SSMED and SOA:
Service Science, Management, Engineering and Design and Service Oriented Architecture

David Ing
IBM Canada Ltd. and the Helsinki University of Technology
October 30, 2008, at CASCON Toronto

This document was created in Lotus Symphony Presentations, and is clearer when viewed as a Screen Show

Agenda

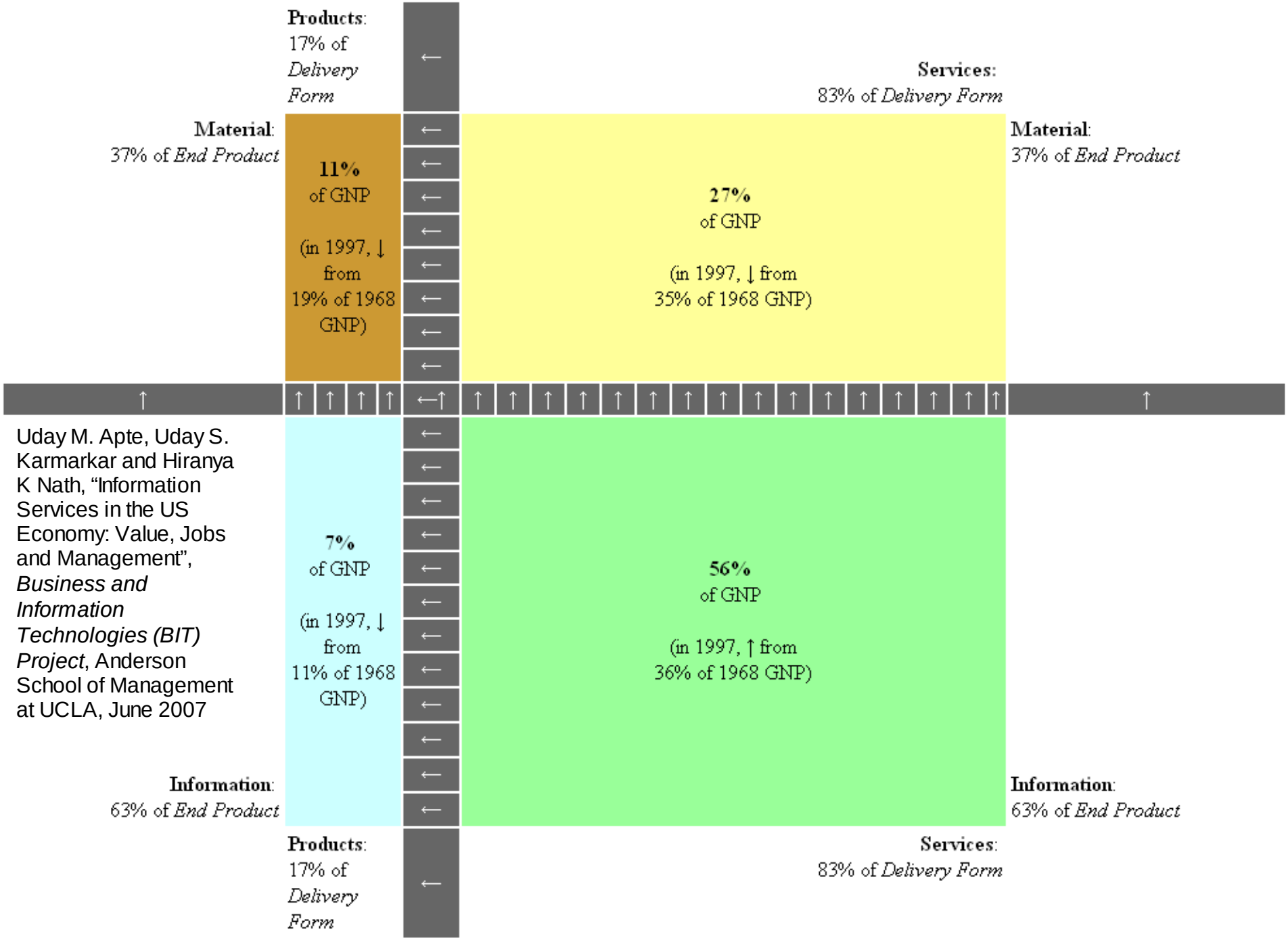
A. Why is SSMED important?

