Service Systems and the Systems Sciences

David Ing
Wuhan University of Technology
March 16, 2016

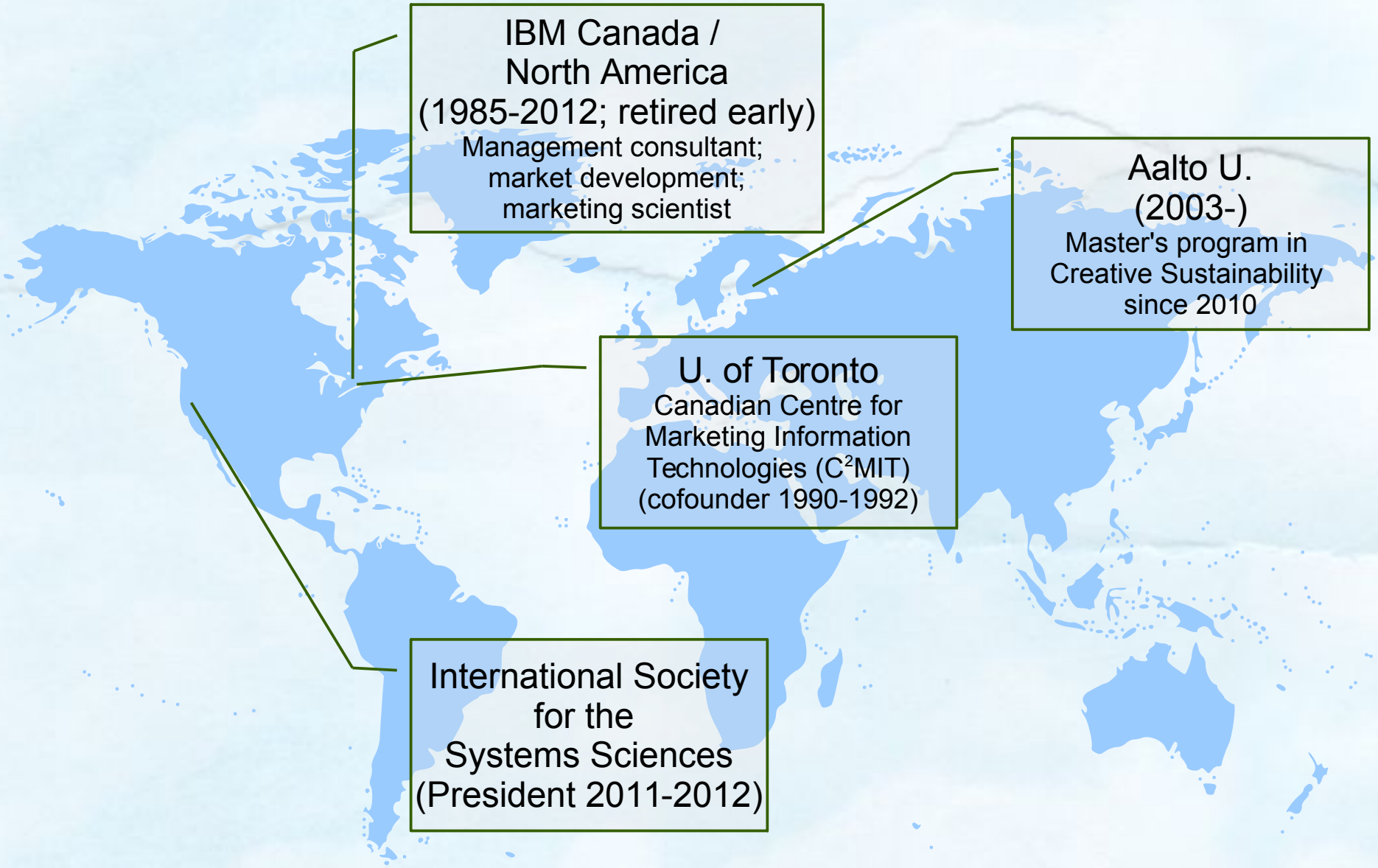
Agenda

1. Industrial services → Service systems

2. SSMED:
   Service Science, Management, Engineering and Design

3. Systems sciences →
   Service systems science

David Ing – Professional experience



David Ing 吳禮維 – Family

Home town (-1976):
Gravenhurst, Ontario
Birthplace of 白求恩
Dr. Norman Bethune

樓崗（開平）
Lougang (Kaiping)
Ancestral village

Toronto (1985-)

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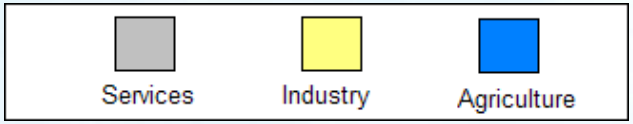
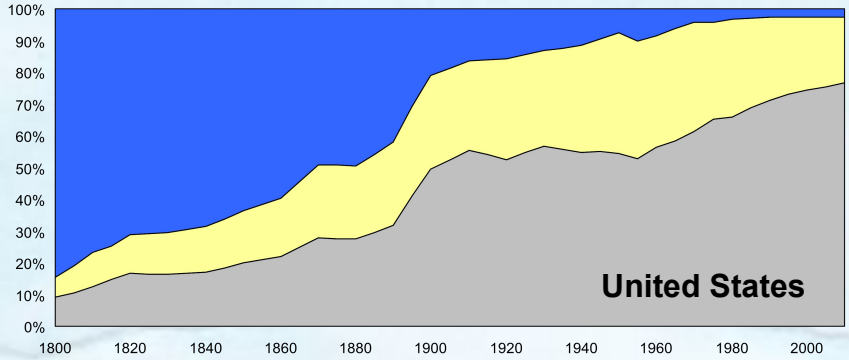
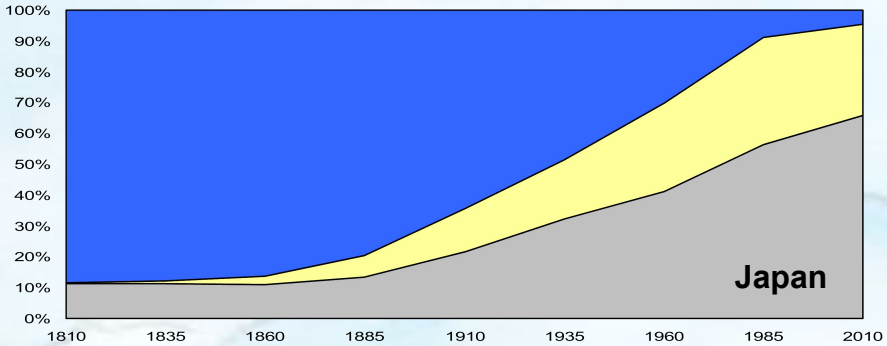
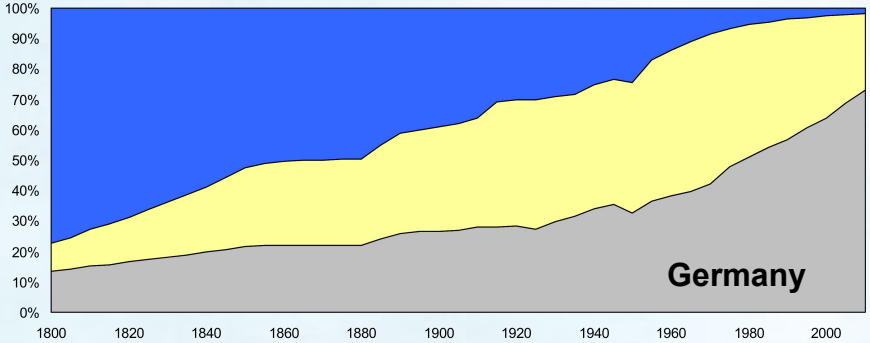
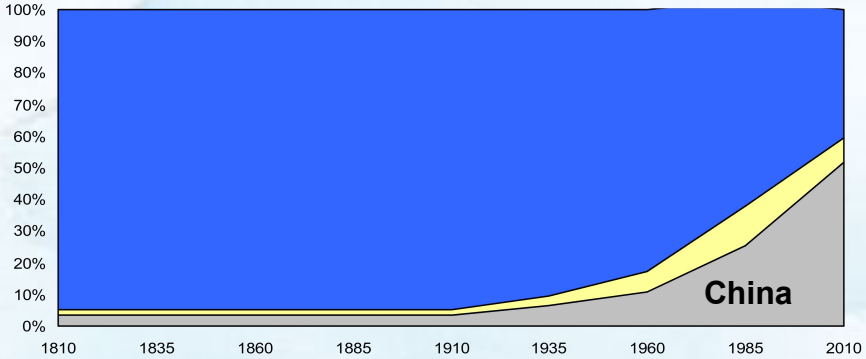
Economies (circa 2006)

