments for stakeholders. However, creation and development of new patents and technologies do not automatically ensure value creation. The key challenge is to discover and exploit the opportunity of new products or services through the entrepreneurial process. The focus of this research is to explore the effect of entrepreneurial alertness on the corporate environment to provide knowledge about the mechanism of opportunity detection. A mix of individual traits and organizational factors is explored surveying CEOs and executive managers of 276 SMEs. The findings provide evidence of a two-level process through the corporate environment.

WD-02.2 [R] Symbiotic Mutualism: Entrepreneurship as Value Co-Creation

Ashwin Goutham Gopi; New York University, United States
Bertha T Jimenez; RISE, United States
Bharat Rao; New York University, United States

In this paper, we present the emergence of a new phenomenon in which entrepreneurs consider sustainability and mutual benefit as the foundation of their new venture. Competi-

tion is no longer a tacit assumption. We draw upon the literature of industrial and organizational ecology to term this strategy "Symbiotic Mutualism". Here, "symbiotic" refers to the ability of an organization to co-exist across multiple industrial boundaries; "mutualism" signifies the co-creation of value for all stakeholders involved. Our paper aims to unveil the mechanisms by which a new venture operates under this new logic. This study is based on a green startup that converts the waste of one industry into the raw material of another, without owning any equipment. By changing their perspective, they are able to span industrial and organizational boundaries. They are thus capable of unlocking and leveraging potential resources that would otherwise have been lost. We argue that this phenomenon is part of a larger cultural shift in how businesses view resources. The increasing focus on resource conservation and environmental impact influences their organizational practices and strategy. Furthermore, the emergence of the sharing economy has changed entrepreneurs' notions of occupation, consumption, and the ownership and access to durable goods.

WD-02.3 [R] Assessing Intangibles in Lean Start-Ups Using Repertory Grids

Enrique Diaz de Leon; ITESM - ITE430714KI0, Mexico
Paul D Guild; University of Waterloo, Canada

The assessment of intangibles in business plans by investors is an important factor of recent interest, particularly in the evaluation of early-stage technology-based ventures. On one hand, investors are challenged to properly assess new opportunities. At the same time, entrepreneurs or innovators face the formidable task of communicating what is, sometimes, nothing more than just an "extraordinary" idea. In such situations, the decision to continue with the due diligence process, and finally to invest, is based frequently on those aspects that are intangible. In an attempt to reveal some of the intangibles assessed by investors and communicated by entrepreneurs, an investigation was conducted using repertory grid, a technique based on personal construct psychology. Five venture capitalists and five entrepreneurs were interviewed. Evidence was found for the importance of intangibles during the investment-decision process of early stage technology-based ventures. For these ventures, the consideration of only tangible criteria is not a guaranteed predictor of success. The repertory grid technique makes a significant contribution to the identification of intangibles assessed by investors and communicated by entrepreneurs.

WD-04 Technology Management in the Energy Sector-2
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Salon D
Chair(s) Jasper L Steyn; University of Pretoria

WD-04.1 [A] Energy Efficiency Measures in Oregon Instructional School Facilities Implemented Under SB 1149, and Improved Student Performance

Virgina Saraswati; Portland State University, United States
Timothy Hulseman; Portland State University, United States
John M Bauer; Portland State University, United States

Energy generation, transmission, and distribution require a costly infrastructure to meet increasing demand. The success of energy efficiency measures (EEM's) are largely based on cumulative energy and cost savings. This research attempts to add improved student learning to the list of benefits when implementing EEM's in instructional school facilities. Our literature review of current research demonstrates that maximizing natural daylight in the design of school buildings reduces energy consumption, as well as improves student performance. Additionally, EEM's can benefit student performance through direct and indirect environmental improvements that enhance usability, productivity, and comfort. Through statistical analysis of data collected by the Oregon Department of Energy and the Oregon Department of Education, student mathematics assessment passing rates, before and after EEM implementations, are compared and analyzed using a panel analysis methodology and a simple pooled regression. The result of our research finds a positive significant correlation between EEM's and improved student performance. An average increase in mathematics assessment passing rates of 0.3808% after EEM implementation provides a basis for further analysis. Finally, this research aims to promote energy conservation projects in instructional school facilities, by identifying improved student learning in addition to already established cost-savings, and environmental benefits.

WD-04.2 [R] Monitoring and Anticipating the Convergence of Lighting Control Strategies

Nina Chaichi; Portland state University, United States
Tugrul Daim; Portland State University, United States

IPC co-classification in conjunction with cross-impact analysis has been used to identify technology convergence and its strength over a specific period of time. In this study, we tried to monitor the convergence of lighting control strategies which yields energy efficiency from 2009 to 2013. Also, we tried to anticipate the trend of impacts for the near future. We take a new approach to utilize detailed information including rate of change of co-classified patents, number of patents in each class, and convergence strength between two classes over time and build possible scenarios to anticipate the convergence trend. In our new approach, convergence strength rate of change is considered alongside two other parameters to understand the reason for the rise or decline in convergence strength and possibility of its change in the future. With recent trends considering lighting as a system rather than a group of components, our approach would help to anticipate the convergence trends of the controlling strategies including time control, presence control, illuminance control and so forth as a controlling system.

WD-04.3 [R] Framework for Managing Transmission and Distribution Losses in Pakistan's Power Transmission and Distribution Networks

Rizwan Tahir; NAMAL, Pakistan
Muhammad A Choudhary; NAMAL, Pakistan
Akram Ali; National Power Control Center, Pakistan

Pakistan is facing chronic power shortages, and the demand supply gap generally fluctuates between 4000-6000 MW. Persistent shortages warrant scheduled load management as well as system security load management. The system comprises 22,574 MW installed capacity with 20,553 MW de-rated capacity with the maximum dispatch of 16,870 MW. The transmission system comprises 5183 KM of 500KV lines and 9104 of 220KV lines which are managed by National Transmission and Dispatch Company (NTDC). While 28,892 KM of 132/66/33KV lines are managed by 9 Distribution Companies (DISCOs) and Karachi Electric Supply Company (KESC). The system is blemished by colossal transmission and distribution (T&D) losses which stand at 22% of net generated electricity. These losses are huge when compared with 6% of North America, 7% of OECD (Organization for Economic Corporation & Development), 8% of China, 9% of the Middle East, and 12% world average. Customers are penalized for the technical and management inefficiencies, losses and theft. Our managerial framework includes the analysis to separate out the last ten years of T&D losses of DISCOs. It also includes the reasons for intense T&D losses and recommends effective measures for reducing T&D losses, which are figured out with the consultancy of competent managers and engineers of NTDC, National Power Control Center (NPCC) and Water and Power Development Authority (WAPDA).

WD-05 Intellectual Property-2
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Salon E
Chair(s) Tsung-Han Ke; National Chi Nan University

WD-05.1 [R] The Development of Product and Process Claims in Blu-ray Technology

Sven Wittfoth; Universitat Bremen, Germany
Michael Wustmans; University of Bremen, Germany
Martin G Moehrle; University of Bremen, Germany

In their well-known theory Utterback and Abernathy present insights into the dynamics of innovation. They distinguish product innovations from process innovations in a technological field, showing the different dynamics of each as well as their interplay in the course of time.

