Services Sciences, Management, Engineering (SSME):
A next frontier in education, employment, innovation, and economic growth

Jim Spohrer
Director, Almaden Services Research
spohrer@us.ibm.com
Laying the ground work…

- First, a brief history of modern regional innovation...
  The rise of the modern innovation economy
  Enabled by the services economy (gov, ed, finance, trans, comm, etc.)
  Increasingly made up of specialized knowledge workers

- But how do we make sense of the diversity of services?
  What will the next new service industry be?
  Can we formally represent a service system?
  Can we understand service system design and evolution?

- … perhaps we need …
  a new tool, a CAD&D/CAS for service systems
  a new generalist profession, a service scientist (entrepreneur?)
  a new academic discipline, SSME
What will the next new service industry be?

- Online game worlds for business applications?
- Google Search (less than a decade old)
- Semantic Search?
- Book: Blue Ocean Strategies

Ogre to Slay? Outsource It to Chinese (People Pay Other to Play Video Games for Them)
New York Times | December 9, 2005 | DAVID BARBOZA

Posted on 12/10/2005 7:59:32 PM PST by nickcarraway

One of China's newest factories operates here in the basement of an old warehouse. Posters of World of Warcraft and Magic Land hang above a corps of young people glued to their computer screens, pounding away at their keyboards in the latest hustle for money.

The people working at this clandestine locale are "gold farmers." Every day, in 12-hour shifts, they "play" computer games by killing onscreen monsters and winning battles, harvesting artificial gold coins and other virtual goods as rewards that, as it turns out, can be transformed into real cash.

That is because, from Seoul to San Francisco, affluent online gamers who lack the time and patience to work their way up to the higher levels of gamedom are willing to pay the young Chinese here to play the early rounds for them.

"For 12 hours a day, 7 days a week, my colleagues and I are killing monsters," said a 25-year-old gamer who works here in this makeshift factory and goes by the online code name Wandering. "I make about $250 a month, which is pretty good compared with the other jobs I've had. And I can play games all day."
Innovation sustains skilled employment and exports

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Revolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800-</td>
<td>England</td>
<td>Industrial Revolution</td>
</tr>
<tr>
<td>1850-</td>
<td>Germany</td>
<td>Chemicals Revolution</td>
</tr>
<tr>
<td>1900-</td>
<td>USA</td>
<td>Electrical &amp; Information Revolution</td>
</tr>
<tr>
<td>1950-</td>
<td>Japan</td>
<td>Quality Innovation: Product Revolution</td>
</tr>
<tr>
<td>1990-</td>
<td>Finland</td>
<td>Mobile Communication Revolution</td>
</tr>
<tr>
<td>2000-</td>
<td>India</td>
<td>Cost Innovation: Services Revolution</td>
</tr>
<tr>
<td>2000-</td>
<td>China</td>
<td>Cost Innovation: Product Revolution</td>
</tr>
<tr>
<td></td>
<td>?</td>
<td>Future of Products &amp; Services Exports</td>
</tr>
</tbody>
</table>

*Sustainable growth depends on innovation via regional government, industry, academic collaboration.*
Historical Example: Emergence of new academic discipline and systematic approach to innovation and wealth creation

- Emergence of German dye industry, German mid-19th Century
- Emergence of chemistry as an academic discipline
- Emergence of patent protection in the new area of chemical processes and formula
- Emergence of new relationships connecting firms, academic institutions, government agencies, and clients
- Demonstrates needed coevolution of firms, technology, and national institutions
- Took England and US over 70 years to catch up!!!
“Innovative activity is fundamentally a service activity.”
- William J. Baumol

“We are continually creating a new and novel world.”
- Douglass C. North
Service jobs are increasingly the **high skill** knowledge worker jobs – especially in business and information services.

95% of all business executives and research scientists are alive today.

<table>
<thead>
<tr>
<th>Type of work system</th>
<th>1979</th>
<th>1996</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Service</td>
<td>Manufacture</td>
</tr>
<tr>
<td>High-skill Autonomous</td>
<td>34%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Semi-Autonomous</td>
<td>35%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Unrationalized Labor Intensive</td>
<td>25%</td>
<td>25%</td>
<td>26%</td>
</tr>
<tr>
<td>Tightly Constrained</td>
<td>6%</td>
<td>5%</td>
<td>4%</td>
</tr>
</tbody>
</table>

*From Herzenberg, Alic, Wial (1998)*

More Examples... by Industry...

| High skill | Executive, judge | Doctor, professor, dean | Broker, partner | Executive, lawyer, scientist, engineer, architect, entrepreneur | Executive, engineer | Executive, proprietor | Producer, director, proprietors, designer, star athlete performer | Pilot, executive, engineer |
| Semi-autonomous | Legislator, policy researcher, patent analyst | Pharmacist, nurse, teacher, technician | Analyst, actuary, underwriters | Manager, accountant, HR, PR, marketing, business dev | Technician, system administrator, journalist, writer, announcer | Buyer, high end sales | Actor, performer, artist, technician | Attendant, maintenance technician, plumber, electrician |
| Unrationalized labor intensive | Police, firefighter, security guard | Nurses aid, day care worker, ambulance driver | Adjustors, auditors, investigators | Admin, assistant, hiring specialist, door to door sales | Call center specialist, librarian | Sales clerk, stocker, shipping & receiving | Maid, janitor, waiter, gardener, cook, barber | Truck driver, field force technician, machine operator |
| Tightly constrained | Inspectors, data entry | Data entry | Bank teller, checkers, proofers | Inspectors, receptionists | Telephone operator | Sales counter clerks | Fast food worker | Inspectors |
| Client | Citizen, plaintiff, defendant, subscriber | Patient, student, subscriber | Shareholder, client, subscriber | Client | Subscriber | Consumer, shopper | Guest | Subscriber, commuter |

- based on Herzeberg et al., (1998). All occupations span a range, placement is representative only.
Four worlds of services jobs, down stream and up stream services for...

- **People**
  - enable
  - develop
  - Consumer services
  - Non-market services

- **Business**
  - enable
  - transform
  - Business services

- **Products**
  - design
  - operate & maintain
  - Industrial services

- **Information**
  - create
  - utilize
  - Information services

SSME: Education, Employment, Innovation, and Economic Growth
U.S. Employment Percentages by Sector

Estimations based on Porat, M. (1977) Info Economy: Definitions and Measurement,
Augmented with recent data and projections from http://www.bls.gov/

Service-providing industries are projected to account for most job growth, generating almost 19 million new jobs between 2004 and 2014. This is due, in part, to increased demand for services and the difficulty of automating service tasks.

Services for... people, business, products, and information

<table>
<thead>
<tr>
<th>Has Rights</th>
<th>Spatially localized &amp; drive to increase local capabilities (Physical)</th>
<th>Potentially distributed &amp; drive to increase network capabilities (Virtual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>People</td>
<td><strong>People</strong></td>
<td><strong>Business</strong> (organizations)</td>
</tr>
<tr>
<td>Business</td>
<td><strong>Products</strong> (technology artifacts and environment)</td>
<td><strong>Information</strong> (capital, reputation, process, laws, science)</td>
</tr>
<tr>
<td>Is Owned</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Definition of services (based on Gadrey, 2002)

A. Service Provider
- Individual
- Organization
- Technology owned by A

Forms of Service Relationship
(A coproduces value with B)

B. Service Client
- Individual
- Organization
- Public or Private

Forms of Service Interventions
(A on C, B on C)

Forms of Responsibility Relationship
(A on C)

C. The reality to be transformed or operated on by A, for the sake of B
- People, dimensions of
- Business, dimensions of
- Products, technology artifacts & env.
- Information, codified knowledge

Forms of Ownership Relationship
(B on C)
So What?

- What is the key to being more innovative in services?
- What is the key to increasing high skill jobs that enable more service innovation?
- What is the key to developing innovative, high value services exports?
- In short, what policies, investments, research, and education is most needed?
- Challenge: Services breeding like rabbits – is the future simply an unending stream of new specialists hopping from innovation to commoditization, and back?
  - Herzenberg et al, Economies of depth and coordination
  - Carley, Specialists and generalists
Today’s talk

- What is SSME or “a Science of Services”?  
- Why is SSME so important?  
- Why does IBM care?  
- Who else cares?  
- What kinds of skills should a service scientist have?  
  - Is there a “Services Rosetta Stone?”  
- What kinds of tools should a service scientist have?  
- What does a service scientist actually do?  
- Are there “scale laws” of service innovation?  
- Questions?
What is SSME?  
(Services Sciences, Management, and Engineering)

- An urgent “call to action”
  - To become more systematic about innovation in services
  - Complements product and process innovation methods
  - To develop “a science of services”

- A proposed academic discipline
  - Draws on many existing disciplines
  - Aims to integrate them into a new specialty

- A proposed research area
  - Service systems are designed (computer systems)
  - Service systems evolve (linguistic and social systems)
  - Service systems have scale-emergent properties (economic systems)
What is SSME?
(Services Sciences, Management, and Engineering)

- The application of scientific, management, and engineering disciplines to tasks that one organization beneficially performs for and with another (‘services’)

  Understand the evolution and design of service systems
  Make productivity, quality, compliance, sustainability, and innovation rates more predictable
  Services are anything of economic value that cannot be dropped on your foot
  Services are value coproduction performances and promises between clients and providers

- Science is a way to create knowledge
- Engineering is a way to apply knowledge and create new value
- Management improves the process of creating and capturing value
Why is SSME so important?

