PICMET 2007

Symposium on "Technology Management in the Service Sector"

Report Out

Tugrul Daim, Antonie Jetter, Haluk Demirkan, Bill Hefley, Richard Donnelly, Chris Tofts, John Pease, Eppie Clark, Tetsuro Fujiwara

PICMET '07

August 8, 2007

Symposium Objectives

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- To explore, how technology management research and education can contribute to the evolving field of Service Science, Management, and Engineering
- To define a research agenda for the field of engineering and technology management that addresses the critical needs of the evolving service economy
- To discuss needed funding structures and programs to foster service research

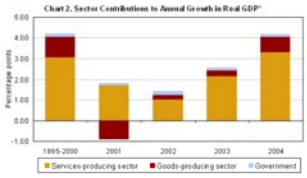
Symposium Agenda

Services – Why Now?	**Paul Maglio (IBM), Doug Morse (Oracle) and Connie Chang (DOC)**
Research Perspectives	**Dan Berg (RPI), Anatole Gershman (CMU), Elie Geisler (IIT) and Bill Hefley (CMU)**
Industry Specific Needs	**Bridget Haggerty (OHSU), Bob Chlebowski (Wells Fargo), Chris Tofts (HPLB) and Terry Oliver (BPA)**
"Open Space" break-out groups and final presentations	**all participants**

Defining Services

•Service systems are value co-creation configurations of people, technology, internal and external service systems connected by value propositions, and shared information (such as language, laws, measures, models, etc.).

Service Economy



- Economic growth depends on innovation
- National economies are shifting to services
- Service industries account for:
  - More than 75% of U.S. private sector GDP
  - Approximately 8 of 10 U.S. jobs
  - Lions share of GDP growth for more than a decade, nearly all net GDP growth since 2001
  - BLS 2014 projections show all job growth (20 percent) in the services sector
  - Fastest growth in business and professional services, information services
- New skills needed for the study, management, and engineering of service systems
  - Combination of business, organization, technology skills
  - Softer skills enhance harder skills
- Educational system is slowly shifting toward services
  - service management, operations, marketing, and engineering courses and programs exist
- U.S. needs to move quickly enough to stay competitive
  - China aims to shift 420M workers from farms to services in five years

US Congress Perspective

US House and Senate voted to approve on August 2nd,, 2007; Presidential approval pending.

- ***SEC. 1106. STUDY OF SERVICE SCIENCE.***
  - *(d) Service Science Defined- In this section, the term `service science' means curricula, training, and research programs that are designed to teach individuals to apply scientific, engineering, and management disciplines that integrate elements of computer science, operations research, industrial engineering, business strategy, management sciences, and social and legal sciences, in order to encourage innovation in how organizations create value for customers and shareholders that could not be achieved through such disciplines working in isolation.*

Working Groups

- Definitions
  - Science Base
  - Metrics
- Adoption
  - Service Comprehension
  - Industrialization of Services
- Innovation
  - Service Platform Innovation
  - New Service Development
- Applications
  - Embedded IT for Predictive Services
  - Healthcare Organizations
- Education
  - Curriculum Needs
  - Case Studies

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Results of Work Group "Science Base of Service"

Tugrul Daim

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Science Base of Service

- Participants and contact information
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  - Participants:
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    - *Yasuo Ikawa, JAIST, ikawa@jaist.ac.jp*
    - *Shahrul Yahaya, UTM, shahrul.y.yahaya@gmail.com*
    - *Diane Kiel, PSU*

Definitions: Science Base

- *Science is the discovery and understanding of nature.*
- *Technology is the manipulation of nature for human purposes.*
- *What part of nature is to be addressed by service science?*
- *Service systems are value co-creation configurations of people, technology, internal and external service systems connected by value propositions and shared information.*
  - *People*
  - *Technology*
  - *Value*