We introduce a new method for measuring relevant variables of these dynamics by means of patent analysis. In particular, we develop a semantic tool for a rule-based categorization of patent claims. We select Blu-ray technology as a promising test field. It is a patent-active technology which has recently reached the maturity state of its life cycle, so that we have access to the full time scale of the Utterback and Abernathy model for analysis. Focusing on product claims and manufacturing process claims of Blu-ray patents, we cannot only provide insights into their dynamics, but can also link the time series to the phases described by Abernathy and Utterback. Our method does not just offer a new possibility to measure innovation dynamics for researchers in this field, it also helps managers in companies to obtain early information about a technology.

WD-05.2 [R] A Study of the Correlation Between Number of Classification Symbols and Patent Citation Count

Chung-Huei Kuan; National Taiwan Univ. of Science and Technology, Taiwan
Tsai-Hsuan Yang; National Taiwan Univ. of Science and Technology, Taiwan

Patents' classification symbols are a valuable source of information for patent analysis. The number of different classification symbols assigned to a patent is often considered as an indicator of the patent's technical scope, breadth, or diversity. However, the validity of the indicator is dubious. This study speculates that, if this indicator indeed reflects some characteristics of a patent, and that, if more different classification symbols a patent is assigned with, the patent is considered more valuable or desirable, the indicator should have a positive correlation with the patent's citation count, which is widely accepted as representative of the patent's quality, value, importance, or impact. Using empirical data and statistical analysis, this study finds that, for patents of three different ages, their numbers of Cooperative Patent Classification symbols at two different levels are all positively correlated to their citation counts, confirming the validity of this simple indicator. This finding is especially helpful when evaluating young patents that are issued for only a limited period of time.

WD-06 Science and Technology Policy-3
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Salon F
Chair(s) Takashi Onoda; JAIST

WD-06.1 [R] New Science and Technology Policy Evaluation Using Bibliometric Approach

Kazuya Tanaka; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

Governmental commitment is crucial for the research system, and this commitment, especially science and technology public policy, needs evaluation and feedback for the next public policy. However, the evaluation methodology for science and technology public policy is mainly occupied by a non-quantitative approach such as interviews or just summary of research papers. To address qualitative and essential evaluation, we suggested a new quantitative policy evaluation bibliometric approach such as research paper networks. This paper tries to approach the next strategic public policy making use of a statistically and quantitatively corrected evidenced-based policy making methodology. As a result we found a gap between the timing of financial support and the timing which the researcher achieved important researches.

WD-06.2 [R] Cooperation as a Mediator Variable between Research Fund and Scientific Outputs: Evidence from NSFC-Guangdong Joint Fund

Huizhu Yu; Beijing Institute of Technology, China
Lu Huang; Beijing Institute of Technology, China
Yi Zhang; University of Technology Sydney, China
Kangrui Wang; Beijing Institute of Technology, China
Wen Miao; Beijing Institute of Technology, China
Donghua Zhu; Beijing Insitute of Technology, China

Recent studies shed light on the key elements that influence the link among research funds, collaborative activities and scientific outputs. However, most researches focused on the effects of research fund, and cooperation was only considered as an independent determinant of research productivity. In this paper we evaluate the mediating role of cooperation in the relationship between research fund and scientific outputs of individuals. We conduct a multiple linear regression study to NSFC-Guangdong Joint Fund. Leveraging 40 interviews to the correlated scientists of NSFC-Guangdong Joint Fund, 16 interviews to research directors from universities, and 12 interviews to program managers in the government of Guangdong Province, we examine how NSFC-Guangdong Joint Fund may affects the scientific outputs of individuals in Guangdong through promoting their cross-regional cooperation. Then, we estimate this effect using Web of Science database and our own application database, and find cross-regional cooperation plays a mediating role in prompting the interaction between the fund and scientific outputs of individuals in Guangdong Province.

WD-07 Project/Program Management-2
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Salon G
Chair(s) Bryan Moser; Massachusetts Institute of Technology

WD-07.1 [R] Requirements Engineering Principles Applicable to Technology and Innovation Management

Naude P Scribante; University of Pretoria, South Africa
Leon Pretorius; University of Pretoria, South Africa
Siebert Benade; University of Pretoria, South Africa

In the field of Technology and Innovation Management, several key principles have been identified in literature. These include technology development, technology improvement, technology leadership, technology partnerships and supplier participation, technology pioneering, technological integration, technological value and technology standards. Many of these key principles are based on actions that are intended to provide a new or enhanced technology, product or service to the consumer market. It is however important that this new or enhanced product or service that results for the innovation process, does indeed address a market or user need. This is the focus of the field of Requirements Engineering in the determination of market and user need. Research in this field have identified various challenges and pitfalls that exist that may hinder the determination of the actual need and the consequential acceptance of the new or enhanced technology by the market or user. The purpose of this paper is to explore areas of commonality within the requirements engineering domain that may be applicable to technology and innovation management and that can be exploited to add value and reduce risk.

WD-07.2 [R] Systems Engineering and Project Management: Points of Intersection, Overlaps, and Tensions

James W Boswell; SKEMA Business School, France
Frank T Anbari; Drexel University, United States
John W Via, III; Drexel University, United States

There are significant points of intersection and overlaps between project / program managers (PMs) and the chief systems engineer (CSE) / systems engineers (SE). In some projects, the PM is the technical lead, or the CSE is the PM; regardless of role, the project leader is responsible for project success through adherence to the "golden triangle." However, if roles and responsibilities are not clearly defined early in the project lifecycle when both professions are present, this can lead to unproductive tensions between PMs and the CSE that can be an impediment to project / program performance. Key sources of unproductive tensions are the lack of integrated planning, lack of or unclear communications, unclear definition roles and authority, and conflicting practices between the two overlapping roles. We address relevant causes of unproductive tensions, highlight the importance of collaboration between project management and systems engineering, describe the points of intersection and overlaps in the core competencies between the disciplines, as described by their respective professional organizations (PMI & INCOSE), and explore the overlaps between the educational curricula for an M.S. in project management and an M.S. in sys-

tems engineering. We then suggest promising practices for enhancing effective integration between the two disciplines with the aim of improving project and program performance.

WD-09 Emerging Technologies-1
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Salon I
Chair(s) John Francis Agwa-Ejon; University of Johannesburg

WD-09.1 [A] Why is Korea Lagging behind in Electric Vehicle Technology Innovation?