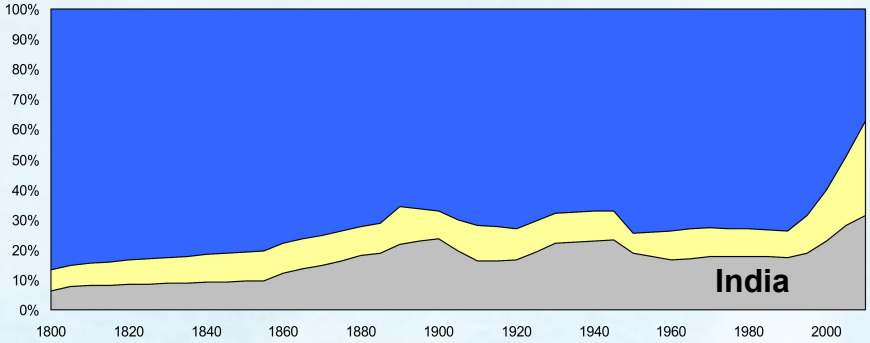


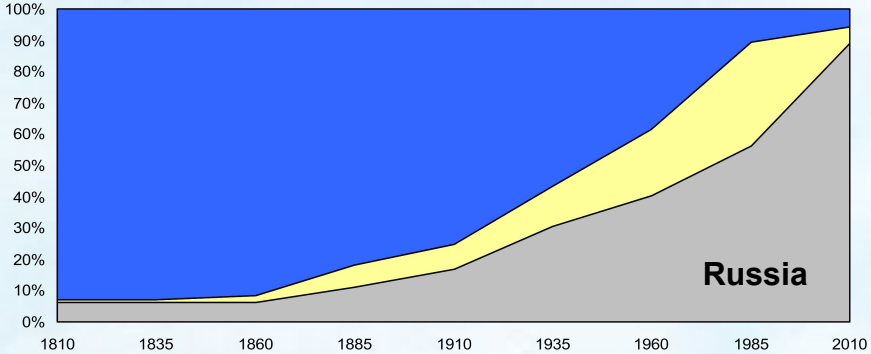




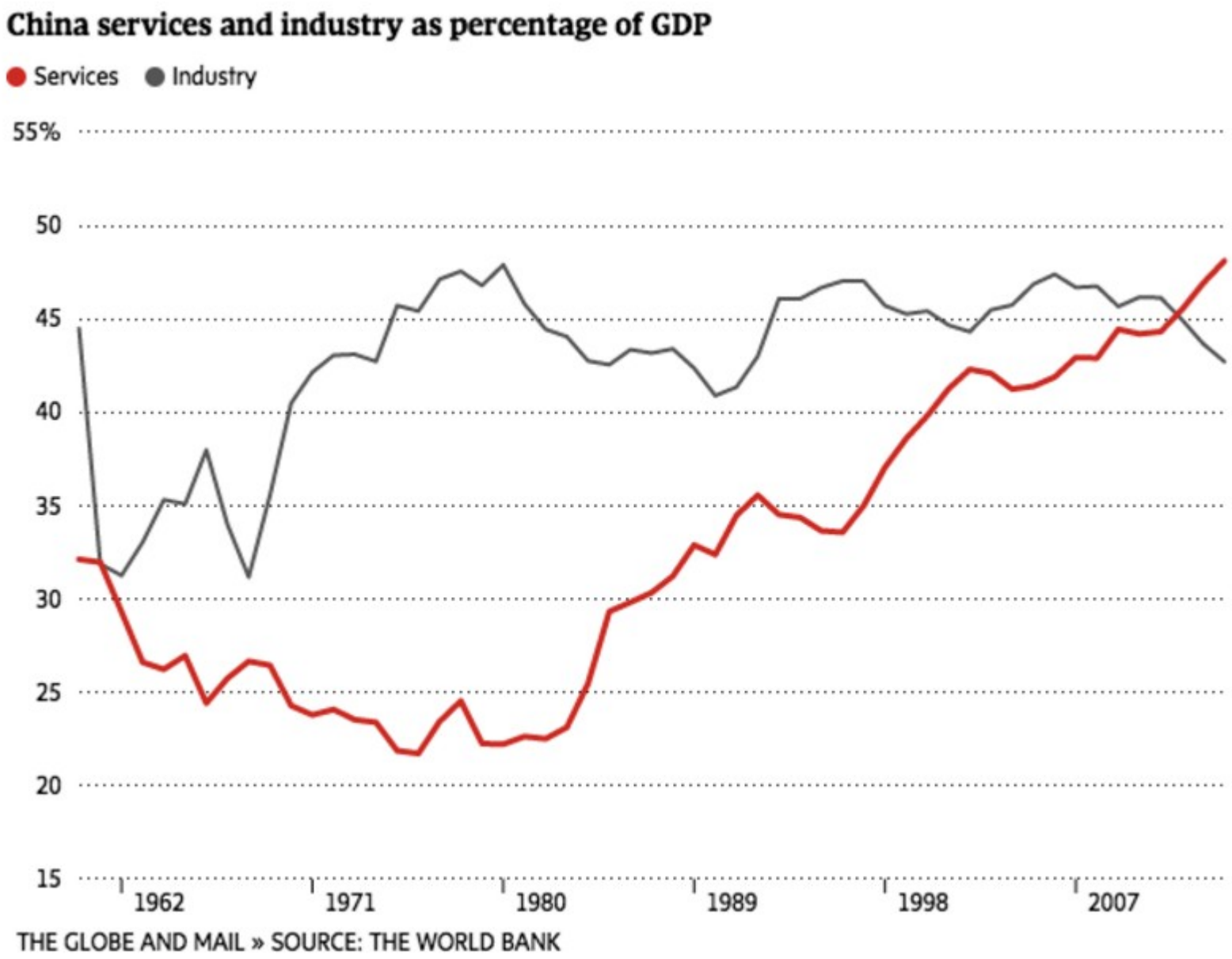




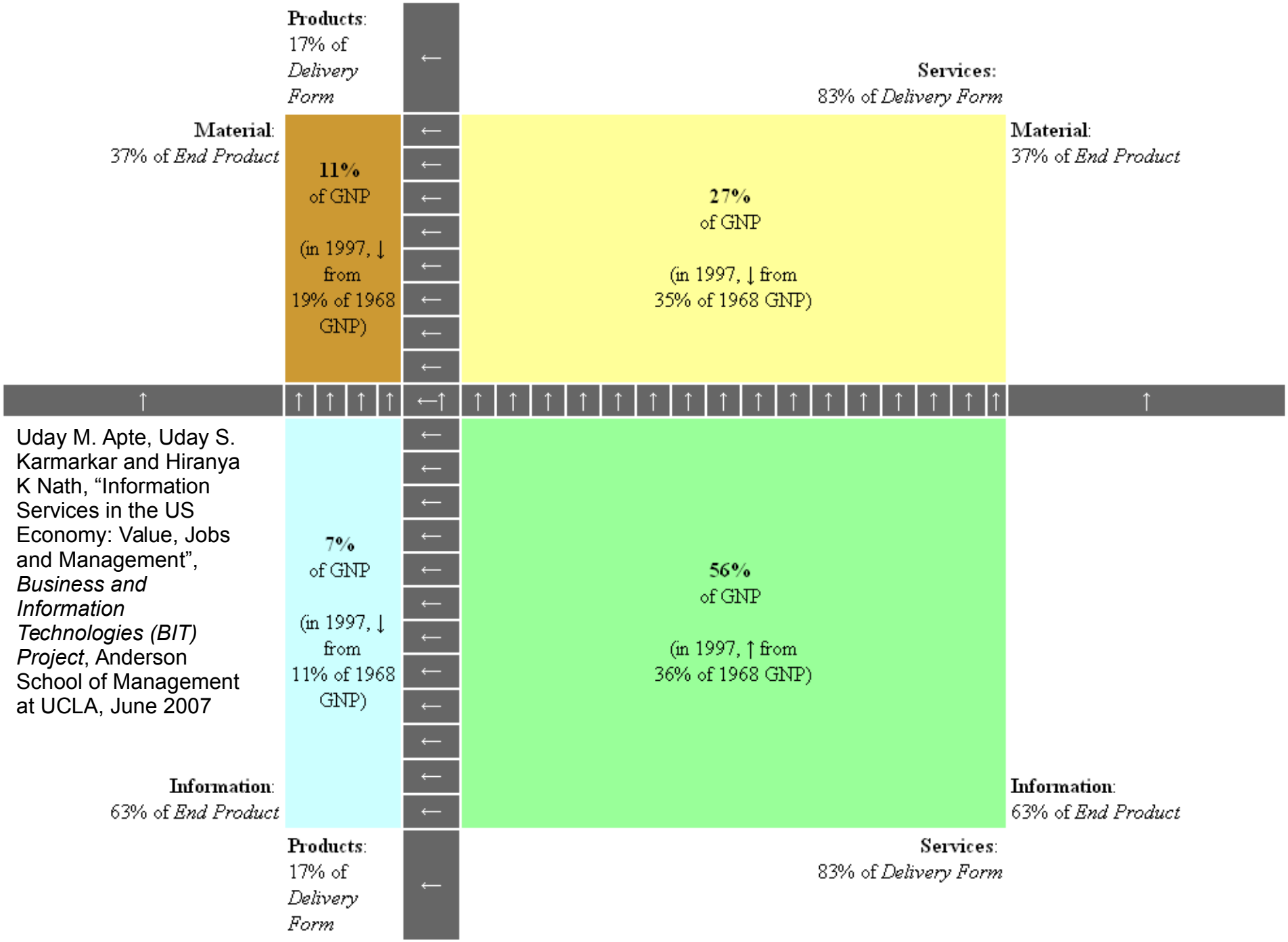




Source: IBM analysis and projections for Service Science Management, Engineering and Design, circa 2006



Source: Milner, Brian. 2016. "China's Pending Five-Year Plan Faces Steep Challenges." *The Globe & Mail*, March 3. http://www.theglobeandmail.com/report-on-business/international-business/asian-pacific-business/chinas-pending-five-year-plan-faces-steepchallenges/article29021808/.