B. SSMED and SOA

C. Progress to date

D. Challenges and gaps

E. Where to start?



Uday M. Apte, Uday S. Karmarkar and Hiranya K Nath, "Information Services in the US Economy: Value, Jobs and Management", *Business and Information Technologies (BIT) Project*, Anderson School of Management at UCLA, June 2007

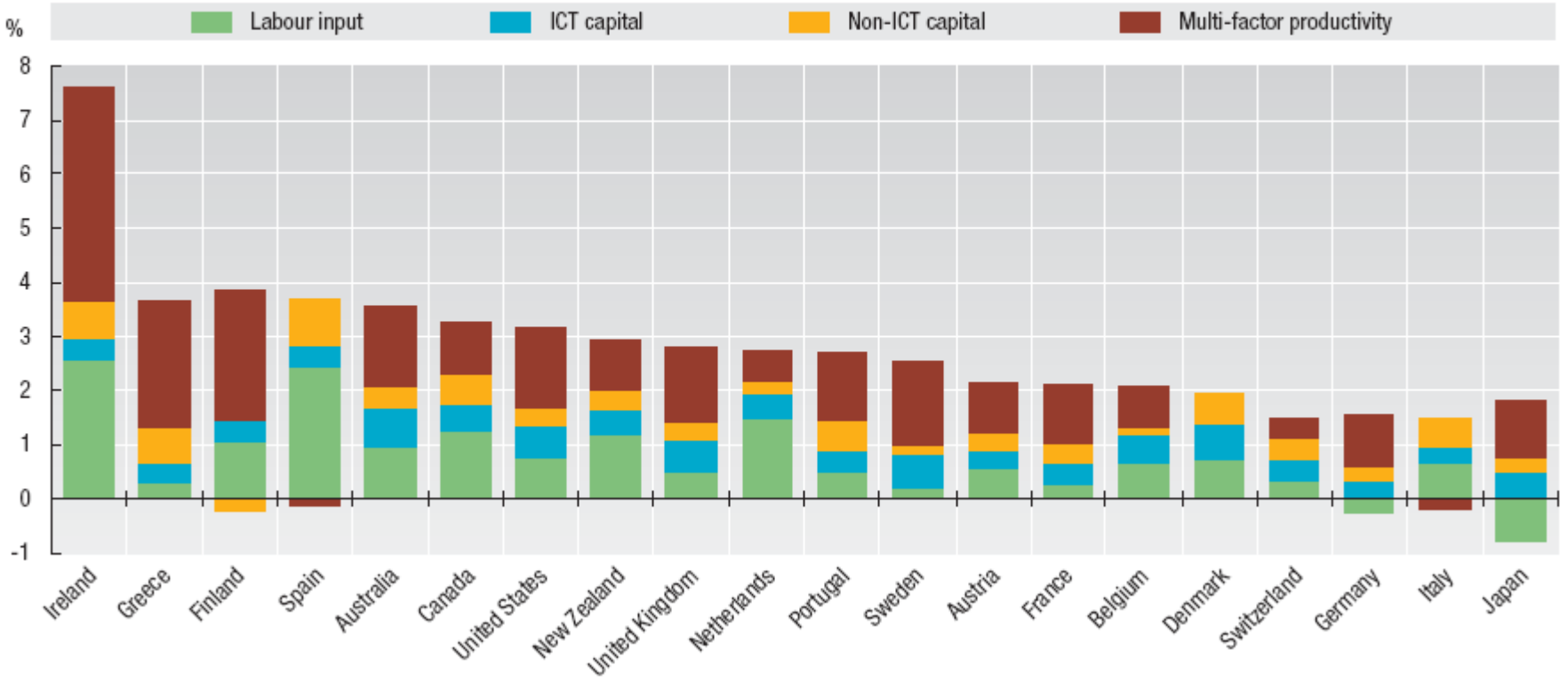
Contributions to GDP growth, G7 countries, 1995-2000 and 2000-05[1]

Percentage points

OECD Science, Technology and Industry Scoreboard 2007: Innovation and Performance in the Global Economy, p. 206, available from oecd.org.