Mekyung Lee; SUNY Korea, Korea, South
Gang He; Stony Brook University, United States

This study analyzes the electric vehicle (EV) innovation policy in Korea. Korea has a number of good pre-conditions and indigenous capabilities that can create a new EV market and deploy EVs fast across a nation. Korea also has urgent needs to adopt EVs and develop advanced EV technologies as it is vulnerable to energy supply disruptions. Despite these pre-conditions and urgent needs, however, none of the domestic automobile makers so far have sold its own EV to the global market, and the adoption of EVs is very low domestically. Consequently, technological innovation of EVs in Korea lags behind. This cannot be solely explained by the neoclassical view of "market failures" in an increasingly interdependent and interconnected system; instead, it can be explained by systemic failures. Based on the problems and evidence, this paper reveals some distinctive features answering the following questions: (i) why such advanced technologies are not introduced in the market place when they deliver a variety of benefits to society when the society has urgent needs, (ii) if there is no market, what are the roles of actors and institutions in introducing and deploying these technologies, (iii) what is the society's particular character in technological innovation and what are the barriers, (iv) how can the new technological innovation be introduced and sustained in the current system?

WD-09.2 [R] Dynamics of Patent Collaboration: The Case of Nanocomposite Materials

Nazrul Islam; The University of Exeter Business School, United Kingdom
Sercan Ozcan; University of Portsmouth, United Kingdom

Nano-composite materials are reported to be the smartest materials of the century due to the property combinations that were not found in conventional composites. Since nanocomposite materials are at an early phase of their life-cycles, an exploratory analysis on collaborations between actors seems to be important towards the generation and dissemination of the required knowledge for actually benefiting from nano-composite applications. This study analyzes the actors' patent collaboration structures and dynamics and identifies the determinants of collaboration in the sector. Through the use of the tech-mining method and patent data on nano-composite materials (multi-dimensional nano-composites and single dimensional nanorods), the paper examines whether such collaborations in nano-composite materials affect national systems of innovation owing to its interdisciplinary type and its dispersion across scientific fields. The results indicate that Asian organizations have a significant advantage in developing strong collaborations networks, with the active involvement of large organizations. Linear (mono-linkage) collaborations among actors in the case of multi-dimensional nano-composites appeared to be an effective model and revealed the stronger bonds, particularly in Japan, China and South Korea. Whilst in single dimensional nanorods' case, more distributed and decentralized collaborations appeared to be the most efficient model and revealed the strongest bonds among actors.

WD-10 Manufacturing Management-3
Wednesday, 7/12/2017, 14:00 - 15:30
Room: Portland
Chair(s) Kem Ramdass; University of South Africa

WD-10.1 [R] Absenteeism - A Major Inhibitor of Productivity in South Africa: A Clothing Industry Perspective

Kem Ramdass; University of South Africa, South Africa

Absenteeism is an aspect of the organizational performance that can go unnoticed and is known to be as high as 15 percent in some companies, especially if late starting and early finishing are included. Absenteeism is a drain on productive work, especially in the manufacturing industry, and may be described as unorganized conflict where people show their dissatisfaction through absenteeism. Absenteeism is hampering economic growth in the region of R12 billion annually. While companies are working on continuous improvement initiatives that improve efficiency and performance, the severity of the problem of absence is a topic that has been neglected. Even though technology may enable one to work from home, the impact of what should be achieved in the workplace is hindered. To achieve a real competitive edge in industry, innovative managers are realizing the crucial importance of making the most of existing resources. The clothing industry, being a labor-intensive industry, was used to obtain data in the form of qualitative research, to shed light on the impact of lost productivity through absenteeism. The focus will therefore not only be on the negative issues of absence and how to improve it, but on the more positive (and critical) goal of developing an overall strategy to promote and improve attendance in industry. Absenteeism is directly related to technology management as it causes inefficiency in several ways. However, the primary objective is to investigate the causes of absenteeism levels and the means of improving attendance, and the secondary objective will be to identify ways to manage and minimize absenteeism levels in the clothing industry.

WD-10.2 [A] Prio-T: Successful Application of ICT on the Shop Floor in Tool and Die Industry

Gunther Schuh; RWTH Aachen University, Germany
Michael Salmen; RWTH Aachen University, Germany
Advan Begovic; RWTH Aachen University, Germany
David Goertz; RWTH Aachen University, Germany

In recent years digitization has opened new potentials to optimize manufacturing processes by effectively linking digital technologies with employees. Today, manufacturing companies throughout all industries are facing the challenge to realize those potentials. It requires a successful implementation of information and communication technology (ICT) in order to maintain the competitiveness of companies. Especially manufacturing companies with small- and medium-sized batches, as from the tool and die industry, are confronted with substantial difficulties to apply new technologies effectively. High quantity of parts per tool, low repetition rates as well as ever-interfering rush orders result in a low transparency on the shop floor as well as time-consuming planning and adjusting of planning. In order to face the coherent lack of transparency and the ineffectiveness of planning in the tool and die industry, the Laboratory for Machine Tools and Production Engineering WZL of RWTH Aachen University has developed the digitized "Interactive Prioritization Table - Prio-T". Connecting the companies' planning system, with its resources and its machine operators in real time, the Prio-T displays the work in progress and optimizes transparency without complicating the day-to-day work. This leads to a reduction of idle times, a better involvement of employees, and ultimately an optimization of the productivity by the efficient use of ICT on the shop floor.

WE-01 Innovation Management-8
Wednesday, 7/12/2017, 16:00 - 17:30
Room: Salon A
Chair(s) Yasutoshi Komatsu; Watanabe Co. Ltd.

WE-01.1 [R] Developing Disruptive Innovations for Sustainability: A Review on Impact of Internet of Things (IOT)

Mina Nasiri; Lappeenranta University of Technology, Finland
Nina K Tura; Lappeenranta University of Tehcnology, Finland
Ville Ojanen; Lappeenranta University of Technology, Finland

Demands towards sustainable choices in business operations are increasing and more

influential solutions are required. This means changes and development of innovations that allow the creation of new markets and value networks by combining new set of sustainability-driven values-finding disruptive innovations for sustainability. Increased digitalization is seen to provide multiple value creation mechanisms and possibilities by enhancing the more effective use of resources. The emergence of IOT (Internet of Things) has connected objects (e.g., physical devices, buildings and vehicles) to existing networks of information. IOT can work as a trigger for creation of new markets and value networks by connecting existing information, networked economies and societies together in a new way. Expectations towards IOT solutions are high and they are expected to revolutionize the business markets by promoting the emergence of disruptive innovations for sustainability, e.g., in healthcare and transportation solutions, smart cities, intelligent energy services and circular economy. The study focuses on reviewing the impact of IOT in developing these innovations aiming to foster disruptive sustainable change.