Definitions: Science Base

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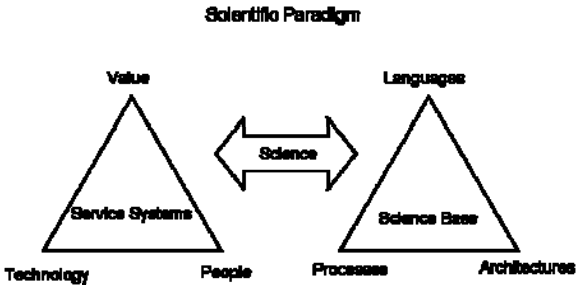
- *Science base includes*
  - *a set of common **languages** that must be shared in the creation and delivery of service systems.*
  - *generic **processes** common to the operation of any service system.*
  - ***architectures** of societal activities for which service systems provide functional capability.*



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Results of Work Group

"*Metrics for Technology in the Service Sector*"

John Pease

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Metrics for Technology in the Service Sector

- Participants and contact information
  - Initiator(s):
    - *Elie GEISLER,Illinois Institute of Technolgy*
  - Participants:
    - *Joseph F.CASE, BPA, R&D Portfolio Manager*
    - *Connie K.N. CHANG, US DOC, Research Director*
    - *Stephen JORDAN, Intel, PSU*
    - *Kotaro NAKAMURA, ECraft Japan, CEO*
    - *John H.PEASE, BPA, R&D Project Manager*
    - *Nermin SOKMEN, TUBITAK MAM, Information Technologies Institute*
    - *Ilknur TEKIN, PSU, PhD Student*

Metrics for Technology in the Service Sector

Organizational
- *Balanced Scorecard (Common Measure)*
- *Do all the stakeholders buy that?*

Technology
- *R&D used for services*
- *Does the existing R&D measures work services as well ?*
- *Technology for the services*

Economic and Financial
- *Cost*
- *Productivity*
- *Time Delivery*
- *Intellectual Property*
- *Sales, Profit, Market Share*

Human Side
- *Experience with Service that is personal*
- *Experience Satisfaction _ Emotional*
- *Stakeholders, Emotions _ Maslow's Hierarchy*

Value Added
- *Customers Willingness to Pay*

Metrics for Technology in the Service Sector

- ***Required Action***

  - *A multi stakeholder oriented approach for creating the Metrics for Technology in the Service Sector*

    - ***Government***
    - ***Regulatory Entities***
    - ***Industry***
    - ***Universities***
    - ***Firms***
    - ***NGOs for the Development of Service Sector***
      - ***SRI.net***
      - ***SRII _ Services Research Innovation Initiative***

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Results of Work Group "Service Comprehension"

Chris Tofts, HPLB presenting

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Service Comprehension - I

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- Participants and contact information
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    - *Daniel Berg, Rensselaer Polytechnic Institute berga@rpi.edu*
    - *Matthew Realff, NSF, mrealff@nsf.gov*
    - *Antonie Jetter, Portland State University, jettera@cecs.pdx.edu*

Service Comprehension - IIa

- Key issues identified
  - *We capitulate to the complexity of service systems and simply assume they cannot be predicted, full understood, forecasted, ...*
    - *We need abstract modeling of services so that all stakeholders understand them.*
    - *Professional modelers have a tendency to only use one model in decision process – no wider 'buy in'*
    - *Customers often make demands without any understanding of the implications for the service system, leading to overly complex systems.*
    - *What boundaries should we look at when analyzing service systems*
    - *There is no feedback in a direct customer encounter in many business to business services*
    - *The tools (systems engineering, optimization, queuing theory, etc.) exist, but they are not used.*

Service Comprehension - IIb

- Reasons for not comprehending the service system
  - *Systems are created with they idea to handle everything with technology (rather than automating some and leaving exceptions to humans)*
  - *Service Design practices are not robust enough*
    - *The Service Design practices used today are strictly focused on creating a user experience: there is no deep theory of design*
    - *There is no theory of service design, we are tinkering*
    - *If Service is about co-production it should be about co-design as well*
  - *Academic community does not have sufficient access to real world data to develop appropriate theories*

Service Comprehension - IV

- Further support and relevant experience
  - *NSF – they can grant money*
  - *HPLB – systems modeling team*
  - *Daniel Berg, systems engineering*
  - *Uk ex-DTI TSB, EU Framework 7*

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Results of Work Group
"Industrialization of Services"
<Anatole Gershman>

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Industrialization of Services