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

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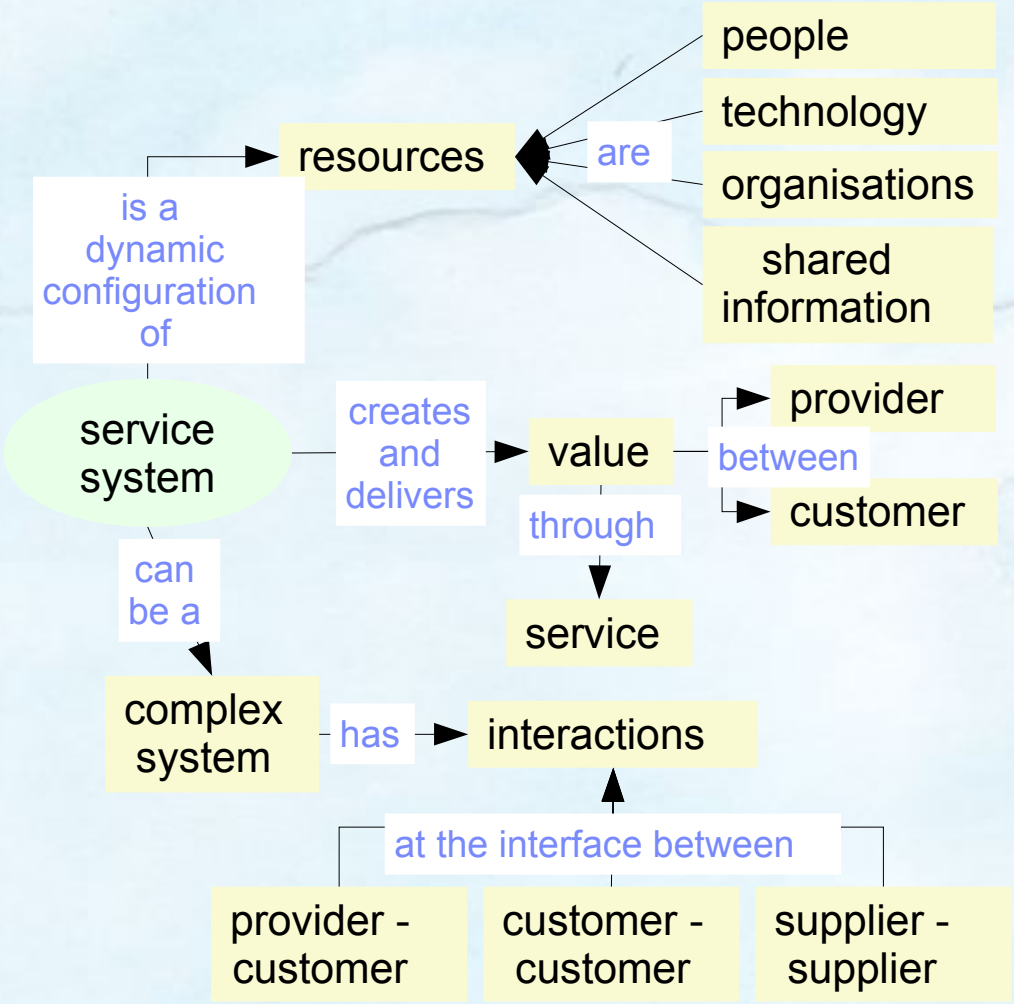
   Service systems science

Service systems in our society can be ranked from concrete to abstract, as subjects for schoolchildren

Systems that move, store, harvest, process	• Transportation	K
	• Water and waste management	1
	• Food and global supply chain	2
	• Energy and energy grid	3
	• Information and communications (ICT) infrastructure	4
Systems that enable healthy, wealthy and wise people	• Building and construction	5
	• Banking and finance	6
	• Retail and hospitality	7
	• Healthcare	8
	• Education (including universities)	9
Systems that govern	• Government (cities)	10
	• Government (regions / states)	11
	• Government (nations)	12

Source: Spohrer, James C., and Paul P. Maglio. 2010. "Toward a Science of Service Systems: Value and Symbols." In Service Science: Research and Innovations in the Service Economy, edited by Paul P. Maglio, Cheryl A. Kieliszewski, and James C. Spohrer, 157–94. 10.1007/978-1-4419-1628-0_9

Service systems (Cambridge IfM and IBM, 2008)

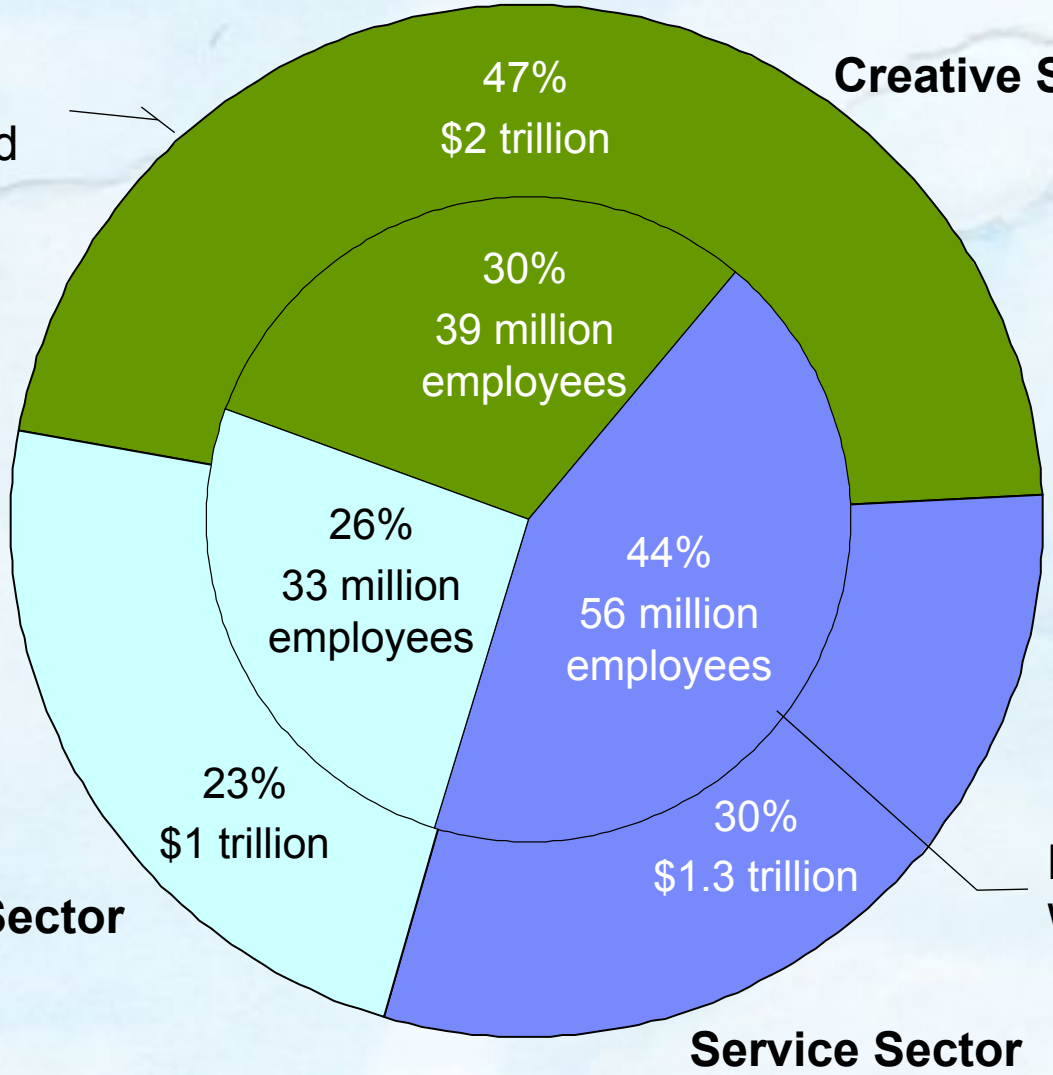


A service system can be defined as a dynamic configuration of resources (people, technology, organisations and shared information) that creates and delivers value between the provider and the customer through service.

In many cases, a service system is a complex system in that configurations of resources interact in a non-linear way. Primary interactions take place at the interface between the provider and the customer. However, with the advent of ICT, customer-to-customer and supplier-to-supplier interactions have also become prevalent. These complex interactions create a system whose behaviour is difficult to explain and predict.
(IfM and IBM, 2008, p. 6)