WE-01.2 [R] Exploring Effective Factors for the Generation of Innovative Ideas and Technologies in Functional Food R&D

Kosuke Kato; Tokyo University of Agriculture and Technology, Japan
Shin Ito; Tokyo University of Agriculture and Technology, Japan
Kazuhiko Itaya; Tokyo University of Agriculture and Technology, Japan

Functional foods are promising products with physiological effects that may provide health benefits. Innovative concepts and technologies that derive from individual creativity and serendipitous findings are indispensable in order to make good sales and achieve a share in the growing functional food market. However, there have been few reports discussing manufacturers in the food industry adapting any kind of a management system for promoting creativity and serendipity. In this paper, we demonstrate the analogy of the R&D processes between functional foods and drugs to point out the important role of serendipity in functional food R&D. To achieve our goal of constructing an effective management system for idea generation in the functional food sector, we conducted survey analysis of 114 R&D researchers and engineers at 74 companies in the sector using a questionnaire on idea generation. Through factorial analysis, we extracted the novel factors underlying idea generation in functional food R&D. We would like to show how these factors may promote creativity and serendipity.

WE-01.3 [R] National, Sectoral and Technological Innovation Systems: The Case of Taiwan's Pharmaceutical Industry

Yi-Siang Lin; National Chung Hsing University, Taiwan
Hsin-Ning Su; National Chung Hsing University, Taiwan

The pharmaceutical industry is a capital driven industry and is heavily dependent on R&D for new products and growth in a globalized economy. Since the 1980s, the Taiwan government has recognized that the pharmaceutical industry is important for Taiwan's future development, so the government has formulated national institutions to foster and innovate the development of the pharmaceutical industry. However, previous studies suggested that the innovation of Taiwan's pharmaceutical industry is incomplete. To address the problems and a uncover potential solutions from a systematic perspective, this study aims to propose a multi-level framework consisting of national, sectoral and technological views for analyzing Taiwan's pharmaceutical industry. The framework allows providing the landscape of Taiwan's innovation capability in the pharmaceutical industry as well as systematically understands the interaction among government regulations, university researches, industrial evolutions, and market developments.

WE-01.4 [R] A Comparison of Two Innovation Tools: Application on Smart Kitchen Design

Burcu Taskin; Izmir Institute of Technology, Turkey
Nuri Basoglu; Izmir Institute of Technology, Turkey
Tugrul Daim; Portland State University, United States

The process is one of the significant issues of companies in innovative product design. The designers and the management deal with producing high quality products with the creativity in a short-term period. The researchers developed techniques to solve that problem as TRIZ. The TRIZ-based techniques aim to recover the gaps of the creative innovation to solve specific problems of technical products and technologies. However, the traditional innovation techniques are still preferred for the design process. This study conducted a comparative research on outcomes regarding the process of two design groups. The assignment was given to 10 design students to identify the design requirements of smart kitchen design that answers the specific problem and to propose a product through needs and demands. The first group with five students applied TRIZ-based techniques, while the other five students applied one of another innovation techniques. In this study the outcomes of the group design of smart kitchen is discussed to compare the application of the process and quality of the products.

WE-02 Entrepreneurship/ Intrapreneurship-4
Wednesday, 7/12/2017, 16:00 - 17:30
Room: Salon B
Chair(s) Bharat Rao; NYU-POLY

WE-02.1 [R] A Mexican National Entrepreneurship and Innovation System Study Proposal

Armando Elizondo-Noriega; Texas Tech University, United States
David Guemes-Castorena; Tecnologico de Monterrey, Mexico
Mario G Beruvides; Texas Tech University, United States

Following W. Edwards Deming's theory of profound knowledge to achieve economic development, in this article the importance of the hypothetical relationship between the national entrepreneurship system and the national innovation system is presented. In a sense, entrepreneurship is an activity that can take place while linking technology push and market pull. Therefore, to demonstrate the hypothesis regarding the existence of this relationship, a dynamic system simulation is proposed to validate it. A causal model is proposed for its construction and later simulation. A research plan to build, validate and calibrate a causal model according to the literature guidelines is presented. Finally, this research plan is proposed to become a baseline methodology to analyze a national innovation system in a systematic way.

WE-02.2 [R] Sustainable Innovative Business: Enhancing Elements and Challenges in the Context of a Brazilian Startup

Rodrigo L Melan; Universidade Estadual de Londrina, Brazil
Aline M Santana; Universidade Estadual de Londrina, Brazil
Gysele F Santos Rogo; Universidade Estadual de Londrina, Brazil
Milton A Canova Barbeiro; Universidade Estadual de Londrina, Brazil
Saulo F Amancio-Vieira; Universidade Estadual de Londrina, Brazil

Sustainability is relevant in discussions regarding current businesses, given the need to reconcile economic, environmental, social and cultural development in the reality of the problems present in society. In this sense, innovation has a prominent role in enabling new ventures to offer sustainable products and/or services. This research aims to understand the facilitating elements and the challenges for the development of a sustainable business in a startup incubated at UEL - INTUEL / Londrina, PR, Brazil. So, themes such as innovation, sustainability and sustainable business were used for the theoretical basis. As for the methodological procedures, the research is characterized as a qualitative and descriptive approach, developed through a single case study. Data collection was based on secondary data (documents and the company's website) and primary data (via a semi-structured interview with the company managers). The company studied develops technologies related to the prevention of floods and recovery of springs, and it still faces many challenges for the proper development of the enterprise. It is hoped that the study can contribute to better understand innovation in the scope of sustainable enterprises, providing elements that can subsidize the creation of mechanisms of support for this type of business.

SESSIONS

WE-05 Intellectual Property-3
Wednesday, 7/12/2017, 16:00 - 17:30
Room: Salon E
Chair(s) Masakazu Takahashi; Yamaguchi University

WE-05.1 [R] Toward an Efficient Search Method to Capture the Future MOT Curriculum Based on the Society 5.0

Masashi Shibata; Yamaguchi University, Japan
Yuichi Ohtsuka; Yamaguchi University, Japan
Kazuya Okamoto; Yamaguchi University, Japan
Masakazu Takahashi; Yamaguchi University, Japan

This paper proposes an efficient search method of future education theme for the technology management curriculum from the public information. In these days, the industrial structure is changing drastically due to the social implementation of the ICT (information and communication technology) and IoT (Internet of Things). In order to respond to the change, the education curriculum development method which can cope with the changes is required. This paper focuses on the patent information, and applies the link mining method for visualizing the future technology structure. With the proposed method, the latent market needs are extracted. Based on our findings, it is possible to capture the knowledge and the technology for the future technology management curricula.

WE-05.2 [R] The Typologies of Technological Transactions: An Analysis of the Patent Transaction Market in the TFT-LCD Industry

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

This investigation reveals several distinctive features of market players in patent transactions. Through transaction network analysis, patent transaction markets have determined that mature markets are informative environments whereby the majority of transactions are created by minority players. Thus, patent transaction markets are highly structured, and the distinctive features of market players are characterized. First, market players exhibit different market powers in transactional opportunity and capability. Second, the flow chain of technological transactions is revealed whereby market players are able to strategize their technological assets. Consequently, these findings and results not only depict the IPR strategy of leading technology players but also demonstrate the social structure of their competitive advantage. Thus, this study provides insights into patent transaction networks, and also addresses management implications for firms interested in acquiring market competition.

