

Tutorial
The Design Science Research Method

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Abstract

- In this tutorial, we will review the evolution of design science (i.e., systems development) research in the information systems field. The process, opportunities, risks, and challenges in conducting design science research will be elaborated.
- The complementary relationships between systems development research methodology and other research methodologies will be explained.
- Examples of researches in design science will be discussed to illustrate how to apply such an approach to information systems research. Participants are encouraged to bring their design science research projects into the discussion.

Presentation Outline

- 1. A Brief Historical Design Science Research Method**
- 2. IS Research and Design Science Research Defined**
- 3. The Lifecycle & Guidelines of Design Science Research**
- 4. Integration of Multiple Research Methods**
- 5. Evolution of Emerging Technologies and Its Impacts to Design Science Research**
- 6. Case Studies of Design Science Research**
- 7. Conclusion**

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The Story of My Involvement in Design Science Research

- EE Background**
- MBA with focus on MIS 1981-1983**
- University of Arizona, 1984-1988**
- Applications built**
 - MRP system (ITRI project)– 1982-1983
 - Library information system (National Chia-Tung University) 1983-1984
 - Application for Taipei Golf Club 1983-1984
 - ICE (Information Center Expert), 1987-1988 (IBM sponsored project) 1988 JMIS paper and 1992 IEEE SMC paper
 - MetaPlex, 1987-1988 (My dissertation) – IEEE Tx KDE 1989 and JMIS 1995
 - TeamSpirits, 2004-present (2006 DSS)
 - E-Procurement using Web Service research (2003 JECR, 2005 ISM, 2007 DSS)

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Systems Development as an IS Research Methodology

- **Personal story**
 - Ph.D. seminar (circa 1987)
 - Chapter 2 of my dissertation, the methodology chapter.
 - HICSS conference paper 1990
 - JMIS journal paper 1991
- **Nunamaker, J. F. and Chen, M., “Systems Development in Information Systems Research,” *The 23rd Annual Hawaii International Conference on System Sciences*, January 1990.**
- **Nunamaker, J., Chen, M. and Purdin, T., “System Development in Information Systems Research” *Journal of Management Information Systems*, Winter 1990/1991, Vol. 7 Issue 3, pp. 89-106. (Cited by 380 according to Google Scholar)**

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Simon’s Work

- **Design Science has its roots in engineering and other applied sciences.**
- **Herbert Simon’s *The Sciences of the Artificial* (first published in 1969, third edition in 1996).**
- **Simon (1996) noted that “Schools of architecture, business, education, law, and medicine, are all centrally concerned with the *process of design*.” Clearly this includes the entire field of Information Systems.**
- **Simon believes researchers in such schools can achieve their purpose (and establish their credibility) “to the degree that they can discover a *science of design*, a body of *intellectually tough, analytic, partly formalizable, partly empirical, teachable doctrine about the design process*.”**

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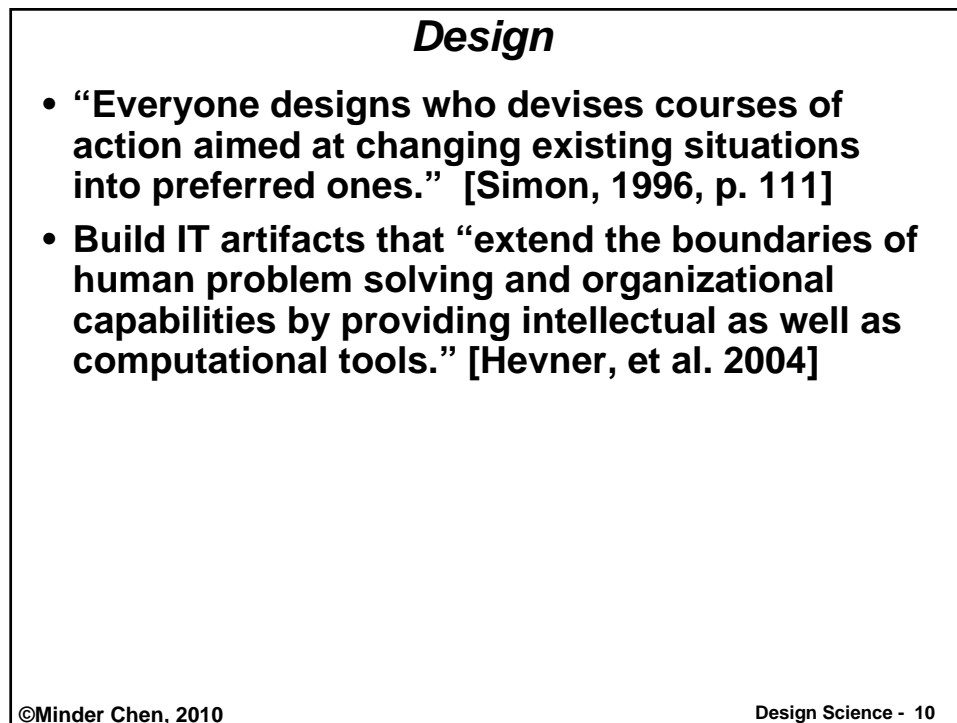
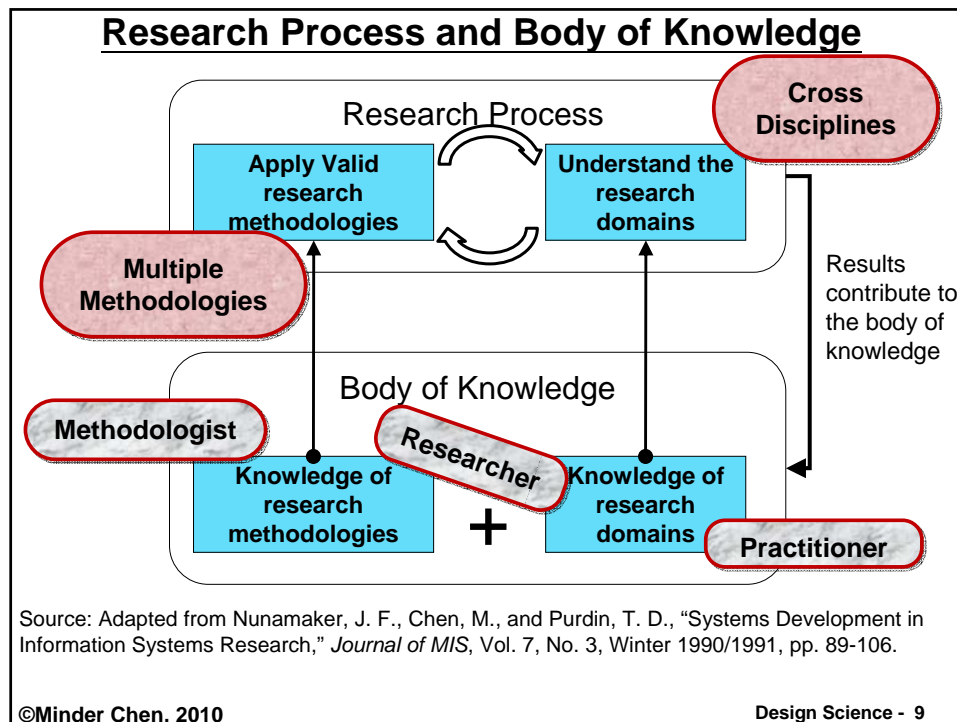
Milestones

- **First Workshop on Information Technologies and Systems (WITS) in 1991.**
- **A keynote at the 1992 WITS in Dallas resulted in the development and publication of “Design and Natural Science Research on Information Technology” (March and Smith, 1995).**
- **That paper, along with seminal articles by Nunamaker et al. (1991) and Walls et al. (1992), generated significant interest in the articulation of the design science research paradigm as it applies to the information systems discipline.**

Source: Salvatore, T. M. and Storey, V. C., “Design Science in the Information Systems Discipline: An Introduction to the Special Issue on Design Science Research,” *MIS Quarterly*, Vol. 32 No. 4, December 2008, pp. 725-730.

Milestones

- **Allen Lee was editor-in-chief of *MIS Quarterly* visited University of Minnesota in 1999. “Jinsoo Park, then an assistant professor at the University of Minnesota, a design-science researcher, told me about how poorly the IS mainstream treated design-science research, which was being largely excluded from certain major journals and conferences, and how the mainstream really did not understand or know how to judge design science research. ... I suggested to Jinsoo and to Sal March to write a paper for the *Quarterly* with a title along the lines of “A Theory of the Science of Design for MIS.”**
 - [Allen Lee, Three Wishes for the the Information Systems Field](#)
- **Hevner, A., March, S., Park, J. and Ram, S., "Design Science in Information Systems Research." *MIS Quarterly*, 28(1), 2004, pp. 75-105.**



Impacts of Engineering to Society



- The [Watt steam engine](#), a major driver in the [industrial revolution](#), underscores the importance of engineering in modern history.
- Source: http://en.wikipedia.org/wiki/File:Maquina_vapor_Watt_ETSIM.jpg

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Engineering

- [T]he *creative* application of scientific principles to *design or develop* structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behavior under specific operating conditions; all as respects an intended function, economics of operation and safety to life and property.
- Source: The [American Engineers' Council for Professional Development](#)

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Design Science

- **Design vs. Development**
- **Design vs. Evaluation**
- **Design vs. Analysis**

- **Science vs. Engineering**
- **Design science vs. Natural science**
- **Design science vs. Social/behaviorial science**

Activities, Principles, and Tools for Design

- **Understanding the user's psychology, cognitive behavior and problem-solving patterns**
- **Understand problems faced by individuals, groups, or organizations and how they are currently handling these problems; and then determine how IT can be used to enable approached guided by conceptual frameworks or theories in addressing these problems.**
- **Determining the optimal design decision – satisficing instead of optimizing**
- **Decomposition, hierarchy**
- **Representation: Data model, knowledge representation, process model, UML**

Design Science IS Research

- **A design science IS research is an inventive or creative problem solving activity in which new information systems (tools, applications, etc.) are the primary artifacts.**

-- Adapted from March, S. T. and Smith, G., "Design and Natural Science Research on Information Technology," *Decision Support Systems*, Vol. 15 No. 4, December 1995, pp. 251-266.

Design Science IS Research

- **"Build and evaluate *IT artifacts***
- **that extend the boundaries of known applications of IT,**
- **addressing important problems heretofore not thought to be amenable to computational approaches."**

(Sal March and Veda Storey, 2008; based on Hevner et al. 2004; Markus et al. 2002; Walls et al. 1992).

IT Artifacts

- **Real problems must be properly conceptualized and represented, appropriate techniques for their solution must be constructed, and solutions must be implemented and evaluated using appropriate criteria.**
- **Research activities: build, evaluate, theorize, and justify**
- **Outputs produced by design research: representational constructs, models, methods, and instantiations.**

Source: March, S. T. and Smith, G., "Design and Natural Science Research on Information Technology," *Decision Support Systems*, Vol. 15 No. 4, December 1995, pp. 251-266.

