

Reconsidering research in eServices innovation and design

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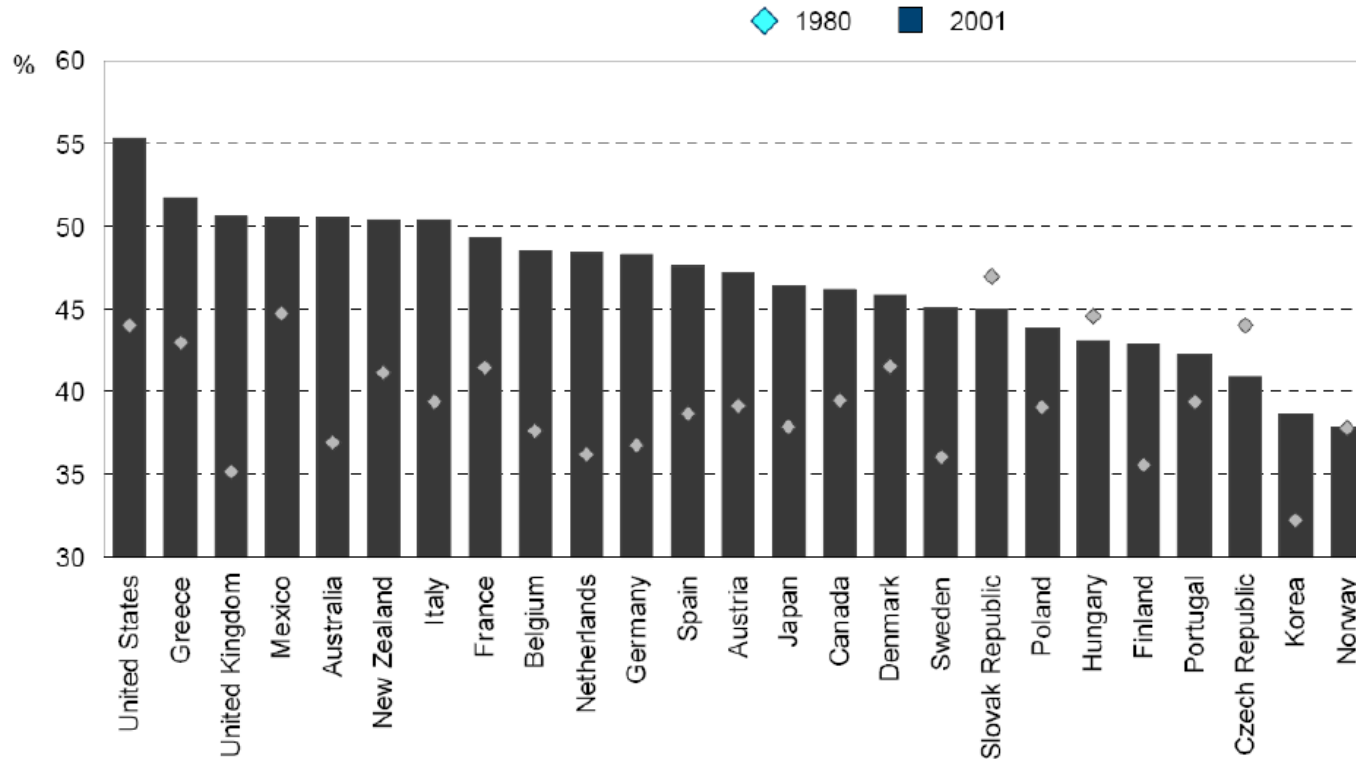
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Topics to be discussed

- Relevance of service innovation and design
- Our main interest : ICT based services or eServices
- Formal service design methodologies
- Research Questions dependent on
 - Role of technology-concepts in service research
- (Service) design and IS research
- Multiplicity

Importance of services

Figure 2.1: Share of the market services in total value added, 1980 and 2001



Source: OECD (2005) Enhancing the performance of the services sector. October 2005 Paris. (p. 6) / OECD STI scoreboard, 2003

R&D services expenditure

- Relative to their economic importance services account for a small share of R&D. Business expenditure on service R&D is about 15% in EU, compared to US 39%
- R&D in services is growing rapidly (albeit from a small base)