- Governments need to make service innovation a priority
  GDP growth of nations increasingly depends on it

- Businesses need to make service innovation a priority
  Revenue and profit growth increasingly depend on it

- Academics need to make service innovation a priority
  Students’ futures depend on it
  Improved education productivity and quality depends on it
  New frontier of research with business and societal impact
Why is SSME so important?
Because the world is becoming a service system.

*Top Ten Nations by Labor Force Size*
(about 50% of world labor in just 10 nations)
*A = Agriculture, G = Goods, S = Services*

<table>
<thead>
<tr>
<th>Nation</th>
<th>% WW Labor</th>
<th>% A</th>
<th>% G</th>
<th>% S</th>
<th>25 yr % delta S</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>21.0</td>
<td>50</td>
<td>15</td>
<td>35</td>
<td>191</td>
</tr>
<tr>
<td>India</td>
<td>17.0</td>
<td>60</td>
<td>17</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>U.S.</td>
<td>4.8</td>
<td>3</td>
<td>27</td>
<td>70</td>
<td>21</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3.9</td>
<td>45</td>
<td>16</td>
<td>39</td>
<td>35</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.0</td>
<td>23</td>
<td>24</td>
<td>53</td>
<td>20</td>
</tr>
<tr>
<td>Russia</td>
<td>2.5</td>
<td>12</td>
<td>23</td>
<td>65</td>
<td>38</td>
</tr>
<tr>
<td>Japan</td>
<td>2.4</td>
<td>5</td>
<td>25</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2.2</td>
<td>70</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>2.2</td>
<td>63</td>
<td>11</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>Germany</td>
<td>1.4</td>
<td>3</td>
<td>33</td>
<td>64</td>
<td>44</td>
</tr>
</tbody>
</table>

>50% (S) services, >33% (S) services

The largest labor force migration in human history is underway, driven by global communications, business and technology growth, urbanization and low cost labor.
Why does IBM care? Our ability to hire needed talent and innovate

IBM played a role in establishing Computer Science

Now IBM is working with academics and government to establish Service Science

PhD’s & Masters in U.S. IGS and IBM Research

Need to hire Computer Scientists

Need to hire Service Scientists
Who else cares?

- Governments
  - US, EU, European Commission, China, Japan, Germany, UK, Finland, Norway, Denmark, Sweden, Italy, Netherlands, Russia, India, Belgium, and others
  - US Department of Commerce, NSF, NIST, DARPA, VTT, etc.

- Industry
  - IBM, Accenture, HP, EDS, CSC, Cisco, P&G, American Express, John Deere, Avaya, Oracle, and many others

- Academics
  - ASU, PSU, NCSU, Berkeley, RPI, UCSC, Georgia Tech, Bentley, Stanford, CMU, UCLA, BYU, Yale, Harvard, MIT, Northwestern, UArizona, UMaryland, UGeorgia, UMichigan, UTexas, MichiganSU, Columbia, Oxford, Warwick, Tokyo University, Peking University, Carlsruhe, AIO, Norwegian School of Economics, Helsinki University of Technology, University of Rome La Sapienza, and many others

- Others
  - BestServ, OECD, Institute for the Future, Bay Area Economic Forum, etc.
<table>
<thead>
<tr>
<th>School</th>
<th>Discipline</th>
<th>Evolution &amp; Revision</th>
<th>Selection &amp; Aggregation</th>
<th>Transformation &amp; Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Management</td>
<td>Marketing</td>
<td>Service Marketing</td>
<td>Service &amp; Solutions Excellence Centers</td>
<td>Services Sciences, Management, and Engineering (SSME) and Solutions Engineering</td>
</tr>
<tr>
<td></td>
<td>Operations</td>
<td>Service Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accounting</td>
<td>Service Accounting (Activity-Based Costing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contracts &amp; Negotiations</td>
<td>Service Sourcing (eSourcing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Management Science</td>
<td>Management Science</td>
<td>Service Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Management of Technology</td>
<td>Management of Innovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School of Engineering and Science</td>
<td>Operations Research</td>
<td>Service Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial &amp; Systems Engineering</td>
<td>Service Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer Science</td>
<td>Service Computing, Web Services, SOA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School of Social Sciences</td>
<td>Economics</td>
<td>Institutional Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Psychology</td>
<td>Labor Psychology (Human Capital Mgmt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anthropology</td>
<td>Business Anthropology</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organization Theory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Information Science &amp; Systems, Service professional schools</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What kinds of skills should a service scientist have?

- **Technology**
  Make, Verify, Deliver, Operate, plus eServices & eMarkets

- **Business**
  Propose (win-win), Finance, Market, Manage, plus eBusiness & eMarkets

- **Social-Organizational**
  Coordinate, Motivate, Govern, Learn, plus eSourcing and eMarkets

*Education in reading, writing, and arithmetic (3 R’s) enabled 19th century innovation. Add science, technology, engineering, and mathematics (STEM) for the 20th century. Add more info. technology, business, and social-organizational enable 21st century, or Social-Technology-Economic-Environmental-Political (STEEP).*
What kinds of skills should a service scientist have? Academic disciplines evolving to combine technology, business, and social-organization.
What kinds of tools should a service scientist have?

- Empirical tools – simulation tools and techniques
- Analytic tools – mathematical tools and techniques
- Engineering tools – workbench to assemble standard components, and infrastructure platform to deploy them into practice
- Multidisciplinary design tools – palette of customizations
- Theoretical tools – standard terminology, measures, and principles
What kinds of tools should a service scientist have?

For Example: Computer-Aided Market Engineering System

Operating & Monitoring

Knowledge Based Market Design

Trader A

Market outcome

Conduct

Market structure

Transaction object

Trader B

CAME (WEB) Suite

What would service scientists actually do?

- Service scientists own the body of knowledge around service system problem solving

- Service scientists identify a service system that needs improvement

- Service scientists identify the stakeholders, their concerns, and perceived opportunities

- Service scientists envision augmentations (additional new service systems) or reconfigurations (of old service systems components) that best address all problems and opportunities
  - Identify year-over-year improvement trajectories
  - Identify incentives to change (ROI, leadership, laws)
Example: Are there “scale laws” of service innovation – year-over-year compounding effects?

- **Problems**
  - Input: Student quality
  - Process: Faculty motivation
  - Output: Industry fit

- **Augmentations**
  - A: -20% eLearning certification
  - B. +10% Faculty interest tuning
  - C. +10% On-the-job skills tuning

Year 1: 20%
Year 2: 20%
Year 3: 20%
Year N: 20%

After a decade the course may look quite different.

Service systems are learning systems: productivity, quality, etc.
### A Grand Challenge: Predictable Service Productivity Growth

<table>
<thead>
<tr>
<th>Productivity</th>
<th>Other Considerations</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global</strong></td>
<td>Values, Demands, Aspirations, Wants, Needs</td>
<td><strong>Sustainability &amp; Demand</strong></td>
</tr>
<tr>
<td><strong>National</strong></td>
<td>Policies &amp; Laws, Public Infrastructures</td>
<td><strong>Growth &amp; Innovation</strong></td>
</tr>
<tr>
<td><strong>Industry</strong></td>
<td>Crime, Terrorism, Cheating, Other Mischief</td>
<td><strong>Standards &amp; Compliance</strong></td>
</tr>
<tr>
<td><strong>Enterprise</strong></td>
<td>Foundations, Not-for-Profits, Research Organizations</td>
<td><strong>Growth &amp; Innovation</strong></td>
</tr>
<tr>
<td><strong>Work System</strong></td>
<td>Graduates from Schools &amp; Universities</td>
<td><strong>Quality &amp; Learning</strong></td>
</tr>
<tr>
<td><strong>Knowledge Worker Professions</strong></td>
<td>Family Life, Local Community, Environment</td>
<td><strong>Opportunity &amp; Sustainability</strong></td>
</tr>
</tbody>
</table>

**Measurement of Sociotechnical Systems**

**Measurement of Service Systems**
Service Marketing, Operations, and Management
Operations Research and Management Science
Industrial & Systems Engineering, Control Theory
Information Sciences and Systems Engineering
Management of Technology and Innovation
Computer Science, Distributed AI, CSCW
Computational Organization Theory
Social and Cognitive Science
Economics & Jurisprudence
Game Theory and Mechanism Design Theory
Management of Information Systems
Organization Science, Complexity Management Theory
Business Informatics and Document Engineering
Business Anthropology and Learning Organizations
Decision Science and Knowledge Management
Human Capital Management & Incentive Engineering
Quality, Six Sigma, Statistics, Process Optimization
Computer Aided Market Engineering

Services: Value coproduction acts, promises, and relationships via sharing work, risk, information, assets, decisions, responsibility, and authority
REST IS BACKUP

Contact Wendy Murphy (wendym@us.ibm.com)
“Innovative activity is fundamentally a service activity.”
- William J. Baumol

“We are continually creating a new and novel world.”
- Douglass C. North
Are there “scale laws” of service innovation?