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Information Systems Research Framework (March & Smith)

		Design Science Research Activities		Natural Science Research Activities	
		Build	Evaluate	Theorize	<i>Justify</i>
Research Outputs	Constructs				
	Models				
	Methods				
	Instantiations				

Source: March, S. T. and Smith, G., "Design and Natural Science Research on Information Technology," *Decision Support Systems*, Vol. 15 No. 4, December 1995, pp. 251-266.

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IS Research & Practice

- **“IS field concerns itself with research and practice about the problems and solutions that emerge from the interactions at the interface between the technological and the behavioral.”**

- **Allen Lee, <http://www.people.vcu.edu/~aslee/ICIM-keynote-2000/ICIM-keynote-2000.htm> slide# 13**

The Three Dilemmas in IS Research by Allen Lee

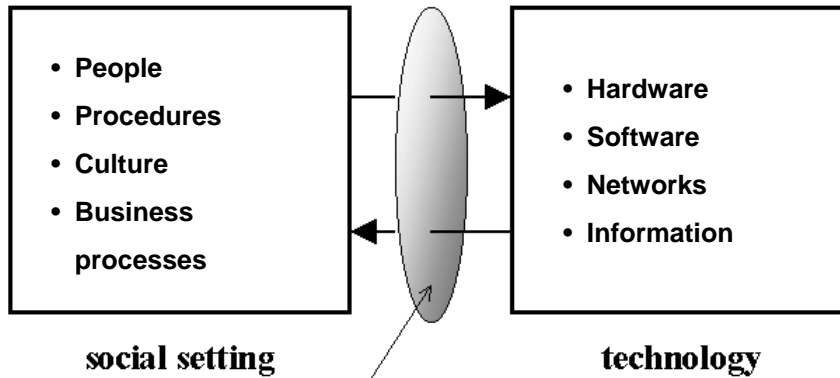
- **rigor vs. relevance**
- **reference discipline vs. independent discipline**
- **technology vs. behavior**

- **Dilemmas → Trade-off**
- **The three lessons:**
 - **enact true systems thinking**
 - **enact design science**
 - **enact paradigms: formal language (symbolic generalizations), models (theories), and exemplars**

Source: Allen Lee, <http://www.people.vcu.edu/~aslee/ICIM-keynote-2000/ICIM-keynote-2000.htm> slide #6

A way of conceptualizing information systems

As a system



**managing the emergent interactions between
the social setting and the technology**

Source: Adapted from Allen Lee,
<http://www.misq.org/archivist/vol/no23/issue1/edstat.html>

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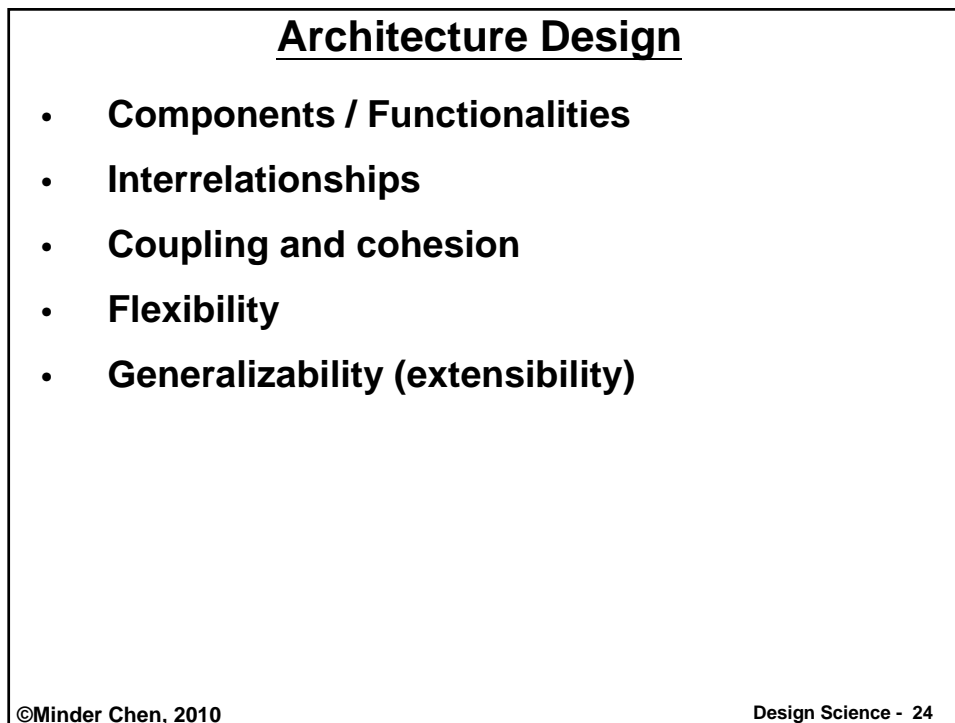
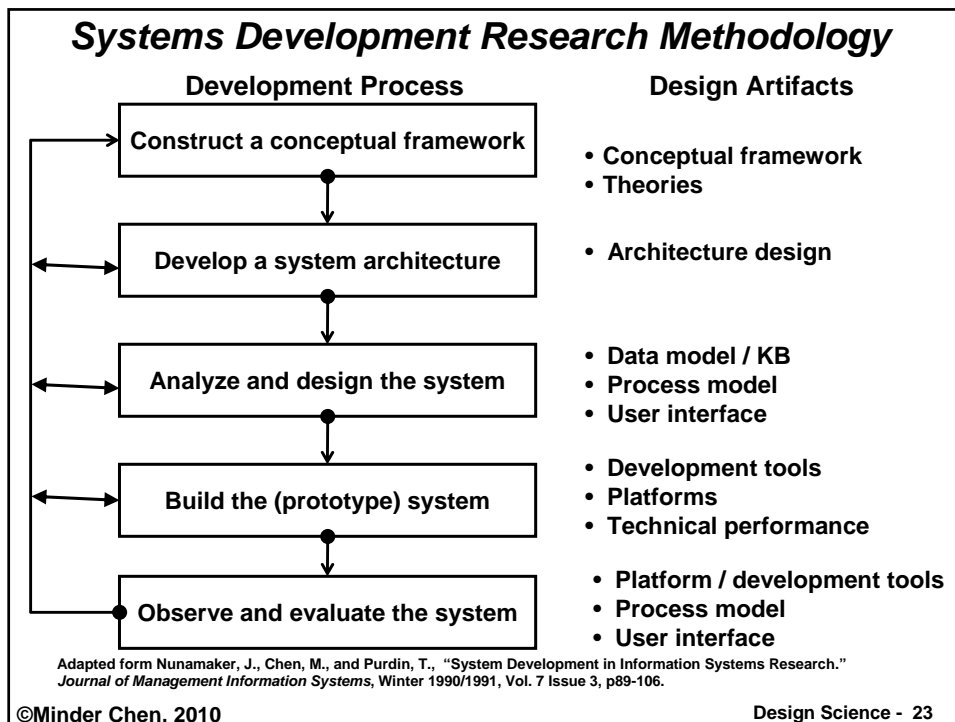
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Systems Development Research Methodology

- Engineering → Software Engineering → Systems Development
- Systems Development Life Cycle from a research perspective
- Integration and interactions of multiple research methods → Mutually beneficial instead of mutually exclusive

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Architectural Design

- **Inputs:** specification, general context of desired system, knowledge of similar systems
- **Outputs:** Description of system internal structure and external environments (definition of modules and their interfaces)
- **Major Operations:**
 - Discovery of problem structure
 - Identification of major pieces of system
 - Establishment of relationships between parts
 - Abstraction
 - Decomposition

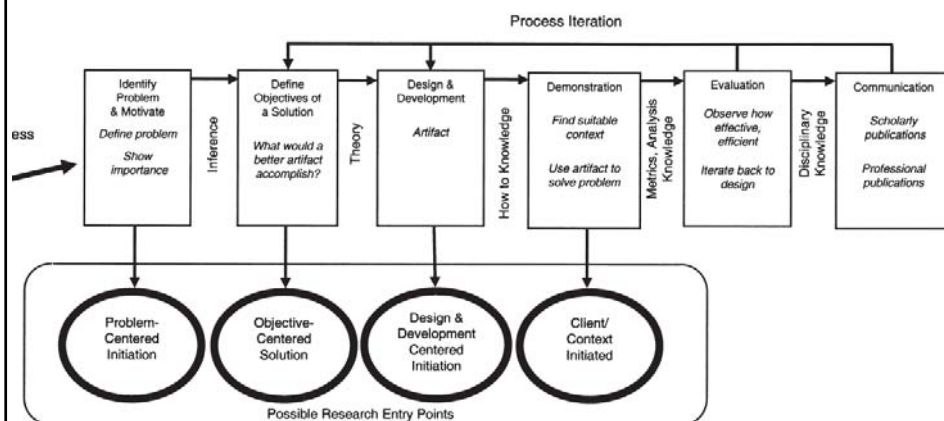
Source: Peter Freeman, "On Design," in Tutorial on Software Design Techniques,

edited by Peter Freeman, Anthony I. Wasserman, 4th edition, 1983, pp. 2-22.