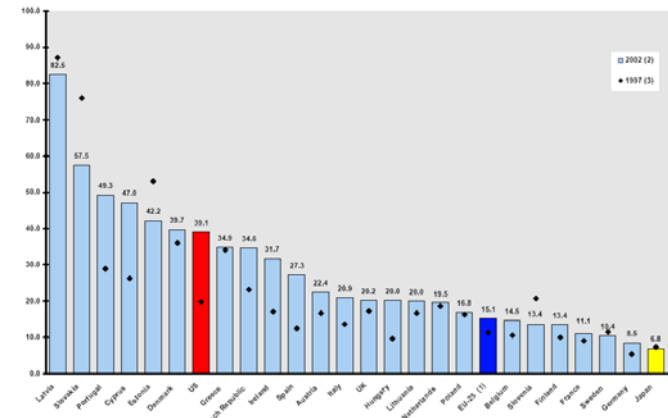
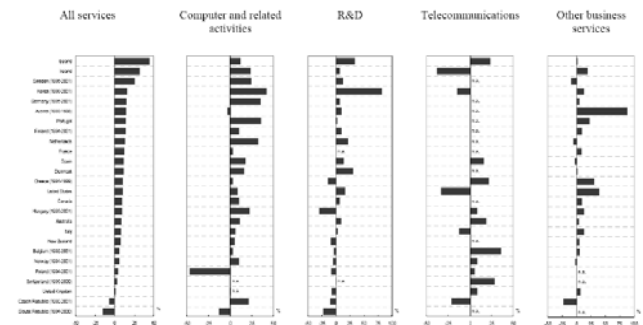


Figure 2.8: Growth of R&D intensity, services sector, 1990-2001. Average annual growth rates (%)



Source: OECD (2005) Enhancing the performance of the services sector. Revised and extended version, October 2005 Paris, p.22. / OECD ANBERD and STAN databases, 2004.

Service innovation is important, but not always very successful yet

- (Mobile) Broadband services, however
 - no real (mobile) broadband services
 - Mobile: walled garden versus Open Mobile Internet
- ICT enabled service innovation and design, however
 - Healthcare, i.e. EMD... on the agenda since 1990's
 - Financial services, payment services, insurance
 - Content industry, Triple play, new service concepts are lacking, DRM
 - SME's lagging behind
- eCommerce and multi-channel, however
 - Limited volume
 - Still looking for synergies
 - Service development slow and chaotic process

Services R&D is widely underestimated

Definition and measurement problems obscure contribution of services to innovation, productivity and economic growth

- the process of managing innovation in most services firms is different from the more “standardised” approach in industrial sectors which rely heavily on technological R&D;
- a large amount of services’ “classic” R&D activity is hidden behind labels such as business development, service improvement, etc. without being explicitly recognised as services R&D;
- many service firms engage in R&D-like activities that fall outside, or at the boundary of the classic understandings of R&D
- the de facto exclusion of social science research from R&D statistics;
- in manufacturing firms, R&D which is aimed at development of product related services seems to be a forgotten category

Definition and measurement problems

- Current Frascati definition of R&D is too narrow and inflexible to pick up research activity within service business (e.g. software activities)
- Service businesses do not acknowledge that they undertake R&D
- A significant amount of services R&D is performed by 'manufacturing' firms, and is either classified as 'manufacturing' R&D or not at all
- Lastly, national statistical agencies have had difficulty in identifying R&D activity within service industries because they have traditionally been fragmented, dispersed and are small-scale activities that cut across large sectors and for these reasons have not received priority in sampling frames

However

- Increasingly, leading-edge service firms show some form of structured attention to management of services' R&D and service innovation activities.
- Most service firms are poorly linked to the science base and innovation and R&D programmes. This partly results from an (often implicit) manufacturing bias in existing R&D and innovation policies.
- Apart from some Business Related services, innovative service firms are less likely to receive public innovation support than are their manufacturing counterparts.
- There is considerable room to improve R&D collaboration between service firms and research organisations, not least in Business Related service industries.
- There is clearly room to improve the way in which we facilitate and support services R&D and innovation as part of wider innovation systems

Policy

- Issues
 - Policy limited attention for services innovation and services R&D, while 70% of economic growth and increase in labor force is service based
- ESB-article
 - Network formation and orchestration for service innovation: internal, external
 - Knowledge sharing: academic and professionals (community of practice), and definition of competence centers for service engineering