WE-05.3 [R] A Patent-Based Approach for the Identification of Strategic Reactions to Technological Change

Oliver Kraetzig; Helmholtz-Institute Muenster, Germany
Nathalie Sick; University of Muenster, Germany

Assessments regarding the strategic reactions of companies towards technological change are highly complex and often lack generalization. Methods for analyzing company resources were rather applied than methods directly focusing on the respective strategic reactions. There is, however, a need for a methodology that provides a more comprehensive overview and enables an early recognition of strategic reactions to technological change, for example through the use of easily available secondary data. Thus, the aim of our study is the development of a patent-based approach to identify particular strategic reactions of respective companies towards technological change. Achieving this objective involves an analysis of patent activities for the case of relevant cell manufacturing companies of lithium-ion and post-lithium-ion battery technologies. The developed methodological approach could be applied successfully to the identification of strategic reactions in the battery field. From a practical point of view, our findings give detailed and above all early insights in strategic decisions and enable technology managers to better assess investment options in different technologies.

WE-06 PANEL: Trends in Technological Emergence Indicators
Wednesday, 7/12/2017, 16:00 - 17:30
Room: Salon F
Panelist(s) Ying Guo; Beijing Institute of Technology
Ying Huang; Beijing Institute of Technology
Nils C Newman; Search Technology
Alan Porter; Georgia Institute of Technology
Arho Suominen; VTT Technical Research Centre of Finland

This panel session will conclude the Indicators of Technological Emergence track to discuss insights from across the presentations at PICMET and discuss trends for future research and applications.

WE-07 Project/Program Management-3
Wednesday, 7/12/2017, 16:00 - 17:30
Room: Salon G
Chair(s) Leon Pretorius; University of Pretoria

WE-07.1 [R] Xploring the Role of Production Management Concepts for Managing Projects

Boaz Ronen; University of Tel Aviv, Israel
Thomas Lechler; Stevens Institute of Technology, United States
Edward A Stohr; Stevens Institute of Technology, United States

We have come to accept that approximately one-third of projects are successful, one-third of projects suffer from overruns of time or cost or failed delivery of desired functionality, and fully one-third are abandoned as complete failures. These dismal statistics have defied years of project management research and all manner of innovative ideas ranging from the early introduction of critical path methods, to the more recent critical chain methodologies, agile software development ideas and much behavioral research on project leadership and teams. Moreover, to manage expertise and share scarce resources, the majority of projects today are executed in matrixed organizations with their attendant problems of confused lines of responsibility and complex relationships between the project managers responsible for the timely completion of projects and functional managers responsible for the management of resources. In this paper, we outline a three-pronged attack on these problems. Our main supposition is that projects with different size, complexity and economic or strategic importance should be managed differently. Important large projects should be assigned dedicated resources and managed as projects using accepted project management techniques. Medium-sized projects should be managed in matrixed organizations, while small repetitive projects should not be managed as projects at all. Rather, they should be managed using techniques borrowed from production and process management. The paper develops the conceptual underpinnings for these ideas and describes how projects in the latter two categories can be best organized and managed. Our "divide and conquer" approach should help management deal with the need for a faster and more sure-footed response to the pressures for change in the face of global competition and ever-changing technology.

WE-07.2 [A] Engineering Change Management Impact on Project Success within a South African Petrochemical Company

Thabiso Serapelo; University of Johannesburg, South Africa
Louwrence D Erasmus; University of Johannesburg, South Africa
Jan-Harm Pretorius; University of Johannesburg, South Africa

Engineering changes are greatly influenced by the evolving technology, and as a result customers' requirements are continuously changing. There is, therefore, a need to effectively manage these changes as they arise. This research paper focuses mainly on the engineering change management (ECM) in projects within a petrochemical company. Based on the fact that changes are inevitable, it is crucial to find out if these changes are managed properly in a project or not, and what will be the impact thereof. The literature review conducted

in this paper discusses various ECM frameworks, and the knowledge obtained assisted in propositions formulation. These propositions were then tested by means of questionnaires of experienced personnel working with the ECM on a daily basis. The results obtained revealed that proper ECM in a project will decrease the overall project cost and reduce the overall project schedule. However, based on the knowledge of the people who participated in the survey, there is no correlation between ECM and project quality.

WE-07.3 [R] Optimizing Resource Allocation in a Portfolio of Projects Related to Technology Infusion Using Heuristic and Meta-Heuristic Methods

Maximiliano S Zuloaga; Massachusetts Institute of Technology, United States
Bryan R Moser; Massachusetts Institute of Technology, United States

This paper proposes a method to address the planning and scheduling required to infuse technologies into a portfolio of product development projects. Definitive selection of technologies for infusion cannot be applied without taking into account available resources, time required to mature technologies and the interactions among them. Portfolio selection and the scheduling process have often been treated separately, although they are interdependent. This research aims to bridge the gap between portfolio scheduling and technology infusion by considering both with realistic performance dynamics, in which the iterative nature of activities is included in the model. Given these improvements, methods for effectively allocating resources in a portfolio of projects related to technology infusion are recommended. Initially, a heuristic method is proposed based on priority rules. However, as the assumptions of the model are loosened, a novel method is suggested that combines genetic algorithm (GA) and artificial bee colony (ABC) approaches. Numerical results indicate that the hybrid meta-heuristic method based on GA-ABC is effective in finding good resource allocations while considering rework. At the same time, results confirm that rework can dramatically affect the projects that comprise the portfolio, and therefore rework should be included in these analyses.

WE-09 Emerging Technologies-2
Wednesday, 7/12/2017, 16:00 - 17:30
Room: Salon I
Chair(s) Mark Ahn, Portland State University

WE-09.1 [R] Detection of Emerging Technologies for Field Effect Transistors: A Citation-Based Analysis

Chika Fujisue; The University of Tokyo, Japan
Ichiro Sakata; The University of Tokyo, Japan

Field Effect Transistors (FET) are used as switching and amplifying devices due to their fast switching and voltage blocking capabilities, and are important as energy-efficient devices. However, no academic landscape of FET exists. In this study, we investigated the existence of academic publications in relation to this field by analyzing the citation network of papers published in academic journals. Using a topological-based method, all the papers were categorized into clusters based on their own specific topics. We categorized all the papers into clusters, and found some rapidly developing research domains. To compare the research situation of each country, a matrix was created. Based on the data, 11 countries are classified into three categories that focus on the "emerging technology area," "intermediate technology area" or "mature technology area." As a result, the share of the emerging technology area of Japan is lower than that of the intermediate technology area and the mature technology area. This is partly because big discoveries by Japanese researchers, for example, conducting polymer, have a huge impact on Japanese research policy and make policy makers focus on Japanese-dominated research fields. This may indicate that policymakers should pay more attention to non-Japan-dominated research fields.