- Moore’s Law underlies much of the information technology and business capability growth over the last half century
  - Are there analogous “predictable capability doubling laws” that apply in the realm of services? If so, how might they be exploited to improve service productivity and quality in a predictable manner?
  - It seems three improvement or learning curve laws that might be applicable in services:
    - The more an activity is performed (time period doubling, demand doubling) the more opportunities there are to improve the process
    - The better an activity can be measured (sensor deployment doubling, sensor precision doubling, relevant measurement variables doubling) and modeled the more opportunities there are to improve the process
    - The more activities that depend on a common sub-step or process (doubling potential demand points), the more likely investment can be raised to improve the sub-step.
- Example: Amazon’s Book Buying Recommendation Service Quality
  - The quality of the recommendations depends on accurate statistics – the more purchases made, the better the statistical estimates for recommendations
- Example: Call Centers Query-Response Productivity and Quality
  - The speed and quality of call center responses can be improved significantly given accurate statistics about the kinds and number of queries that are likely to be received.
- Example: New Service Offerings Viability (Blue Ocean Strategy)
  - The viability of new service offerings often depends on the scale (amount of demand) in adjacent market segments where service satisfaction is low enough to result in sufficient critical mass of defections to bootstrap the new offering.
- Example: Predictable Education Gains (Student Knowledge, Teacher Satisfaction)
  - If eLearning can be used to shift 20% of routine teacher activities into automation that can be covered in half the normal time, freeing up 10% of teacher time each year to innovate and add new content or exploratory activities to the curriculum, then each year students will be learning more and teachers will have time to try new things.
What is SSME? (Services Sciences, Management, and Engineering)

- The application of scientific, management, and engineering disciplines to tasks that one organization beneficially performs for and with another (‘services’)

  Make productivity, quality, compliance, sustainability, learning rates, and innovation rates more predictable in the service sector, especially complex organization to organization services – business to business, nation to nation, organization to population

  Services are anything of economic value that cannot be dropped on your foot – the key to service value is in actions, performed now or promised for the future. Services transform/protect or promise to transform/protect a state of the target of the service. The client may not have the skill, time, desire, or authority to perform self-service, do it themselves. Services often create mutual interdependencies.

  Services are value coproduction performances and promises between clients and providers, with alternative work sharing, risk sharing, information sharing, asset sharing, and decision sharing arrangements and relationships (promises to perform now or in the future, once or repeatedly, when needed or demanded, standard or customized, satisfaction guaranteed or best effort, service levels fixed or variable)

- Science is a way to create knowledge
- Engineering is a way to apply knowledge and create new value
- Business Model is a way to apply knowledge and capture value
- Management improves the process of creating and capturing value
What can you do to get involved? [government]

- Does your agency fund innovation?
- Does your agency influence innovation policy?
- Does your agency establish standards?
- Does your agency deal with intellectual property?
- Does your agency deal with economic statistics?
What can you do to get involved? [industry]

- Does your business develop, sell, and/or deliver service offerings?
- Does your business have a service innovation process?
- Does your business use services to complement and add value to manufactured products?
- Does your business invest in internal R&D?
- Does your business fund university or other external R&D?
- Does your business create case studies, success stories, white papers, or point-of-view documents about service offerings?
- Does your business recruit service professionals? Service researchers?
- Does your business provide feedback to schools (survey recent graduates hired) on what skills are desired to be most effective in your business?
- Does your business procure services? eSource of services? Outsource services?
- Does your company patent or otherwise protect intellectual property related to service innovation?
What can you do to get involved? [academics]

- Do you teach courses that include or could include complex business to business service case studies?
- Do you have responsibility for revising or creating new curriculum?
- Do you perform research that could be published in the *Journal of Service Research* or other relevant journals or conferences?
- Do you have students who could intern with business service or service research organizations? Compete for PhD fellowships in services?
- Are you interested in industry-academic rotations?
- Are you interested in developing tools that could enable SSME?
- Are you interested in creating business proposals or grant proposals related to SSME and service innovation? Competing for university research awards?
- Are you interested in participating/speaking in SSME events? Hosting one at your university?
- Does your school already have services related courses, degrees, centers, or institutes?
- Are you a service innovation pioneer? Are you interested in competing for a faculty award?
What is IBM doing to support others?

- Publicizing a “call to action” around SSME and the need for systematic approaches to service innovation (identify IBM relationship/ambassadors)
- Hosting and cosponsoring SSME and service innovation related events with government, industry, and academics around the world
- IBM Faculty Awards to select service innovation pioneers
- IBM PhD Fellowships to select services-related PhD students
- IBM University Research (SUR) awards to select academic institutions proposing leading edge service innovation and SSME related work
- Providing best paper awards for leading service research related journals and conferences
- Working with government funding agencies to increase focus and establish new programs related to service innovation
- Inviting people to contribute to an SSME blog, and share information about their SSME related efforts (http://www.research.ibm.com/ssme)
- Working with some academic institutions to provide access to service data
- Hiring recent graduates into IBM Global Services and IBM Research
- Supporting curriculum development and research efforts, and much more…
IBM’s SSME Course (Under Development)

1. **Services** – What are services?
2. **Systems** – Services depend on sociotechnical systems
3. **Methods** – Service delivery depends on methods
4. **Industrialization** – Services are being standardized
5. **Quality** – How do we ensure quality of service?
6. **Components** – Business processes are being modularized
7. **Science** – Is there a science of services?
8. **Management** – What is different in management of services?
9. **Engineering** – Can service engineering foster innovation?
10. **Productivity** – Why do services resist productivity gains?
11. **Challenges** – What are the big problems for the service economy?
12. **Innovation** – Can we be systematic about innovation on services?
Who else cares?

- Governments
  - National innovation initiatives
  - Research funding agencies

- Industry
  - Numerous service providers, partners, clients
  - Even some competitors

- Academics
  - Deans and teaching faculty
  - Research faculty
  - Entrepreneurial students who want high value professional skills and who want to address complex societal challenges
Services, Services, Services – A big part of our world

- Financial
  Banking, investment

- Transportation
  Trains, planes

- Infrastructure
  Telephone, electricity

- Entertainment
  Movies, television

- Hospitality
  Hotel, restaurants

- Government
  Police, fire

- Healthcare
  Doctors, nurses

- Education
  K-12, colleges, universities

- IT Services
  Outsourcing, search

- Business & Professional Services
  Consulting, outsourcing, lawyers
Fastest growth in new business and information services

- Financial
  Banking, investment

- Transportation
  Trains, planes

- Infrastructure
  Telephone, electricity

- Entertainment
  Movies, television

- Hospitality
  Hotel, restaurants

- Government
  Police, fire

- Healthcare
  Doctors, nurses

- Education
  K-12, colleges, universities

- IT Services
  Outsourcing, search

- Business & Professional Services
  Consulting, outsourcing, lawyers
What Services Does IBM Provide?

- Strategic Outsourcing & IT Hardware, Software & Services
- Business Consulting Services & Project-based Systems Integration
- Transformational Consulting
- Operational Processes Support Processes
- Management Processes
- IBM's Full Equation

- Application Development, Migration, Support
- Second Level Help Desk
- Network Operations Centre
- First Level Help Desk
- Hardware System Operations Support
- Desktop Support
- Telecom Operations Support

Business Transformation Outsourcing
Example: Service Science at ASU

Science - We are in the business of the science of services - we base our understanding of effective services on research and objective criteria, not just platitudes.

Community - We are in the business of building a cross-industry and cross-functional network of companies and academics who can help each other discover fresh ways to compete through service - not just business as usual.

What makes us different from other university centers and consulting organizations?

Science - We are in the business of the science of services - we base our understanding of effective services on research and objective criteria, not just platitudes.

