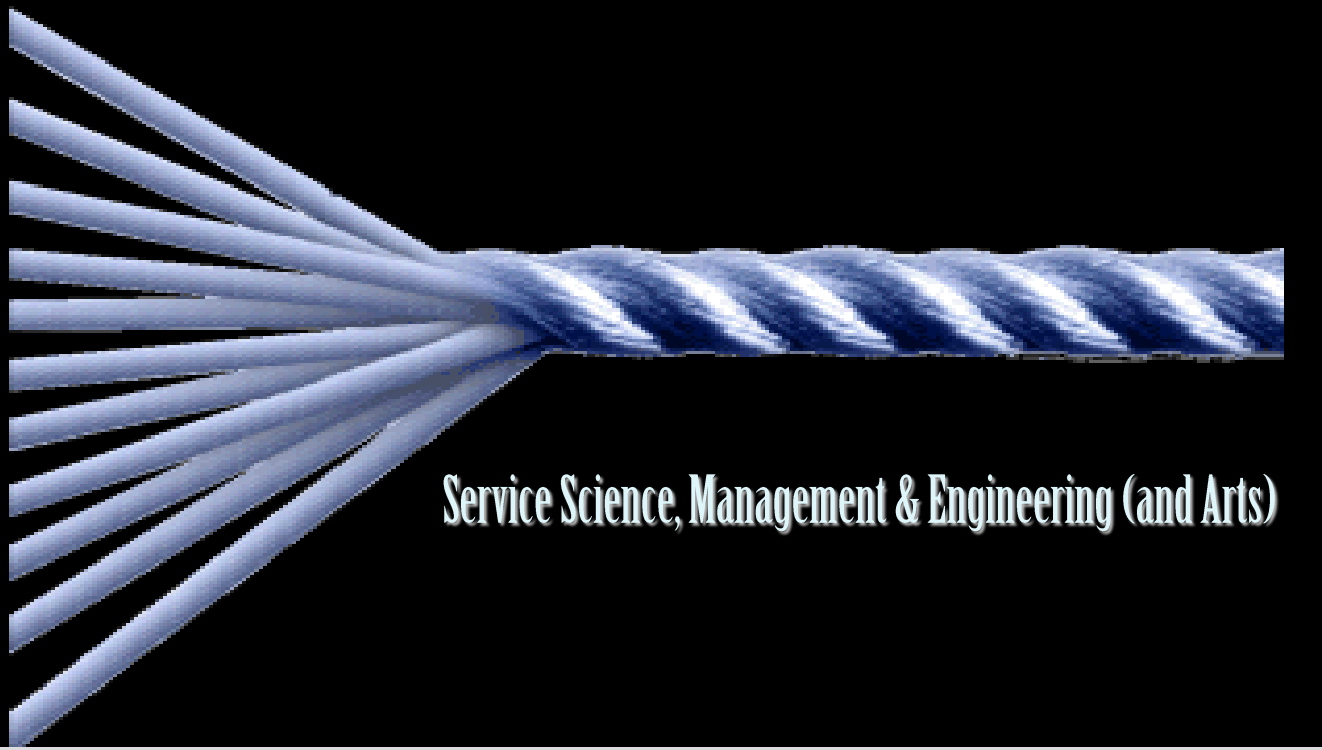

Innovating Services: A Challenge for Higher Education

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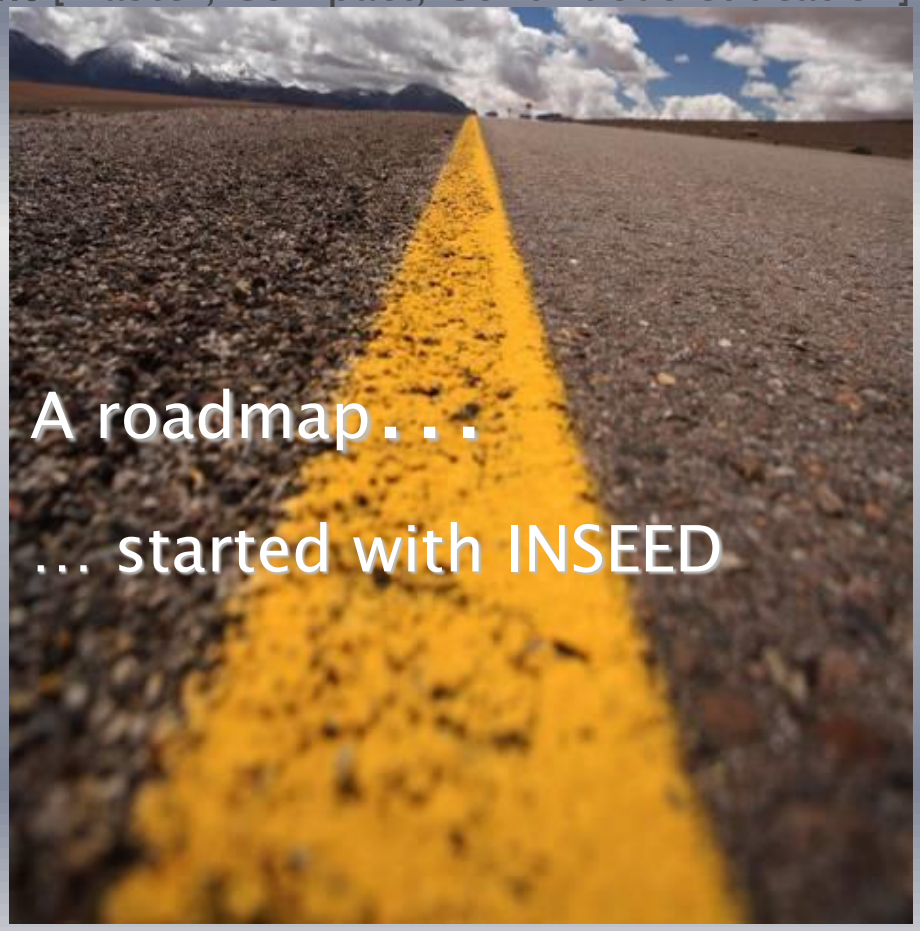
The Context–demand for service innovation

1. Promote innovation in the service industry, based on: (a) **Research in Master programs**: SEM, SOEA, e-Gov, e-Administration, Advanced Software Systems, EaaS (b) **SS-KE**: a shared knowledge environment, ontology-based & available in the Cloud, interconnecting public and private organizations.
2. Create an open framework for learning in higher education, in the domain of service science, design and management [Master, Compact, Continuous education]

- Innovation: Service system & service networks modelling, design and management, optimization
- New types of services: knowledge intensive, scientifically founded, IT-based, described by metrics, KPI
- Foundations for a new science: **Service Science**
- T-shaped education for service innovation [expert thinking (deep) + complex communication (broad)]
- IT support for service industry: Service Oriented Computing
- Research for service innovation



The demand for service innovation

Service innovation is the output of applied research and development activities that have one or more of the following goals [National Science Foundation]:

- Pursue a planned search for new knowledge, regardless of whether or not the search points to a specific application.
- Apply existing knowledge to problems related to the creation of a new service or process, including work to evaluate feasibility.
- Apply existing knowledge to problems related to improving a current service or process

Service innovation is a combination of:

- technology innovation,
- business model innovation,
- social-organisational innovation and
- demand innovation,

with the objective to **improve existing service systems** (*incremental innovation*), **create new value propositions** (*offerings*) or **create new service systems** (*radical innovation*).