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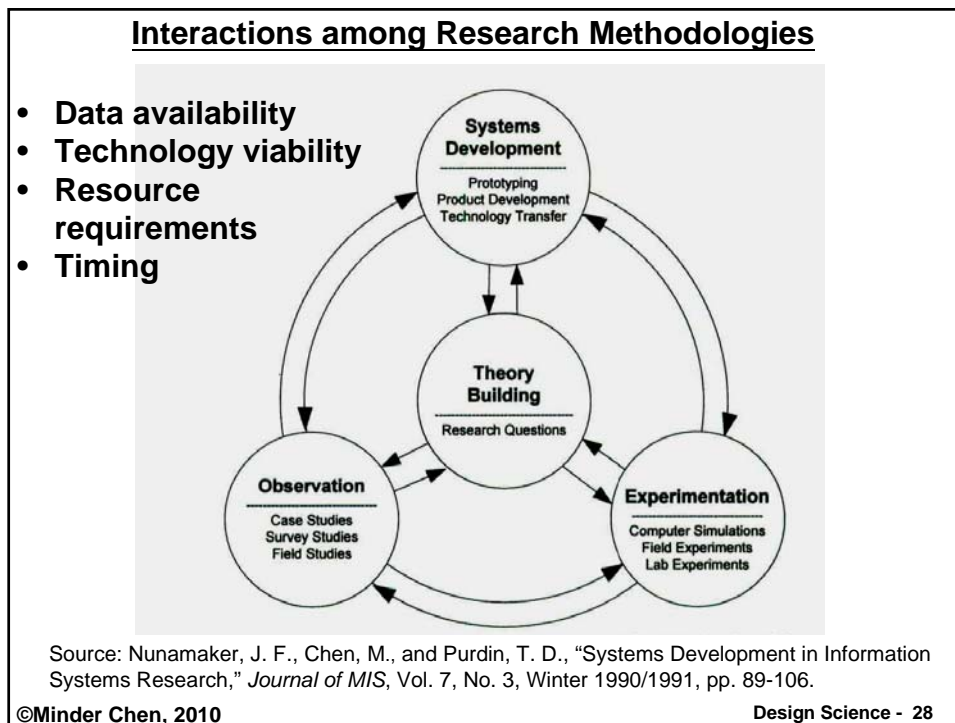
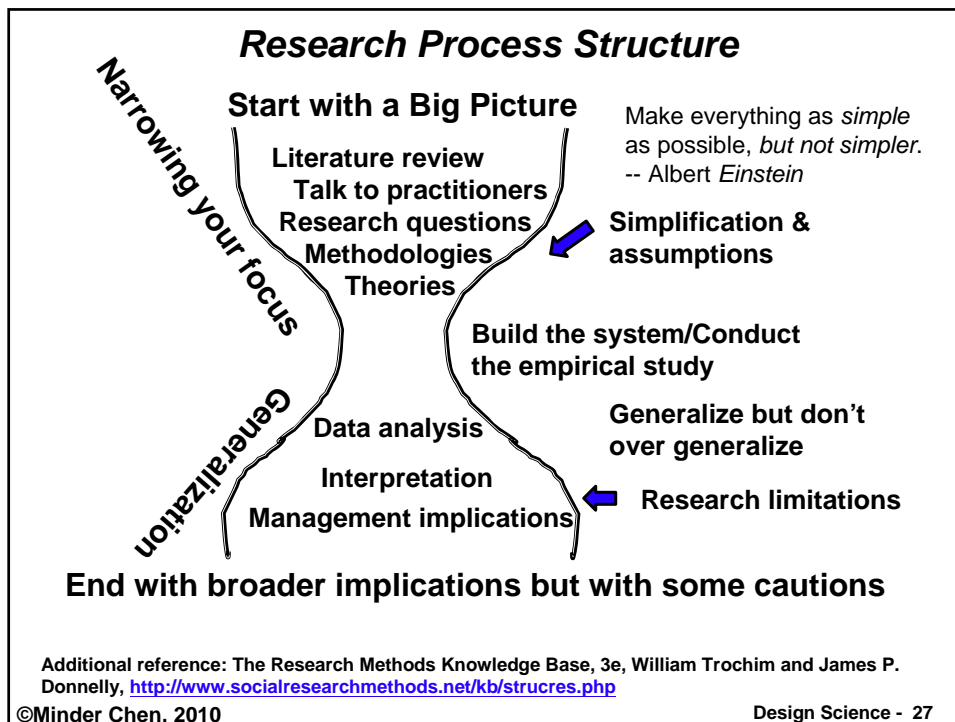
Design Science Research Methodology

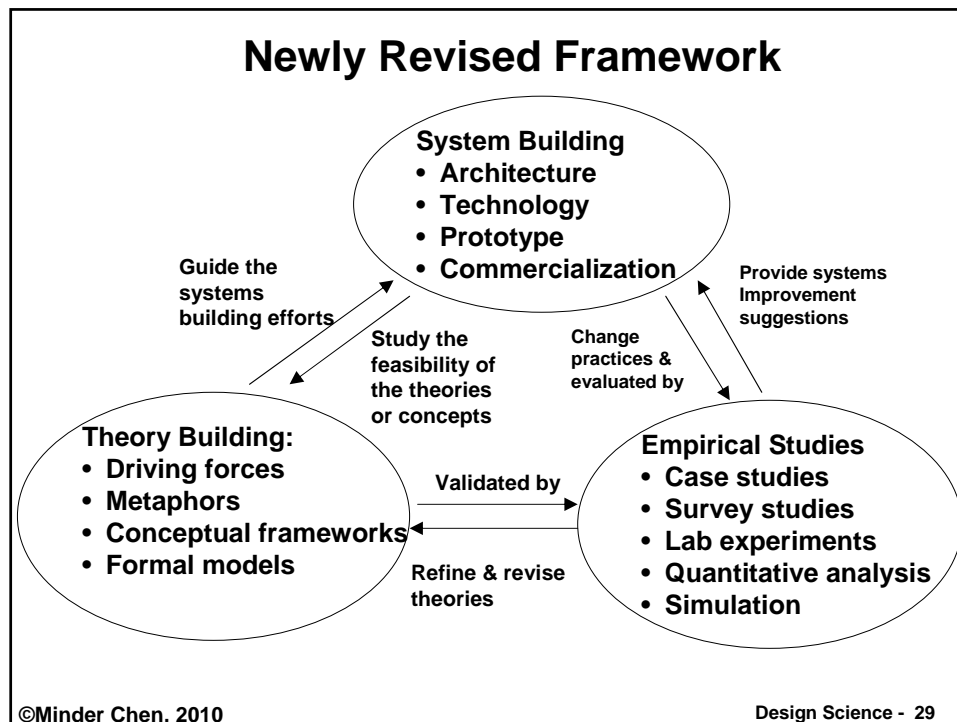


Source: Peffers, K., Tuunanen, T., Rothenberger, M. A. and Chatterjee, S., "A Design Science Research Methodology for Information Systems Research," *Journal of Management Information Systems*, Vol. 24 No. 3, Winter 2008, pp. 45 – 77.

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Multi-methodological Approach to IS Research

- Explicitly recognized that complementary IS research methods are needed and asserted that “an integrated multi-dimensional and multi-methodological approach will generate fruitful IS research results” (p. 89).
- Developed a framework of a “Multi-methodological Approach to IS Research” (figure 2, p. 94) incorporating four complementary forms of research: theory building, systems development, observation, and experimentation, all of which inform each others.

Source: Venable, J. R. The Role of Theory and Theorising in Design Science Research. *First International Conference on Design Science Research in Information Systems and Technology*. Claremont, California (2006), pp. 1-18.

Design Evaluation Methods

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

Hevner, A., March, S., Park, J. and Ram, S., "Design Science in Information Systems Research." *MIS Quarterly*, 28(1), 2004, pp. 75-105.

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Build and Evaluate

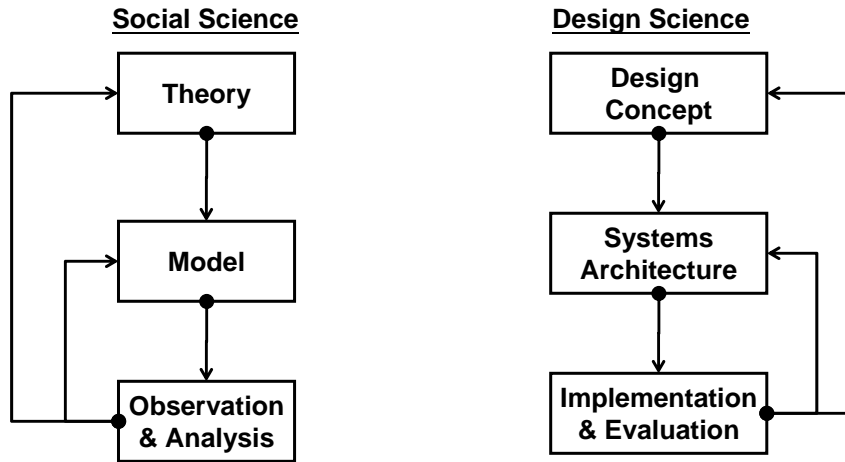
- **Building an artifact demonstrates that such an artifact can be constructed and answers the basic question, "Does it work?"**
- **Evaluating the artifact tries to determine the performance of the artifact by answering the question, "How well does it work?"**

- **Source: Cao, Jinwei , Crews, Janna M. , Lin, Ming , Deokar, Amit , Burgoon, Judee K. and Nunamaker, Jay, "Interactions Between System Evaluation and Theory Testing: A Demonstration of the Power of a Multifaceted Approach to Information Systems Research," *Journal of Management Information Systems*, Vol. 22 No. 4 , Spring 2006 , pp. 207 – 235.**

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Systems Building Process

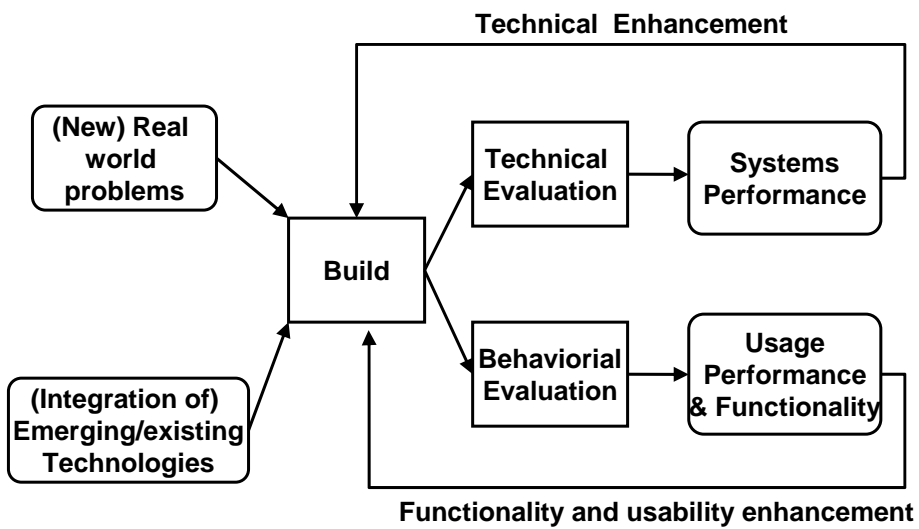


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Build-Evaluate-Learn Cycle

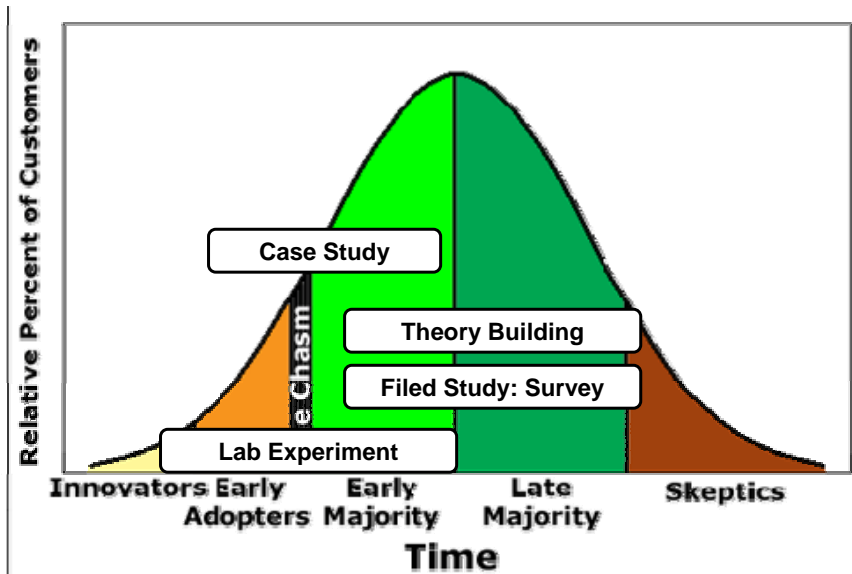
- Build and Learn vs. Evaluate and Learn