Significance - We are in the business of developing and sharing what works in the real business world, not just pure theory.
### 1. Decision Making in Economic Systems

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Econ 101B</td>
<td>Economic Theory Macro (4)</td>
<td></td>
</tr>
<tr>
<td>Econ 104</td>
<td>Advanced Microeconomic Theory (4)</td>
<td></td>
</tr>
<tr>
<td>Econ 141</td>
<td>Economic Statistics and Econometrics (4)</td>
<td></td>
</tr>
<tr>
<td>IEOR 165</td>
<td>Engineering Statistics, Quality Control and Forecasting (3)</td>
<td></td>
</tr>
<tr>
<td>Econ 161</td>
<td>Economic Systems (3)</td>
<td></td>
</tr>
<tr>
<td>Math 104</td>
<td>Introduction to Analysis (4)</td>
<td></td>
</tr>
<tr>
<td>E120</td>
<td>Princ. of Eng. Econ. (3)</td>
<td></td>
</tr>
</tbody>
</table>

### 2. Decision Making in Industrial and Service Systems

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEOR 150</td>
<td>Production Systems Analysis (3)</td>
<td></td>
</tr>
<tr>
<td>IEOR 151</td>
<td>Service Operations Design and Analysis (3)</td>
<td></td>
</tr>
<tr>
<td>IEOR 153</td>
<td>Facilities Planning and Design (3)</td>
<td></td>
</tr>
<tr>
<td>IEOR 162</td>
<td>Linear Programming (3)</td>
<td></td>
</tr>
<tr>
<td>IEOR 165</td>
<td>Engineering Statistics, Quality Control and Forecasting (3)</td>
<td></td>
</tr>
<tr>
<td>EOR 166</td>
<td>Decision Analysis (3)</td>
<td></td>
</tr>
<tr>
<td>EOR 170</td>
<td>Human Factors for Eng. Des. (3)</td>
<td></td>
</tr>
<tr>
<td>Bus Ad. 123</td>
<td>Managerial Accounting (3)</td>
<td></td>
</tr>
<tr>
<td>Bus Ad. 142</td>
<td>Prod. and Opns. Mgt. (3)</td>
<td></td>
</tr>
</tbody>
</table>

### 3. Decision Making in Societal Systems

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soc 101A</td>
<td>Sociological Theory (5)</td>
<td></td>
</tr>
<tr>
<td>Soc 105</td>
<td>Introduction to Sociological Methods (5)</td>
<td></td>
</tr>
<tr>
<td>Soc 106</td>
<td>Intermediate Sociological Methods (4)</td>
<td></td>
</tr>
<tr>
<td>IEOR 165</td>
<td>Engineering Statistics, Quality Control and Forecasting (3)</td>
<td></td>
</tr>
<tr>
<td>Soc 119</td>
<td>Society and Info. Theory (4)</td>
<td></td>
</tr>
<tr>
<td>Econ C110</td>
<td>Game Th. in the Soc. Sci. (4)</td>
<td></td>
</tr>
<tr>
<td>Econ 101A</td>
<td>Economic Theory Micro (4)</td>
<td></td>
</tr>
</tbody>
</table>

### 4. Algorithmic Decision Making

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 61B</td>
<td>Data Structures (4)</td>
<td></td>
</tr>
<tr>
<td>CS 170</td>
<td>Efficient Alg. and Intractable Prob. (4)</td>
<td></td>
</tr>
<tr>
<td>CS 172</td>
<td>Computability and Complexity (4)</td>
<td></td>
</tr>
<tr>
<td>CS 174</td>
<td>Combinatorics and Discrete Probability (4)</td>
<td></td>
</tr>
<tr>
<td>IEOR 115</td>
<td>Indust. and Comm’l. Data Syst. (3)</td>
<td></td>
</tr>
<tr>
<td>IEOR 162</td>
<td>Linear Programming (3)</td>
<td></td>
</tr>
<tr>
<td>IEOR 166</td>
<td>Decision Analysis (3)</td>
<td></td>
</tr>
<tr>
<td>Math 110</td>
<td>Linear Algebra (4)</td>
<td></td>
</tr>
</tbody>
</table>
Example: Berkeley SSME Certificate Program

Services: Science, Management and Engineering curriculum launched

The Center for Information Technology Research in the Interest of Society (CITRIS) is pleased to announce that IBM is supporting a new curriculum initiative in Services: Science, Management and Engineering (SSME) designed to prepare graduate students for careers in the emerging multidisciplinary field of services sciences, engineering, and management.

The new curriculum addresses the expansion of the services sector, which now represent over 75 percent of the U.S. economy. As the country’s economy shifts from a manufacturing base to an information services base, the services field is growing rapidly. Companies across the board are making new business opportunities by streamlining business procedures, constructing more efficient IT systems, and embracing the online marketplace. At IBM, services now account for about half of the company’s revenue. The globalization of the services workforce raises new and complex issues for services providers since they need to manage their workers’ time and skills efficiently in order to be competitive.

However, the services field does not have a solid foundation of data and research, let alone a base for educational offerings. To that end, professors and staff at UC Berkeley and UC Santa Cruz are developing a curriculum and research agenda focused on services. With its emphasis on its multidisciplinary research and mission of tackling society-wide issues, CITRIS is taking a lead role in furthering this new discipline by launching an SSME certificate program for UC Berkeley graduate students. Recently, CITRIS hosted a luncheon to honor Corporate Founding Member IBM’s support of the new program, and the announcement of a program director is forthcoming.

*Universities have an important role to play in conducting research that will innovate current services.

http://www.citris-uc.org/news/2006/01/25/services_science_management_and_engineering_curriculum_launched
Example: Business School SSME Curriculum for MBA

- Services Management
- Consulting

Relationship Management Focus:
- Business Relationship Management
- Organizational Culture
- Market Analytics
- Market Research
- Marketing Strategy
- Project Management
- Supplier Relations

Service Innovation Focus:
- Process Analysis and Design
- Organizational Culture
- New Service Development
- Project Management
- Marketing Strategy
- Service Modeling
- E-Commerce Practicum
IBM’s SSME Course Outline

1. Services – What are services?
2. Systems – Services depend on sociotechnical systems
3. Methods – Service delivery depends on methods
4. Industrialization – Services are being standardized
5. Quality – How do we ensure quality of service?
6. Components – Business processes are being modularized
7. Science – Is there a science of services?
8. Management – What is different in management of services?
9. Engineering – Can service engineering foster innovation?
10. Productivity – Why do services resist productivity gains?
11. Challenges – What are the big problems for the service economy?
12. Innovation – Can we be systematic about innovation on services?
13. Business Transformation Services & Industry Solutions
Service Science – Reading List

- Motivation

- Philosophy

- Exemplar Model

- Economics

- Technology

- Textbooks

- Evolution and Change: Managed, Designed, and Emergent
Select efforts to promote service science

- Dec. 2002: Almaden Service Research established, the first IBM Research group completely dedicated to understanding service innovations from a sociotechnical systems perspective, including enterprise transformation and industry evolution (http://www.almaden.ibm.com/asr/)
- March 2003: IBM-Berkeley Day: Technology... At Your Service! (http://www.eecs.berkeley.edu/IPRO/IBMday03/)
- June 2004: Paul Horn, VP IBM Research, briefs analysts on “Services as a Science”
- September 2004: Chesbrough’s “A failing grade for the innovation academy” appears in the Financial Times (http://news.ft.com/cms/s/9cb743b2a-0e0b-11d9-97d3-00000e2511c8.dwp_uuid=6f0b3526-07e3-11d9-9673-00000e2511c8.html)
- December 2004: IBM expands academic initiatives related to service innovations, including sponsoring Tannenbaum Institute of Enterprise Transformation at Georgia Tech.
- February 2005: Chesbrough’s “Service as a Science” in Harvard Business Review Breakthrough ideas of 2005
- 2005 - Oxford, Warwick, Bentley, Penn State, UMaryland, ASU, NCState, Japan, China, Norway, etc.
Spotlight

- Find the pioneers of service innovation research & practice

- IBM has invested well over $1M in faculty and university awards to service innovation pioneers over the last two years

- IBM invests far more in hiring top talent from universities for our service business and IBM Research in service innovation
Henry Chesbrough, Berkeley, a service science pioneer. IBM Faculty Award

Harvard Business Review

Breakthrough Ideas for 2005

14. Toward a New Science of Services

Services is the name of the game in today’s economy. Services represent about 80% of the U.S. gross domestic product and between 60% and 80% of the GDPs of the rest of the world’s advanced economies. Getting better at services management must be a priority. Companies like General Electric, Xerox, and IBM that are seeing their own businesses shift from products to services are acutely aware of this. (At IBM, for example, more than half of total revenue now comes from services.)