Knowledge-intensive services

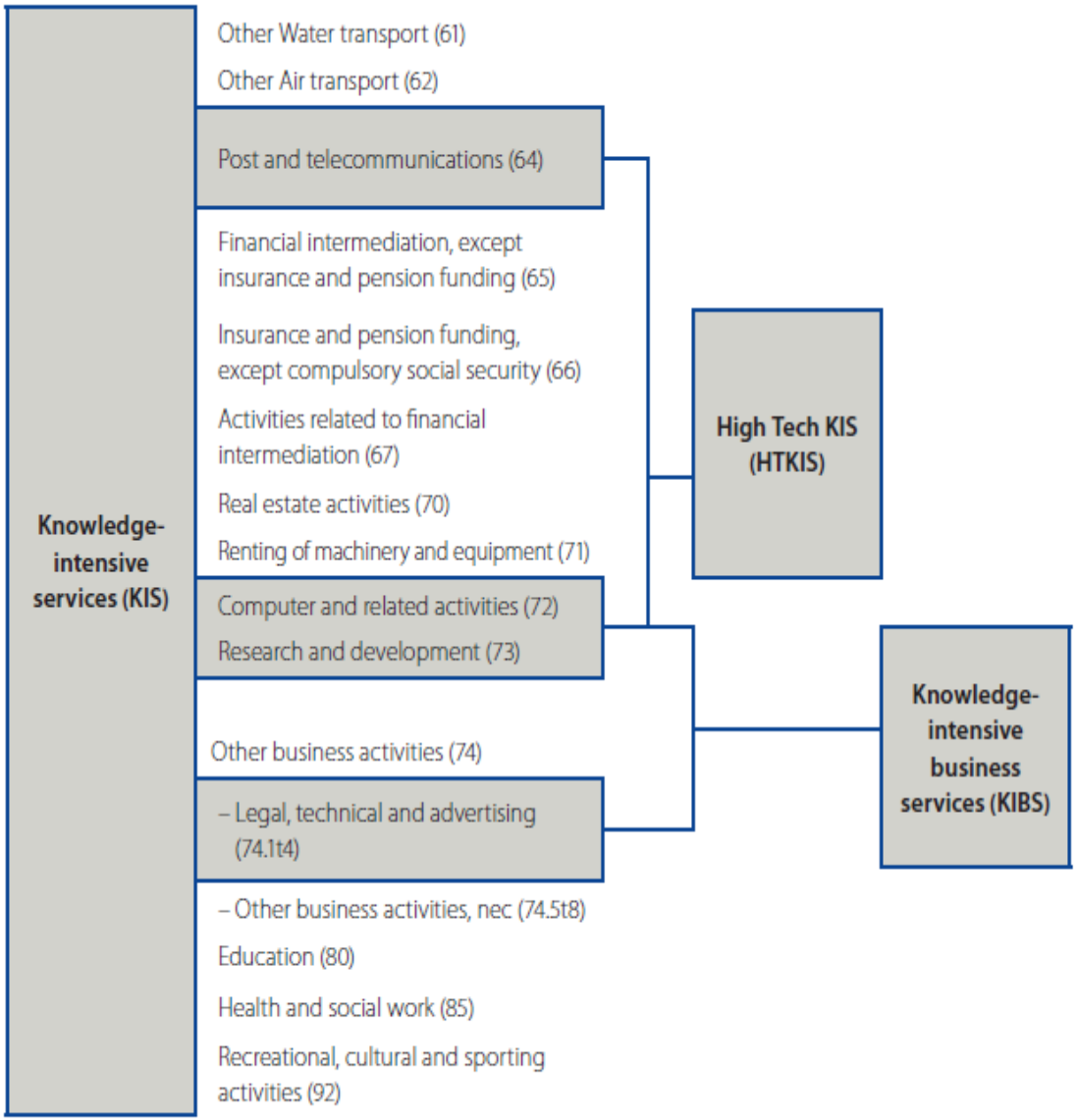
Knowledge Intensive Services (KIS) are services with high levels of technological opportunity: computer services, telecommunications, transport and R&D and engineering services.

KIS subcategories:

- *high-tech KIS* (HTKIS)
- *knowledge-intensive business services* (KIBS)

KIS affect innovation processes:

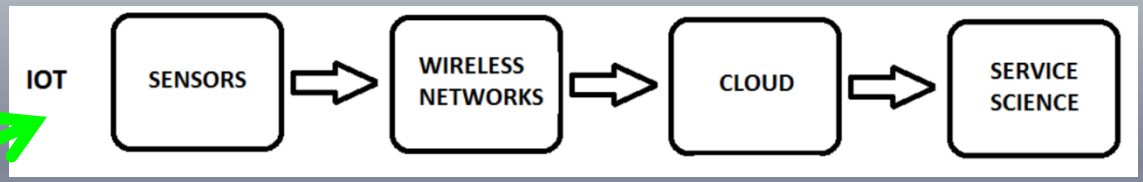
- Renewal service activities (*R&D services* and *strategic management consulting*) relate closely to innovation
- Routine services (*accounting*) improve, maintain and manage various subsystems within organisations
- Compliance services (*auditing and some legal services*) assist organisations to work within the legal framework and various other regulatory regimes
- Network services (*informal personal networks and professional networks*) facilitate communication, knowledge exchange & flexible resource allocation



A Services Science context driven by Disruptive Innovation & the Internet of Things

Internet of Things (IoT) is an integrated part of Future Internet and could be defined as **a dynamic global network infrastructure with self configuring capabilities** based on standard and interoperable communication protocols where physical and virtual 'things' have identities, physical attributes, and virtual personalities, *use intelligent interfaces*, and *are seamlessly integrated into the information network*

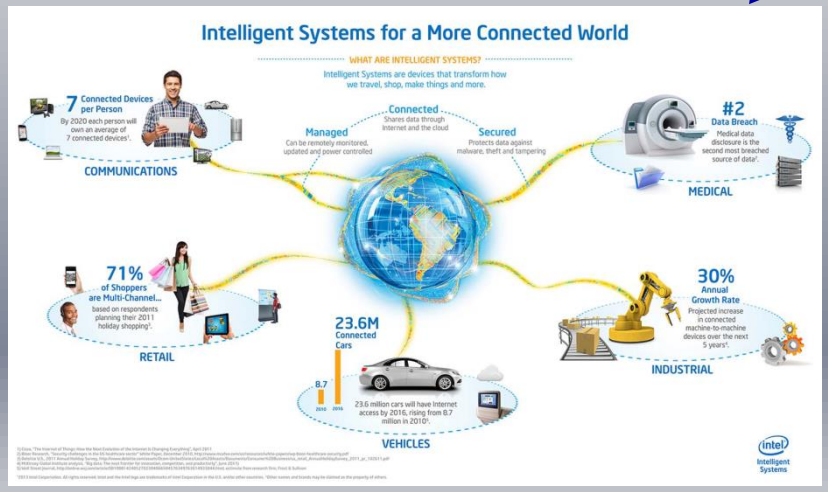
IOT [Ashton, 1999]



Disruptive Innovation (Christensen, 1995)

A disruptive innovation : an innovation that helps create a new market and value network, and eventually goes on *to disrupt an existing market and value network* (over a few years or decades), displacing an earlier technology.

SSME [Spohrer, 2008]



Collaborative Engineering as an IOT Based Service System

- Business Component
- Engineering Component
- **Service Science Component**
- Innovation

Smart services

Smart Service Systems are considered those systems that feature *sustainable innovation* (continuously reduce waste, expand capabilities); they are capable of *self-reconfiguration* (or at least of *easy inducted re-configuration*) in order to perform enduring behaviour capable of satisfying all the involved participants in time :

A. Systems and services that focus on flow of things that humans need (~15%)

1. Transportation and supply chains
2. Water and waste recycling / Climate and green technologies
3. Food and products from manufacturing
4. Energy and electricity grids
5. Information and Communication Technologies (ICT access)

B. Systems that focus on human activity and development (~70%)

6. Buildings and construction (smarter spaces) (~5%)
7. Retail and hospitality / Media and entertainment (tourism) (~23%)
8. Banking and finance / Business and consulting (wealth) (~21%)
9. Healthcare and family (~10%)
10. Education and work life /Professional jobs and entrepreneurship (wise) (~9%)

C. Systems that focus on human governance - security and opportunity (~15%)

11. Cities and security for families and professionals (property tax)
12. States / regions and development opportunities / investments (sales tax)
13. Nations (NGOs) and rights / rules / incentives / policies / laws (income tax)