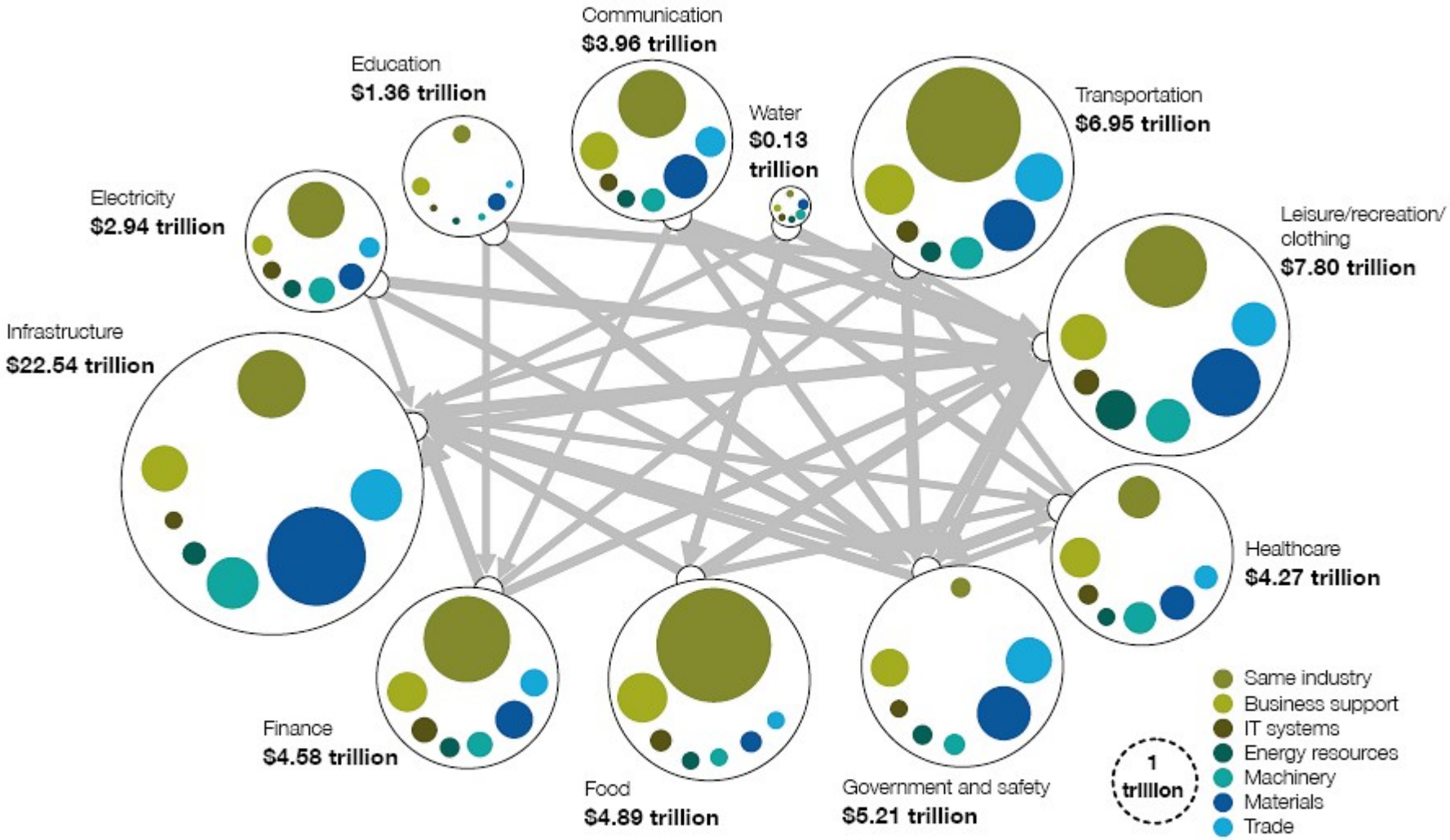
Source: IfM, and IBM. 2008. *Succeeding through Service Innovation: A Service Perspective for Education, Research, Business and Government.* Cambridge, UK: University of Cambridge Institute for Manufacturing. http://www.ifm.eng.cam.ac.uk/ssme/ .

Creative class generates greater wealth per employee



Source: Richard L. Florida (2004) *The flight of the creative class : The new global competition for talent.*

US$54 trillion system of systems -- IBM

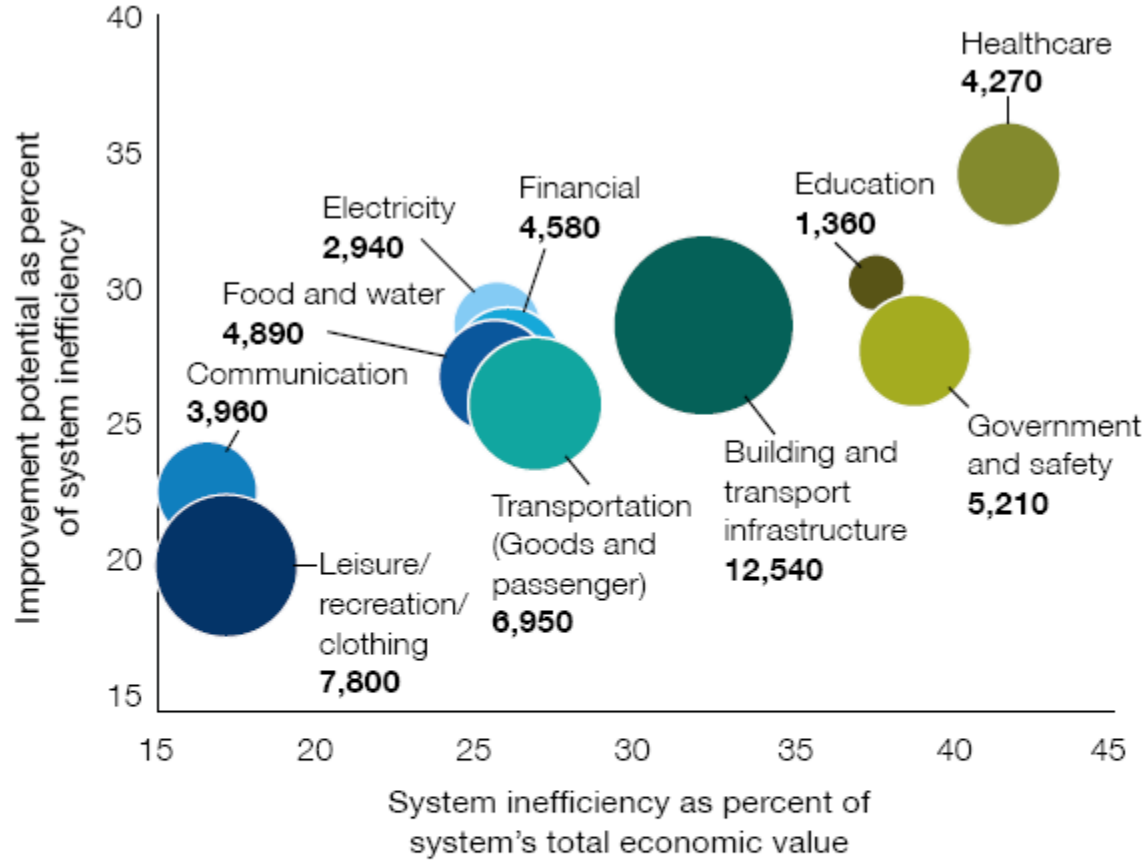


http://www-935.ibm.com/services/us/gbs/bus/html/ibv-smarter-planet-system-of-systems.html.

Note: Size of bubbles represents systems' economic values. Arrows represent the strength of systems' interaction.
Source: IBM Institute for Business Value analysis of Organisation for Economic Co-operation and Development (OECD) data.

Figure 1: We live and work within a complex, dynamic and interconnected US$54 trillion system of systems.

The world's $4 billion challenge -- IBM



Note: Size of the bubble indicates absolute value of the system in US$ billions
Source: IBM Institute for Business Value analysis based on inefficiency and improvement potential estimates reported during 2009 survey of 518 economists.

http://www-935.ibm.com/services/us/gbs/bus/html/ibv-smarter-planet-system-of-systems.html.

Figure 2: Of the US$15 trillion in inefficiencies within our global system, approximately US$4 trillion could be eliminated.

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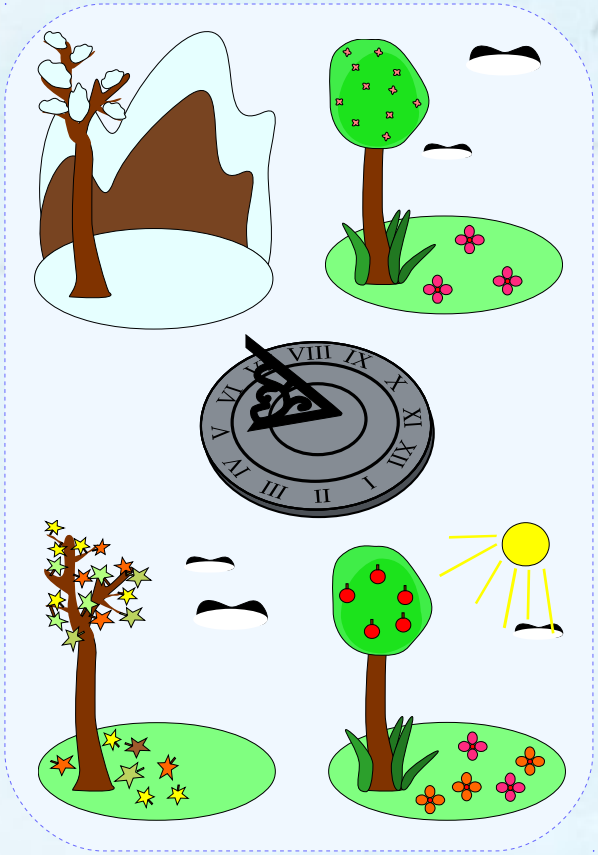
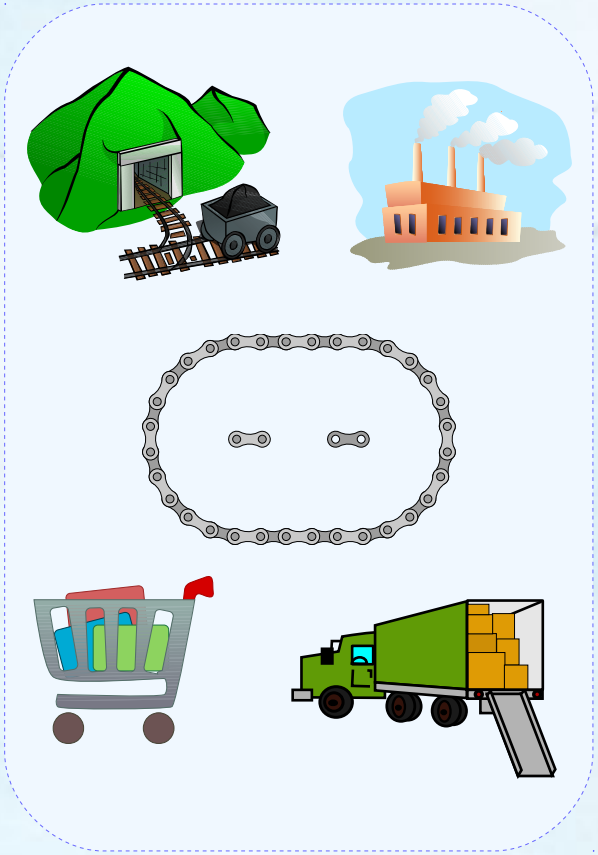
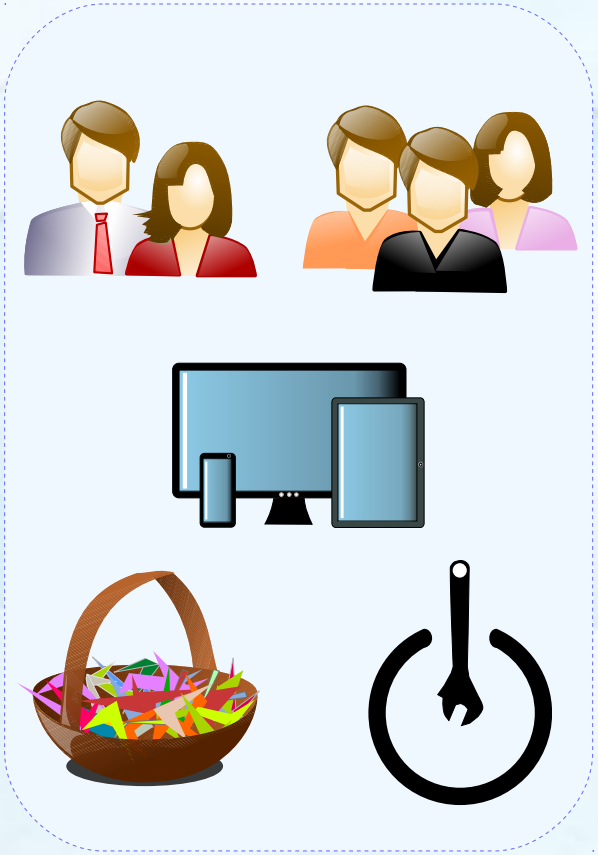
Is thinking different across agricultural systems, industrial systems, and service systems?