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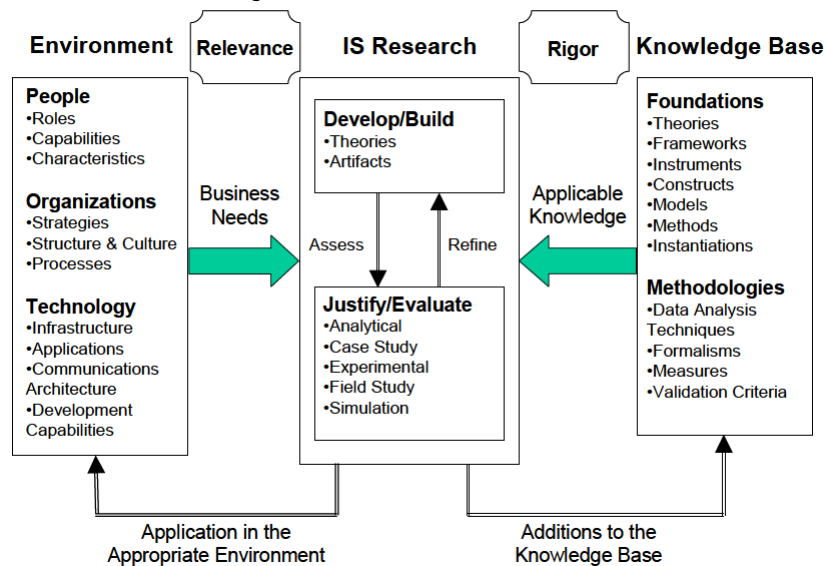
Empirical Evaluation Methods and Technology Lifecycle



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Information Systems Research Framework



Hevner, A., March, S., Park, J. and Ram, S., "Design Science in Information Systems Research." *MIS Quarterly*, 28(1), 2004, pp. 75-105.

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Design-Science Research Guideline

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.

Hevner, A., March, S., Park, J. and Ram, S., "Design Science in Information Systems Research." *MIS Quarterly*, 28(1), 2004, pp. 75-105.

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Justify (Communicate) Design Sciences Research Contributions

A design science research contribution requires

- **Identification and clear description of a relevant organizational IT problem**
- **Demonstration that no adequate solutions exist in the extant IT knowledge-base**
- **Development and presentation of a novel IT artifact (constructs, models, methods or instantiations) that addresses the problem**
- **Rigorous evaluation of the IT artifact enabling the assessment of its utility**
- **Articulation of the value added to the IT knowledge-base and to practice**
- **Explanation of the implications for IT management and practice.**

Source: Salvatore, T. M. and Storey, V. C., "Design Science in the Information Systems Discipline: An Introduction to the Special Issue on Design Science Research," *MIS Quarterly*, Vol. 32 No. 4, December 2008, pp. 725-730.

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Eight components of an Information Systems Design Theory

Component	Description
Core components	
1) Purpose and scope (the <i>causa finalis</i>)	"What the system is for," the set of meta-requirements or goals that specifies the type of artifact to which the theory applies and in conjunction also defines the scope, or boundaries, of the theory.
2) Constructs (the <i>causa materialis</i>)	Representations of the entities of interest in the theory.
3) Principle of form and function (the <i>causa formalis</i>)	The abstract "blueprint" or architecture that describes an IS artifact, either product or method/intervention.
4) Artifact mutability	The changes in state of the artifact anticipated in the theory, that is, what degree of artifact change is encompassed by the theory.
5) Testable propositions	Truth statements about the design theory.
6) Justificatory knowledge	The underlying knowledge or theory from the natural or social or design sciences that gives a basis and explanation for the design (kernel theories).
Additional components	
7) Principles of implementation (the <i>causa efficiens</i>)	A description of processes for implementing the theory (either product or method) in specific contexts.
8) Expository instantiation	A physical implementation of the artifact that can assist in representing the theory both as an expository device and for purposes of testing.

Mutability: Capable of or subject to change or alteration.

Source: Gregor, S., and Jones, D. 2007. "The Anatomy of a Design Theory," *Journal of the Association for Information Systems* (8:5), pp. 313-335.

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Eight components of an Information Systems Design Theory

- **Example of the skeleton of a design theory (from Codd, 1970, 1982)**

Article details	The design theory anatomy
The introduction says better database technology is needed to increase human productivity. (Motivation is also provided: This need is significant because current approaches are failing.)	The purpose and scope of the theory are stated.
The relational database model has principles such as "the order of rows in the tables is arbitrary and irrelevant."	Principles of form and function incorporating underlying constructs (such as "table") are given.
The argument is made that the relational model allows for relatively simple adaptation and change to base tables, while user views appear unchanged.	Artifact mutability is addressed.
Statements are made such as "A relational database can perform as well as a non-relational database."	These statements are testable propositions .
It is shown how the relational model works, by reference to underlying set theory and also human cognitive processes.	Justificatory knowledge (kernel theory) is provided.
Guidelines are given on how to produce a relational database through normalization procedures.	Principles of implementation are given.
An illustration of working relational databases is provided.	An expository instantiation is given.

Source: Gregor, S., and Jones, D. 2007. "The Anatomy of a Design Theory," *Journal of the Association for Information Systems* (8:5), pp. 313-335.

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Design Science Research Issues

- **Technologies:** Emerging technologies, new platforms
- **Development Tools:** IDE, open source solutions
- **Application Domains and Applications**
- **Adoption and Adaption:** Getting insights
- **Impacts and Performance:** Technical performance and human performance
- **IT interactions with People:** methods for proper usages
- **Unit of Analysis:** Individual / Group/ Organization / Institution / Society

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Evolution of Distributed Computing

Technologies

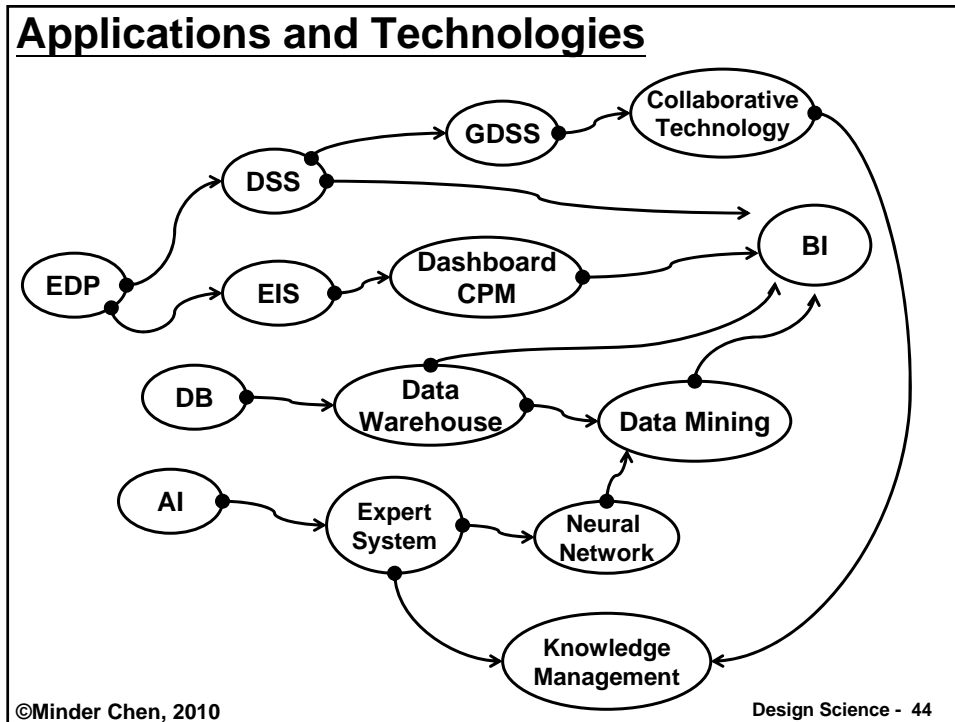
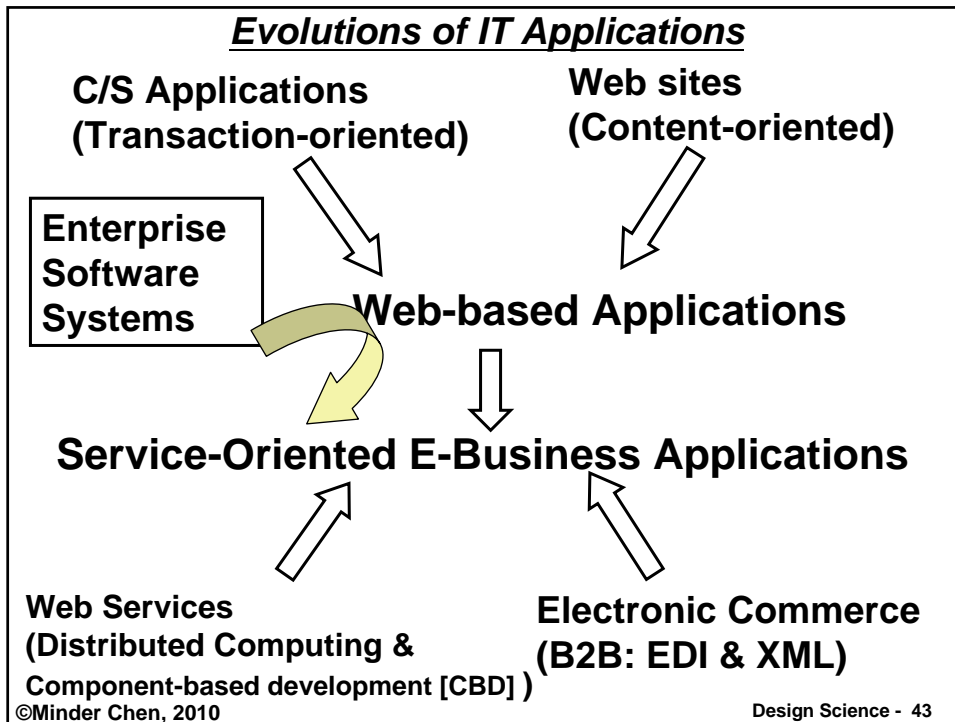
- **Client/Server Systems**
- **Enterprise software systems**
- **Internet and Web-based Applications**
- **Web services and SOA**
- **ASP, SaaS, virtualization, cloud computing**
- **Web 2.0 - Ajax**