Smart service systems – in the context of Smarter Planet

Smart traffic systems

Intelligent oil field technologies

Smart food systems

Smart healthcare

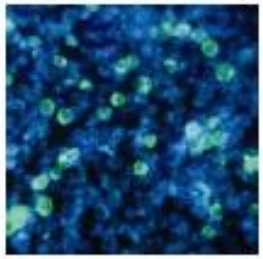
Smart energy grids

Smart retail

Smart water management

Smart supply chains

Smart countries

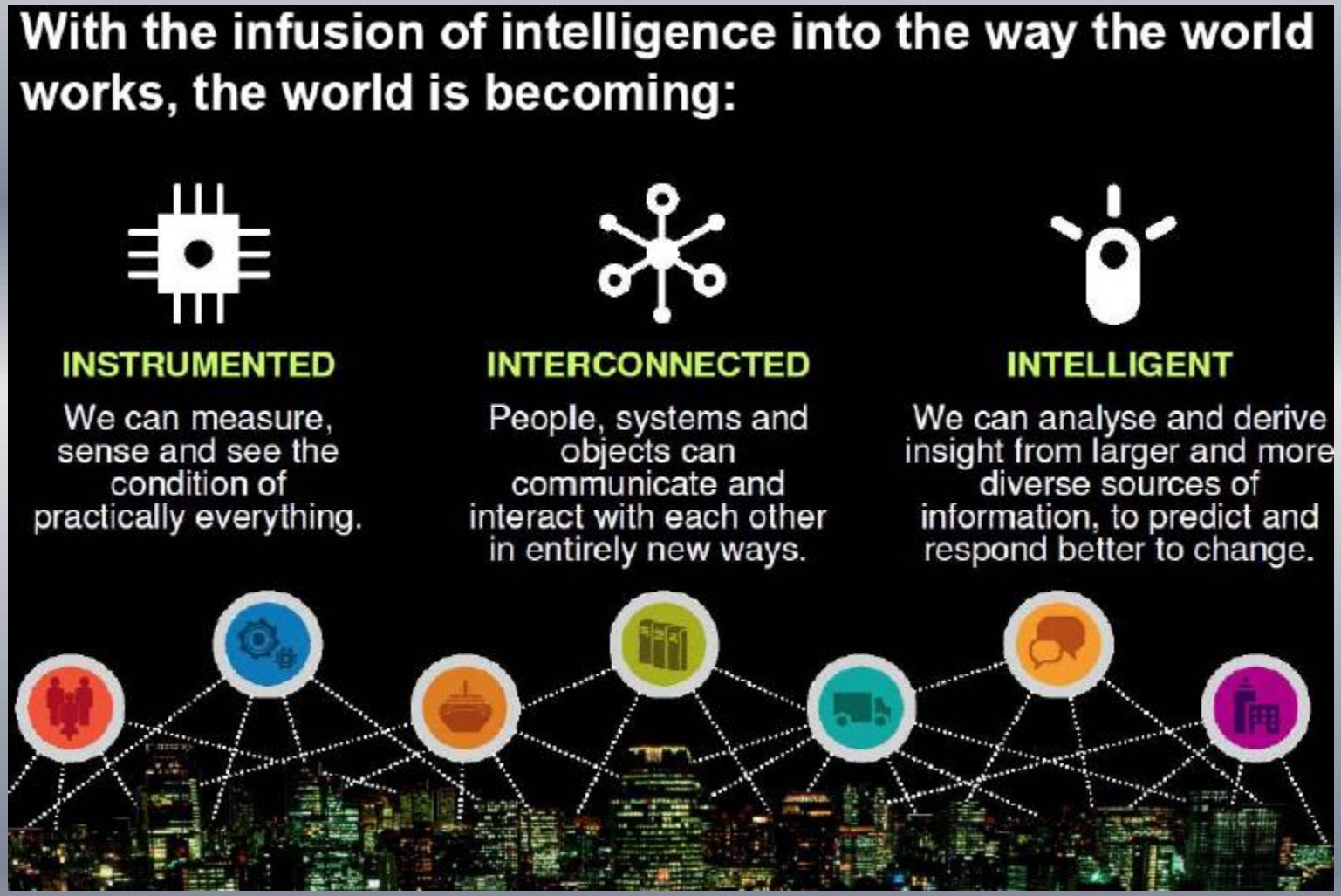


Smart weather

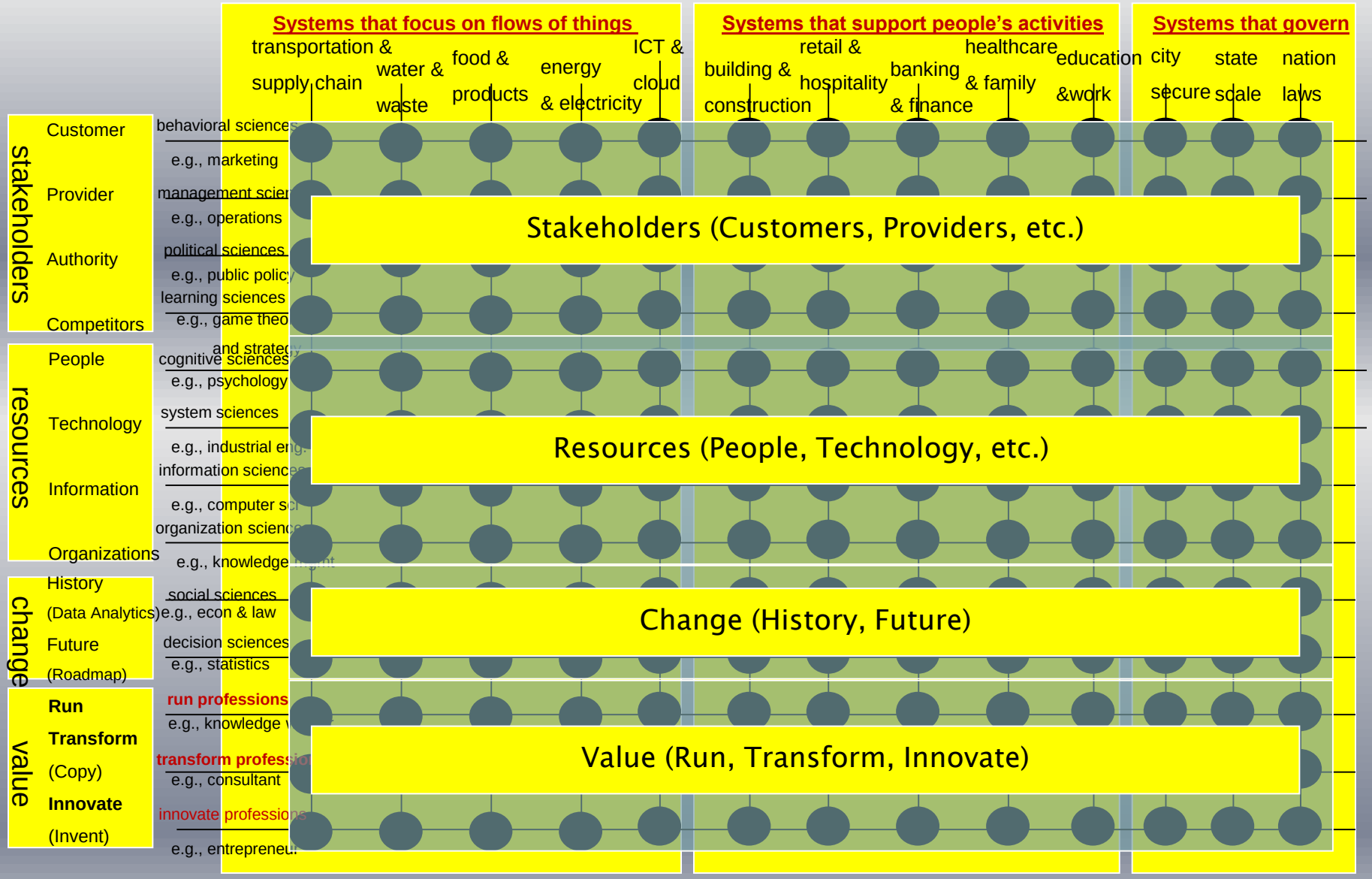
Smart regions

Smart cities

Smarter Planet



Skill for Smart Services & Disciplines

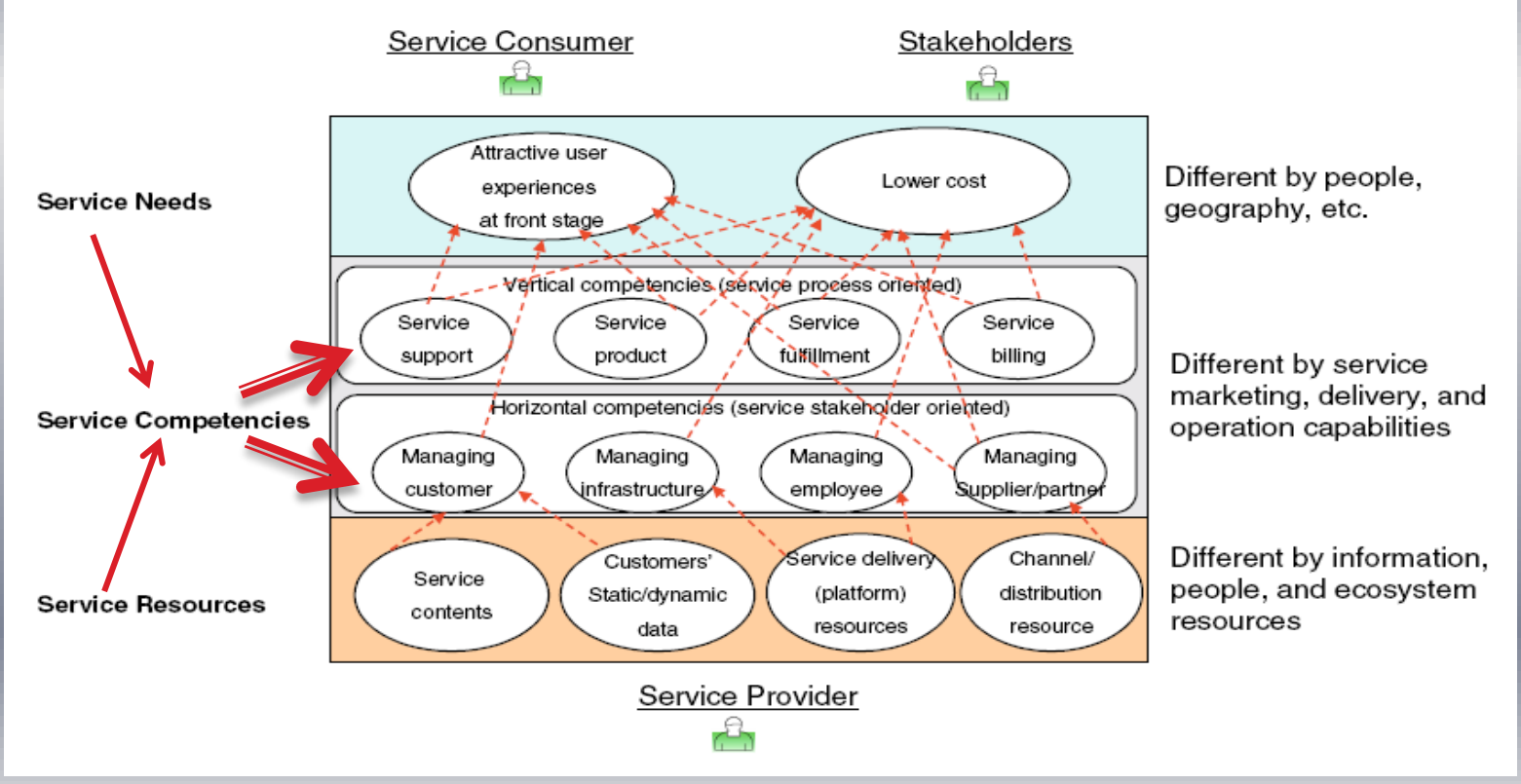


Run: use existing knowledge or standard practices (exploit / use)
Transform: adopt a new best practice (explore / copy)
Innovate: create a new best practice (explore / invent)

3-layer Service Innovation framework

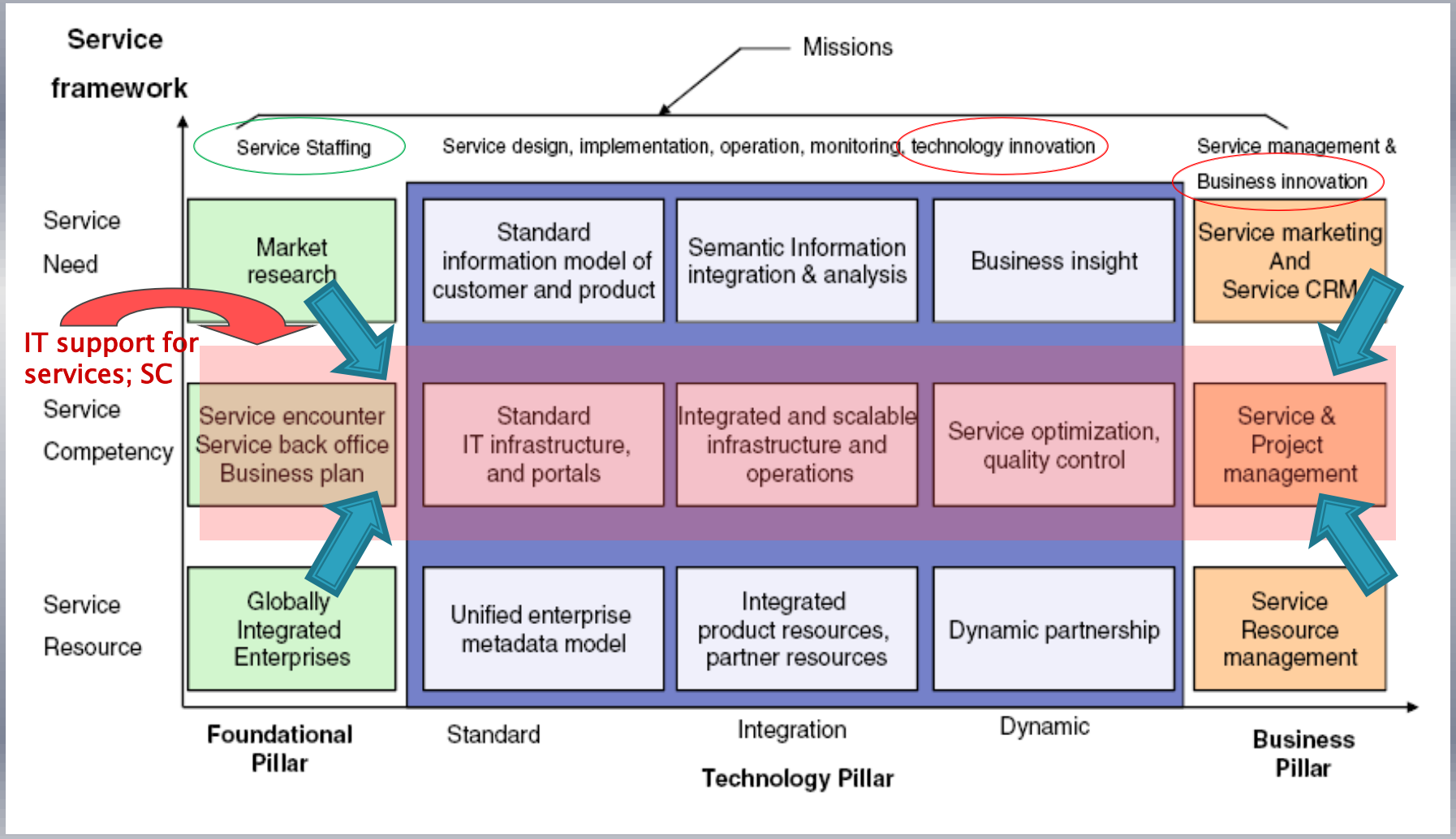
The **service lifecycle** perspective covers:

- service requirements from service consumers [specs., perception, experience]
- capabilities of service providers [resources/infrastructure, channels/distribution, people/organization]
- interactions among the service roles in a service project [internal, external, dynamic]
- the processes of service design & development, delivery, marketing [core, support, KPIs]
- service (operations) management [value, measures]



Mapping the 3-layer service framework to competencies

Competency pillars sustained by SC for the 3-layer service innovation framework



Mapping result: the SS Educational Model

Transposes:

- The multilevel framework, organizational and technological innovation methods / directions to ensure service requests, competencies and resources;
- The roles: context of partnership in co-creating value through services (supplier, customer, competitor, authority);
- The principles and methodology of configuration, interconnecting, integration, exploration and innovation of services (people, technology, shared information, organizations) needed for services implementation [model-based]

in **sets of disciplines** for curricular areas, associating :

1. The Service Resources level with: *technologies* (platforms/resources for service implementing, distribution resources/channels), *shared information* (service content, client data), and *personnel* (resource exploitation);
2. The Service Competencies level with the discipline set related to:

   organizations: horizontal competencies (staff and organizational management);

   partnership: horizontal competencies (supplier, partner, competitor, …)

   provider: vertical competencies (support for services, execution, billing)

3. The Service Needs level: discipline set related to the customer (service *availability, customization*, *customer/community contribution* in service execution, cost & market analysis) and the authority (supplier-customer *relation settlement*, SLA, IP).