So why can’t we agree that services science is a legitimate field? Even as it is researched,
Glushko (Berkeley): Document Engineering

- Document Engineering: A new synthetic discipline
  With roots in Information and Systems Analysis (Data Analysis), Electronic Publishing (Document Analysis), Organization Science (Business Process Analysis), Business Informatics (Transaction Analysis), User-Center Design (Task Analysis)
  Design of Documents and Business Processes
  Design of Web Services and Service Oriented Architectures
- Related to Business Informatics—"combine the modern theory, methods, and techniques of business (i.e., organization science) and informatics (information and computing science) into one integrative programme." (definition from Utrecht University)
Berkeley’s new ORMS undergraduate major
Rhonda Righter, IBM Faculty Award
http://www.ieor.berkeley.edu/AcademicPrograms/Ugrad/ORMS.pdf

<table>
<thead>
<tr>
<th>1. Decision Making in Economic Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Econ 101B</td>
</tr>
<tr>
<td>Econ 104</td>
</tr>
<tr>
<td>Econ 141</td>
</tr>
<tr>
<td>IEO 165</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Decision Making in Industrial and Service Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>IEO 150</td>
</tr>
<tr>
<td>IEO 151</td>
</tr>
<tr>
<td>IEO 153</td>
</tr>
<tr>
<td>IEO 162</td>
</tr>
<tr>
<td>IEO 165</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Decision Making in Societal Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soc 105</td>
</tr>
<tr>
<td>IEO 165</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. Algorithmic Decision Making</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 61B</td>
</tr>
<tr>
<td>CS 170</td>
</tr>
<tr>
<td>CS 172</td>
</tr>
<tr>
<td>CS 174</td>
</tr>
</tbody>
</table>
Implementing successful self-service technologies

Mary Jo Bitner, Amy L. Ostrom, and Matthew L. Meuter

Executive Overview

As companies race to introduce technology that enables customers to get service on their own, managers often find that implementing and managing effective self-service technologies (SSTs) is more difficult than it looks. In this article, we present findings from qualitative interviews and survey research investigating SSTs from the customer’s point of view. This research identifies factors that impact customer satisfaction and dissatisfaction with SSTs. It also explores the issue of customer adoption of SSTs and highlights factors that are necessary for a customer to try an SST for the first time. Based on this research and our work with companies, we present important lessons to guide managers in developing successful SSTs.
A CASE FOR SERVICE SYSTEMS ENGINEERING

James M. TIEN    Daniel BERG

Department of Decision Sciences and Engineering Systems
Rensselaer Polytechnic Institute
Troy, New York 12110-3590, U.S.A.

Abstract

A case is made for further developing a branch of systems engineering that focuses on problems and issues which arise in the service sector. We promulgate this special focus not only because of the size and importance of the service sector but also because of the unique opportunities that systems engineering can exploit in the design and joint production and delivery of services. We begin by considering the economic, technological and demographic contexts within which the service sector has flourished; we then address both services, especially emerging services, and systems engineering, followed by a discussion of how to advance the field of service systems engineering, and concluding with several remarks. In particular, a number of service systems engineering methods are identified to enhance the design and production/delivery of services, especially taking advantage of the unique features that characterize services – namely, services, especially emerging services, are information-driven, customer-centric, e-oriented, and productivity-focused.

Keywords: Service sector, systems engineering, information technology, decision technologies, customer-centric, productivity
Advances in Sociotechnical Systems Integration: Object-Oriented Simulation Modeling for Joint Optimization of Social and Technical Subsystems

Marietta L. Baba and Olugbenga Mejabi
Wayne State University

1. INTRODUCTION

The realization that human factors are integral to the effective deployment and operation of advanced manufacturing systems has come slowly, and painfully, to American industry. While the technological imperative is still alive and well in many American organizations, much of the intellectual and practitioner elite seems ready to admit that “getting the technology right” does not, by itself, guarantee success (Grayson, 1990; Manufacturing Studies Board, 1986; MIT Commission on Industrial Productivity, 1989; National Research Council, 1987). To ensure that new manufacturing technologies perform and deliver as promised, human factors—which we construe broadly to include the characteristics of all of the individuals and social groups that directly or indirectly interact with a technical system—have to be recognized and understood, and also managed and often changed. Change is needed because human factors and technological systems are interdependent; one is not strictly causal (in a linear sense) with respect to the other (Majchrzak, 1992). This means that a new technological system will not automatically drive changes in human factors that may be necessary if new technology is to operate effectively. Rather, existing human factors may place constraints on new technology that limits its effectiveness (Adler, 1989; Hayes and Jaiman, 1988). Therefore, to the extent that new technology has capabilities and requirements that place new demands on existing human factors, those factors also may need to change simultaneously.
Augier and March: “Models of a Man”

- “Herbert Simon (1916-2001), in the course of a long and distinguished career in the social and behavioral sciences, made lasting contributions to many disciplines, including economics, psychology, computer science, and artificial intelligence. In 1978 he was awarded the Nobel Prize in economics for his research into the decision-making process within economic organizations. His well-known book *The Sciences of the Artificial* addresses the implications of the decision-making and problem-solving processes for the social sciences. “

*Models of a Man : Essays in Memory of Herbert A. Simon*

by Mie Augier (Editor), James G. March (Editor)
Milgrom & Roberts: "Economics, Organization & Management"

- “First, and most fundamentally, organizations and business strategy can be as important as technology, cost, and demand in determining a firm's success.”

- “The study of organization is not about how berries are arranged on a tree of authority, but about how people are coordinated and motivated to get things done.”

- “We study coordination: what needs to be coordinated, how coordination is achieved in markets and inside firms, what the alternatives are to close coordination between units, and how the pieces of the system fit together. We also study incentives and motivation: what needs to be motivated, why incentives are needed, and how they are provided by markets and firms, what alternative kinds of incentive systems are possible, and what needs to be done to make incentive systems effective.”

Economics, Organization and Management
by Paul Milgrom, John Roberts
Bryson, Daniels, Warf: “Service Worlds: People, Organisations, and Technologies”

- People, organizations, technologies
- Space/Geography in the economics of services
- Consumer power in services: Client demand
- Dynamics of knowledge value
- Unifying themes across all service sectors

Service Worlds: People, Organisations, Technologies
by John R. Bryson, Peter W. Daniels, Barney Warf

Also, see “Age of Services”
By James Teboul
**Example Model:**


### Table 2 Parameters and Sources for Service Model

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \eta ) Minimum time required to process an order</td>
<td>0.1 week</td>
<td>Set based on observations</td>
</tr>
<tr>
<td>( \lambda_0 ) Desired delivery delay</td>
<td>0.1 week</td>
<td>Set based on stated goals</td>
</tr>
<tr>
<td>( \tau_0 ) Time to adjust labor</td>
<td>11.3 week</td>
<td>Estimated to fit past data on labor hiring</td>
</tr>
<tr>
<td>( \tau_1 ) Hiring delay</td>
<td>29.9 week</td>
<td>Estimated to fit past data on labor hiring</td>
</tr>
<tr>
<td>( \tau_2 ) Time for attituation</td>
<td>401.0 week</td>
<td>Estimated to fit past data on attrition</td>
</tr>
<tr>
<td>( \tau_3 ) Time to cancel vacancies</td>
<td>1.0 week</td>
<td>Set based on stated procedures</td>
</tr>
<tr>
<td>( \tau_{ip} ) Time to perceive labor effectiveness</td>
<td>6.7 week</td>
<td>Estimated to fit past data on desired labor</td>
</tr>
<tr>
<td>( \tau_{ip} ) Time to adjust desired labor</td>
<td>18.8 week</td>
<td>Estimated to fit past data on desired labor</td>
</tr>
<tr>
<td>( \tau_{ix} ) Time for experience</td>
<td>12.0 week</td>
<td>Judgementally set based on interviews</td>
</tr>
<tr>
<td>( \varepsilon ) Relative effectiveness of rookies</td>
<td>0.35 dimensionless</td>
<td>Judgementally set based on interviews</td>
</tr>
<tr>
<td>( \eta ) Fraction of experienced personnel for training</td>
<td>0.05 dimensionless</td>
<td>Judgementally set based on interviews</td>
</tr>
</tbody>
</table>

### Employees’ responses

- \( f_{net} \) Effect of workload on time per order: \( \rho_{w}^{0.6w} \) time less
- \( f_{td} \) Time for upward adjustment of time per order: 813, 564 week
- \( f_{td} \) Time for downward adjustment of time per order: 18.8 week
- \( f_{wi} \) Effect of workload on work intensity: \( \phi_{w}^{1.0w} \)
- \( f_{tp} \) Time for effect of fatigue on work effectiveness: 3.0 week
- \( f_{ta} \) Time for effect of fatigue on attituation: 52.0 week
- \( f_{fa} \) Effect of fatigue on effectiveness, \( f_{ae} \): 1.0 - \( 0.5F_{ae} \) dimensionless
- \( f_{fa} \) Effect of fatigue on attituation, \( f_{at} \): 1.0 - \( 0.2F_{at} \) dimensionless