Service design

- Product design, formalized
 - Fundamental engineering, system engineering, total design, concurrent engineering, Structured Analysis and Design Technique (SADT), Failure Model and Effects Analysis (FMEA) and Quality Function Deployment
- Service Blueprinting (Shostack, 1984)
 - Assess impact of new service on organization
 - Visualization of process
- Service System Planning (Normann, 2000)
 - Focus on service system components
 - Checklist based
- Service concept (Goldstein et al., 2002)
 - How and what of a new service
- Service engineering (Fährnich & Meiren, 2006)
 - Idea management, requirement analysis, service conceptualization, service implementation, and market latch

Example tools and projects

Service design in Delft

- MuCH-QFD
 - Development of multi-channel service design methods (Simons, 2006)
- STOF
 - Context aware mobile service bundle design in the safety and health care sector (Frux: Haaker et al., 2004, 2006)
- Tools for service orchestration and service composition (Janssen, Gortmaker, Feenstra)
- Consent Decider
 - Interdomain user profiling and privacy control, and security architecture design (Eldi, Daskapan)
- ICT and crisis management (simulation, design, user tests)

Research in Service and Service design

Generic questions:

- What kind of conclusions do you want to draw?
 - Theory versus empirical data: testing of hypothesis
 - Theory versus practice: designing
- What population? What unit of observation?
- What is the role and 'meaning' of technology in your research project?

Technology variable in research

- IT as omitted variable or IT as black box
- IT an independent, a dependent, an intermediary or even a non-existing variable
- IT assumed to be natural, neutral, universal, given objects; stable, discrete, independent and fixed, however
 - Technology is dynamic, continuous and flexible, changing, embedded in social (community), time-place context
 - Technology is fragmented, fragile, integration, interoperability
 - Developed, designed, implemented, used, effect in social practices