Educational Model for SS [deployment]

SS Model based on the 3-layer service innovation framework

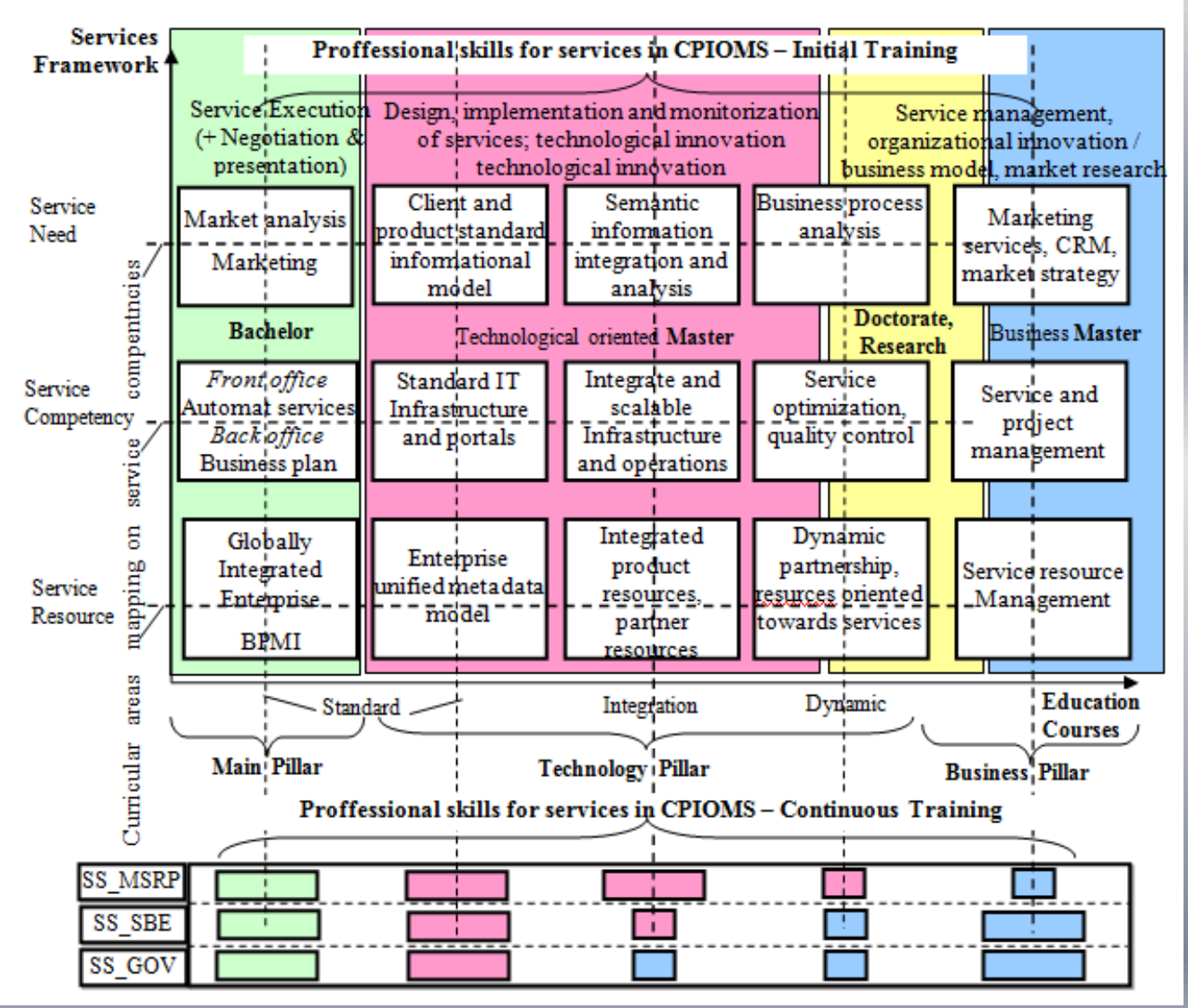
A new fundamental domain: Service Sciences?

Two new study domains:

- Service Engineering
- Service Management

Types of Master Programs:

- General (ITC, OMM, PSO)
- IT Oriented: Services Computing; IT Services, Software Services
- Business Oriented: Business & Services Mgmt
- Service Sector Oriented: Healthcare Services, e-Gov, e-Admin, manufacturing, supply chains, Energy_aaS



SS education model: programs / levels, skills areas, curricula mapping on service competencies

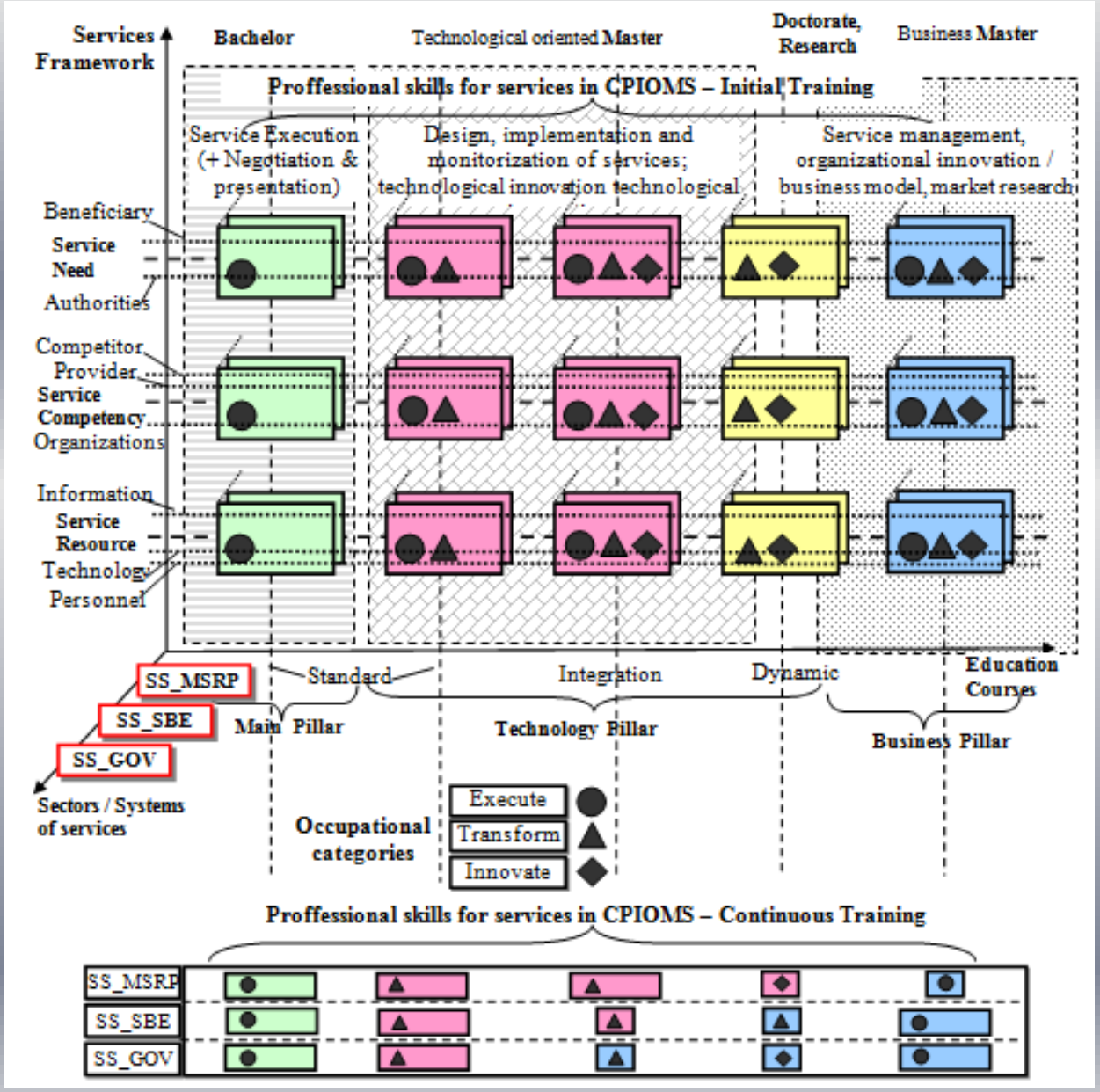
Educational Model in SS – occupations

Positioning occupations/careers in the service field

(a) Service execution– specialist in: service *execution* , *presentation*, *marketing*– and service *negotiation*

(b) Service design, implementation and monitoring and *technological innovation* – consulting, design, service management

(c) Service management *organizational innovation* and research / *market strategies* – research and development, expertise in system engineering services, IT architecture, marketing consulting and market strategy, *entrepreneurship*



A new science – the Service Science

The vision of Service Science: to discover the underlying principles of complex service system entities (and the value propositions that interconnect them into service networks) for the practical purpose of creating investment roadmaps to continuously improve globally integrated service systems and create a smarter planet.

Service Science should provide the structure and rigour for building a widely accepted and coherent body of knowledge to support ongoing **innovation in service systems.**

Develop knowledge about:

(1) how to *invest in service systems to sustainably improve key performance indicators* (e.g. revenue, margin, growth, customer satisfaction, productivity, innovation, quality of life, social responsibility, environmental sustainability, and regulatory compliance), and

(2) how to *develop new service offerings*, together with creative value propositions and improved business models.