### Service quality

- \( w_c \) Weight for customers’ service expectation: 1.0 dimensionless
- \( w_p \) Weight for employees’ quality expectation: 1.0 dimensionless
- \( p_c \) Customers’ service expectation reference: 1.16 hours/week
- \( f_{q} \) Effect of quality on pressure on time per order: \( \phi_{q}^{0.1} \)
- \( f_{q} \) Effect of quality on attituation: 1.00 dimensionless
- \( f_{mp} \) Time for employees’ perception of quality: 4.0 week

---

**Figure 4** Feedback Structure of Erosion of Service Standard

**Figure 6** Response to a 10% Increase in Demand
# Model of service business

Profitability measures for each of the 14 items below…
(profits/time; time is life-span, year, quarter, month, week, day, hour, minute, second)

<table>
<thead>
<tr>
<th>First level measures</th>
<th>Second level measures</th>
<th>Third level measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship &amp; Sales Excellence</td>
<td>Operations &amp; Delivery Excellence</td>
<td>Value Chain &amp; Partnership Excellence</td>
</tr>
<tr>
<td><strong>Client-provider negotiations</strong></td>
<td><strong>Internal to service provider</strong></td>
<td><strong>External to service provider</strong></td>
</tr>
<tr>
<td>1. value creation</td>
<td>1. providers resources</td>
<td>1. clients resources</td>
</tr>
<tr>
<td>2. differentiation</td>
<td>2. investments &amp; incentives</td>
<td>2. suppliers resources</td>
</tr>
<tr>
<td>3. cost cutting</td>
<td>3. quality &amp; productivity</td>
<td>3. complementors resources</td>
</tr>
<tr>
<td>4. compliance</td>
<td>4. innovation &amp; growth</td>
<td>4. substitutors resources</td>
</tr>
<tr>
<td>5. market insights</td>
<td>5. life cycle management</td>
<td>5. academic, government, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First level measures</th>
<th>Second level measures</th>
<th>Third level measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relationship &amp; Sales Excellence</td>
<td>Operations &amp; Delivery Excellence</td>
<td>Value Chain &amp; Partnership Excellence</td>
</tr>
<tr>
<td><strong>Client-provider negotiations</strong></td>
<td><strong>Internal to service provider</strong></td>
<td><strong>External to service provider</strong></td>
</tr>
<tr>
<td>1. value creation</td>
<td>1. providers resources</td>
<td>1. clients resources</td>
</tr>
<tr>
<td>2. differentiation</td>
<td>2. investments &amp; incentives</td>
<td>2. suppliers resources</td>
</tr>
<tr>
<td>3. cost cutting</td>
<td>3. quality &amp; productivity</td>
<td>3. complementors resources</td>
</tr>
<tr>
<td>4. compliance</td>
<td>4. innovation &amp; growth</td>
<td>4. substitutors resources</td>
</tr>
<tr>
<td>5. market insights</td>
<td>5. life cycle management</td>
<td>5. academic, government, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>clients</th>
<th>proposals &amp; renegotiation</th>
<th>engagements &amp; offerings (solutions)</th>
<th>methods</th>
<th>assets</th>
<th>products</th>
<th>people</th>
<th>service organizations</th>
<th>methods</th>
<th>assets</th>
<th>products</th>
<th>people</th>
<th>service organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Governance &amp; Management Excellence</th>
</tr>
</thead>
</table>

| Geographies, Industry Sectors, Solutions |
One Policy Challenge:
Beyond Technology Patents… Patenting Business, Social-Organizational, Demand Innovations

Source:
Robert M. Hunt
“You can patent that? Are patents on software and business models good for the new economy?”

Source: U.S. Patent and Trademark Office and author’s calculations.
Having a vision is not enough ...
Bob Sutton, IBM Faculty Award, pro-Service Innovations

<table>
<thead>
<tr>
<th>Vision +</th>
<th>Skills +</th>
<th>Incentives +</th>
<th>Resources +</th>
<th>Action Plan</th>
<th>= Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>= Confusion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>= Anxiety</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>= False starts</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>= Frustration</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>= Slow change</td>
</tr>
</tbody>
</table>

[Image: The Knowing-Doing Gap book cover]

[Diagram: Strategy, Structure, Culture, Implement, Process, People, Tools, Portfolio, Programs, Projects, Operations]
Information services is fastest growth

Uday Karmarkar & Uday Apte: “Service industrialization in the global economy”
Author of HBR article: “Will you survive the services revolution?”
Growing role of services

Average annual growth rate of business R&D expenditure, 1990-2001

Source: OECD Science, Technology and Industry Outlook 2004
Jerry Sheehan
Even though R&D is less closely linked to service-sector innovation

Source: OECD Science, Technology and Industry Outlook 2004
Jerry Sheehan
Science, technology and innovation are receiving greater policy attention as their links to economic growth are more widely appreciated.

Innovation policy has been slow to adapt to the needs of the service sector, which accounts for growing share of output and employment in OECD economies.

Science, technology and industry are increasingly globalized, requiring further adaptation of policy to ensure benefits accrue to national economies.
<table>
<thead>
<tr>
<th>School</th>
<th>Discipline</th>
<th>Evolution &amp; Revision</th>
<th>Selection &amp; Aggregation</th>
<th>Transformation &amp; Integration</th>
</tr>
</thead>
<tbody>
<tr>
<td>School of Management</td>
<td>Marketing</td>
<td>Service Marketing</td>
<td>Service &amp; Solutions Excellence Centers (Information Science &amp; Technology Management)</td>
<td>Services Sciences, Management, and Engineering (SSME) and Solutions Engineering</td>
</tr>
<tr>
<td></td>
<td>Operations</td>
<td>Service Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Accounting</td>
<td>Service Accounting (Activity-Based Costing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Contracts &amp; Negotiations</td>
<td>Service Sourcing (eSourcing)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Management Science</td>
<td>Service Management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Management of Technology</td>
<td>Management of Innovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School of Engineering and Science</td>
<td>Operations Research</td>
<td>Service Operations</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Industrial &amp; Systems Engineering</td>
<td>Service Engineering</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Computer Science</td>
<td>Service Computing, Web Services, SOA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>School of Social Sciences</td>
<td>Economics</td>
<td>Institutional Economics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Psychology</td>
<td>Labor Psychology (Human Capital Mgmt)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anthropology</td>
<td>Business Anthropology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Information Science &amp; Systems, Service professional schools</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Terms & Definitions

- **Service Science, short for Services Sciences, Management, and Engineering (SSME)**

- **Definition 1:** The application of scientific, management, and engineering disciplines to tasks that one organization beneficially performs for and with another (‘services’)
  
  Make productivity, quality, performance, compliance, growth, and learning improvements more predictable in work sharing and risk sharing (coproduction) relationships.

- **Definition 2:** The study of service systems.

  Evolution & Design: Services systems evolve in difficult to predict ways because of naturally emergent and rationally designed path dependent interactions between economic entities, acting in the roles of clients and providers coproducing value.

  Interactions & Value Coproduction: Service systems are made up of large numbers of interacting clients and providers coproducing value. Each economic entity is both a client and a provider. Service system dynamics are driven by the constantly shifting value of knowledge distributed among people, organizations, technological artifacts (culture), and embedded in networks or ecosystems of relationships amongst them.

  Specialization & Coordination: One mechanism for creating value is specialization of clients and providers, which results in the need for coordination via markets, organizational hierarchies, and other mechanisms. Specialization creates efficiency. Efficiency creates profits and leisure. Profits and Leisure create investment (profits to innovation) and new demand (leisure to new aspirations).
Definitions of Services

- Deed, act, or performance (Berry, 1980)
- An activity or series of activities… provided as solution to customer problems (Gronroos, 1990)
- All economic activity whose output is not physical product or construction (Brian et al, 1987)
- Intangible and perishable… created and used simultaneously (Sasser et al, 1978)
- A time-perishable, intangible experience performed for a customer acting in the role of co-producer (Fitzsimmons, 2001)
- A change in condition or state of an economic entity (or thing) caused by another (Hill, 1977)
- Characterized by its nature (type of action and recipient), relationship with customer (type of delivery and relationship), decisions (customization and judgment), economics (demand and capacity), mode of delivery (customer location and nature of physical or virtual space) (Lovelock, 1983)
- Deeds, processes, performances (Zeithaml & Bitner, 1996)
So, services are...

Pay for performance in which client and provider coproduce value

- High talent performance
  Knowledge-intensive business services (business performance transformation services) (e.g., chef’s, concert musicians)

- High support performance
  Environment designed to allow average performer to provide a superior performance (average cook with great cook book and kitchen; average musician with a synthesizer)

- High tech performance
  Computational services (e-commerce, self service – client does work)
  Even here… talent builds, maintains, upgrades, etc. the technology

- Routine performance (sometime High Finance)
  This is being automated, outsourced, labor arbitrage, financial arbitrage, migrated to high talent/value sectors, or otherwise being rationalized
Service Science Core Questions: How do work systems reconfigure? What role does innovation play? Can integration relationships be found across different types of work system?