- Participants and contact information
  - Initiator(s):
    - *Anatole Gershman*
  - Participants:
    - *Mathew Liberatore*
    - *John McCreery*
    - *Robert Chlebowski*
    - *Terry Oliver*

Industrialization of Services

- Key issues identified
  - *Standardization of service components and processes*
  - *Assembly from standard components*
  - *Personalization and customization of standardized services*
  - *Metrics and "moments of truth"*
  - *Standards*
  - *Professional education*
  - *Legal and intellectual property framework*
- *If the problems are not addressed, the economy will continue to lose its productivity and competitiveness*

Industrialization of Services

- Moment of Truth in Services
  - *"moments of truth" – the exceptions that must be made part of the standard process*
  - *Identification using analytics*
  - *Detection during the encounter*
  - *Appropriate action – resolution protocols*

Industrialization of Services

- Why these issues have not been addressed?
  - *Lack of fundamental understanding of service processes (varies by industry)*
  - *Gaps in enabling technologies and integration tools*
  - *Lack of fundamental understanding of markets for service components*
- *What do you propose to improve the situation?*
  - *Research in improving service process components that cuts across different industries*
  - *Development of good metrics for process performance*
  - *Supporting professional bodies and organizations that help drive standards*
  - *Industrialization of tools and methods for services design and implementation*
  - *Requirements for a national services infrastructure*

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Results of Work Group

"*Service Platform Innovation and New Service Development*"

Dr. Richard Donnelly

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Service Platform Innovation

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Participants and organizations:

- Nora Auseklis, *Intel, U.S.*
- Atsuko Koizumi, *Hitachi, Japan*
- Dr. Richard Donnelly, *George Washington University, U.S.*
- Dr. Robert Harmon, *ETM, Portland State University, U.S.*
- Linda Lin, *volunteer, ETM, U.S.*

New Service Development

Participants and organizations:

- Paul Newman, *Portland State University, U.S.*
- Haluk Demirkan, *Arizona State University, U.S.*
- Urachada Ketprom, *NECTEC, Thailand*
- Laor Kovavisaruch, *NECTEC, Thailand*
- Cathy Killen, *University of Technology Sydney, Australia*
- Misook Sohn, *ETRI, South Korea*
- Jisun Kim, *volunteer, Portland State Univ., U.S.*

Service Platform Innovation - I

Key issues, risks and opportunities:

- *What is a service platform? – needs definition.*
- *Is platform concept appropriate for services? (efficiency, effectiveness)*
- *Status of service platform development?*
- *Integration between product and service platforms (co-development, work together) "Design for Service"…*
- *Relative value delivery of service platform*
- *User friendliness/usability as a platform issue*

Service Platform Innovation - II

Key issues, risks and opportunities (cont'd):

- *Payoff of R&D for service platforms?*
- *Customer role in service platform development and delivery:*
  - *capturing customer response to service elements*
  - *feeding it back to platform development*
- *Need better testing methods and metrics*
- *How to effectively market new/improved service platforms to an existing customer base?*
- *Open-source service platforms*

New Service Development - II

Key issues, risks and opportunities:

- *Where do ideas for new services come from?*
- *How to develop and launch a new service faster, cost effectively and with better quality.*
- *Use of portfolio management processes to align internal resources towards the goal.*
- *Become agile service-sector practitioners.*
- *Refocus strategic management on process level, not just marketing and environment.*

Service Platform Innovation - II

Importance to researchers and practitioners in the service sector and in the field of technology management?

- *Contribute to the* **scientific** *development of services*
- *Avoidance of haphazard development of service platforms*
- *Important domain for university and private sector collaboration*
- *Fostering new ventures through risk mitigation*

Service Platform Innovation - III

Enhancing the impact on service development of the field of technology management …

- *Go beyond the traditional tangible product-oriented thinking*
- *Address lack of service focus esp in engineering*
- *Incorporate improved understanding of user / buyer behavior*
- *This is exploratory ("basic") research – needs government funding*
- *Recognize service as the key engine for future value generation*