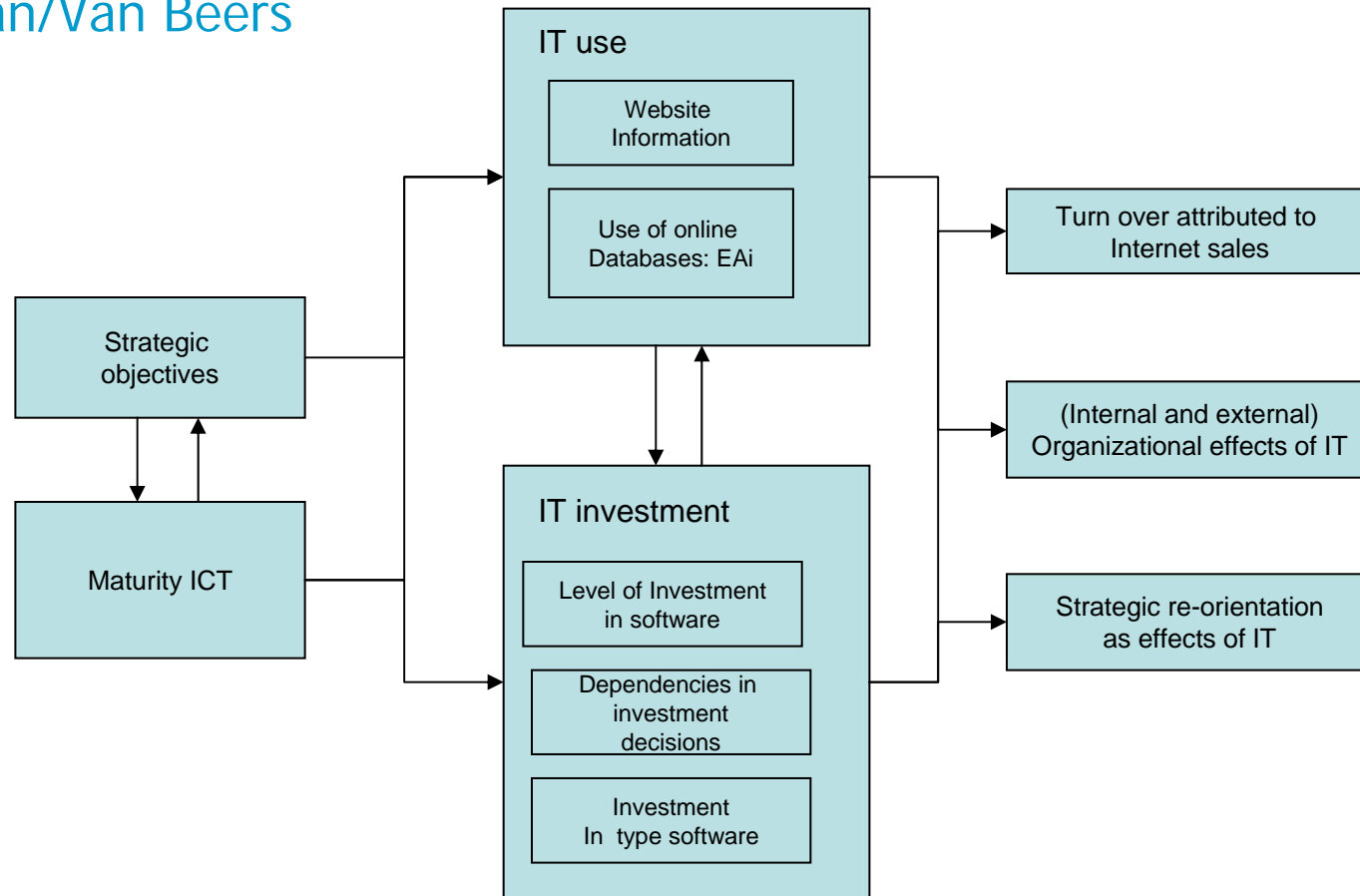
Technology as tool

- As tool: engineered, offering information processing power
 - Technology: independent variable
 - Focus on dependent variable: productivity, information processing (overload), changing social relations and networks
 - Examples
 - Productivity: Brynjolfsson, CPB
 - CMC-literature: Media Richness, Daft & Lengel, Trevino, but also Rice, early Steinfield (Social Influence), Van den Hooff
 - Networks: Contractor, Monge

Model tested in ICWAS

Capturing organizational change

Bouwman/Van Beers



Technology as proxy

- As proxy: essential property or value of IT
 - Focus on: perceptions, cognitive, affective, attitudinal response to technology
 - and on: diffusion, adoption, and penetration patterns
 - Examples
 - Diffusion: Rogers
 - Critical Mass: Alan, Lynn Markus
 - Collective action: Fulk, Steinfield, Wigand
 - TAM, TAM+, TPB, UTAUT: Davis, Venkatesh,

Technology: a socio-techno view

- Ensemble view
 - Technology as a social-economic artifact (Latour, Byker): dynamic interaction between technology and people is core
 - SCOT and SST
 - Examples
 - Focus on design, development and technical and social implementation process: Sol, Andriessen
 - Focus on supply side: Policy-regulation: Verhoest, Ballon, IDC-studies
 - Focus on embedded system/structure of organization: Orlikowski, DeSanctis & Poole, Bouwman et al. 2005

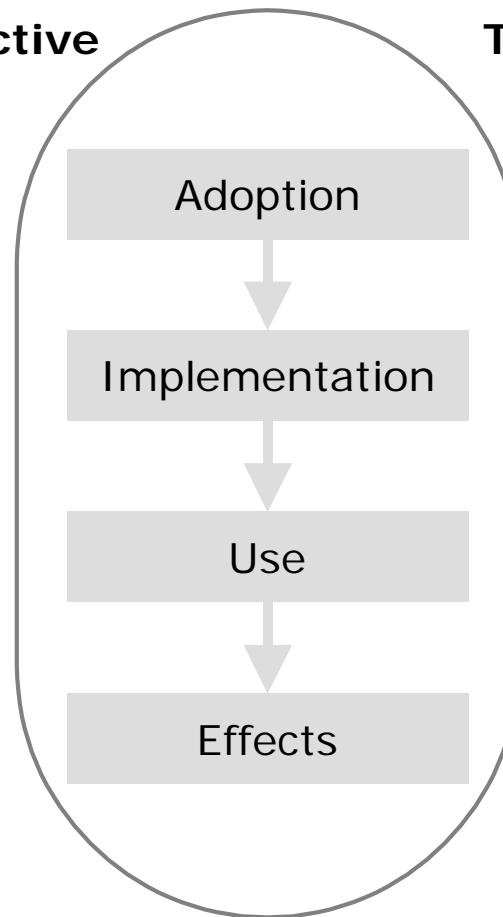
Generic model

Organizational perspective

- Environment
- Strategy
- Structure and culture
- Processes
- Decision taking

Economic perspective

- Macro-economical developments
- Costs and
- Positive and negative effects
- Control of implementation costs