Agricultural Systems

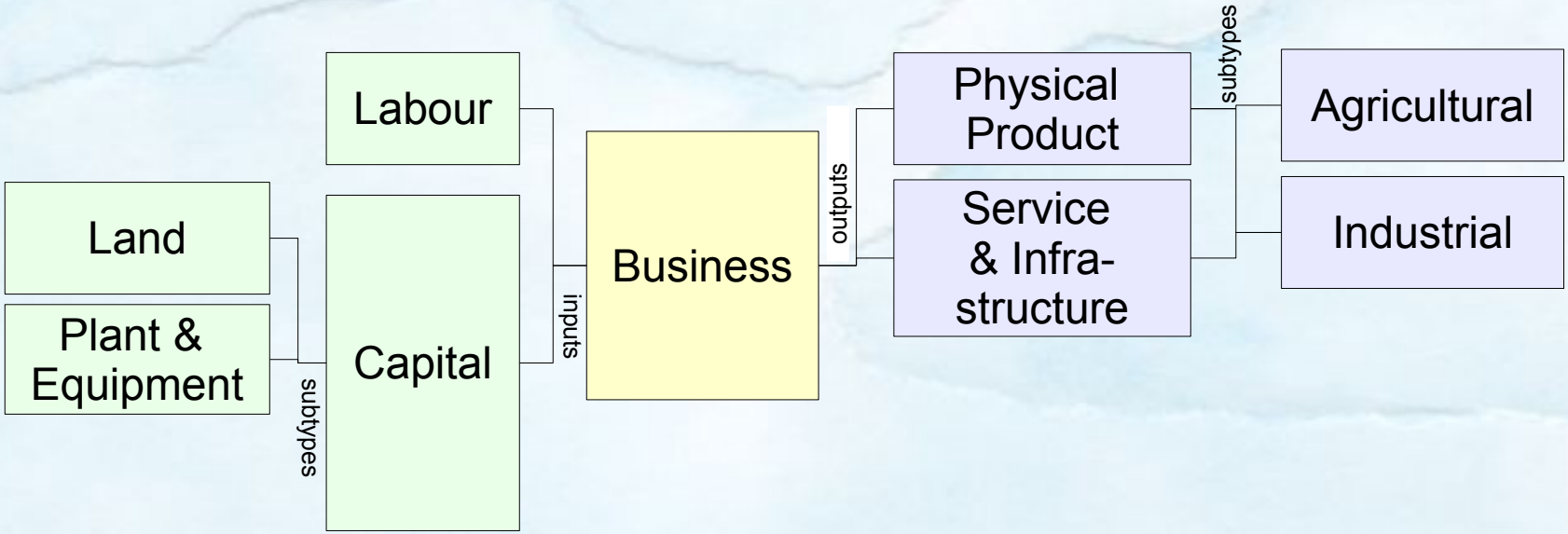


Industrial Systems

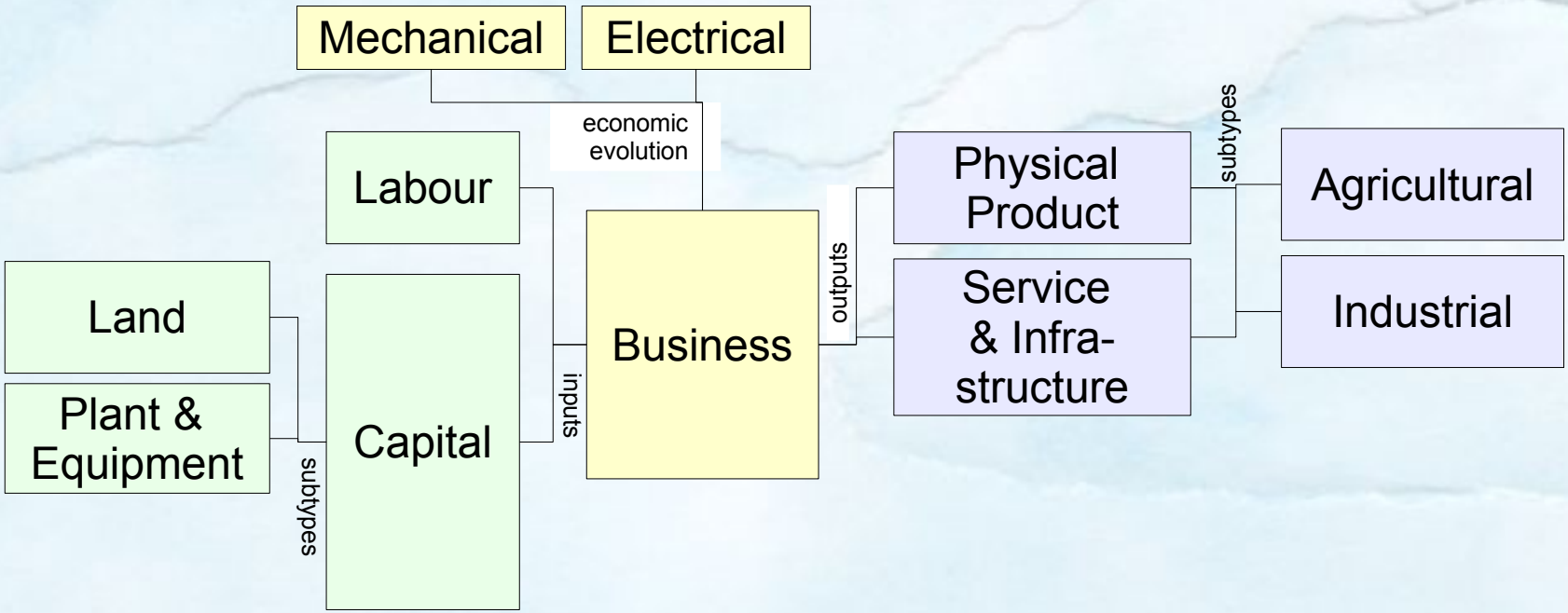


Service Systems(?)

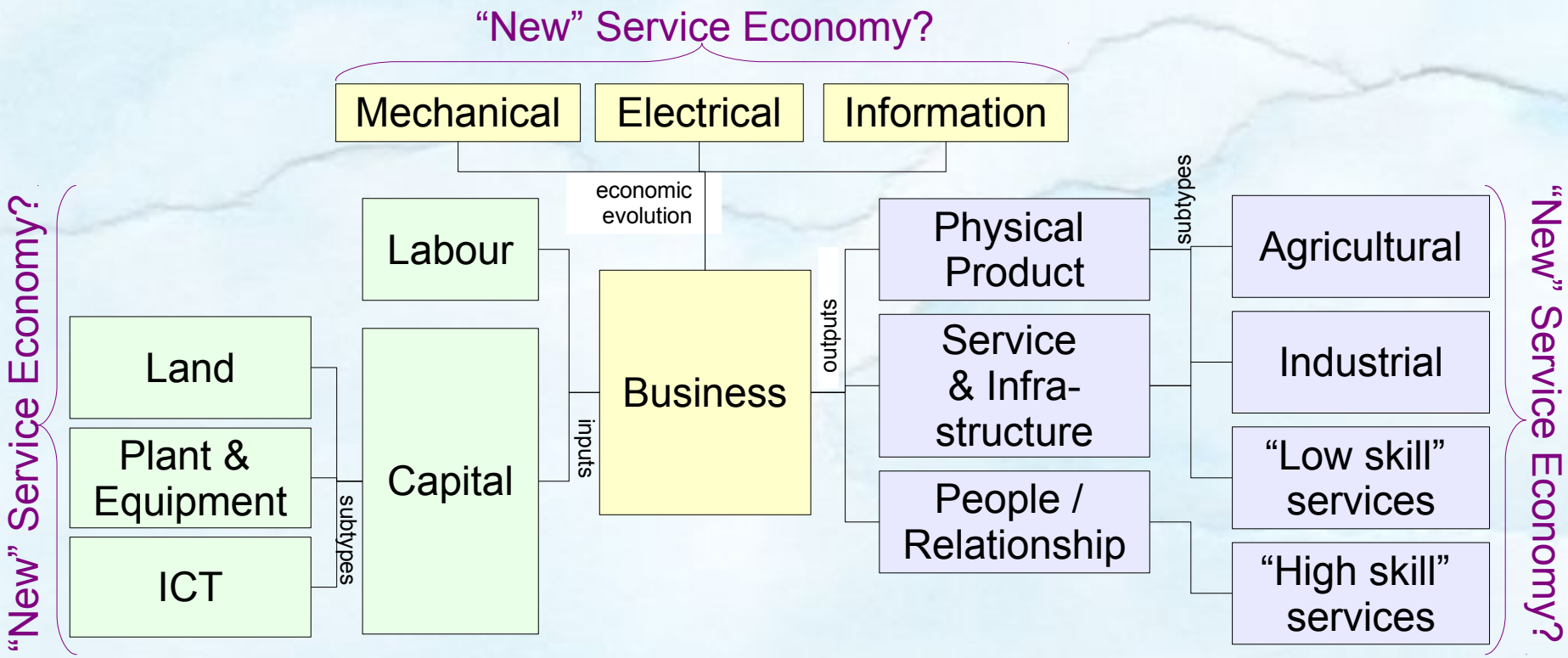
Inputs and outputs (physical product, service & infrastructure)