WE-09.2 [R] Technology Connectivity: A Tool for the Selection, Recruitment and Enrolment of Potential Students in South African Universities

John Francis Agwa-Ejon; University of Johannesburg, South Africa
Anup Prodhan; University of Johannesburg, South Africa

Most of the higher academic institutions in the world have grown accustomed to automating manual application and registration processes to stay abreast with increasingly advancing information technology. Whilst the paper-based application would normally require a lot of work and time, the online process (paperless) speeds up the enrolment and registration process. This paper evaluates the usage and impact of the online application and registration process in the enrolment of potential students in the University of Johannesburg (UJ), South Africa. The study revealed that the current online process is satisfactory. Ease of use, reduction in time and cost, no loss of documents, and accessibility of the process remotely anytime from anywhere were reported to be the major benefits of the online process. The study reported the positive impact of the current online process; however, the process requires a continuous improvement in the future to address the issues raised by the respondents.

HA-00 PLENARY - 4

DATE: THURSDAY, 7/13/2017
TIME: 08:30 - 10:00
ROOM: SALON E-F
CHAIR: DILEK CETINDAMAR; SABANCI UNIVERSITY

HA-00.1 [K] Industry 4.0 – Chances and Challenges of the Digital Transformation

Dietmar Theis; Institute for Physics of Electrotechnology, Germany

A profound digital transformation is now underway in the world´s leading industrial and manufacturing companies. They are digitizing essential functions within their vertical operation processes and along their horizontal value chains. The new product portfolios are enhanced with digital functionalities and innovative data-based services are generated. At the end of these transformative processes we will see the emergence of truly digital enterprises, working together with customers and suppliers in industrial digital ecosystems. The term Industry 4.0 was coined in Germany to emphasize the computerization of manufacturing, the core of this vision being built on the (Industrial) Internet of Things, IoT, the ubiquitous interlinking and networking of persons, things and machines. While Industry 1.0 refers to water/steam power, Industry 2.0 to electric power, and Industry 3.0 to computer power, Industry 4.0 stands for the most recent revolution - the Internet of Things power. The talk will highlight developments in Industry 4.0 from a German/European perspective, include a glance at global future trends, and will put some emphasis on people, social aspects and ethics in the context of digital transformation.

HA-00.2 [K] Lessons Learned from International Innovation

John R. McDougall, Hon Col (ret), B.Sc. (Alberta) 1967, P.Eng., CD, CStJ, C.Dir., FCAE, FEC, FGC (Hon), Fellow PICMET, United States

A study completed in June of 2017 of 16 countries at various stages of development in various regions of the world has exposed fascinating similarities and differences between them in terms of innovation policies and practices. What can we learn from such an analysis? How can we use the findings to improve our own approaches to technology management and innovation whether we work in government, academia, research organizations or business?

This presentation will address key questions faced everywhere around the world and share the key findings which emerged.

1. Is there a "right level" of overall research and innovation funding?
2. Do countries need an industrial strategy to be successful?
3. How should funding be allocated between basic and applied research?
4. Should public funding support needs-driven research?

5. Is innovation most successful when driven top down or bottom up?
6. Is excellence the best basis for funding?
7. Is collaboration necessary for success?
8. What elements lead to a successful cluster?

HB-01 Innovation Management-9
Thursday, 7/13/2017, 10:30 - 12:00
Room: Salon A
Chair(s) J. Michael Munson; University of Santa Clara

HB-01.1 [R] The Impact of Technological and Market Uncertainty on Innovative Development Processes

Dov Dvir; Western Galilee College, Israel
Arik Sadeh; Holon Institute of Technology, Israel

Innovations in products, new services and infrastructure have become a necessity for the survival and sustainability of modern organizations. In this study the impact of technological and market uncertainty on the success of new ventures is investigated. The effect of some personal characteristics of entrepreneurs on their choice of the new venture is treated as well. The study uses a two-dimensional framework to assess the level of uncertainty new ventures are facing. The novelty dimension that reflects market uncertainty mainly affects the way information about the customers' needs and desires is collected and incorporated into the product design. The technology dimension deals mainly with the way the development process should be managed. Higher levels of technological uncertainty require longer development periods, more design cycles and later design freeze. The impact of technological and market uncertainty on the performance of 160 innovations is analyzed. For example, we found that there is no contradiction between high levels of uncertainty and business success. Moreover, high levels of uncertainty may yield business opportunities that may not be available for low-level technological uncertainty innovations. We also found that older and more educated entrepreneurs are likely to be engaged in more novel initiatives than younger, less experienced ones.

HB-01.2 [A] The Impact of CRISPR on Precision Medicine: Revolutionizing Melanoma Standards of Care

W. Austin Spivey; University of Texas at San Antonio, United States
Donald N Berg; University of Texas at San Antonio, United States
J. Michael Munson; University of Santa Clara, United States

About 132,000 new diagnoses of skin melanoma are made worldwide each year. The deadliest of skin cancers, in the US incidence has risen by three-fold over the last three decades; it is the most common cancer among young women; treatment nationally costs over $3 billion. Early detection remains the key to survival. Disruptive solutions ameliorating suffering are on the horizon. Long-term, one potential disruption connects three emerging technologies: medical tricorders; clustered regularly interspaced short palindromic repeats (CRISPR); and nanobots. This disruptive portfolio will work by leveraging results from the Big Data for Melanoma Project. Imagine today's at-home pregnancy kit. Now, imagine a melanoma kit that contains not only a handheld, portable scanning device (tricorder) that diagnoses melanoma, forwarding the results to a smartphone app, but also a transdermal patch with autonomous nanobots designed to travel through the surface of the skin to mitigate the affected areas. Patchbots are based on CRISPR, which allows editing of DNA with great precision, efficiency and flexibility, including identifying RNA strands that specifically target melanoma cancer cells. This disruptive portfolio can bring the ideal of precision medicine to fruition, but not without challenges. The technologies must be integrated within the changing health-care system.

HB-01.3 [R] Influence of Social Networks, Opportunity Identification on the Performance of Internet Entrepreneurship: The Evidence of Zhejiang Province in China

Yangxue Xiang; Hangzhou Normal University, China
Xuesong Chen; Zhejiang SCI-TECH University, China
Liang Mei; Zhejiang University, China
Jin Chen; Tsinghua University, China

The purpose of this study was to investigate the mediating role of opportunity identification on the relationship between social networks and entrepreneurial performance by using the method of structural equation model (SEM). The study involved 136 valid questionnaires of internet entrepreneurs in Zhejiang province of China. The results show that the structure characteristics and relationship characteristics of the entrepreneurial network influence the ability of opportunity search, and the characteristics of cognition of entrepreneurial network affect the ability of opportunity judgment. And further, this paper compared the characteristics of the internet entrepreneurs at different stages of the internet entrepreneurial environment in Zhejiang province of China. The theoretical and managerial implications that are relevant have been discussed.