Technical perspective

- Basic technologies
 - Accessibility
 - Compatibility
 - Technological innovations
- Organization infrastructure

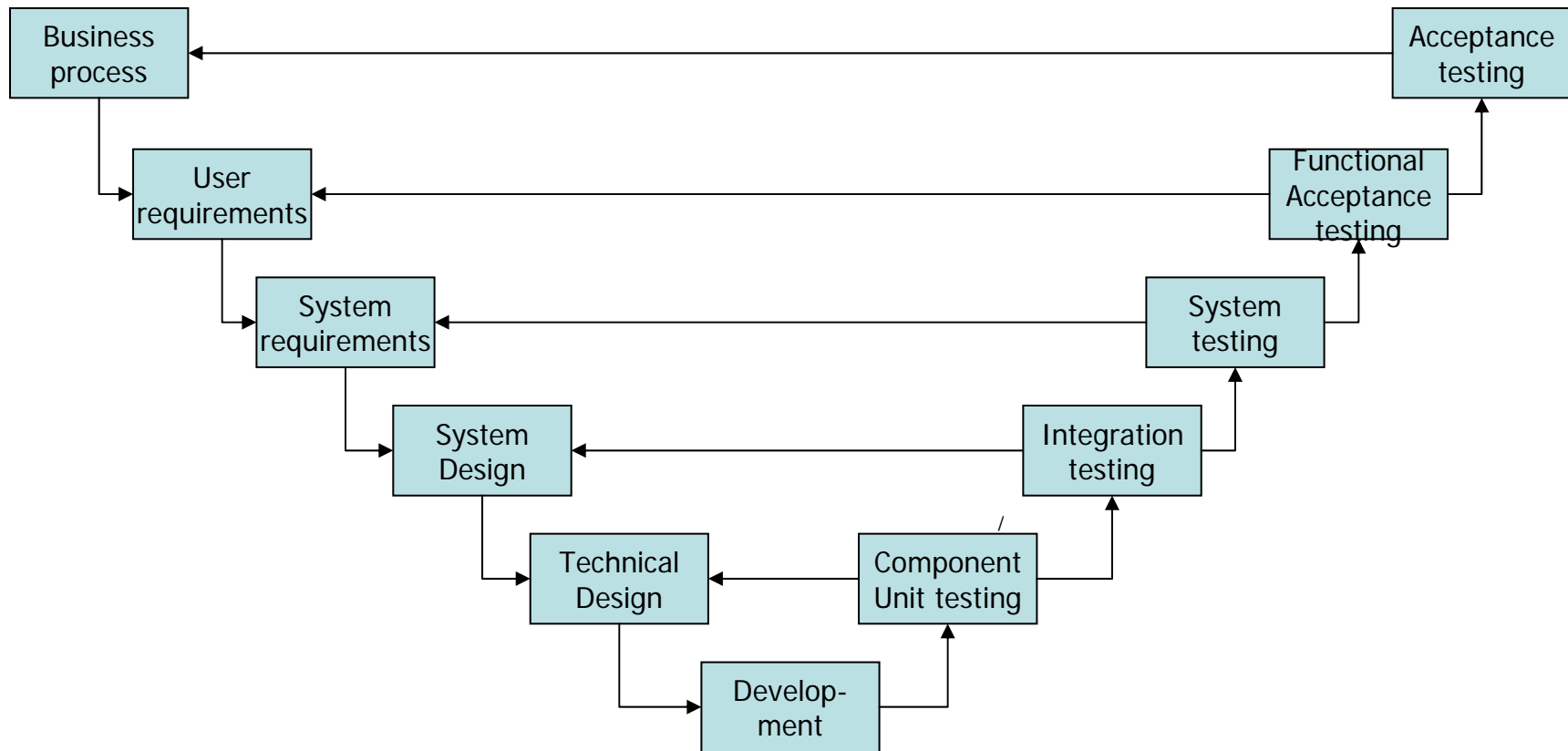
User perspective

- Media choice
- Degree and type of use
 - Individual efficiency and effectiveness
- Interaction individual and environment

Technology: a computer science view

- Computational view
Electrical Engineering, Computer Systems, Software engineering,
Database Technology
 - Example
 - Focus on technology per se
 - Computer systems, software development, data modeling, simulations, business modeling
 - Waterfall and Spiral, or miniature waterfall models (Boehm)
 - Brinkkemper, Verbraeck, Gordijn, Janssen,