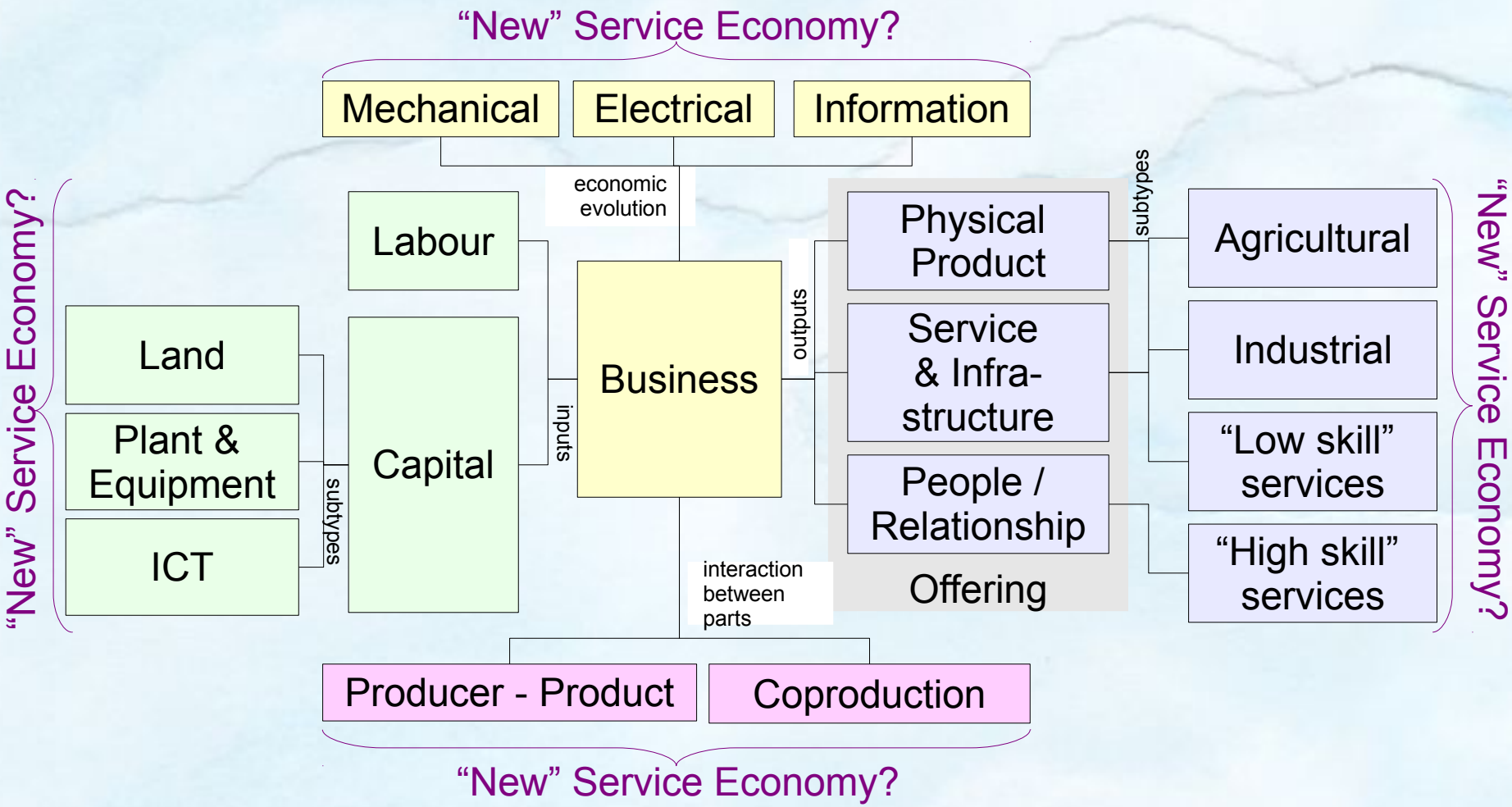
Economic evolution with mechanical and electrical



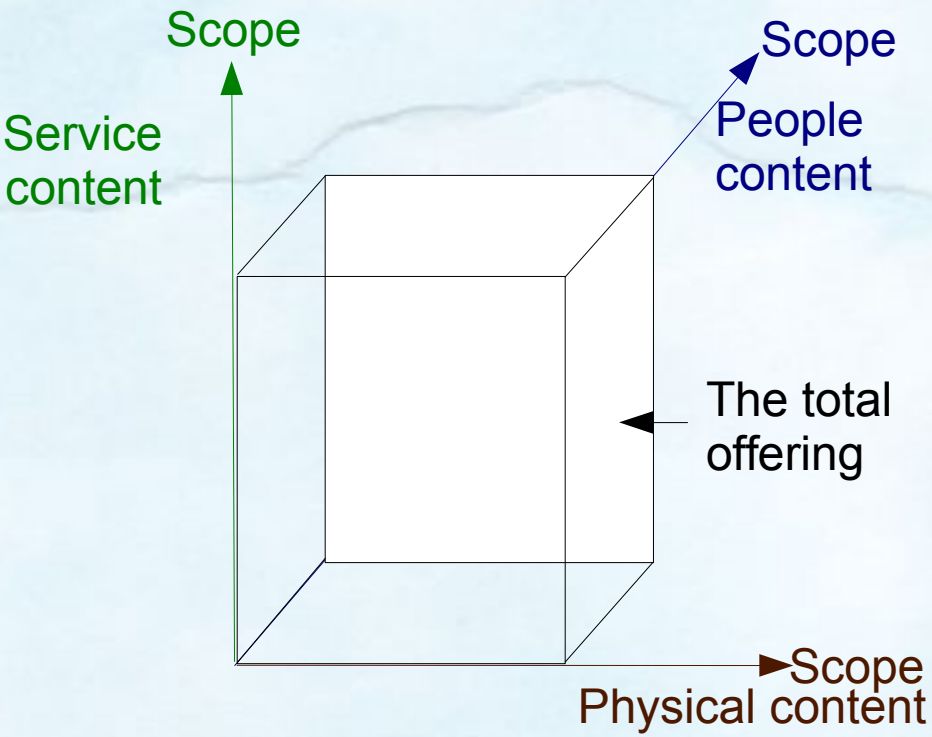
New service economy: on inputs, processes, outputs?