Questions:

- What are the architectures of service systems?

- How is hierarchical complexity and diversity built up from simpler elements (i.e. how can be service systems understood in terms of a small number of building blocks that get combined to reflect the observed variety?)

- How might architectures and building blocks help us understand the origins, lifecycles and sustainability of service systems?

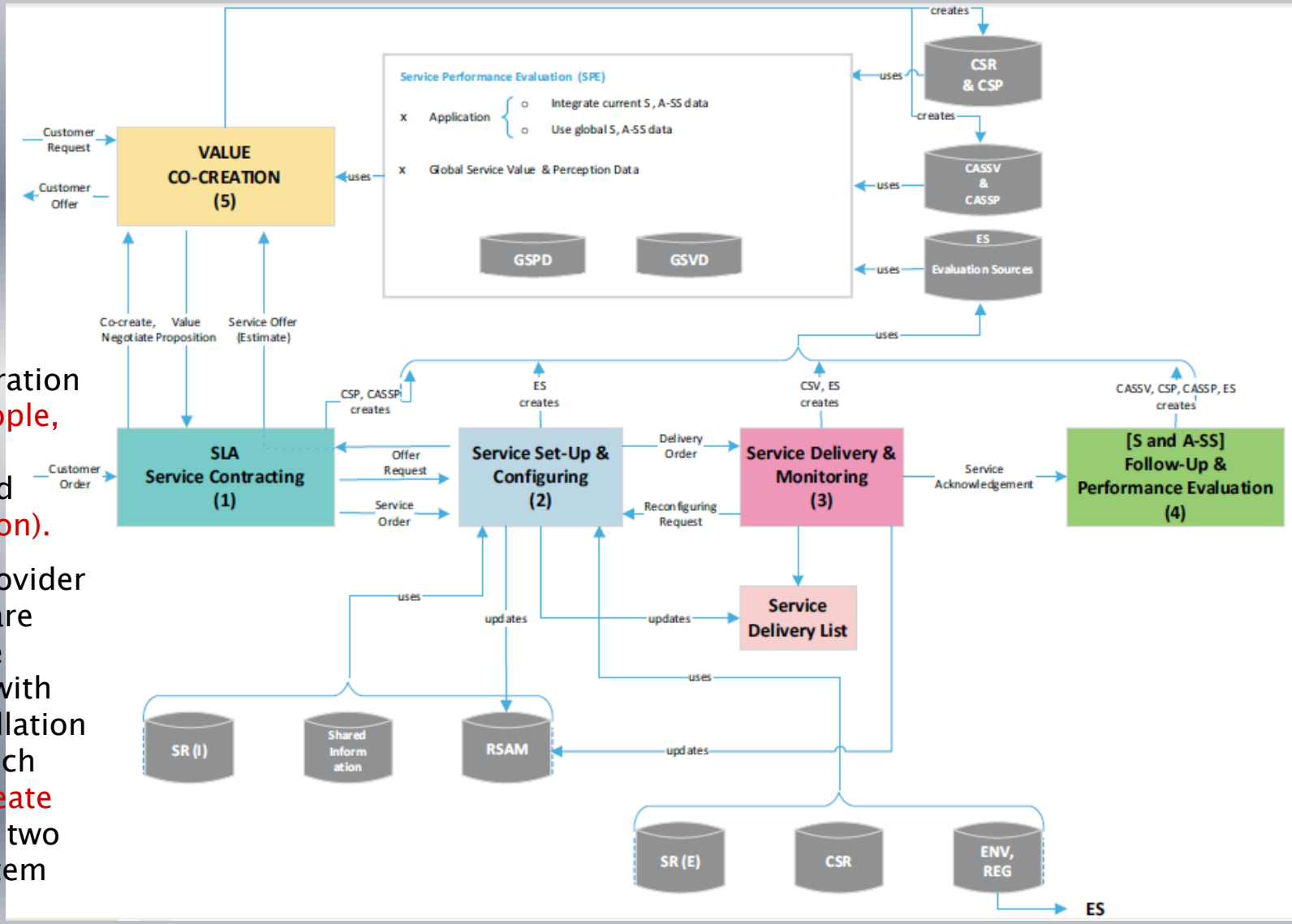
- How can service systems be optimised to interact and co-create value?

- Why do interactions within and between service systems lead to particular outcomes?

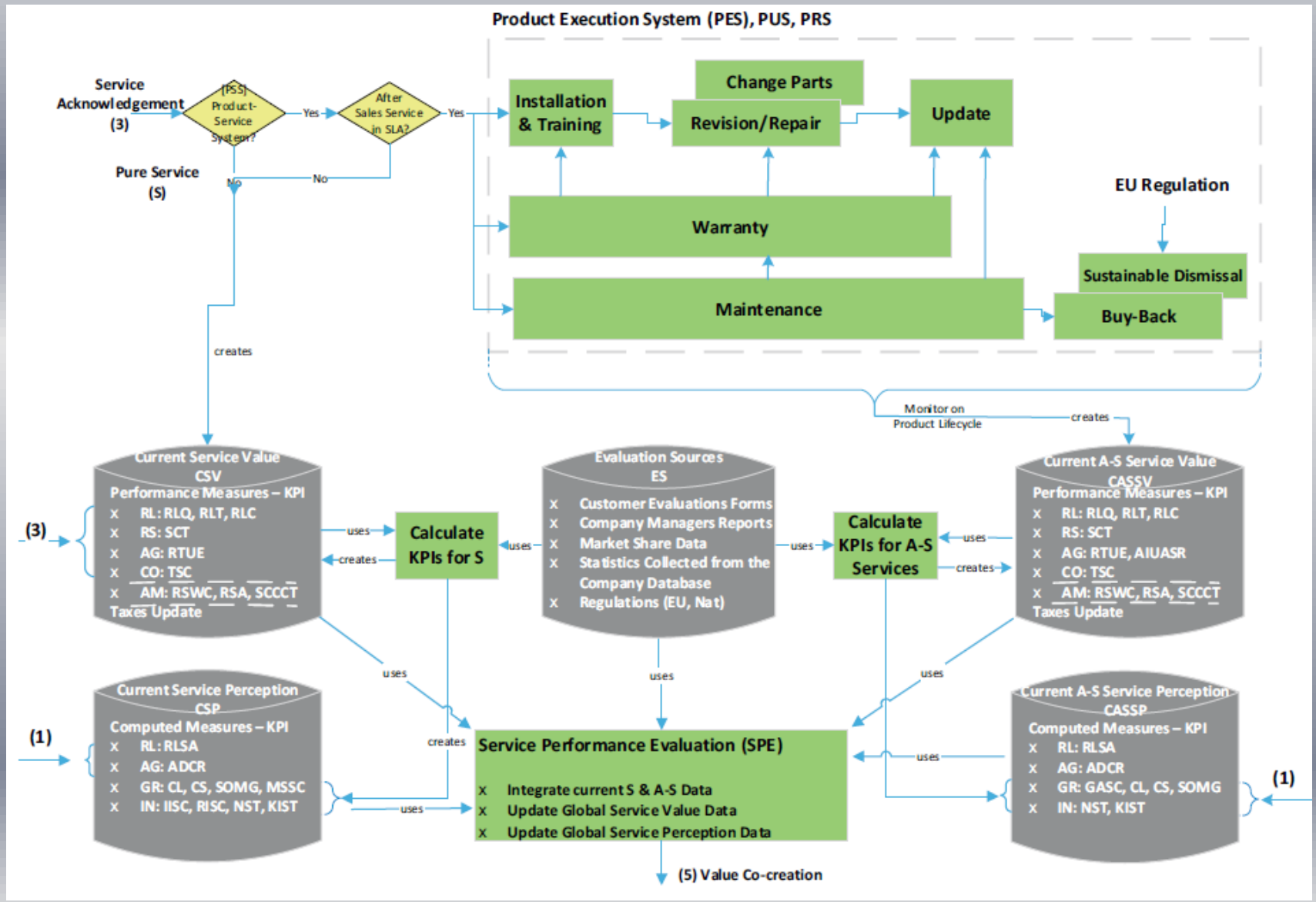
The Service System–A generic model including value co-creation

Service system: a dynamic configuration of resources (people, technology, organisations and shared information).

Both a service provider and a customer are viewed as service system entities, with their own constellation of resources, which interact to co-create value and form a two node service system network.