Contributions to GDP growth, OECD countries, 1995-2005[2]

Percentage points



OECD Science, Technology and Industry Scoreboard 2007: Innovation and Performance in the Global Economy, p. 206, available from oecd.org.

Consider three businesses impacted by ICT capital

Financial services

Banking and insurance "products" in physical branches or local offices

Customer and agents networked on electronic communications (Internet, mobile phone)

Media and entertainment

Tv, radio, newspaper ➔ audio cassette, videotape, CDs, DVDs

Digital content over broadband: Flash video, MP3 audio, blogging

Information technology solutions

Customer and agents networked on electronic communications (Internet, mobile phone)

Distributed personal computers ➔ global service providers / outsourcing ➔ free/libre and open source software

Arming American Scientists: NSF and the Provision of Scientific Computing Facilities for Universities, 1950-1973

WILLIAM ASPRAY
BERNARD O. WILLIAMS

This article discusses the role of the US National Science Foundation in the provision of scientific computing facilities for colleges and universities in the period 1950 to 1973. In this period, the NSF played a major role in establishing computing facilities on American campuses for the purposes of scientific research and science education. By the end of this period, most of these programs at NSF had been disbanded, and the foundation was concentrating its support for computing not on the service of other scientific disciplines, but instead on the establishment of a theoretically oriented discipline of computer science. The primary focus here is on NSF institutional history, with only a few examples of the impact of NSF programs. But it is an important part of a larger story of the role of the federal government in establishing American hegemony in computing in this era.

Academic interest in computing grew to the point that, by 1959, 150 colleges and universities had introduced on campus some research or instructional use of computers. A survey of university computing conducted by Louis Fein for Stanford Uni-

The single strongest impulse for introducing computers on campuses in the mid-1950s did not come from the schools themselves or from any federal agency, but instead from IBM.

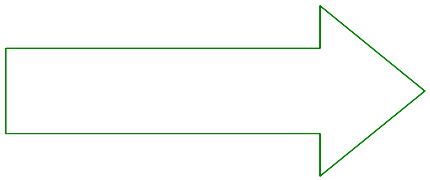
versity reported — perhaps with some overstatement — that universities, government, and industry were reorganizing to invent and apply new techniques of linear programming, game theory, automata theory, artificial intelligence, adaptive mechanisms, psychometrics, neural psychology, learning machines, information theory, coding theory, statistics, cybernetics, and a wide range of modeling techniques. Fein soberly reported that

Physicists

Electrical Engineers

Mathematicians

Philosophers (Boolean Logic)



Computer Science

W.B. Aspray and B. O. Williams 1994. Arming American scientists: NSF and the provision of scientific computing facilities for universities, 1950-1973. *IEEE Annals of the History of Computing*, 16 (4), 60-74.

Agenda

A. Why is SSMED important?

B. SSMED and SOA

C. Progress to date

D. Challenges and gaps

E. Where to start?

SSMED studies *service systems*; SOA is a *style*

A service system can be defined as
a dynamic configuration of resources
(people, technology, organisations and shared information)
that creates and delivers value
between the provider and the customer through service.

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Service-Oriented Architecture (SOA)
is an IT architectural style
that supports
the transformation of your business into
a set of linked services,
or repeatable business tasks,
that can be accessed when needed over a network.

Source: https://www.ibm.com/developerworks/webservices/newto/

Basic questions in SSMED

Science of Service Systems
... to improve understanding, map natural history, validate mechanisms, make predictions.

- Service system entities?
  - Their evolution?
  - Their interactions? Influencing their shape?

Management of Service Systems
... to improve capabilities, define progress measures, optimize investment strategy.

- Invest to create, improve, scale?
- Measures of quality, productivity, compliance, sustainability

Engineering of Service Systems
... to improve control, optimize resources

- New technologies, environmental infrastructures or reconfiguration of existing?
- Tools?