Help me by doing some of it for me (custom)
Help me by doing all of it for me (standard)

Human System

Collaborate (incentives)
Augment (tool)
Delegate (outsourcing)
Automate (self-service)

Tool System

The choice to change work practices requires answering four key questions:
- Should we? (Value)
- Can we? (Technology)
- May we? (Governance)
- Will we? (Priorities)

Example: Call Centers


Experts: High skill people on phones
Tools: Less skill with FAQ tools
Market: Lower cost geography (India)
Technology: Voice response system

Organize People (Socio-economic models with intentional agents)
Harness Nature (Techno-scientific models with stochastic parts)
High talent performance is on the rise in the US economy

*95% of all scientists are alive today.*

<table>
<thead>
<tr>
<th>Type of work system</th>
<th>1979</th>
<th>1996</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Services</td>
<td>Goods</td>
</tr>
<tr>
<td>Tightly Constrained</td>
<td>6%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Unrationalized Labor Intensive</td>
<td>25%</td>
<td>25%</td>
<td>26%</td>
</tr>
<tr>
<td>Semi-Autonomous</td>
<td>35%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>High-skill Autonomous</td>
<td>34%</td>
<td>40%</td>
<td>40%</td>
</tr>
</tbody>
</table>

From Herzenberg, Alic, Wial (1998)
The emerging challenges

- Many general challenges
  - Defining, measuring, and scoping services
  - Creating more case studies, especially IT & B2B cases (urgent need!)
    - Service “mind set” needed in curriculum reform
    - Especially, knowledge-intensive business services cases – sociotechnical systems evolution
  - Integrating across discipline boundaries
    - Jurisdiction and fundamental question – “coopetition” with other disciplines
    - Overcoming multidisciplinary stigma to find true leaders – future Herb Simon’s
  - Government and industry challenges
    - compiling accurate and meaningful industry data sets; sharing confidential data
    - patenting service innovations
    - Coordinating collaborator activities (government, industry, academic, non-profit)
      - especially motivating funding from government agencies, industry, non-profit

- Five key science and research challenges
  - Challenge 1: Empirical frameworks needed
  - Challenge 2: Analytic framework needed
  - Challenge 3: Engineering framework needed
  - Challenge 4: Theoretical framework needed
  - Challenge 5: Multidisciplinary Design framework needed
Getting systematic about service innovations

- Improve back stage provider or client productivity: Applying six sigma, process re-engineering, and other transformation activities to the back stage. Function of costs of activities, including costs of unwanted variance.

- Improve front stage scope: Expanding the scope of front stage services – addressing more or better the custom requests of clients, as well as exploiting more of the unique capabilities of providers. Function of value of needs, including enabling new capabilities.

- Improve coordination: Standardize processes and interactions. This can boost quality (compliance) and productivity. Function of scale, complexity, and uncertainty in the system.

- Improve dynamic evolution: Continuously migrate provider-client pairs to higher value creation and capture points on an on-going basis. Function of time. Systematically move lectures into eLearning systems improve productivity of learning, and quality screening for problem-based learning.

- Improve capabilities of people, organizations, institutions or technologies to enter into higher value creation and capture configurations. Function of systems productive capacity – innovating new capabilities (incremental, radical, and super-radical innovations).
Services: Client pays provider for a performance or promise of a performance. The client and provider share responsibility for coproduction of value within the boundaries of the relationship (aspire to “win-win”).

- Performance: Activities that transform the state of something.

- Coproduction relationship: A relationship in which goals/work responsibilities and risks/rewards are shared, with an explicit or tacit contract defining initial/intermediate/ongoing/ongoing states/results/effort/quality levels. External factors that might impact the relationship may or may not be enumerated. Third party partners may be involved in establishing, evaluating, and working front stage or back stage in the coproduction relationship.

- Front stage activities: Sometimes called the “moments of truth” in which client and provider directly interact. Pure services are mostly front stage. Variance in the front stage is largely due to the client’s requests and actions, and provides opportunities to provide higher value services. Eliminating front stage variance can lead to standards and higher quality, but may also destroy a lot of high end value creation opportunities.

- Back stage activities: Both provider-side activities that do not directly involve the client, and client-side activities that do not directly involve the provider. Pure products are mostly back stage for providers (manufacturer). Six sigma is an effective method for eliminating unnecessary variance in the backstage, which leads from custom processes to standard processes.

- Services vary based on how much front-stage or back-stage activities are required, how custom or standard the activities are, and how client intensive or non-client intensive the activities are.

- Provider firms orchestrate or coordinate employees, partners, and clients in the coproduction of value. Some have referred to this as creating economies of coordination – simple to complex.
Services

- Services include government, security, healthcare, education, financial, insurance, retail, wholesale, leisure, entertainment, information, communication, transportation, utilities, professional, and business services

- Characteristics of service systems
  
  Service systems are made up of clients and providers interacting & investing effort to coproduce value

  Clients and providers, especially businesses, care how much value is created & captures (coproduced), quality, productivity, experience

  Clients can play greater (self service) or lesser roles during performance

  Clients and providers as economic entities with preferences, capabilities, assets, relationships, roles, and unique histories are transformed by the nature of the service experience

  The primary output of the service performance is always transformed clients and providers – assets, preferences, capabilities, relationships, roles, history
Intangibility of services...

**Big Companies Go Intangible**

Companies are putting more emphasis on R&D and less on capital investment. Since 2000, the “intangibility index”—the ratio of R&D to capital spending, multiplied by 100—has risen for 9 of the 10 biggest U.S. companies that report R&D.

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>INTANGIBILITY INDEX</th>
<th>LATEST**</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXXONMOBIL</td>
<td>5.1</td>
<td>4.4</td>
</tr>
<tr>
<td>GE***</td>
<td>73.6</td>
<td>100.7</td>
</tr>
<tr>
<td>MICROSOFT</td>
<td>429.1</td>
<td>761.6</td>
</tr>
<tr>
<td>PROCTER &amp; GAMBLE</td>
<td>62.9</td>
<td>89.0</td>
</tr>
<tr>
<td>PFIZER</td>
<td>211.0</td>
<td>296.4</td>
</tr>
<tr>
<td>JOHNSON &amp; JOHNSON</td>
<td>183.8</td>
<td>239.2</td>
</tr>
<tr>
<td>ALTRIA</td>
<td>32.0</td>
<td>42.3</td>
</tr>
<tr>
<td>CHEVRONTEXACO</td>
<td>2.2</td>
<td>2.9</td>
</tr>
<tr>
<td>INTEL</td>
<td>58.4</td>
<td>88.4</td>
</tr>
<tr>
<td>IBM</td>
<td>95.6</td>
<td>129.9</td>
</tr>
<tr>
<td>ALL 10</td>
<td>56.8</td>
<td>79.1</td>
</tr>
</tbody>
</table>
Services Businesses are “People Businesses”

<table>
<thead>
<tr>
<th>RANK</th>
<th>COMPANY</th>
<th>INDUSTRY</th>
<th>REVENUE ($ billion 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IBM Global Services*</td>
<td>IT services</td>
<td>42.6</td>
</tr>
<tr>
<td>2</td>
<td>UPS</td>
<td>Postal and courier</td>
<td>33.5</td>
</tr>
<tr>
<td>3</td>
<td>Deutsche Post World Net*</td>
<td>Postal and courier</td>
<td>30.5</td>
</tr>
<tr>
<td>4</td>
<td>FedEx</td>
<td>Postal and courier</td>
<td>24.7</td>
</tr>
<tr>
<td>5</td>
<td>Hospital Corporation of America</td>
<td>Hospital management, health care</td>
<td>21.8</td>
</tr>
<tr>
<td>6</td>
<td>EDS</td>
<td>IT services</td>
<td>21.5</td>
</tr>
<tr>
<td>7</td>
<td>Compass Group</td>
<td>Contract catering</td>
<td>18.4</td>
</tr>
<tr>
<td>8</td>
<td>Deloitte Touche Tohmatsu</td>
<td>Accounting, consulting</td>
<td>16.4</td>
</tr>
<tr>
<td>9</td>
<td>PricewaterhouseCoopers</td>
<td>Accounting, consulting</td>
<td>16.3</td>
</tr>
<tr>
<td>10</td>
<td>Bechtel</td>
<td>Oil, engineering, industrial</td>
<td>16.3</td>
</tr>
<tr>
<td>11</td>
<td>Halliburton</td>
<td>Oil, engineering, industrial</td>
<td>16.3</td>
</tr>
</tbody>
</table>

Service jobs are increasingly the High Skill knowledge worker jobs – especially in business and information services