Interactions between parts: producer-product and coproduction



Offerings as three-dimensional activity packages



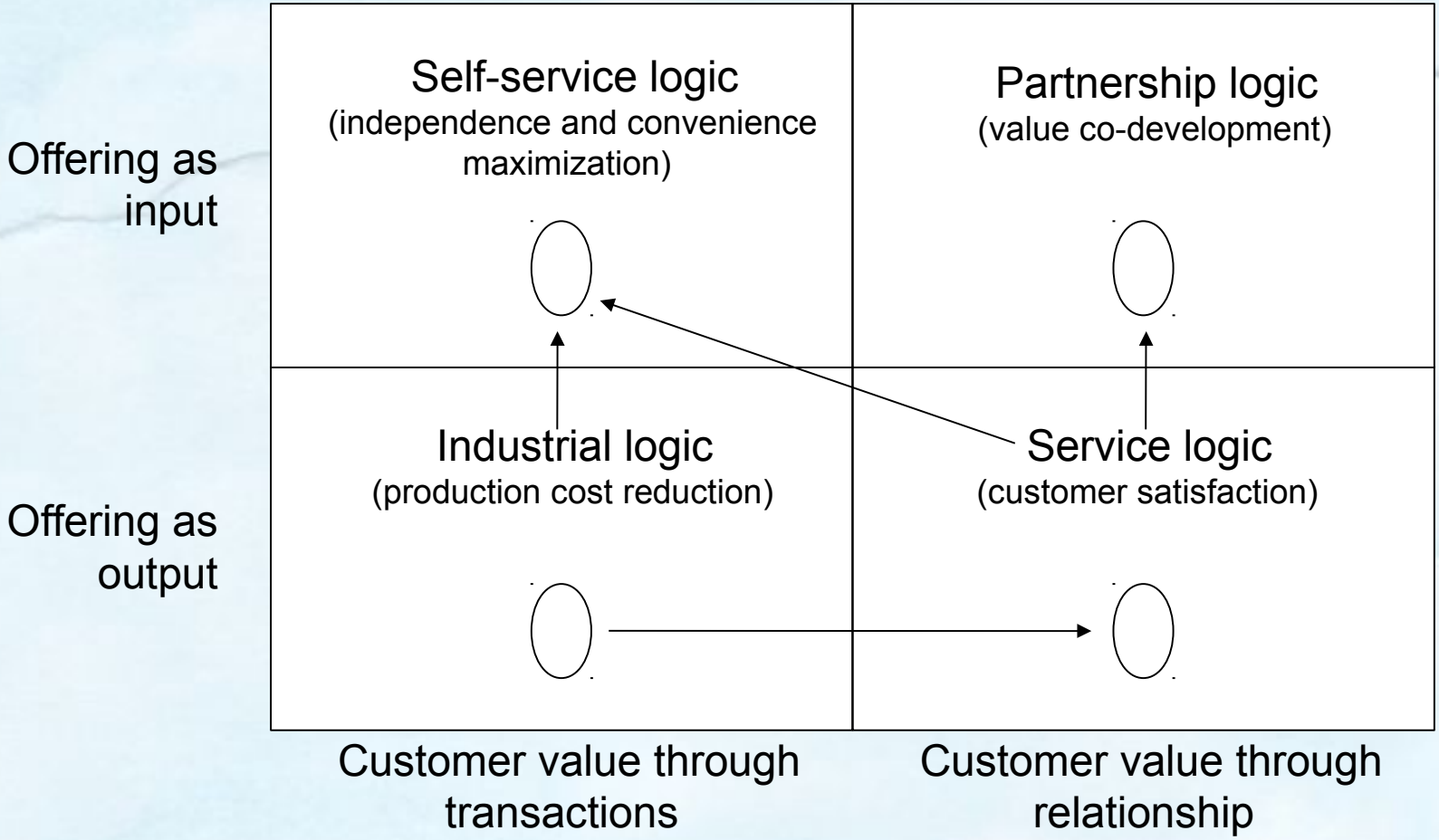
•... it is useful to examine the offering in terms of a three-dimensional activity package ....

- The physical content of the offering consists of elements such as the core product, the packaging, the quality and dependability of the good and its material components, the product range, etc.
- The service content includes distribution, technical support, product modifications, customer training, on-line advice, troubleshooting, warranties and other trust-supporting insurance aspects, information brochures, brand reputation, complaint handling, invoicing, integrated information systems, etc.
- The people content covers issues like long-term partnerships, interpersonal trust, reputation, human resource co-development, etc.

•... different customers will emphasize different axes of the offering.

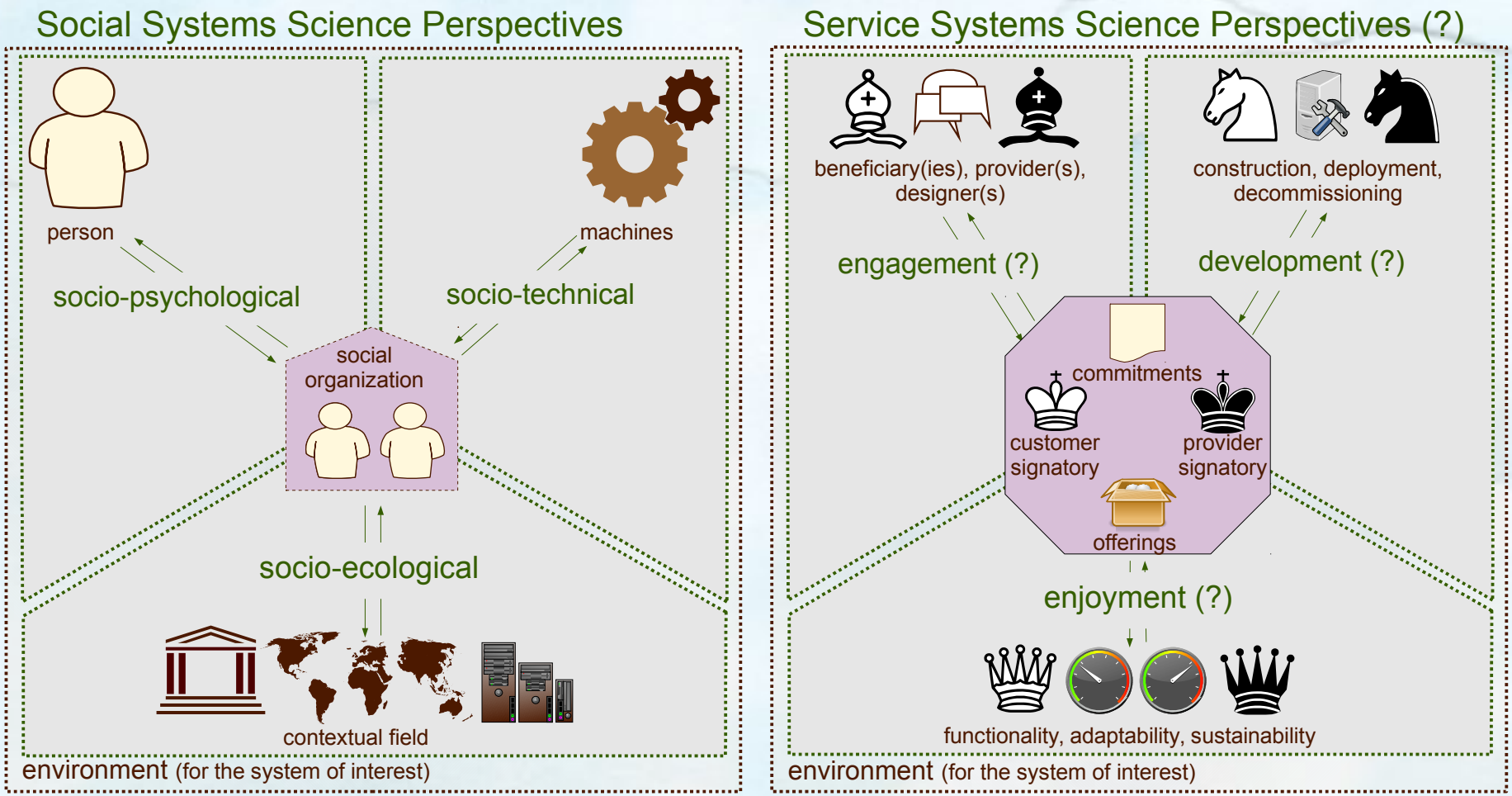
Source: Rafael Ramirez and Johan Wallin. *Prime Movers: Define Your Business or Have Someone Define It Against You*, 2000, pp. 58-59.

An offering can either be an output of coproduction, or an input to coproduction

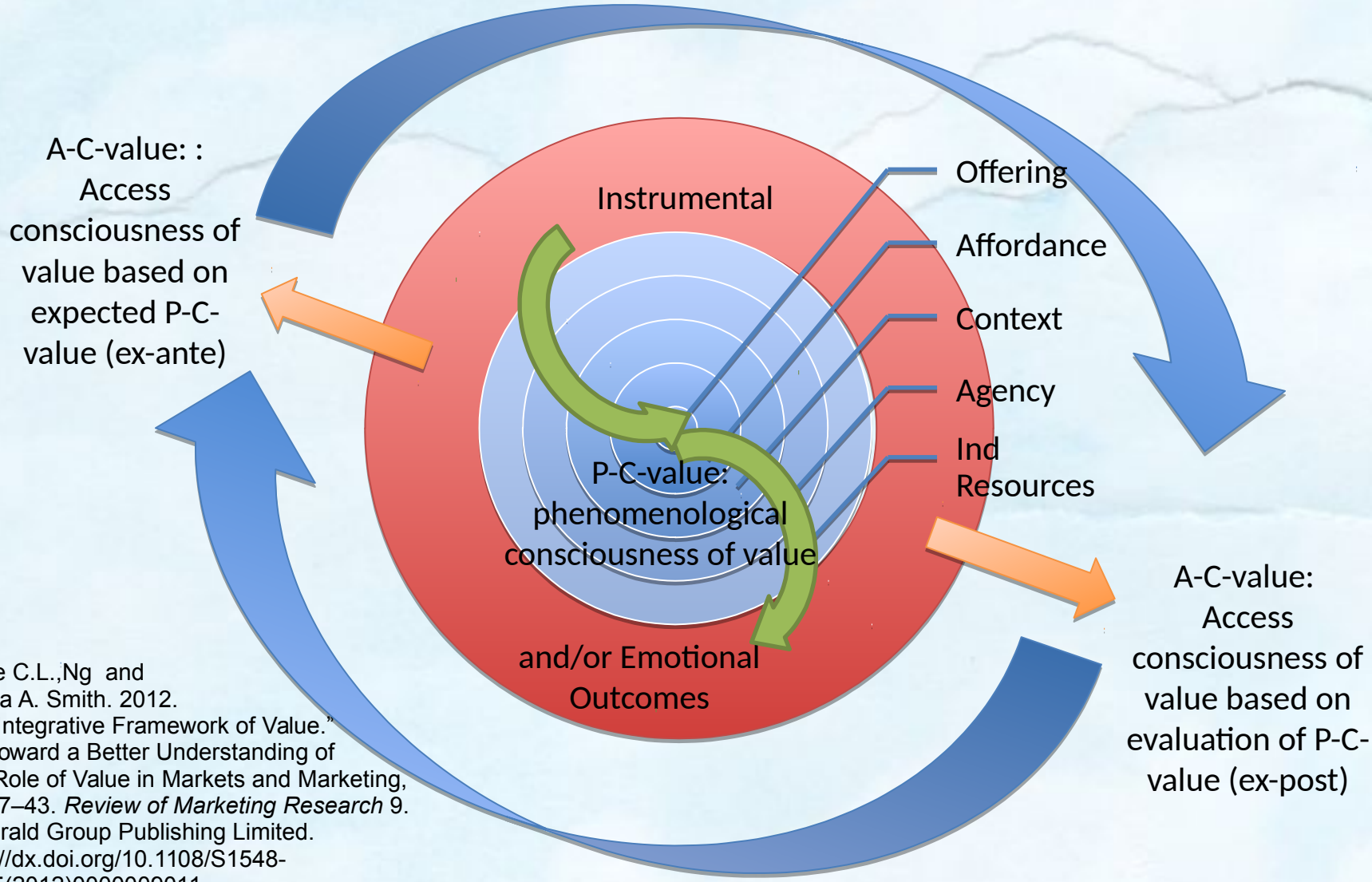


Source: Rafael Ramirez and Johan Wallin. *Prime Movers: Define Your Business or Have Someone Define It Against You*, 2000, p. 141.