Service Performance Evaluation – the feedback for value co-creation



The knowledge gap in Service Science

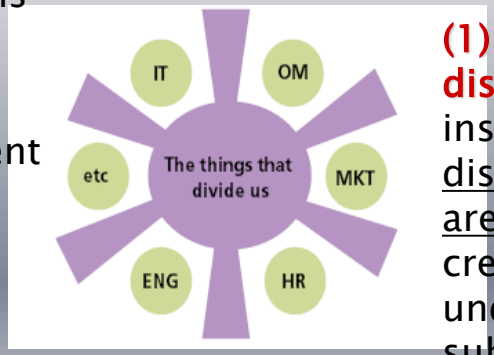
The resources used to form service systems are divided into four clusters:

(1) **Whole businesses and organisations**: Studied primarily by schools of management (marketing, operations management, operations research and management sciences, supply chain management, innovation management)

(2) **Technology**: Studied primarily by schools of science and engineering (ind. engineering, computer science, statistical control theory)

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

(4) **Shared information**: Studied primarily by schools of information (management IS, communications, document engineering, process modelling, simulation)



(1) The gaps between academic disciplines: traditionally, academic institutions are structured along disciplines and sub-disciplines (or areas of study). Academic silos are created to encourage deeper understanding of a specialised subject.

(2) The gap between academic output & practical interest:

The **academic disciplines** span:

- marketing (customer systems),
- operations (provider systems),
- governance (government systems),
- strategy (competitor systems),
- cognitive systems,
- engineering systems, information systems,
- organizational systems,
- historical systems (economics and law),
- future systems (design), and
- value co-creations systems (industry and societal sectors, and run-transform-innovate).

The **industry sectors** span:

- *flows* (transportation, materials & food & products, energy & electricity, information & communication),
- *development* (buildings, retail & hospitality, finance & business consulting, health, education),
- *governance* (city, state, nation).

(3) The skills gap: prepare students to become adaptive innovators, rather than for jobs

The solution: bridging the gaps

The need to reassess our approach to research and education in the service domain – solves the problem of gaps in knowledge and skills:

Service Science can be seen as an **interdisciplinary activity** which attempts to create an appropriate set of new knowledge to bridge and integrate various areas based on *transdisciplinary* and *cross-disciplinary* collaboration.

One way to overcome the barriers to integration is to accept their existence and build bridges over them. This approach will lead to:

> "curricula, training, and research programs that are designed to teach individuals to apply scientific, engineering, and management disciplines that **integrate elements** of computer science, operations research, industrial engineering, business strategy, management sciences, and social and legal sciences, in order to encourage innovation in how organisations create value for customers and stakeholders that could not be achieved through such disciplines working in isolation."

Service science is the **transdisciplinary study** of service phenomena in networks of entities, from person-to-person, to business-to-business, and even nation-to-nation customer-provider interactions.

Service (new):

The application of knowledge for mutual benefits (knowledge-based value co-creation phenomena in business and society, per Service-Dominant Logic). The application of knowledge by an entity requires some measure of routinized and/or innovative conscious effort or work, which may be cognitive, physical, or social in nature. Service outcomes depend as much on the customer perception and experience of value.

Transdisciplinary is concerned with interpreting nature as well as interpreting human interpretations, so both knowledge and meta-knowledge (knowledge about knowledge).

Towards Service-Oriented Science

- Advances in Information Technology are changing the way in which data is turned into insight – by *automating time-consuming activities*
  - Service-Oriented Computing, i.e. technology that allows powerful *information tools* to be *made available over the network* – may contribute to that evolution – the Cloud
  - Service-Oriented Science ("e-Science") refers to scientific research enabled by *distributed networks of interoperability services*
    - new information architectures
    - new approaches to publishing and accessing valuable data and programs
    - automated access by software programs, data integration from many sources and relationships identification
    - service orientation of processes, resources, activities…

Ten IT-enabled business trends for the decade ahead [McKinsey, May 2013]

1. **The social matrix**: *Harnessing the ability to make any interaction or activity social—to* influence actions, solve problems, and innovate, potentially creating new types of organizations that are not constrained by traditional boundaries

2. **The Internet of All Things**: *Linking machinery, equipment, and other physical assets with networked sensors and actuators to capture data and manage performance*, enabling machines to collaborate and even act on new information independently

3. **Big data, advanced analytics**: Growing ability to *collect, analyze, experiment with, and act on ever-larger and more complex data sets*; harnessing real-time data flows (e.g., from the Internet of Things and the social matrix) for nuanced insights that improve decision making and results

4. **Realizing anything as a service**: *Sharing services accessed or arranged over the Internet, including use of infrastructure, products, and other assets as "services," enabling new asset-light business models*

5. **Automation of knowledge work**: *Using advances in artificial intelligence, deep learning, big data, and natural user interfaces to automate knowledge work tasks*

Ten IT-enabled business trends for the decade ahead [McKinsey, May 2013]

6. **Me + free + ease**: *Rising consumer expectations for instant access to information, transparency, customization, low prices, and ease of use*, based on the model of Internet services, now being applied offline as well

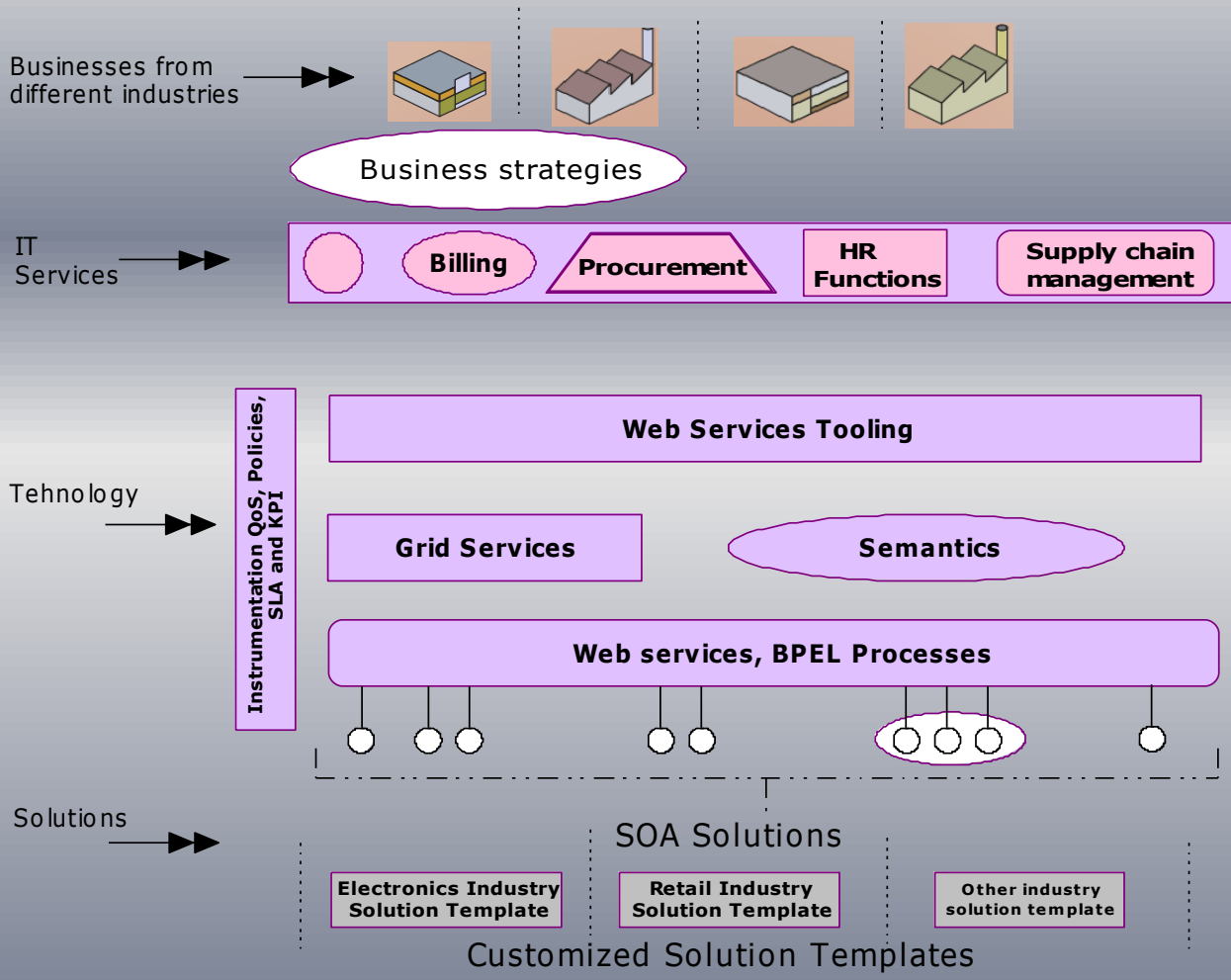
7. **The e-volution of commerce**: Low-cost, high-speed, seamless exchange of information enables new types of *online markets, payment systems, and business models*