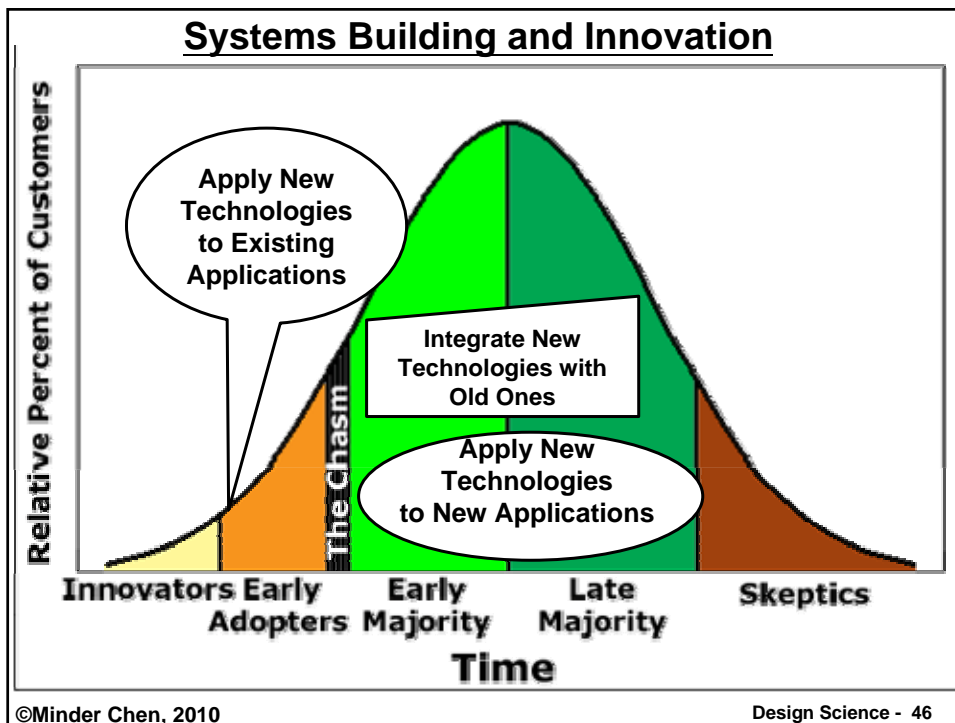
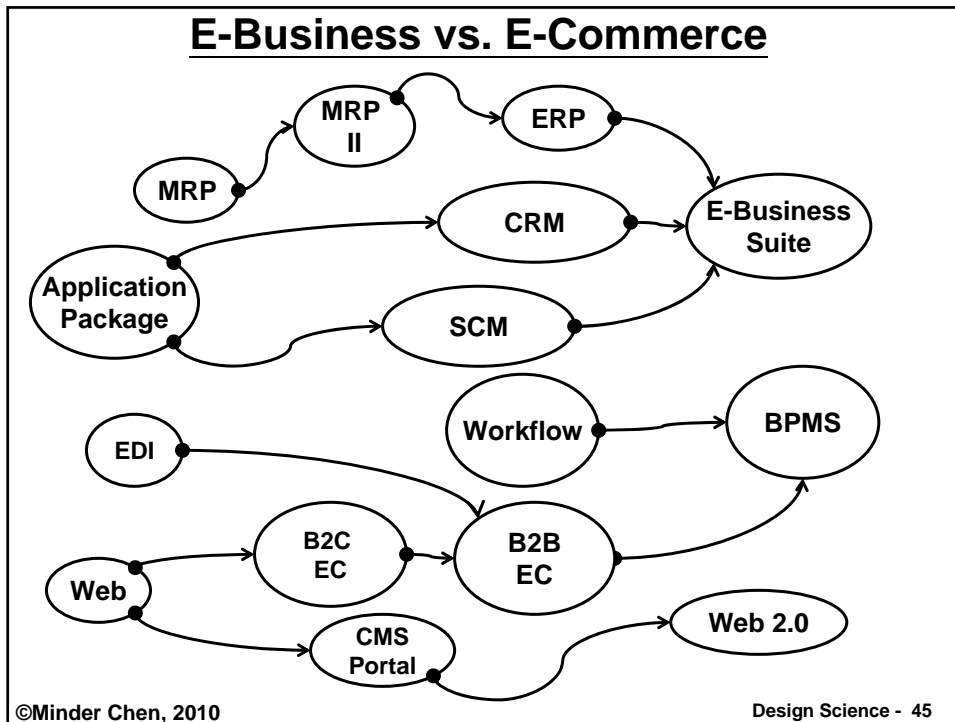
Business initiatives

- **End use computing**
- **Business process engineering**
- **E-business & e-commerce**
- **Service-oriented enterprises**
- **Globally integrated enterprises**
- **Web 2.0 – Social capital**

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General Patterns of Emerging Technology Evolution

- X technology is at the center of the world →
X technology can access other technologies or systems → X technology can be interfaced and interacting with other technologies. → X technology can be imbedded into other systems.
- X technology is for the developer → for the end user.
→ becomes transparent to its end user.
- X technology for a specific domain ↔ multiple domains.
- Application ↔ Tool ↔ Meta-Tool

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Communication: How to “Package” Your Research

- Malone, T. W., Grant, K. R., & Turbak, F. A. The Information Lens: An intelligent system for information sharing in organizations. *Proceedings of the CHI '86 Conference on Human Factors in Computing Systems* (Sponsored by ACM/SIGCHI), Boston, MA, April, 1986.
- Malone, T. W., Grant, K. R., Lai, K. Y., Rao, R. & Rosenblitt, D. A. **Semi-structured messages are surprisingly useful for computer-supported coordination**, *ACM Transactions on Office Information Systems*, 1987, 5, 115-131.
- Malone, T. W. **Modeling coordination in organizations and markets**, *Management Science*, 1987, 33, 1317-1332.
- Malone, T. W., Yates, J., & Benjamin, R. I. **Electronic markets and electronic hierarchies**, *Communications of the ACM*, 1987, 30, 484-497

AI + Email = Intelligent Email → Information Lens
Collaborative Works → Coordination Theory

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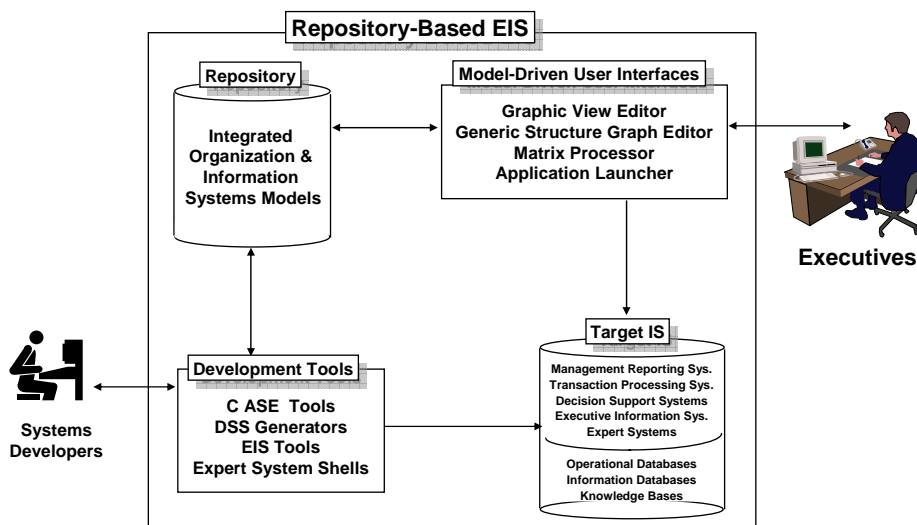
Case Study I: Case Tools

- CASE Tools
- Organization and Information Systems Modeling
- Meta-CASE Tools
- Integrated CASE
- A Repository-based Executive Information Systems

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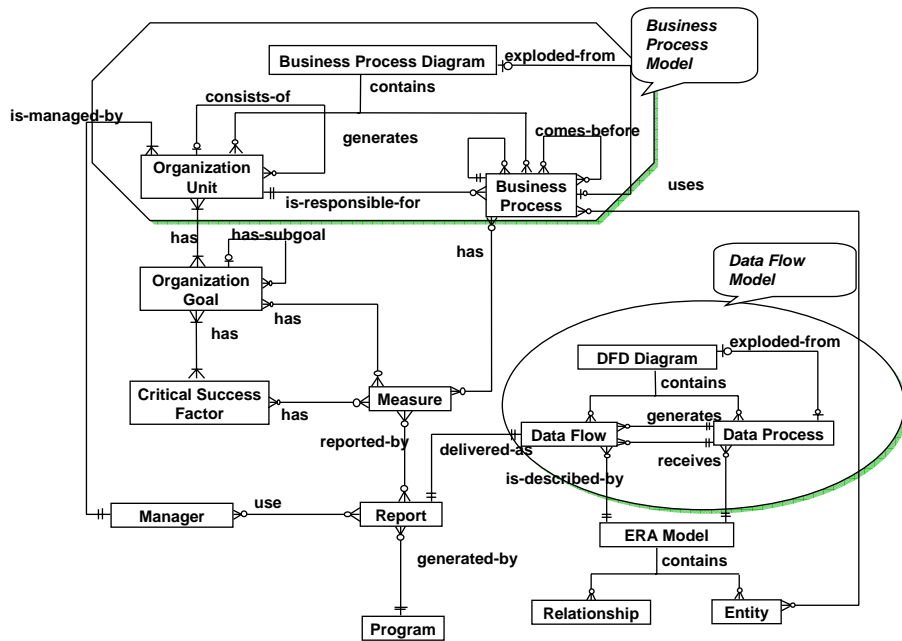
The Architecture of a Repository-Based EIS



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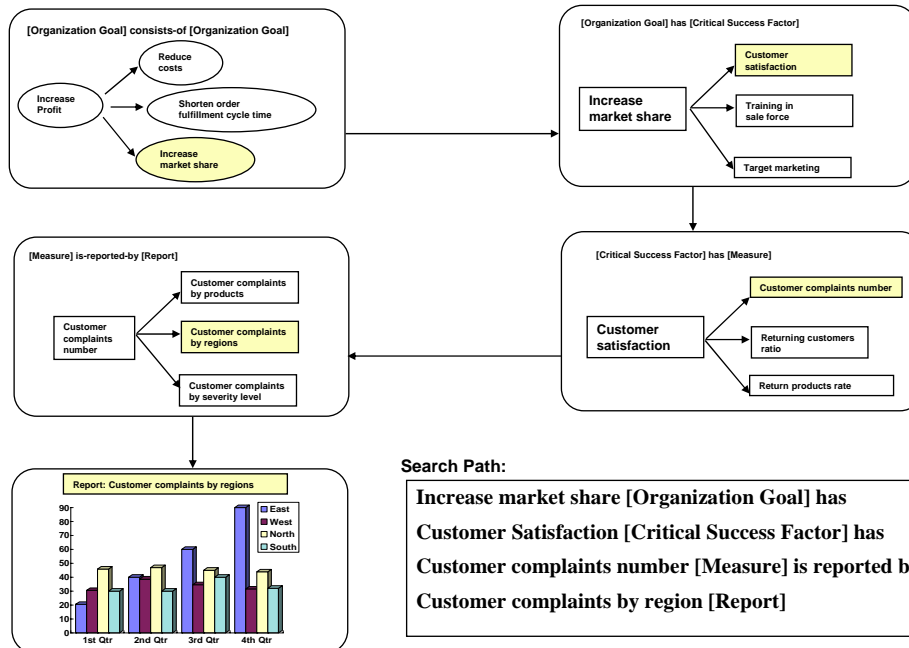
An Integrated Organization and Information Systems Model