Product v. Service Platform Matrix

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PLATFORM CHARACTERISTICS	PRODUCT PLATFORMS	SERVICE PLATFORMS
Common Elements	Well-defined, standardized	Less well-defined, ill-defined standards
Unique Elements (Differentiating Segments)	Extensive options	Emerging capability
Enabling Technology	Embedded, usually necessary	Embedded or add-on, not always necessary
Customer Involvement	Industry insight important, market research useful, usability labs viable	Intensive involvement required, difficult to prototype, customer input needed to create value
User Experience	Moderately important-to-incidental	Intensive, hard to measure, perception-based
Development Cycle Time	Widely variable, market-responsive	Variable, customer 'must tolerate' developer
Launch Problems	More predictable	More difficult (service is very difficult to gauge)
Market-Expansion Time	Slower	Faster
Product Improvement	Incremental, straightforward	More subjective, user experience hard to measure
Family of Products/Upgrades	ROI-driven, incremental R&D	Episodic, new version more easily rolled-out
Developer Risk	Initially high, less for platform extension	High due to difficulty of understanding user behavior
Human Resource Requirements	Well-known, predictable skills mix	The future of service science!! (mystery)
Benefit/Gross Margin	Can be very good, limited by design	Can be excellent if widely adopted
Cost	Medium-to-high	Can be low (may also depend on industry)
Customization/ Versatility	More difficult	Easier

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Results of Work Group
"Embedded IT for Predictive Services"

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NSF

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Embedded IT for Predictive Services

- Participants and contact information
  - Inititator:
    - *Jay Lee, University of Cincinnati, USA.*
  - Participants:
    - *Tetsuro Fujiwara, Tiffany and Company. Inc. Japan,*
    - *Douglas Morse, Oracle , USA*
    - *Akira Kondo, JAIST – Tokyo MOT, Japan.*
    - *Terry Oliver, BPA - USA*

Applications: Embedded IT

- *More and more low labor cost products made overseas– US companies need to add more innovative technologies to differentiate products and services for enhanced customer value*
- *Service quality should be repeatable and dependable*
- *Fundamental values are missing from business ecosystem*
- *Customer needs (gaps) should be identified to lead for service innovation*
- *Problem formulation for customer service is more important than technology generation – how to identify customer needs and problems to deliver the right solutions*
- *Need scientific-base and tools to design smart embedded IT system for dominant service innovation*

Applications: Embedded IT

Reasons, why the issues are currently not sufficiently addressed in the field of Technology Management in the Service Sector?

- *IT Service is not equal to customer service*
- *Customer service depends on the nature of decision (such as on-time arrival for airline)*
- *We have lots of data but sometime it is incomplete and we do not have time to analyze them → need imbedded systems to autonomously analyze the data*
- *Right data to right computer at right time → right information to the right people at right time*

– ***Need systematic methodology to reduce or eliminate trial-and-error approach***

– ***Scientific base for rapid problem mining and formulation (gaps) vs. data mining***

– ***Need to involve*** *"Emerging Frontiers in Research and Innovation"*

Cognitive Optimization and Prediction

Resilient and Sustainable Systems (product service network systems)

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Results of Work Group

"Healthcare Service Organizational Issues"

Dr. Eppie E. Clark

The University of Warwick

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Healthcare Service Organizational Issues

- Participants and contact information
  - Initiator(s):
    - *Dr. Eppie Clark, The University of Warwick*
  - Participants:
    - *Dr. Charles Weber, Portland State University*
    - *Dr. Tugrul Daim, Portland State University*
    - *Dr. Kagami, Shigeo, The University of Tokyo*
    - *Yuying Wu, Beijing University*
    - *Bridget Haggerty, Oregon Health & Science University*

Healthcare Service Organizational Issues

- Key issues identified
  - *Knowledge Management*
    - *Risks*
      - *Loss of institutional knowledge/best practices*
      - *Higher mortality or level of illness*
      - *Increasing costs*
    - *Opportunities*
      - *Implementing worldwide best practices*
      - *Decrease cost*
      - *Increase quality*
  - *Service Excellence*
    - *Patients -> Family -> Providers -> Hospital Operations -> Patients*
    - *Risks*
      - *Varying service level expectations*
    - *Opportunities*
      - *Improved Quality of Care*
      - *Proactive/Preventives Medicine*
      - *Motivation for healthcare providers*