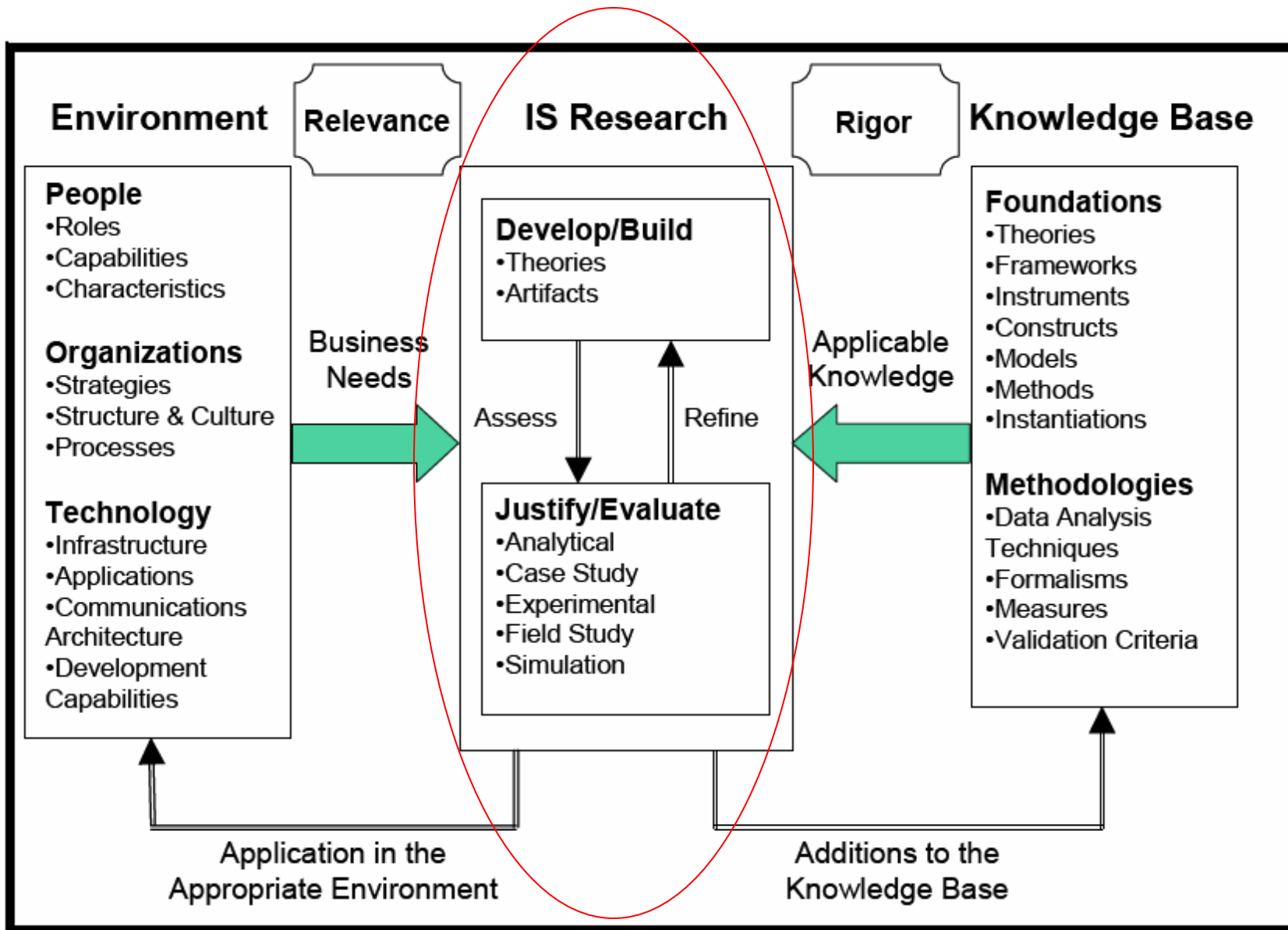
Testing artifacts



Service design and IS research

- Design science, Design based research, Design experiments, Development Research, Development Research, Formative Research:
 - Produce knowledge that can be used in designing solutions to field problems
 - If you want to achieve Y in situation Z, then perform action X
 - Process and product (artifact)
 - Build and evaluate
- Behavioral (explanatory) science
 - Describe, explain, and possibly predict
 - X lead to Y (from S-R to S-O-R to more complex model testing)
 - In search of **Truth**
 - Justify