HB-02 Technology Management in the Service Sector-1
Thursday, 7/13/2017, 10:30 - 12:00
Room: Salon B
Chair(s) Jens Neuhttler; Fraunhofer IAO

HB-02.1 [R] Collaborative Development of Business Models in Smart Service Ecosystems

Hans-Jorg Bullinger; Fraunhofer-Society, Germany
Jens Neuhttler; Fraunhofer IAO, Germany
Rainer Nagele; Fraunhofer IAO, Germany
Inka C Woyke; Fraunhofer IAO, Germany

The growing prevalence of technology-driven concepts, such as the "Internet of Things" or "Industry 4.0", holds substantial potentials for service sectors worldwide. In this context, "Smart Services" describe data-based, individually configurable bundles of physically delivered services, digital services as well as physical products, which are usually performed on integrated platforms. Due to their complexity and the integration of data from customers and other stakeholders as a key resource for value creation, Smart Services are performed in complex ecosystems (e.g., in collaboration among technology, software as well as service specialists and users). However, Value Co-creation in Smart Service Ecosystems requires an adaption of stakeholders' existing business models. Smart Service platforms need to consider value contributions of other actors when defining their business models and vice versa. Based on the use case of Smart City Services our paper illustrates the need for developing Smart Service Business Models collaboratively between ecosystem stakeholders and provides insights about appropriate methods for doing so.

HB-02.2 [R] 'Haste Makes Waste' or 'Slow is Smooth, Smooth is Fast'?

Md Zakir H Khan; Tongji University, China
Song Chen; Tongji University, China
Md Jahir U Khan; Tongji University, China
Munir Chowdhury; Daffodil International University, Bangladesh

Due to the rapid growth of venture capital industry in developing countries, it is essential to provide a diagnosis on its development and future growth in order to maintain its success and continuous financing support on local firms. This study will focus on the venture capital industry in Bangladesh because it was established barely for seven years and there are only a total of four venture capital companies operating investment activities with local firms in Bangladesh. Compared to other southern Asian countries, such as India which already has a well-built venture capital industry, the venture capital industry in Bangladesh is still at its infant age. Therefore, this study will explore a pattern for Bangladesh to observe future development of the venture capital industry based on its banking and financing system. A case study approach will be applied by conducting interviews to three venture capital companies and their partnering investee firms to explore the factors influencing venture capital development in Bangladesh. In addition, this study will also investigate the opportunities and challenges venture capitalist and investee firms have to face in the future.

SESSIONS

HB-03 Supply Chain Management-1
Thursday, 7/13/2017, 10:30 - 12:00
Room: Salon C
Chair(s) Jeong-Hyun Park; ETRI

HB-03.1 [R] Balancing Supply Chain Archetypes and Ambidexterity in the Apparel Industry

David Guemes-Castorena; Tecnologico de Monterrey, Mexico
Brenda C Ruiz; Tecnologico de Monterrey, Mexico

The fashion industry has been noted as one of the most global and fluctuating industries in the world, and apparel supply chains (SC) play a strategic role in the growth of the industry and permanency of the brands through responsiveness with the end consumer. On the other hand, some decades ago the concept of "ambidexterity" has been introduced in the theory and practice of organizations management, but only recently applied to the management of the entire SC. It basically refers to the ability to maintain the daily excellence operations, while looking for constant innovation; it is also related to the ability of keeping balance. This balance might be about SC archetypes. To this end, the goals of this article are (1) to propose a definition for ambidextrous supply chains in in the field of apparel, and (2) to study the three leaders of the industry and identify if they balance SC archetypes on their way to ambidexterity.

HB-03.2 [A] Static Analysis Deployment Model for Code Quality on R&D Projects of SW Development

Jeong-Hyun Park; ETRI, Korea, South
Young-Sik Park; ETRI, Korea, South
Hyo-Taeg Jung; ETRI, Korea, South

This paper presents a static analysis deployment model for code quality on R&D Projects of SW Development. The proposed model includes an index for static analysis of source code, verification process, environments and infrastructure system for R&D projects of SW development. There is a sample of static analysis in the proposed deployment model and environments as a case study. There are also strategic considerations for successful operation of the proposed static analysis deployment model for R&D Projects of SW Development. The proposed static analysis deployment model in this paper will be adapted and improved continuously for quality upgrade of R&D projects, and customer satisfaction of developed source codes and products.

HB-04 Intellectual Property-4
Thursday, 7/13/2017, 10:30 - 12:00
Room: Salon D
Chair(s) Yuichi Ohtsuka; Yamaguchi University

HB-04.1 [R] A Study on Generating Novel Inventions Based on F-term Classification

Yuichi Ohtsuka; Yamaguchi University, Japan
Masakazu Takahashi; Yamaguchi University, Japan

This paper proposes a new invention creation method using patent classification information. Currently, innovation in nearly every field is being generated by the spread of information technology such as IoT and ICT. In Japan, major changes are expected in the country's economic and social structure with the emergence of the "hyper-smart society" (Society 5.0) in the not-so-distant future. In this context, promoting technology-led new inventions in a way that avoids overlapping investment and duplicate research will be essential. In this paper, we propose a method to capture trends in innovation by taking advantage of the information available in Japan's F-term classification system. Uniquely, the F-term system uses a meta-classification structure, with classification tables for each technology unit, identified by "theme code". By using multiple theme codes, including those for information-related technologies, it is possible to compare various technologies. Classification tables are indicators of the current common technical knowledge. These can be a source leading to the creation of new inventions by allowing innovators to identify viewpoints that have not already been explored. Discovering a new invention can also lead to a promising inventive next step. From the result of the analysis, our proposed method of the F-term classification system to foster new inventions related to information technology is effective for capturing the technology trend.

HB-04.2 [R] How Do Patents' Intrinsic Properties Associate with Litigation?

Yang-Tai Chou; Graduate Institute of Technology Management, NCHU, Taiwan
Hsin-Ning Su; Graduate Institute of Technology Management, NCHU, Taiwan

This paper aims to devise a novel method for identifying how patent characteristics are associated with patent litigation. Large-scale patents granted by the USPTO together with litigation data are converted to items by which associations are analyzed by association rule mining. The items considered in this research include assignee country, assignee country count, inventor country, inventor country count, number of patent reference, number of forward citation, number of NPR, number of foreign reference, and numbers of claim. Obtained with the association relationship depicted by the three variables - confidence, support and lift - an associated network of patents' characteristics can be visually created to understand the landscape of associative relations. The association results uncovered in this research provide a channel to assess whether or not a patent is likely to be involved in litigation. Therefore, the influence of a patent's intrinsic property hidden in a patent's characteristics on the likelihood of infringement can be analyzed.

HB-04.3 [R] Study on the Influencing Mechanism of Patent Alliance Upon the Innovation

Jing Hu; China Jiliang University, China
Yong Zhang; China Jiliang University, China
Yilin Wang; Zhongchao Ink Co., Ltd, China

In the context of technical standards highly introducing the technical patents, by obtaining the ownership of patents of technical standards, enterprises influence the expectations of consumers, dominate the leading advantages at the market, improve the entry threshold of technical market and thus get enormous business interests. However, the close connection between technical standards and patents forces the increasing emergence of the "patent thicket" problem, which not only prohibits the promotion of standards and the commercialization of new technologies, but also slows down the innovation motivations of enterprises. As an important tool to promote the technical standards for the enterprises, the patent alliance can reduce the transaction costs and lawsuit disputes as well as accelerate the promotion and application of proprietary technologies. Meanwhile, taking advantages of the network effects of technical standards, the patent alliance can enlarge the installed base, influence consumers' expectations and reinforce the positive feedback mechanism of technical standards, thus making itself one of the effective paths to resolve the problem of patent thicket and promote the innovation. On the basis of theories regarding the network effects of technical standards, this paper proposes the meanings of network effects for the technical standards, and constructs the concept model through which the patent alliance influenced the innovation. The questionnaire investigation was conducted and the analysis was done by the structural equation so as to clarify the factors affecting the innovation of patent tool as well as its acting paths.