Healthcare Service Organizational Issues

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- Why is this important
  - *Society*
    - *Improved Health, Reduced Cost, Longer Life*
    - *Improve Quality of Live, Level of Service*
  - *Service Science Researchers*
    - *Tools/Methodology can be applied across multiple service sectors*
  - *Technology Management Practitioners/Researchers*
    - *Apply best practices/existing knowledge to new industry with unique characteristics*

Healthcare Service Organizational Issues

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- Required action
  - *What are the three main reasons, why the issues are currently not sufficiently addressed in the field of Technology Management in the Service Sector?*
    - *Closed field*
    - *Benefits are difficulty to quantify*
    - *Ethics based work commitment of healthcare employees*
    - *Perceived lack of skill set*
  - *What do you propose to improve the situation?*
    - *Education Opportunities*
      - *Specialized program development*
      - *New degree/specialization or new organizational positions*
      - *Imbedded technology management methodology as part of healthcare professional curriculum*
    - *Research Opportunities*
      - *From tacit knowledge to explicit knowledge (How Dr.'s Think)*
      - *User acceptance of monitoring/predictive tools*
    - *Identify methods to address standardization vs. customization = optimization*
  - *We believe many currently available research orientations, frameworks, methodological approaches, funding tools, could be applied to meet these needs. e.g. vendors, technology companies, government agencies.*
  - *International collaboration may be a unique and available give "public" interest in quality of life and cost containment.*

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Results of Working Groups on Education and Case Studies

Bill Hefley
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Contributors: Education Working Group

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- **Initiator:**
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  - Patrick Mantey, University of California at Santa Cruz (United States)
  - Frank Steiner, Portland State University (Germany)
  - Carl Chang, MS Program in Service Systems Engineering, Dept of Industrial Engineering, State University of New York at Buffalo (United States)
  - Benjamin Nakashima, University of Alberta (Canada) (previously taught in services program at ITESM, Mexico)
  - Al Thal, Dept of Systems and Engineering Management, Air Force Institute of Technology (United States)
  - Douglas Morse, Oracle (United States)

Contributors: Case Studies Working Group

- Initiator:
  - Harvey Greenberg, Portland State University (United States)
- Participants:
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  - Sheila Bennet, Bonneville Power Administration (United States)
  - Juan Arturo Ortega,Universidad del Valle (Colombia)
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  - Hideki Yoshida, Japan Science & Technology Agency (Japan)
  - Neslihan Sener, Portland State University (Turkiye)

Why Focus on Education?

- There is an absolute need to innovate in education.
- Why?
  - If more than half the jobs will be created in service sector – are we properly preparing students?
  - There is a major, radical shift taking place
    - Service economy is rapidly growing
      - Largest component of US economy
      - China is planning to move >400 Million people into services
    - Represents a paradigm shift – like moving from horse -> steam -> electricity

Education Needs - 1

- We need to:
  - Understand service globally
    - Service measures and definitions differ across geographies
      - Cultural aspects – personal touch, trust
      - What do we optimize for – efficiency, employment (i.e, what is the objective function)
  - Understand today's services people
    - Need to better understand what people are really doing (post-graduation) – how many are working in services today?
    - What distinguishes the real models of a T person – at early stages in career, focus on vertical, in-depth; later in career focus on horizontal?

Education Needs - 2

- We need to:
  - Educate the next generation of services leadership
    - Not just people who can do a service, but people who have business understanding, technical grounding, organizational awareness
    - Need interdisciplinary people (not just MBAs – need the T person with depth and breadth)
  - Educate people who understand services
    - Industrial engineers, quality, etc.
  - Provide professional (vocational) education and training

Designing Educational Offerings

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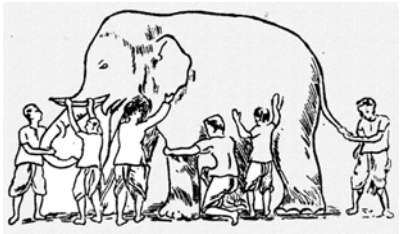
- Which cage does this elephant belong in? Where is the home for technology management / service science programs?
  - The need to focus on the entire system (technology, business, social systems) makes this hard
  - Need for flexible organizational forms – new programs and adaptations of existing programs (industrial engineers moving to more emphasis on services)