Design of Service Systems
... to improve experience, explore possibilities

- How to improve the experience of people?
- Possible value propositions? Governance mechanisms?

Reference: Jim Spohrer and Stephen K. Kwan, "Service Science, Management, Engineering, and Design (SSMED): An Emerging Discipline – Outline and Reference", *International Journal of Information Systems in the Service Sector*, forthcoming

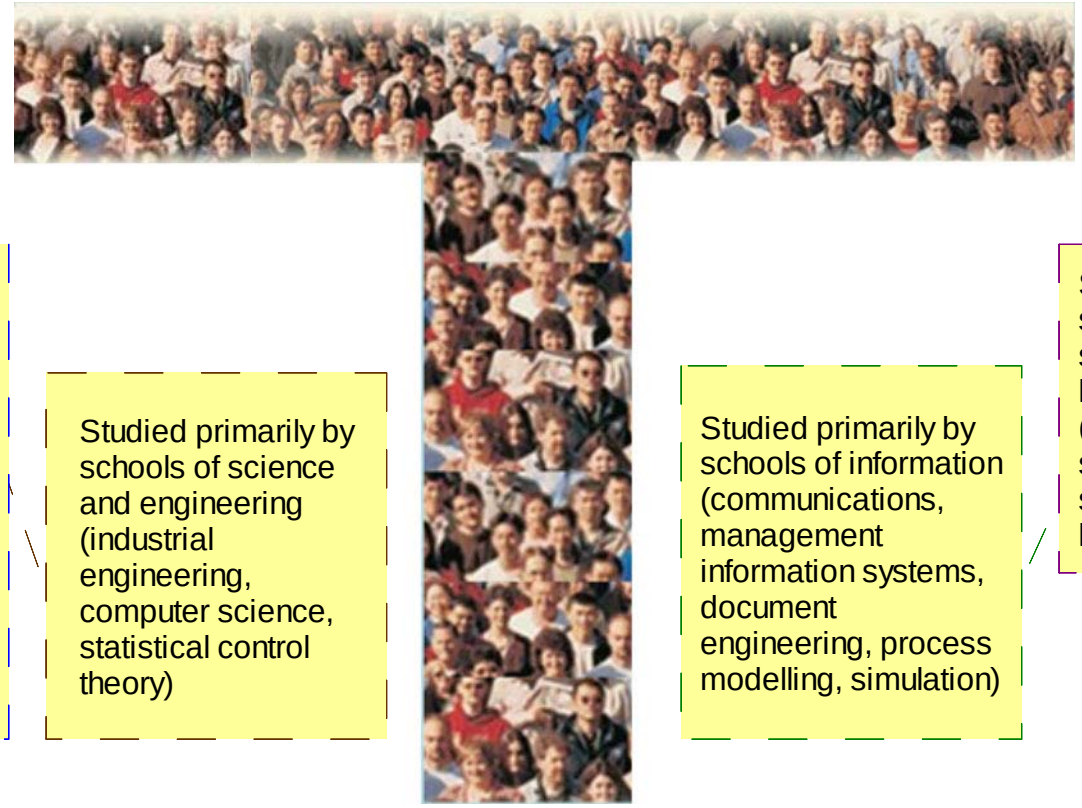
Develop T-shaped professionals along 4 resource types

(1) Whole businesses and organisations

(2) Technology

(3) People

(4) Shared information



Studied primarily by schools of management (marketing, operations management, operations research and management sciences, supply chain management, innovation management)

Studied primarily by schools of science and engineering (industrial engineering, computer science, statistical control theory)

Studied primarily by schools of information (communications, management information systems, document engineering, process modelling, simulation)

Studied primarily by schools of social sciences and humanities (economics, cognitive science, political science, design, humanities and arts)

Source: IfM and IBM 2008.