HB-04.4 [R] Technology Readiness Levels Improving R&D Management: A Grounded Theory Analysis

Joao R Lavoie; Portland State University, United States
Tugrul U Daim; Portland State University, United States

The strategic management of an organization is well understood, and there are several different frameworks and methodologies available to develop and implement strategies that will put the organization on the right track and make it more competitive. Nevertheless, the ability to manage technology and to assess and choose the right technologies to be used and to be invested in is not that well understood and developed. The technology readiness is important to be measured and managed, so that organizations have the chance to make

better decisions on which technologies to rely on and when. Technology Readiness Levels (TRL) is a method developed by NASA nearly 40 years ago and it has been proven to help organizations manage their technologies. The aim of this paper is to understand, in more details, how TRL can help organizations and what are the potential implications of using it to the betterment of R&D management. Interviews were conducted with technology managers and researchers. Grounded theory was used to analyze the data, and the results indicate that TRLs can improve R&D management. Some hypotheses were formulated and should be confirmed or refuted by future research.

HD-01 PANEL: PICMET '17 Debrief and Future PICMET Planning
Thursday, 7/13/2017, 14:00 - 15:30
Room: Salon A
Panelist(s) Mark J Ahn; Portland State University
Timothy R Anderson; Portland State University
Tugrul U Daim; Portland State University
Dundar F Kocaoglu; Portland State University
Joao R Lavoie; Portland State University
Robert H Martin; Software Management Consulting
Charles M Weber; Portland State University
Byung Sung Yoon; Portland State University

This session is for all PICMET attendees to give feedback on PICMET '17 and to discuss plans for future PICMETs.

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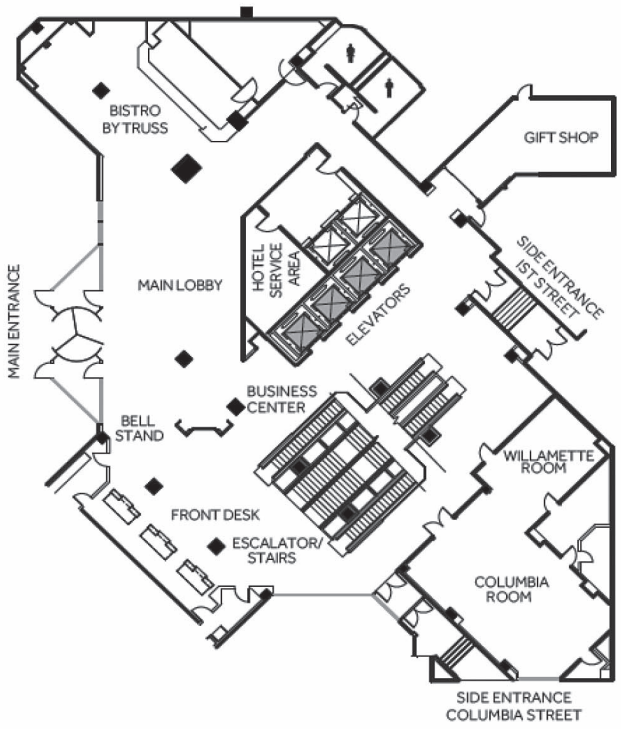
MARRIOTT FLOOR LAYOUT

MAIN LOBBY



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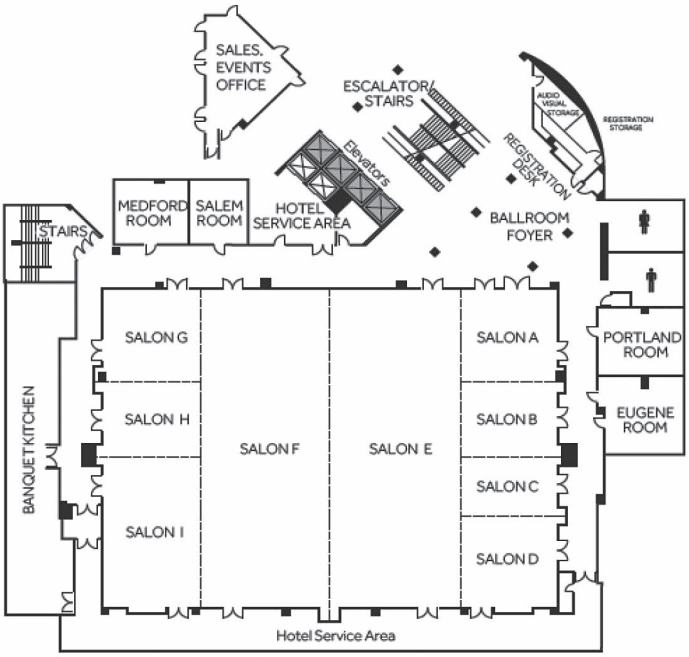

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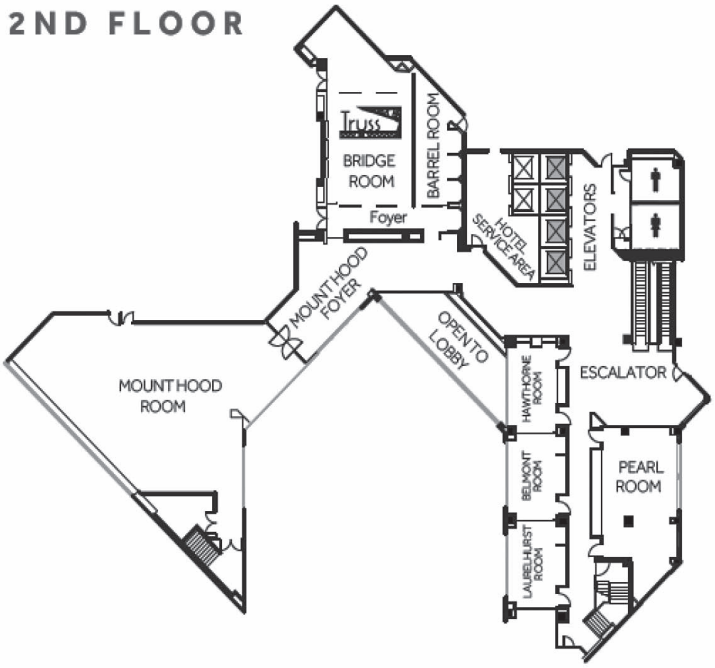

3RD FLOOR