Can we build on Social Systems Science towards a new Service Systems Science?

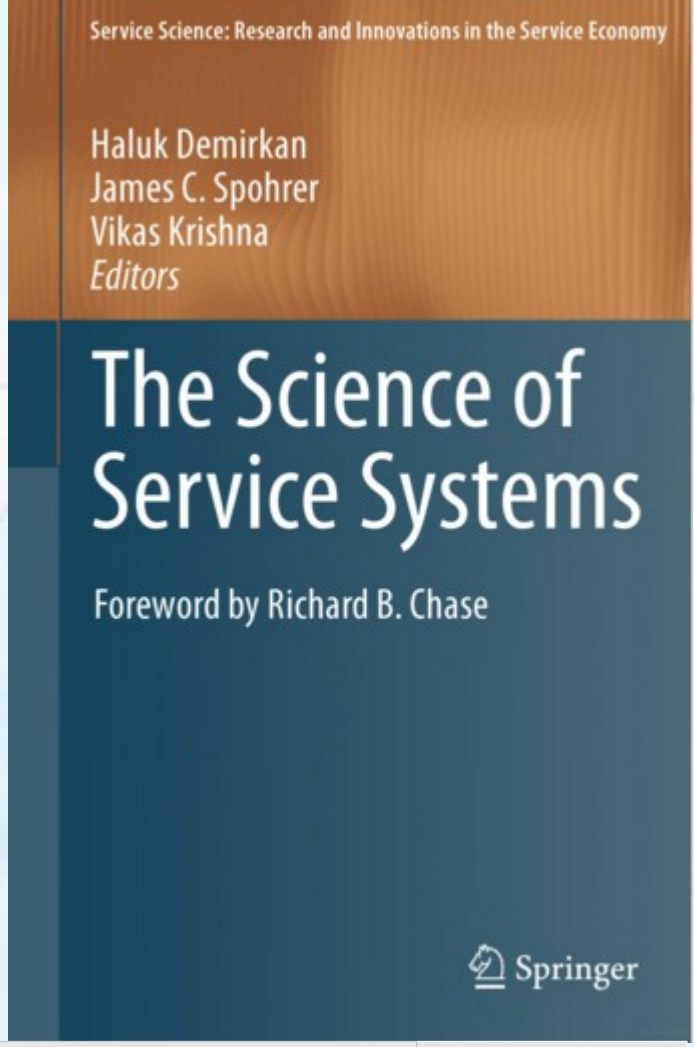


Value is dynamic, with access consciousness ex-ante and ex-post, and phenomenological consciousness in lived experience



Irene C.L.,Ng and Laura A. Smith. 2012. "An Integrative Framework of Value." In Toward a Better Understanding of the Role of Value in Markets and Marketing, 9:207–43. *Review of Marketing Research* 9. Emerald Group Publishing Limited. http://dx.doi.org/10.1108/S1548-6435(2012)0000009011.

Introduction of the Science of Service Systems	Demirkan, Haluk (et al.)
Embedding the New Discipline of Service Science	Ng, Irene (et al.)
Key Dimensions of Service Systems in Value-Creating Networks	Mele, Cristina (et al.)
Making a Science of Service Systems Practical: Seeking Usefulness and Understandability while Avoiding Unnecessary Assumptions and Restrictions	Alter, Steven
Flexible Service Systems	Polyvyanyy, Artem (et al.)
Semantics for Smart Services	Petrie, Charles (et al.)
Designing Auctions for Coordination in Service Networks	Dinther, Clemens (et al.)
Service Systems Modeling: Concepts, Formalized Meta-Model and Technical Concretion	Böttcher, Martin (et al.)
Onto-ServSys: A Service System Ontology	Mora, Manuel (et al.)
A Framework that Situates Technology Research Within the Field of Service Science	Lyons, Kelly
Customer-Driven Value Co-creation in Service Networks	Kwan, Stephen K. (et al.)
Towards Service System Governance: Leveraging Service System Grammar to Empower Value Co-creation	Puehl, Stefan
Service Science: The Opportunity to Re-think What We Know About Service Design	Voss, Chris (et al.)
Service Science Learning: Exploring the Challenge of Cross Disciplinary and Academia–Company Collaboration	Lemmink, Jos G. A. M. (et al.)



An Engineering Perspective on Service Science	McFarlane, Duncan
Service Systems in Changing Paradigms: An Inquiry Through the Systems Sciences	Ing, David
Service Customization Research: A Review and Future Directions	Kannan, P. K. (et al.)
Service and Science	Spohrer, James C. (et al.)

Social Value: A Service Science Perspective	Spohrer, Jim (et al.)
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Four Axiomatic Requirements for Service Systems Research	Reynolds, David (et al.)
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The Limitations of Logic and Science and Systemic Thinking—from the Science of Service Systems to the Art of Coexistence and Co-prosperity Systems	Maeno, Takashi
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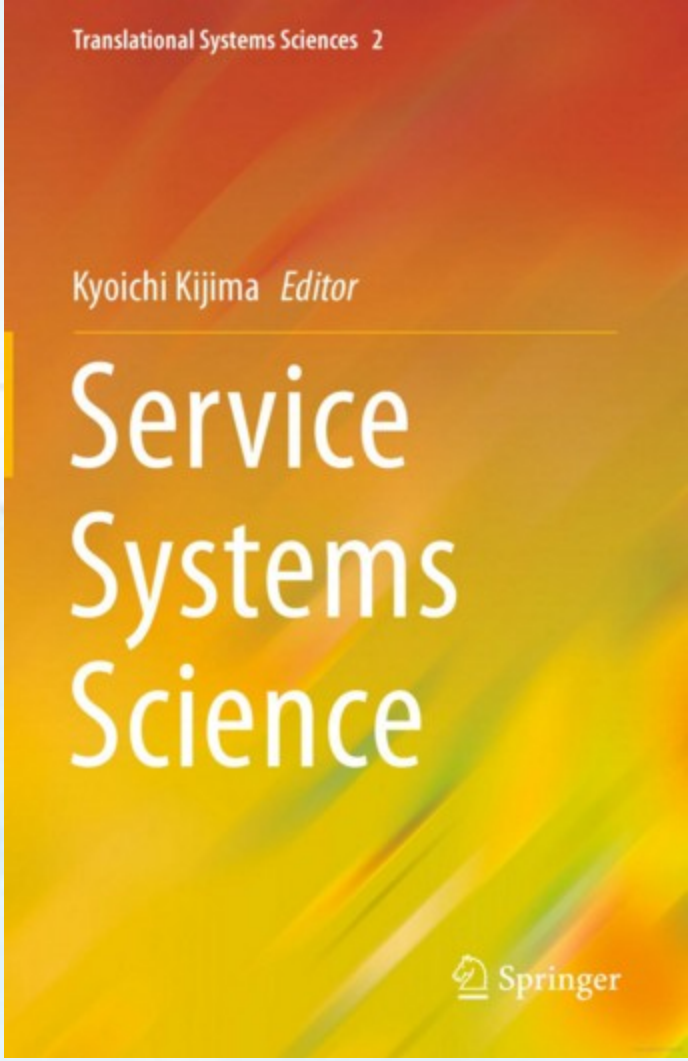
Creating Information-Based Customer Value with Service Systems in Retailing	Rintamäki, Timo (et al.)
Service R&D Program Design Aiming at Service Innovation	Sawatani, Yuriko (et al.)



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Systems Science Working Group

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Home

This is the Wiki site for the Systems Science Working Group (SSWG) of INCOSE. The SSWG is led by James Martin (martinqzx@gmail.com) with Duane Hybertson as co-leader (dhyberts@mitre.org). The purpose of the SSWG is to promot the advancement and understanding of Systems Science and its application of Systems Theories to SE. We have the following objectives:

- Encourage advancement of Systems Science principles and concepts as they apply to Systems Engineering.
- Promote awareness of Systems Science as a foundation for Systems Engineering.
- Highlight linkages between Systems Science theories and empirical practices of Systems Engineering.

The WG has about 100 members who have access to the Discussion List at sysscIwg@googlegroups.com, which can be reached through the hyperlink on the lower left. If you wish to become a member of this WG, please send a request to systems-science@incose.org, or you can join directly from our discussion list page.

The International Council on Systems Engineering (INCOSE) is a not-for-profit membership organization founded in 1990. Our mission is to share, promote and advance the best of systems engineering from across the globe for the benefit of humanity and the planet. This WG is a joint activity of INCOSE and the International Society for the Systems Sciences (ISSS). See the joint agreement MOU here.

Here is our WG page on the INCOSE website.

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