<table>
<thead>
<tr>
<th></th>
<th>1979</th>
<th>1996</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All</td>
<td>Services</td>
<td>Goods</td>
</tr>
<tr>
<td>Tightly</td>
<td>6%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Constrained</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unrationalized</td>
<td>25%</td>
<td>25%</td>
<td>26%</td>
</tr>
<tr>
<td>Labor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensive</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Semi-Autonomous</td>
<td>35%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Autonomous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High-skill</td>
<td>34%</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>Autonomous</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### More Examples… by Industry…

<table>
<thead>
<tr>
<th></th>
<th>Government &amp; security</th>
<th>Health &amp; education</th>
<th>Financial &amp; insurance</th>
<th>Professional &amp; business</th>
<th>Information &amp; communication</th>
<th>Retail &amp; wholesale</th>
<th>Leisure &amp; hospitality</th>
<th>Transportation &amp; utilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>High skill</td>
<td>executive, judge</td>
<td>doctor, professor, dean</td>
<td>broker, partner</td>
<td>executive, lawyer, scientist, engineer, architect, entrepreneur</td>
<td>executive, engineer</td>
<td>executive, proprietor</td>
<td>producer, director, proprietor, designer, star athlete performer</td>
<td>pilot, executive, engineer</td>
</tr>
<tr>
<td>Semi-autonomous</td>
<td>legislator, policy researcher, patent analyst</td>
<td>pharmacist, nurse, teacher, technician</td>
<td>analyst, actuary, underwriters</td>
<td>manager, accountant, HR, PR, marketing, business dev</td>
<td>technician, system administrator, journalist, writer, announcer</td>
<td>buyer, high end sales</td>
<td>actor, performer, artist, technician</td>
<td>attendant, maintenance technician, plumber, electrician</td>
</tr>
<tr>
<td>Unrationalized labor intensive</td>
<td>police, firefighter, security guard</td>
<td>nurses aid, day care worker, ambulance driver</td>
<td>adjustors, auditor, investigators</td>
<td>admin, assistant, hiring specialist, door to door sales</td>
<td>call center specialist, librarian</td>
<td>sales clerk, stocker, shipping &amp; receiving</td>
<td>maid, janitor, waiter, gardener, cook, barber</td>
<td>truck driver, field force technician, machine operator</td>
</tr>
<tr>
<td>Tightly constrained</td>
<td>inspectors, data entry</td>
<td>data entry</td>
<td>bank teller, check proofs</td>
<td>inspectors, receptionist</td>
<td>telephone operator</td>
<td>sales counter clerks</td>
<td>fast food worker</td>
<td>inspectors</td>
</tr>
<tr>
<td>Client</td>
<td>citizen, plaintiff, defendant, inventor</td>
<td>patient, student, subscriber</td>
<td>shareholder, client, subscriber</td>
<td>client</td>
<td>subscriber</td>
<td>consumer, shopper</td>
<td>guest</td>
<td>subscriber, commuter</td>
</tr>
</tbody>
</table>

- based on Herzeberg et al., (1998). All occupations span a range, placement is representative only.
Trend 1: Rise of the Service Economy

Service sector has rapidly grown in US (70% of labor force)

Other nations are following the same pattern (urbanization, infrastructure, and business growth drive the shift)

Service sector buys 80% of the $2.1T IT annual spend (worldwide)

Four service industries are large and growing their IT spend rapidly to transform processes: financial and information, professional and business, retail and wholesale, and government

IT spend contributes to rapid growth of productivity (GDP/Jobs) as well

### U.S. Economy by Industries 2002 (Jobs, Value Add GDP, CAGRs)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Jobs (M)</th>
<th>GDP (GB)</th>
<th>GDP/ Jobs ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Agriculture (incl. forestry, fishing)</td>
<td>2.245</td>
<td>-1.6</td>
<td>98</td>
</tr>
<tr>
<td>G Goods (Manufacturing)</td>
<td>22.551</td>
<td>0.3</td>
<td>1022</td>
</tr>
<tr>
<td>S Professional &amp; Business</td>
<td>16.010</td>
<td>2.7</td>
<td>1220</td>
</tr>
<tr>
<td>S Transportation &amp; Warehousing</td>
<td>4.205</td>
<td>2.0</td>
<td>296</td>
</tr>
<tr>
<td>S Utilities &amp; Other</td>
<td>6.705</td>
<td>1.3</td>
<td>1455</td>
</tr>
<tr>
<td>S Services (subtotal)</td>
<td>108.513</td>
<td>1.8</td>
<td>6430</td>
</tr>
</tbody>
</table>

### Top Ten Labor Forces by Size

<table>
<thead>
<tr>
<th>Nation</th>
<th>% Pop</th>
<th>% A</th>
<th>% G</th>
<th>% S</th>
<th>25 yr % delta S</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>21.0</td>
<td>50</td>
<td>15</td>
<td>36</td>
<td>191</td>
</tr>
<tr>
<td>India</td>
<td>17.0</td>
<td>60</td>
<td>17</td>
<td>23</td>
<td>28</td>
</tr>
<tr>
<td>U.S.</td>
<td>4.8</td>
<td>3</td>
<td>27</td>
<td>70</td>
<td>21</td>
</tr>
<tr>
<td>Indonesia</td>
<td>3.9</td>
<td>45</td>
<td>16</td>
<td>39</td>
<td>36</td>
</tr>
<tr>
<td>Brazil</td>
<td>3.0</td>
<td>23</td>
<td>16</td>
<td>24</td>
<td>53</td>
</tr>
<tr>
<td>Russia</td>
<td>2.5</td>
<td>12</td>
<td>23</td>
<td>65</td>
<td>38</td>
</tr>
<tr>
<td>Japan</td>
<td>2.4</td>
<td>5</td>
<td>25</td>
<td>70</td>
<td>40</td>
</tr>
<tr>
<td>Nigeria</td>
<td>2.2</td>
<td>70</td>
<td>10</td>
<td>20</td>
<td>NA</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>2.2</td>
<td>63</td>
<td>11</td>
<td>26</td>
<td>NA</td>
</tr>
<tr>
<td>Germany</td>
<td>1.4</td>
<td>3</td>
<td>33</td>
<td>64</td>
<td>44</td>
</tr>
</tbody>
</table>

### Worldwide IT Spend Business Process Transformation Services ($21T 2004)

<table>
<thead>
<tr>
<th>Industry</th>
<th>BPTS ($1.4T)</th>
<th>Non-BPTS ($0.7T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Agriculture (incl. forestry, fishing)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>G Goods (Manufacturing)</td>
<td>20%</td>
<td>4</td>
</tr>
<tr>
<td>S Professional &amp; Business</td>
<td>13%</td>
<td>5</td>
</tr>
<tr>
<td>S Retail &amp; Wholesale</td>
<td>9%</td>
<td>4</td>
</tr>
<tr>
<td>S Education &amp; Health</td>
<td>6%</td>
<td>5</td>
</tr>
<tr>
<td>S Professional &amp; Business</td>
<td>6%</td>
<td>6</td>
</tr>
<tr>
<td>S Leisure &amp; Hospitality</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>S Financial &amp; Information</td>
<td>35%</td>
<td>4</td>
</tr>
<tr>
<td>S Transportation &amp; Warehousing</td>
<td>4%</td>
<td>4</td>
</tr>
<tr>
<td>S Utilities &amp; Other</td>
<td>4%</td>
<td>5</td>
</tr>
<tr>
<td>S Services (subtotal percentage)</td>
<td>80%</td>
<td>5</td>
</tr>
</tbody>
</table>
Initially, the emphasis in service research and teaching was on B2C capacity and demand models—because underutilized capacity hurts productivity. Also, demand that is simply waiting in queues may be lost or damage client satisfaction. Service places like banks, airports, hotels, etc.

Academic centers have slowly increased over the past 20 years to advance the practical and theoretical knowledge of services businesses.

Increasingly over the past ten years, the new frontier of service research and teaching has shifted more and more towards B2B business process transformation models. Process re-engineering, IT productivity paradox, and other case studies highlight the need to constantly redesign work to improve productivity through multiple types of innovation (demand, business value, process, and organization).

Service research and practice agree that effective communication in service engagements depends on an appreciation of multiple factors: technology and process, business value and strategy, and organizational culture and people. With proper coordination between these perspectives, BPTS engagements succeed. A top adaptive workforce requires people with a level of capability and familiarity in many relevant areas.

“...the biggest costs were in changing the organization. One way to think about these changes is to treat the Organizational costs as an investment in a new asset. Firms make investments over time in developing a new process, rebuilding their staff or designing a new organizational structure, and the benefits from these investments are realized over a long period of time.” Eric Brynjolfsson, “Beyond the Productivity Paradox”
Why does IBM care? Our growth depends on it

Complex business to business services enabled by IT advances drive economic growth

(BPTS = Business Performance Transformation Services)