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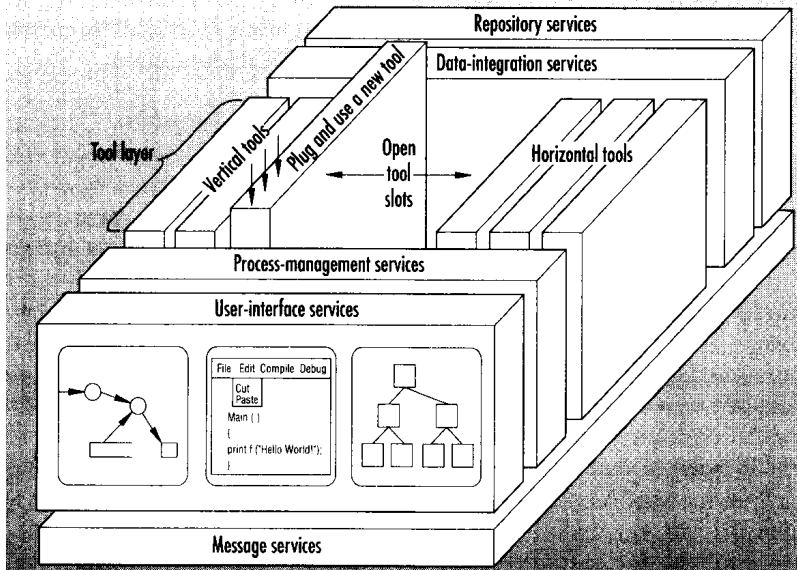
An Example of Navigating an IOIS Model to Access Managerial Information



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NIST/ECMA Reference Model for I-CASE

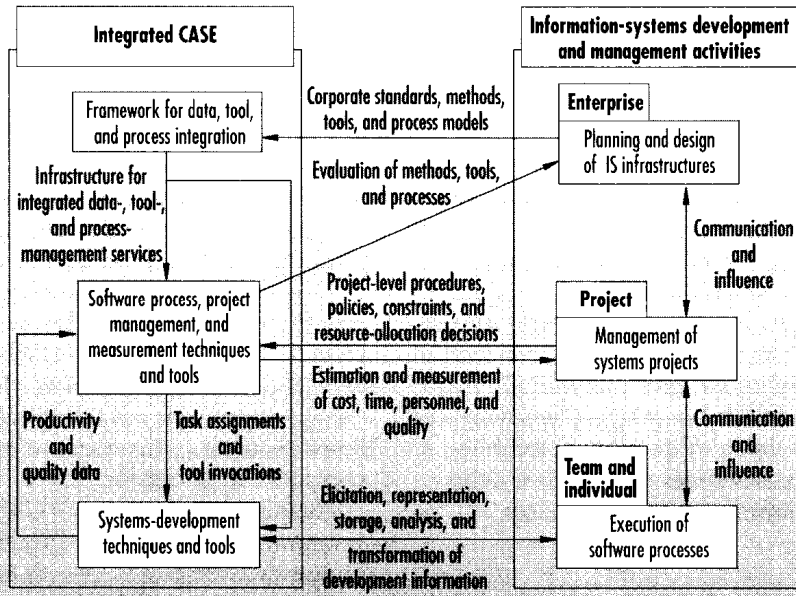


•Chen, Minder and Norman, J. Ronald, "A Framework of Integrated CASE," *IEEE Software*, Vol. 9, No. 2, March 1992, pp. 18-22.

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I-CASE Framework



Source: Chen, Minder and Norman, J. Ronald, "A Framework of Integrated CASE," *IEEE Software*, Vol. 9, No. 2, March 1992, pp. 18-22. (SCI)

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Case Study II: GDSS

- **GDSS for Requirements Elicitations**

- Liou, I. and Chen, M., "Using Group Support Systems and Joint Application Development for Requirements Specification," *Journal of Management Information Systems*, Winter 1993-1994, Vol. 10, No. 3, pp. 25-41. (SSCI)

- **Why build it?**

- Cost becomes an inhibiting factor for adoption
- National language support

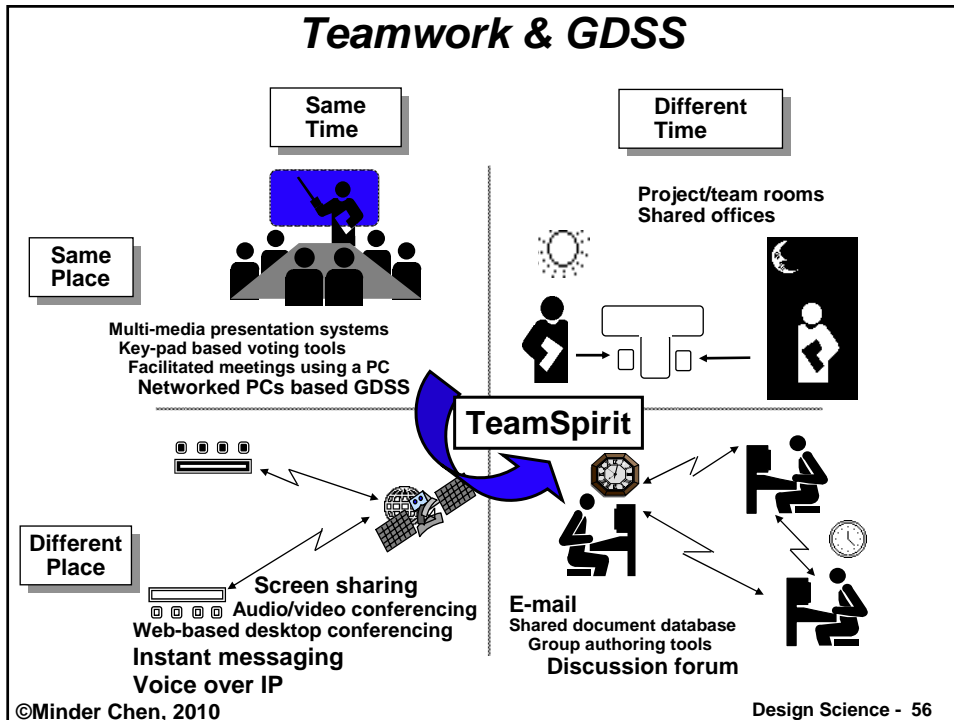
- **Web-Based GDSS**

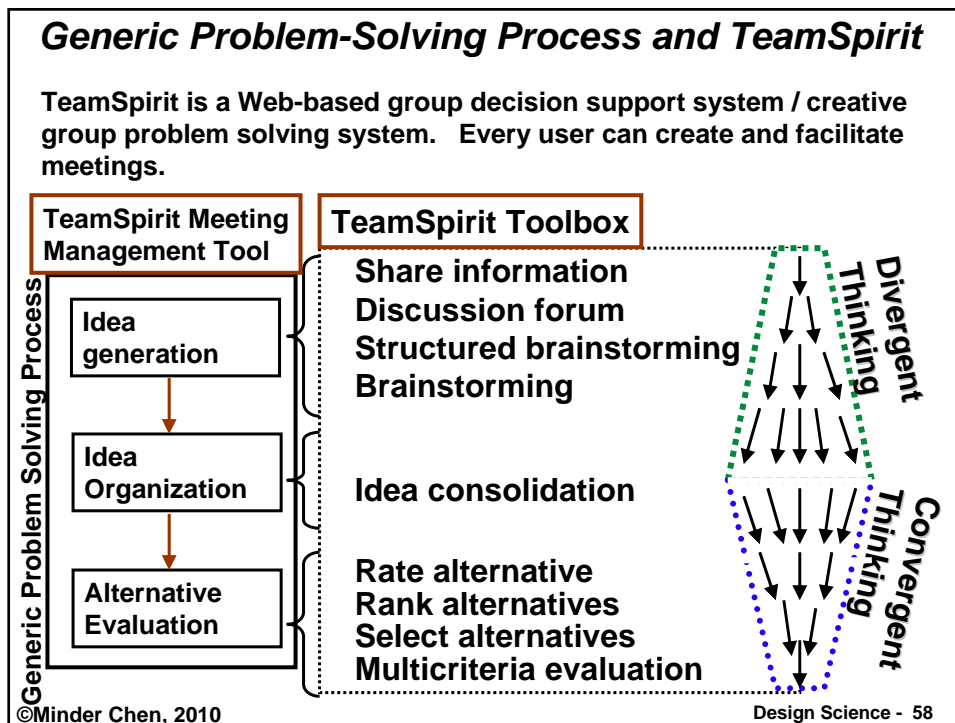
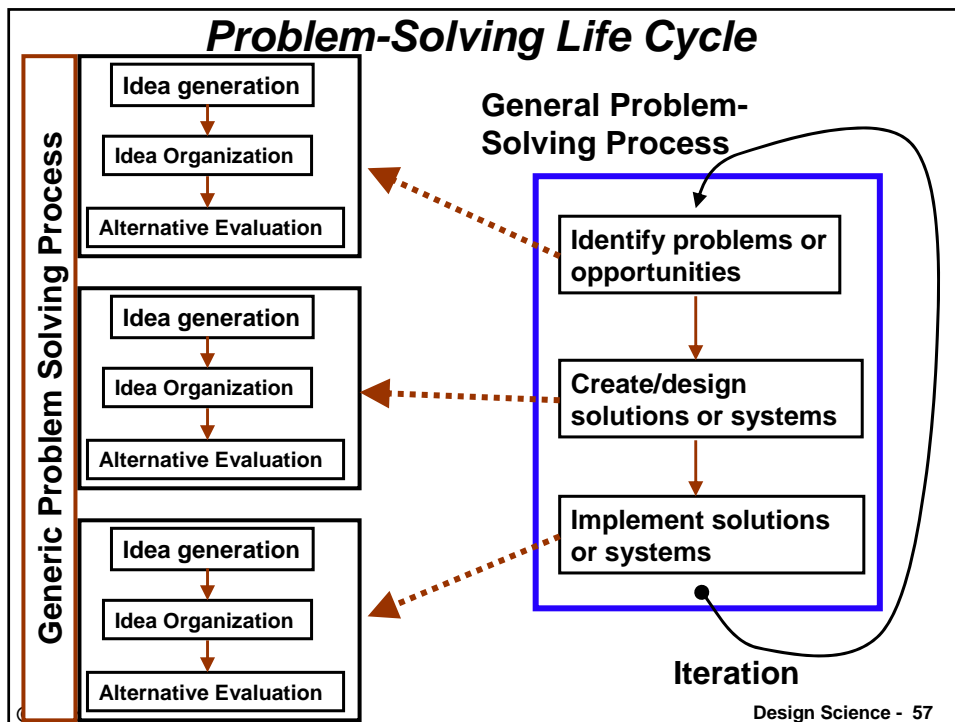
- Use ASP.NET
- Working with a management professor (Ching-Wen Wang) specializing in creativity and group problem solving
- From GDSS to Virtual Teams research
- "Weak" Form of Facilitation
- Evaluation of system's effectiveness