8. **The Integrated digital/physical experiences**: *Blending digital interactions with physical experiences* such as shopping, often by providing data and information to mobile Internet devices

9. **next three billion digital citizens**: Emerging opportunities as *three billion people join the digital economy using the mobile Internet*—driving financial inclusion, entrepreneurship, and the development of new business models

10. **Transformation of government, health care, and education**: *Using the growing power and reach of IT to boost productivity in government, health care, and education*—sectors that have not benefited fully from previous waves of IT—to improve service delivery and increase transparency

Services Computing – IT Perspective



- Service systems with higher:
  - reusability,
  - flexibility,
  - extensibility
  - and robustness

- Expose business applications through well-defined interfaces in a platform-independent manner
  - increase interoperability
  - foster the whole business collaboration chain

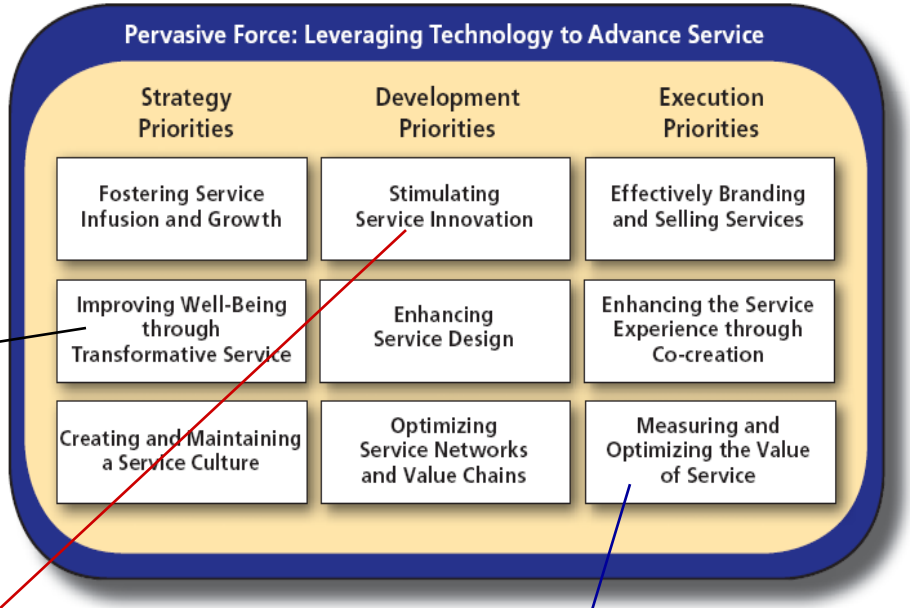
Trend: Realizing Anything as a Service

Key questions:

- *Which products can be provided as a service*, and how can IT enable you to do so?
- *How can you use the cloud to reach new customers* with existing or new services?
- *How can you make your processes more efficient and cost-effective* as a result of your partners/suppliers having provided more of their offerings as a service?
- *How can you ensure security and privacy* when using a public or private cloud?
- As customers adopt more "asset-light" lifestyles, *which existing products / services come under threat, and which can be redesigned*?

Research in Services

- Enhancing *access, quality, and productivity in health care and education*;
- *Delivering service in a sustainable manner* (i.e., one that preserves health, society, and the environment);
- Motivating the development and adoption of *green technologies and related services*;
- Planning, building, and managing *service infrastructure for metropolitan areas, regions, and nations*;
- *Democratizing public services* for the benefit of consumers and society; and
- *Driving service innovation* at the base of the pyramid.



- Identifying *drivers of sustained new service success*;
- Designing emergent and planned *processes for incremental and radical service innovation*;
- Identifying and managing *customers' roles throughout the service innovation* process;
- Infusing *creativity and arts into service innovation* processes;
- Aligning *organization structure, customer, and supplier relationships* with service innovation;
- Generating, prioritizing, and managing *service innovation ideas*; and
- Using *modeling and service simulation* to enhance service innovation.

- Measuring the value and return on investment from service;
- Creating and enhancing tools for capturing the value in use for services and communicating value to customers and throughout the firm;
- Integrating service value and the costs of service delivery into joint optimization models;
- Creating and enhancing service standards and metrics that link to financial outcomes of the firm;
- Managing the sales and service channel portfolio to maximize value; and
- Integrating the role of customers, employees, and technology for value optimization (e.g., the use of self-service technologies).

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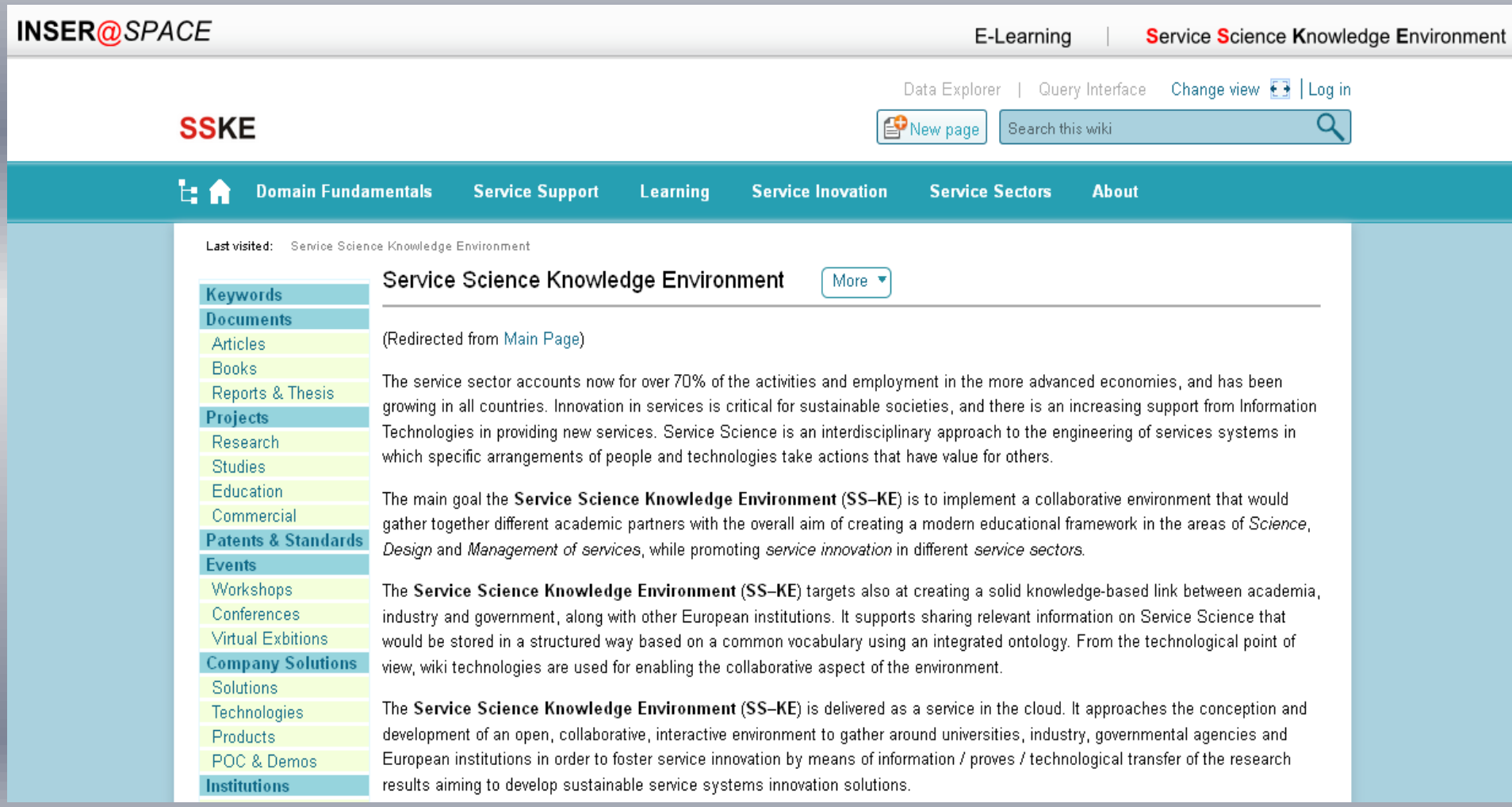

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