



Making Information Systems Relevant, Again: a case for a new paradigm of doctoral programs

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A service-Led World View:

- **Service:** co-creation of value by consumer and provider
- **Service System:** configuration of service resources according to value propositions
- **Service Resources:** people, organization, technology, shared information
- **Production Factors:** person, data, knowledge, technology, land, fund, machine, facility, infrastructure... used in the production of value (service) and product (manufacturing)
- **Production Function:** the micro-economic functional mapping of input (production factors and institutions) into output (service and product) for whole industry or above
- **Mode of Production:** the micro-economic paradigms of production functions

*We are in a new world if we have a **new mode of production.***

Analysis: connection of persons, providers, and co-creation

- **Consumer/Person:** What does social networking teach businesses about business? (value, value proposition, innovation, start-up, barrier to competition, economies of scale, business model, boundaries of industry...)
- **Provider:** How a 100,000 knowledge worker company compete with 10,000 10 knowledge worker companies?
- **Co-Creation:** Why manufacturing and service are coming together? (IBM, GE, ASP/Portal, demand-supply chain...)
- **Value Proposition:** What propels future merge of computing, entertainment (movie, music, theater...), network television, appliances, utility, telecommunications, personal devices...?
- **Production Factors:** where to find joining of resources after the Web, digital library, Web Services, Grid Computing... ?

Theory: Digital Connection is a new mode of production

Observation: Co-Production and Collaboration via Digital Connection

The National Initiative on Innovation (NII 2006) recognizes these foundations for the new world:

- **Network Ubiquity:** digitization of information and systems, Internet/cyber-infrastructure, pervasive (knowledge) support, user-centered devices... (*enable digital connection*)
- **Open Standards:** open source technology, application ontology and protocols for inter-operation of models, Web services and generic processes, SOA/enterprise collaborative computing... (*make digital connection*)
- **New Business Designs:** e-Business models (ASP, Exchange, On-Demand Business), peer-to-peer, virtual and extended firms, new institutions... (*use digital connection*)

Theory: innovation of value, service systems, and micro-economic institutions by scaling with digital connection

Review: Value → Productivity → Value + Productivity

- ***Efficiency = Output/Input***
- Output-pulling (on-demand): the Pre-Industrial Revolution regime, characterized by manual tool and custom work.
- Input-pushing (economies of scale): the Industrial Revolution; characterized by power machinery with standardization (e.g., POM), rationalization (processes) and optimization for ***firms***.
- Output-Input fusing (on-demand and economies of scale): new mode of co-production; characterized by digital connection with concurrent sharing of production factors ***across firms***.

Information System is an enabler of service system. It implements digital connection for user, provider, and the co-creation. It effects Output-Input fusion.

An Economical Thought Model: production function of extended firms (O-I)

Objective: maximization of utility - minimization of cost (C)

Decision Maker: consumers and providers of the service and/or product (*collaboration through digital connection*)

C = h (I, D, F, K, Z) where **I**: the institution; **D**: the digital connection/cyber-infrastructure; **F**: the non-digital production factors; **K**: the digital, knowledge production factors; and

Z = f (A, R, P) where **A**: the consumption activities or enterprise processes; **R**: the restrictions on the selection of A; and **P**: the market price for A. (*The nature of constraints R defines goods vs. services*)

$C^n = h^n (I, D, F, K | Z)$ if $n = p$ (provider) or

$C^n = h^n (I, D, Z | F, K)$ if $n = u$ (user)

(C^n is recursively expandable along the demand chain and the supply chain.)

The Large-Scale Challenge: from Economic Activities to Academic Disciplines

- Service: on-demand **co-production** on global demand chain (maintenance-operation, consulting, personalization...)
- Manufacturing: on-demand **collaboration** on global supply chain (extended CIM-CE-AE, resilient-auto-sustainable...)
- Personal Enterprises: on-demand **networking** on P2P webs (social media, digital repositories, connection providers...)
- Computer Science: beyond single controller/von Neuman machine and deterministic computation/Turing machine ...
- Industrial and Systems Engineering: perpetuating transient states, population orientation, multi-modal algorithms...
- Management and Economics: extended virtual firms...

Observation: information systems could provide a science of scaling with digital connection for innovation.

Elements of IS Are Elements of Service Systems and Digital Connection

- ***User Interface***: dedicated or ubiquitous *access for* clients, enterprise users, and collaborators;
- ***Process resources***: multi-modal protocols, application informatics, decision and control algorithms, business process libraries, and software and application ontology;
- ***Information Resources***: data streams, databases, knowledgebases, and repository of models and methods;
- ***Computing Resources***: servers, clients, and other information acquiring, saving, and processing devices
- ***Infrastructure Resources***: networks and (wired or wireless) telecommunications

Theory: information systems innovation includes elements, systems, and value propositions due to connection.

“Being Relevant” Means New Research Paradigms and New Doctoral Programs

The Traditional Academic-Push Paradigm:

Generalizes from laboratory, case, and/or field study

- Do we already have enough results to answer all the new (e.g., large-scale) challenges? Is synthesis sufficient?
- Do we already know what basic gaps of scientific knowledge exist in the field and how to close them?

The New Paradigm: problem-centric and industry-pull:

Collaboration to address the (cyber-enabled) population

- Mechanism: industry-university collaboration and co-production (mentors and residencies)
- Action plans: new interdisciplinary doctoral programs and new funding (consensus building, research symposia...)

Possible Entrees to Research Agendas: value innovation, service systems design, cyber-enabled institutions