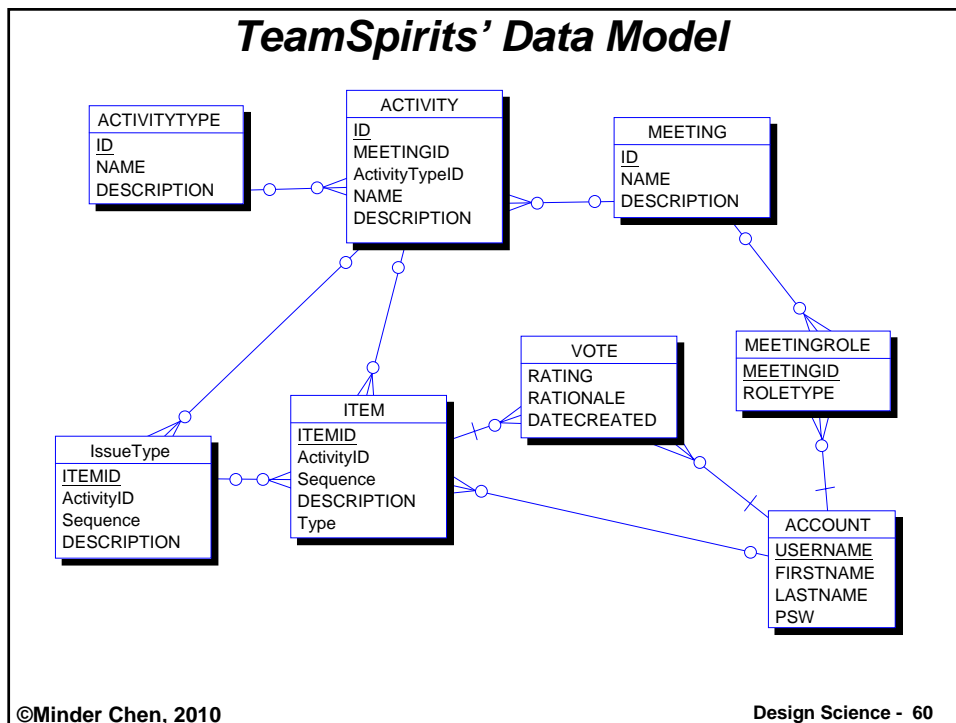
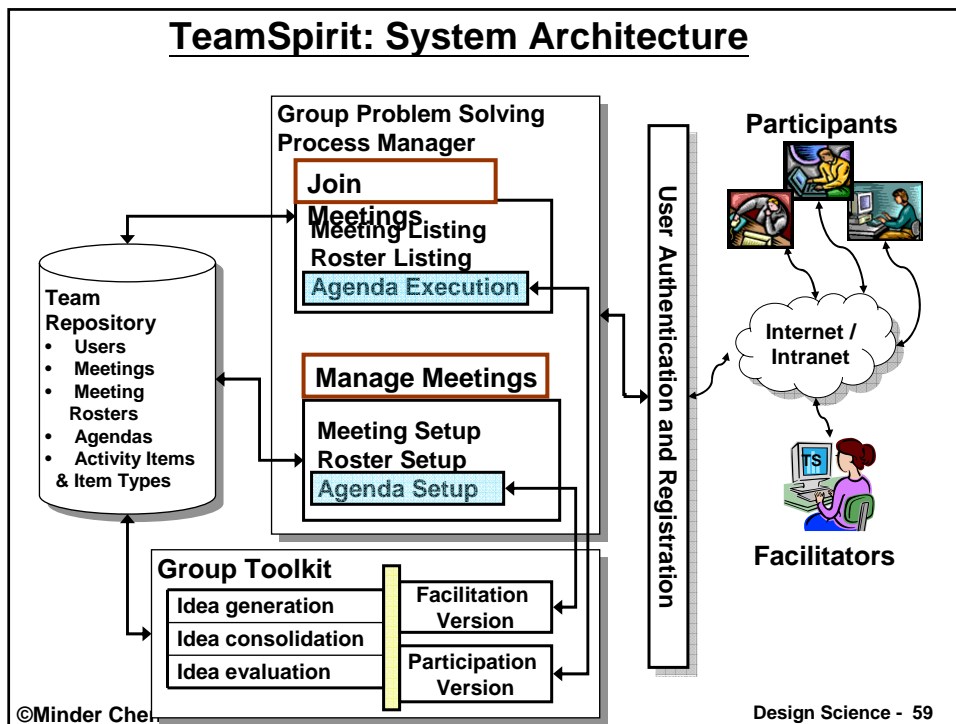
Minder Chen, YiChing Liou, Ching-Wen Wang, Y.W. Fan, and Y.P. Jeffery Chi, "TeamSpirit: The Design, Implementation, and Evaluation of a Web-based Group Decision Support System," *Decision Support Systems*, 43(4), August 2007, pp. 1186-1202. (SCI Expanded)

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Structured Brainstorming

[Meetings | Agenda | Participant List | Log Off] Help

Structured Brainstorming Tool

Meeting: Strategic Planning and Improvement Meeting
Activity: SWOT Analysis
Instruction: **Generate your observations or opinions regarding the SWOT of SOM**

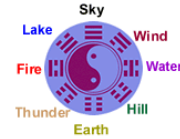
Category: Strengths

Explanation: Internal strengths of your organization
Enter one idea belongs to the category selected above:
 Technology Management program is well known!

Submit an idea Refresh ideas in a category Refresh ideas in all categories

Ideas generated: 26 idea(s) generated in all categories!

Category	Idea
Strengths	Good curriculum
Strengths	Very good energetic dean
Strengths	Strength is as a startup, nothing to lose much to gain by focusing on new business ideas.
Strengths	Superb faculty!!!
Strengths	DC location; Dean has experience in growing a program to a major national player.
Weaknesses	lack of research centers
Weaknesses	GMU has no overall vision--is viewed like a small conglomerate or federation of interests.
Weaknesses	Relatively few faculty with major national reputations.
Opportunities	Other GMU schools have already made good progress toward recognition - let's build some bridges to these schools.



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Multicriteria Evaluation Tool

[Meetings | Agenda | Participant List | Log Off] Help

Multicriteria Evaluation Tool

Meeting: Strategic Planning and Improvement Meeting
Activity: Evaluate ideas based on several criteria
Instruction: **Evaluate proposals based on several criteria**

Submit your vote! View Result



Alternatives ↓	Evaluation Criteria		
	Low cost	High Impacts	Quick gain
Increase research productivity	2	2	2
Need \$ from business community to fuel growth.	1	1	1
Hire more faculty	1	1	1
Increase number of Som faculty authored articles in quality journals	1	1	1
Find synergies among research faculty and build on them	1	1	1
More alliance of high-tech companies.	1	1	1
Have full-time MBA program.	1	1	1
Cook something special!	1	1	1

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Multicriteria Group Evaluation Result

Multicriteria Evaluation Tool: Group Evaluation Result

Vote Count: 15 out of 25 participants have voted!

[Close the window](#)

Sorted by:

Alternatives ↓	Evaluation Criteria (weight in %)			Weighted Group Rating
	Low cost (25.00%)	High Impacts (50.00%)	Quick gain (25.00%)	
Increase research productivity	4.60	8.00	4.33	6.23
Increase number of Som faculty authored articles in quality journals	3.87	7.00	4.93	5.70
Need \$ from business community to fuel growth.	5.40	6.20	5.27	5.77
Hire more faculty	3.20	6.00	3.93	4.78
More alliance of high-tech companies.	4.13	5.47	5.00	5.02
Find synergies among research faculty and build on them	5.00	4.87	3.47	4.55
Have full-time MBA program.	3.33	4.47	4.47	4.18
Cook something special!	4.13	3.40	3.33	3.57

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Challenges for Virtual Teams

- Non-FTF.
- Members may not know each others in advance.
- Lack of interactions.
- Lower decision quality.
- Limited communication media.
- Weak forms of facilitation.

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Ongoing & Potential Research in Web-GDSS

- Study electronic brainstorming with pen input.
- Study the collaboration of global software outsourcing teams in their use of collaboration technologies.
- Research the effectiveness of facilitation/leadership styles of virtual teams
- Use TeamSpirits in collaborative learning and online learning.
- Using TeamSpirits to support TRIZ.
- Incorporate AJAX to make voting tools more interactive and provide better graphic presentation of group results.

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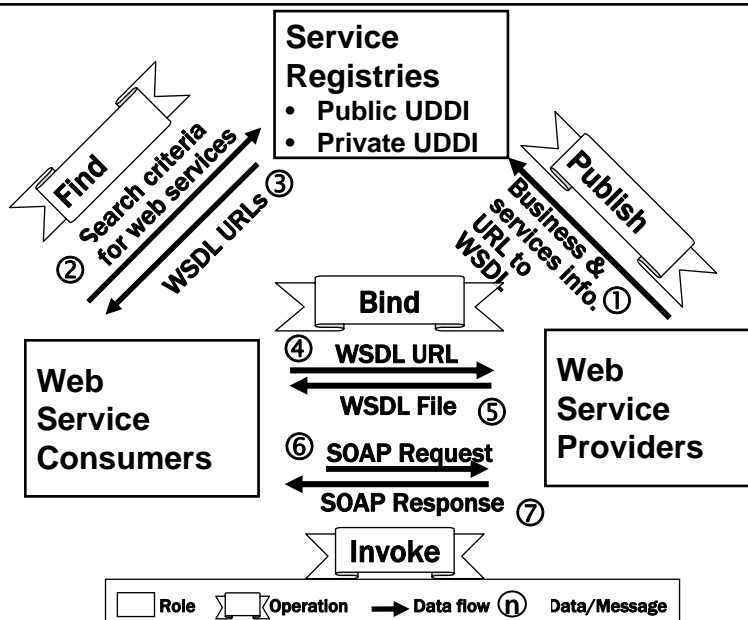
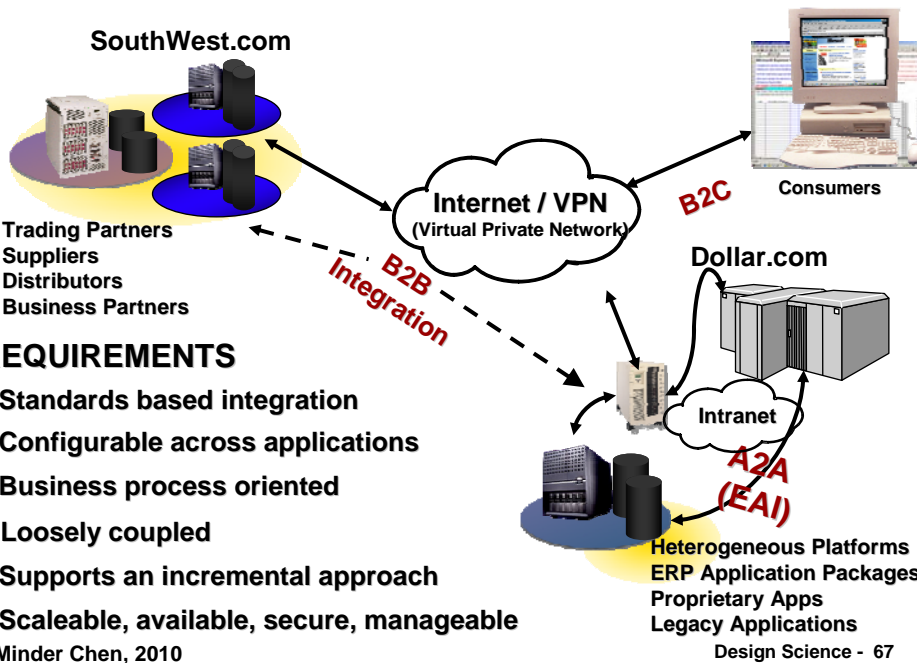
Case Study III: Web Services