- What are the important service sectors – professional services, health care, IT? (US Government defines ~13 service sectors) Does one program fit all or do we need specialized or focused programs?
  - Risk of reducing things to just IT problems, systems analysis and design.
- Should we have service programs or service components of existing programs?
  - Emphases are different.
- Are services something that should be taught to undergraduates or graduates?
  - Undergraduate degrees – with services minors, IT minors, globalization
  - Graduate (MS and PhD) offerings
    - Tracks – management of technology, computing technology, service management, etc.
- How much technology in a program is needed?
  - How much technology underpinnings are needed?
- How to sell this to prospective students?

Important Topics

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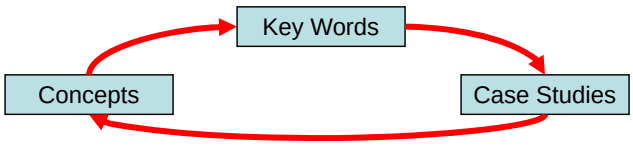
- Topics needed
  - Services 101
    - Beyond burger flipping
    - ***Case studies*** of service offerings – IBM, Google, Amazon, Nipuna, etc.
  - Service design and engineering
  - Globalization and cross-cultural awareness
  - Service innovation
  - IT services management
  - Service measurement / value / intangibles

Case Studies

- What makes a good case study?
  - Harvard Case Study model for education purposes
- Availability of case studies
  - Where are the existing case studies?
  - How do we create new case studies in services?
  - How do you collect them?
  - How can we disseminate or share case studies? Examples: Harvard, ECCH, ITSqc, PICMET website
- Understanding key concepts from case studies (SSME, MOT, technology etc.)



Why are Case Studies important?

- In complex service settings, we cannot easily replicate servicescapes in our labs
- Impact of case studies within an organization to promote use of technology road maps
- Improve communication
  - Promote the use of the same terminology
  - Provide opportunities to share knowledge
  - Support knowledge management “stories”
  - Address multiples aspects (scientific research (R), technology development (D), management of technology, management of services, innovation)
- Importance of learning best practices
  Case studies = testimonials
- The “whole” – case studies integrate
  technology ⟹ business ⟹ society

Proposed Framework for Cases

Case studies about

Where does TM begin and end?

Research, design, development

Management, use, improvement and innovation

Technology, marketing, technology adoption

(Successes AND Failures!)

Many Barriers Exist

- Reason #1 – Not academically structured to introduce services in a typical academic disciplinary setting (silos).
  - Schools / faculty are research-oriented, so teaching new programs are at lower priority (or funding) for many faculty.
  - Junior faculty may not easily do cross-disciplinary (or new) things – they need to publish in established disciplinary outlets to get tenure.
  - We need to provide support for them (herding cats requires moving the food).
- Reason #2 – Resistance to change – no one wants to give up their turf / comfort zone.
  - Industry focuses on today's problems, but academia are trying to prepare labor pool for the future.
  - Lack of multi-disciplinary work.
  - Lack of communication – not having clear understanding of measures and values for each constituent group.
- Reason #3 - Cannot replicate servicescapes in our labs, like we can do other science experiments. We need to have strong teaching cases, internships, and access to real research settings.

Actions Needed - 1

- Where is the Services Directorate/Program at NSF?
  - Jointly between CISE, Engineering, Behavioral Science
  - Extend existing Service Enterprise Engineering program
- Where is Research Agency (i.e., NSF, others) support for service science?
  - Support for education program development and internships
    - Support for Professional Masters and PhD level program development (faculty release time, course development, etc.)
    - Support for IGERT programs related to services
  - Support for research
    - Faculty support
    - Junior faculty fellowships
    - Industry-University Research Centers

Actions Needed - 2

- Where is the industry support for cross-disciplinary services education?
  - Case studies
  - Project courses
  - Guest speakers, visiting faculty
  - Internships
  - Joint program development
- Need funding and access for internships, industry projects, capstone service projects
  - Possibly between multiple schools in different countries
- Where is support to capture and codify experience?
  - Role models
  - Case studies
  - Best practice models, examples of bad practice