Design based research requires literature review and theory generation, uses formative evaluation as a research method, and analysis methods widely used in quantitative and qualitative research (Orill, Hannafin & Glazer, 2003; Wang & Hannafin, 2005)



Design Research (1)

1. Observational	Case Study: Study artifact in depth in business environment
	Field Study: Monitor use of artifact in multiple projects
2. Analytical	Static Analysis: Examine structure of artifact for static qualities (e.g., complexity)
	Architecture Analysis: Study fit of artifact into technical IS architecture
	Optimization: Demonstrate inherent optimal properties of artifact or provide optimality bounds on artifact behavior
	Dynamic Analysis: Study artifact in use for dynamic qualities (e.g., performance)
3. Experimental	Controlled Experiment: Study artifact in controlled environment for qualities (e.g., usability)
	Simulation – Execute artifact with artificial data
4. Testing	Functional (Black Box) Testing: Execute artifact interfaces to discover failures and identify defects
	Structural (White Box) Testing: Perform coverage testing of some metric (e.g., execution paths) in the artifact implementation
5. Descriptive	Informed Argument: Use information from the knowledge base (e.g., relevant research) to build a convincing argument for the artifact's utility
	Scenarios: Construct detailed scenarios around the artifact to demonstrate its utility

Be aware non of these methods contribute to developing theoretical notions on how design artifacts contribute to specific outcomes or to a theory on design itself.

Why does a method work and - if not - why not?

Design Research in IS Strengths

- Problem solving oriented
- “Tangible”
- (Potential) highly relevant
- (Potential) multi-disciplinary
- Innovative
- Trigger for additional / revised / new theory

Design Research in IS

Caveats

Table 1. Design-Science Research Guidelines

Guideline	Description
Guideline 1: Design as an Artifact	Design-science research must produce a viable artifact in the form of a construct, a model, a method, or an instantiation.
Guideline 2: Problem Relevance	The objective of design-science research is to develop technology-based solutions to important and relevant business problems.
Guideline 3: Design Evaluation	The utility, quality, and efficacy of a design artifact must be rigorously demonstrated via well-executed evaluation methods.
Guideline 4: Research Contributions	Effective design-science research must provide clear and verifiable contributions in the areas of the design artifact, design foundations, and/or design methodologies.
Guideline 5: Research Rigor	Design-science research relies upon the application of rigorous methods in both the construction and evaluation of the design artifact.
Guideline 6: Design as a Search Process	The search for an effective artifact requires utilizing available means to reach desired ends while satisfying laws in the problem environment.
Guideline 7: Communication of Research	Design-science research must be presented effectively both to technology-oriented as well as management-oriented audiences.

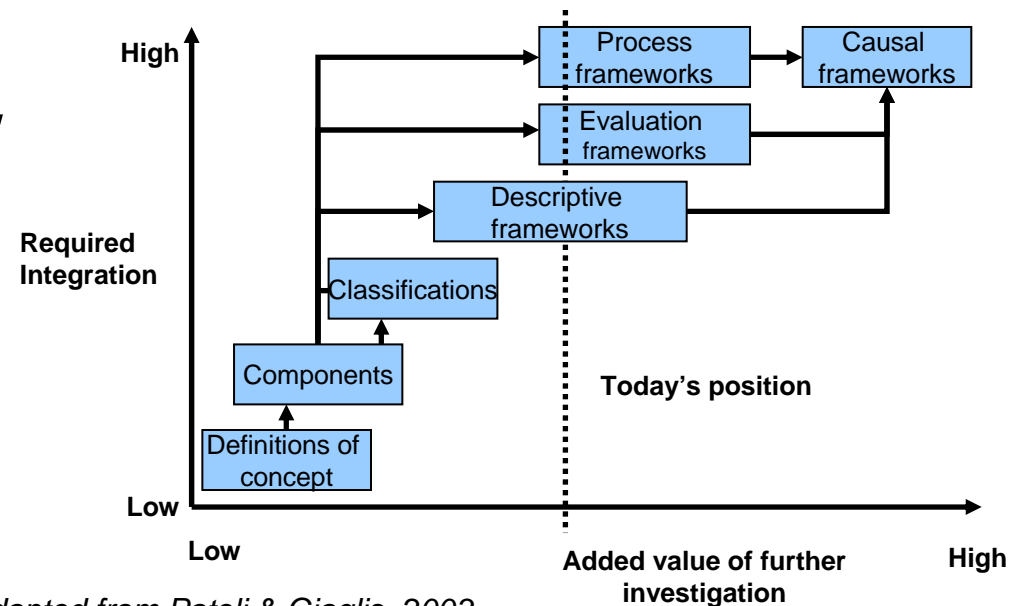
Dependent variables mentioned are utility, quality and efficacy, however