Agenda

A. Why is SSMED important?

B. SSMED and SOA

C. Progress to date

D. Challenges and gaps

E. Where to start?

Knowledge of service systems benefits from disciplines
(page 1 of 3)

Academic disciplines	(1) Whole businesses and organizations	(2) Technology	(3) People	(4) Shared information
Architecture and designed systems	x	x	x	x
Behavioral sciences and education			x	x
Cognitive science and psychology	x	x	x	x
Complex adaptive systems theory		x		x
Computer science and AI/web services		x		x
Computer supported cooperative work	x	x	x	x
Economics and law	x		x	x
Engineering economics and management	x	x		x
Experience design, theatre and arts			x	
Financial and value engineering	x	x	x	x
Game theory and mechanism design			x	x
Human resource management	x		x	

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Knowledge of service systems benefits from disciplines
(page 2 of 3)

Academic disciplines	(1) Whole businesses and organizations	(2) Technology	(3) People	(4) Shared information
Industrial engineering (IE) and systems	x	x	x	x
Industrial and process automation	x	x	x	x
International trade	x			
Knowledge management	x	x	x	x
Management of information systems	x	x	x	x
Management of technology and innovation	x	x	x	x
Marketing and customer knowledge	x	x	x	x
Mathematics and non-linear dynamics	x	x	x	x
Operations management (OM)	x	x	x	x
Operational research (OR)	x	x	x	x
Organisation theory and learning	x	x	x	x
Political science	x		x	

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Knowledge of service systems benefits from disciplines
(page 3 of 3)

Academic disciplines	(1) Whole businesses and organizations	(2) Technology	(3) People	(4) Shared information
Project management	x	x	x	x
Queuing theory	x	x	x	x
Simulation, modelling visualization	x	x	x	x
Sociology and anthropology	x	x	x	x
Software metrics and development		x		
Statistical control theory		x		x
Strategy and finance	x	x	x	x
Supply chain management	x	x		x
System design and software architecture		x		
Systems dynamics theory and design	x	x	x	x
Total quality management, lean six sigma	x	x	x	x

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Agenda

A. Why is SSMED important?

B. SSMED and SOA

C. Progress to date

D. Challenges and gaps

E. Where to start?

Recommendations for education

1 Enable graduates from various disciplines to become T-shaped professionals, who are adaptive innovators with a service mindset and can make early contributions to the service-driven economy.

2 Promote SSME education programmes and qualifications as a way of developing a service mindset, in conjunction with industry recognition and recruitment of SSME qualified graduates.

3 Develop a modular template-based SSME curriculum in higher education, add new materials and refinements as research develops over time, and then extend to all levels of education.

4 Explore new teaching methods for SSME related education.

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Recommendations for research

1 Develop an inclusive interdisciplinary and intercultural approach to service research.

2 Build bridges between disciplines through grand research challenges.

3 Establish service system and value proposition as foundational concepts.

4 Work with practitioners to create data sets to better understand the nature and behaviour of service systems.

5 Create modelling and simulations tools for service systems.

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Recommendations for business

1 Establish employment policies and career paths for T-shaped professionals.

2 Review existing approaches to service innovation and provide grand challenges for service systems research.

3 Provide funding for service systems research.

4 Develop appropriate organisational arrangements to enhance industry-academic collaboration.

5 Work with stakeholders to include sustainability measures and create actionable service innovation roadmaps.

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Recommendations for government

1 Promote service innovation for all parts of the economy and provide funding for SSME education and research.

2 Demonstrate the value of Service Science to government agencies, and thereby create methods, data sets, and tools to inform and challenge current education and research support.

3 Develop relevant measurements and reliable data on knowledge-intensive service activities across sectors to underpin leading practice for service innovation.

4 Make government service systems more comprehensive and citizen-responsive.

5 Encourage public hearings, workshops, briefings with other stakeholders to develop service innovation roadmaps.

Source: IfM and IBM. (2008). *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* University of Cambridge Institute for Manufacturing, available at http://www.ifm.eng.cam.ac.uk/ssme/

Agenda

A. Why is SSMED important?

B. SSMED and SOA

C. Progress to date

D. Challenges and gaps

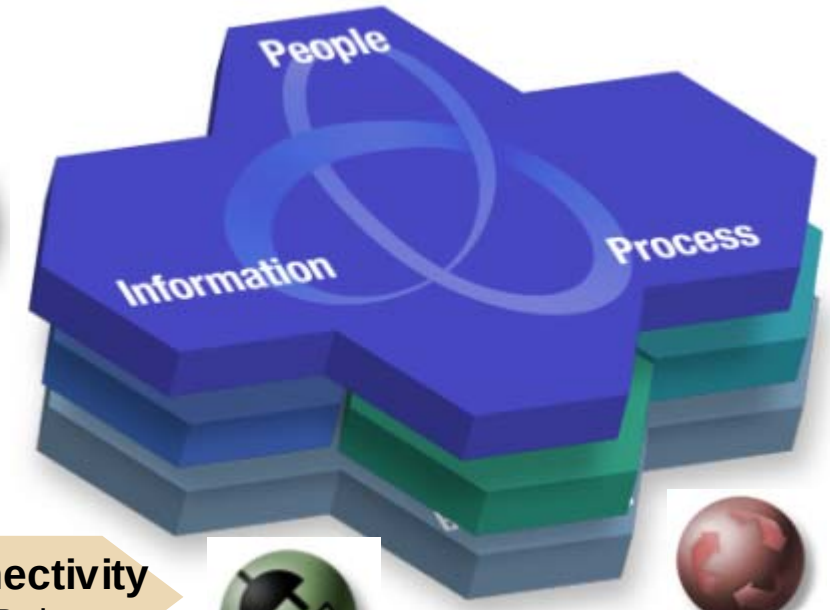
→ E. Where to start?

Entry points

8 scenarios lead to *5 entry points* – 3 business-focused and 2 IT-focused

People
Entry Point

Interaction & Collaboration Services Scenario



Information
Entry Point

Information as a Service Scenario

Process
Entry Point

Business Process Management Scenario

Service Connectivity Scenario

Connectivity
Entry Point

Reuse
Entry Point

Service Creation & Reuse Scenario

Foundation Scenarios

SOA Design Scenario

SOA Governance Scenario

SOA Security & Management Scenario

Reference: https://www.ibm.com/developerworks/webservices/newton/

A challenge

a [?] system ... to ... a service system

... as ...

[?] architecture ... to ... service-oriented architecture

A challenge: *transition* (or *transformation*)

The transition from ...

a
[industrial?]
[production?]
system

... to ...

a service system

... is as significant ..

... as ...

[integrated?]
[procedural?]
[object-oriented?]
architecture

... to ...

service-oriented
architecture

Innovation as open, collaborative, multidisciplinary, global

Posted by **daviding** on June 13, 2008 under **innovation** Edit This

On more than one occasion, I've heard IBM executives assert:

> The nature of innovation has changed. In the 21st century, innovation is *open*, *collaborative*, *multidisciplinary* and *global*.

The ideas of *open*, *collaborative*, *multidisciplinary* and *global* appeared in the **Global Innovation Outlook 2.0 report** that was published in mid-2006. These words appeared on IBM-internal slides presented by **Nick Donofrio** at an *Consulting Leadership Exchange* in September 2005, and at the external-facing conference on ***Education for the 21st Century*** **in October 2006** ... with lots of other occasions in between. But what do these four words mean?

To make some sense for myself, I've extended these words into phrases and contrasted their contexts in a table .

	Industrial age nature of innovation		*21st century nature of innovation*

Recent Posts

- **Innovation as open, collaborative, multidisciplinary, global**
- **World diet is concentrated on a few cereal grains**
- **Conversations for action, commitment management protocol**
- **Coproduction, interactive value, offering, value constellation**
- **Talent in the (new) service economy: creative class occupations?**

Categories

by David Ing

view

Recently on daviding.com

- **2008/02/15 On the farm, Fairfield, Iowa**
- **2008/02/15 Farms and town, Fairfield, Iowa**
- **2008/02/14 The rural perspective, Fairfield, Iowa**
- **2008/02/09 Chinese New Year dinner**
- **2008/02/07 Steps**

http://coevolving.com