are these the main concepts for a meta-theory on design?

Design Research in IS Weaknesses (1)

- Lack of existing theories, models and concepts on
 - design as process
 - design methods and
 - design artifacts
- Used design models are descriptive, seldom explanatory
 - For instance work on business model design

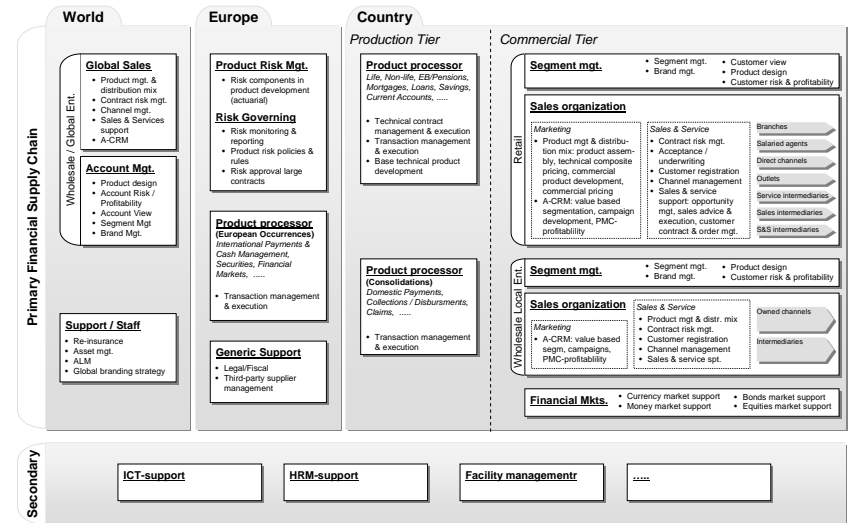
Horváth, 2004: overview



Adapted from Pateli & Giaglis, 2003

Design Research in IS Weaknesses (2)

- If based on models
 - Difficult to communicate due to different views on reality (multiple stakeholders interests)
 - Too complex
 - Too abstract
 - Multilayered
- Ambiguity in evaluation metrics
 - PKI's versus standardized metrics
 - Quality, time-to-market, profitability, effectiveness, affectivity, innovativeness, agility, but also user satisfaction
- Implicit assumptions about values – no rigid underlying theory



Design Research in IS

Weaknesses (3)

- Research design

O1	Xe	O2
O3	Xc	O4
	Xe	O5
	Xc	O6

Xc: placebo or no intervention..

How to deal with iterative character of design, and feedback loops inherent to design ..

Design Research in IS

Weaknesses (4)

- Internal validity issues
 - Standardized measurement tools are lacking for design
 - MISQ 2001-2006: 103 scales; EIS: 70 scales
 - Only scale: Short and long term outcomes of IS design
 - Mainly Adoption, Implementation, Use, Effect
 - PM: SERVQUAL: post hoc
- Limited external validity of results
 - Small number of simulation runs or test cases
 - What is acceptable in Product Design (N=6) is not acceptable in IS research

Multiplicity in design research

Combination of behavioral and design science required in multi-actor IS Research

Explicit Value driven

- Reliable, secure, trust, universally accessible

Theory – Empiricism: multiplicity

- Multi-theory, Multi-trait, Multi-method, Multi-level, Multi-moment

Theory – Practise (problemsolving)

- Multidisciplinary, socio-technical perspective:
behavioral social science (hypothesis based) approach and design
(engineering) approach
- Focus on **DESIGN**, adoption, implementation, use and effect of IS in and
between organizations
- Development of meta-theory on design artifact, design process (tools,
Architectures, web services, components) and methodology, i.e.
comparison of different design approaches