- XML Standards
- Web Services Adoption Case Studies
- Dynamic Web Service Invocation: Dynamic Procurement System
- Adoption of Web Services
- Ecology of IT Standards Adoption
- BPMS and Collaborative E-Commerce
- SOA and Service-Oriented Enterprise

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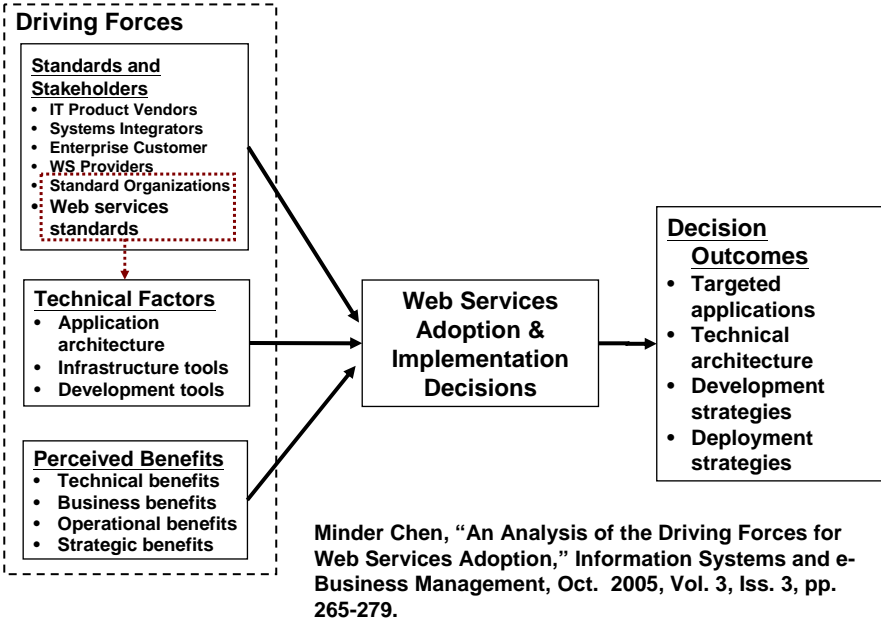
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Integration Imperatives



Minder Chen, "Factors Affecting the Adoption and Diffusion of XML and Web Services Standards for E-business Systems," International Journal of Human-Computer Studies, Volume 58, Issue 3, March 2003, pp. 259-279.

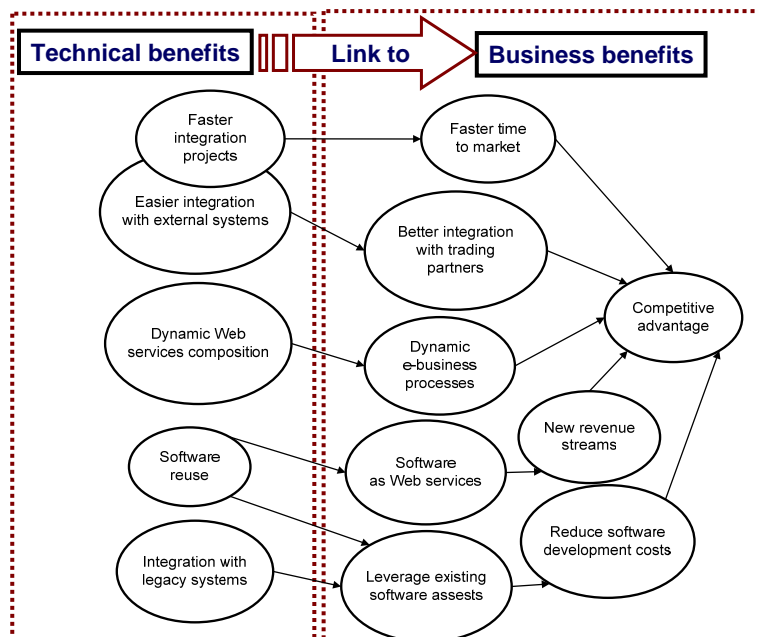
Driving Forces Of Web Services Adoptions And Decision



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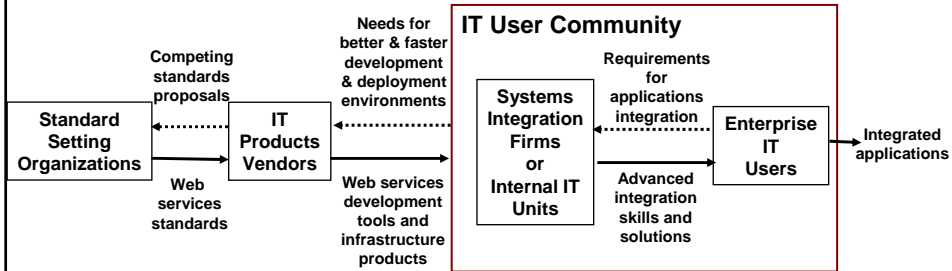
Justification for Web Services Adoption: Technical and Business Benefits



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Ecology of (Web Services) Standards Development and Adoption

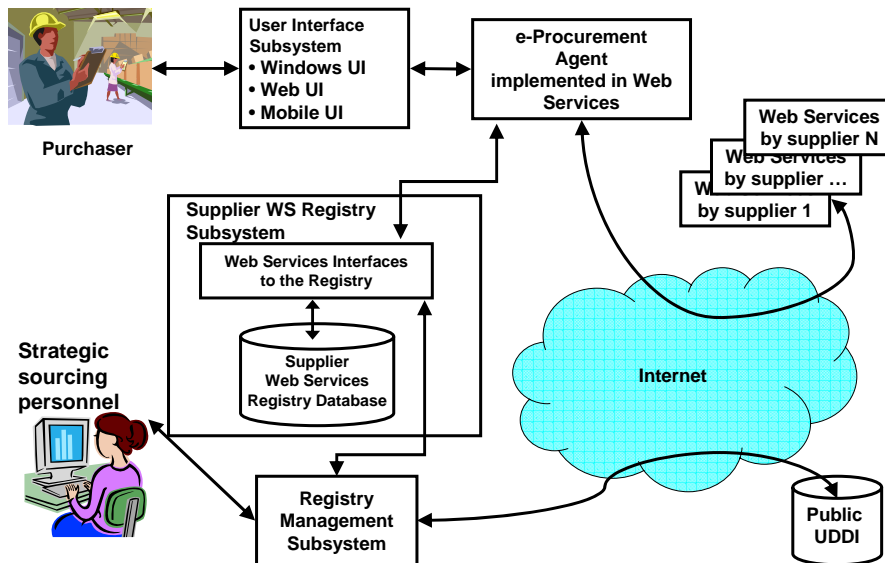


Minder Chen, "An Analysis of the Driving Forces for Web Services Adoption," *Information Systems and e-Business Management*, Oct. 2005, Vol. 3, Iss. 3, pp. 265-279.

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e-Procurement Case Study: Architecture

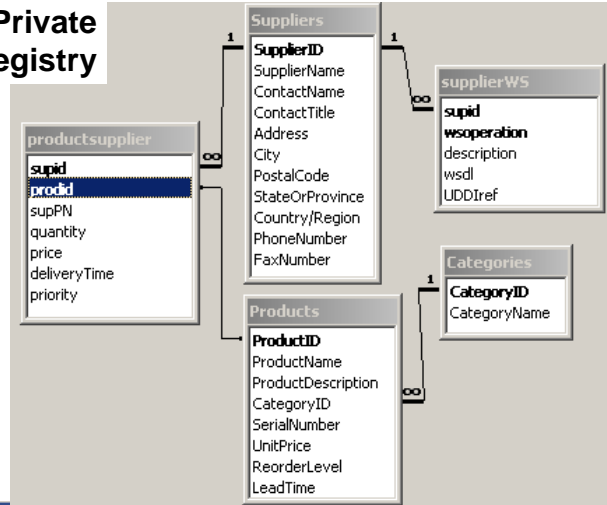


•Minder Chen and Mary J. Meixell, "Web-Services Enabled Procurement in the Extended Enterprise: An Architectural Design and Implementation," *Journal of Electronic Commerce Research*, Vol. 4, No. 4, Nov. 2003, pp. 140-155.

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Data Model of the Private Web Services Registry



supplierWS : Table

	supid	wsoperation	description	wsdl
	1	Check	Check product price	http://localhost/WSVendor1/query.asmx?WSDL
	1	Order	Order items	http://localhost/WSVendor1/order.asmx?WSDL
	2	Check	Check product price	http://localhost/WSVendor2/query.asmx?WSDL
	2	Order	Order items	http://localhost/WSVendor2/order.asmx?WSDL

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ProcurementForm

Real time eProcurement System

Product ID: Quantity Needed:

Place order

Place order from supplier ID:

Quantity:

	Supplier ID	Price	Quantity on Hand	Delivery Time (in Hour)
	1	\$100.00	192	24
	2	\$210.00	294	36
*				

t1: 1/11/2004 5:38:27 PM t2: 1/11/2004 5:38:35 PM

Place Purchase Order

Submit an order of 24 unit(s) of product 1 to supplier 1

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Prototype

ProcurementForm

Real time eProcurement System

Product ID: Quantity Needed: [Get Quotations](#)

Place order

Place order from supplier ID:

Quantity: [Place order](#)

	Supplier ID	Price	Quantity on Hand	Delivery Time (in Hour)
▶	1	\$100.00	168	24
	2	\$210.00	294	36
*				

t1: 1/11/2004 5:40:30 PM t2: 1/11/2004 5:40:30 PM

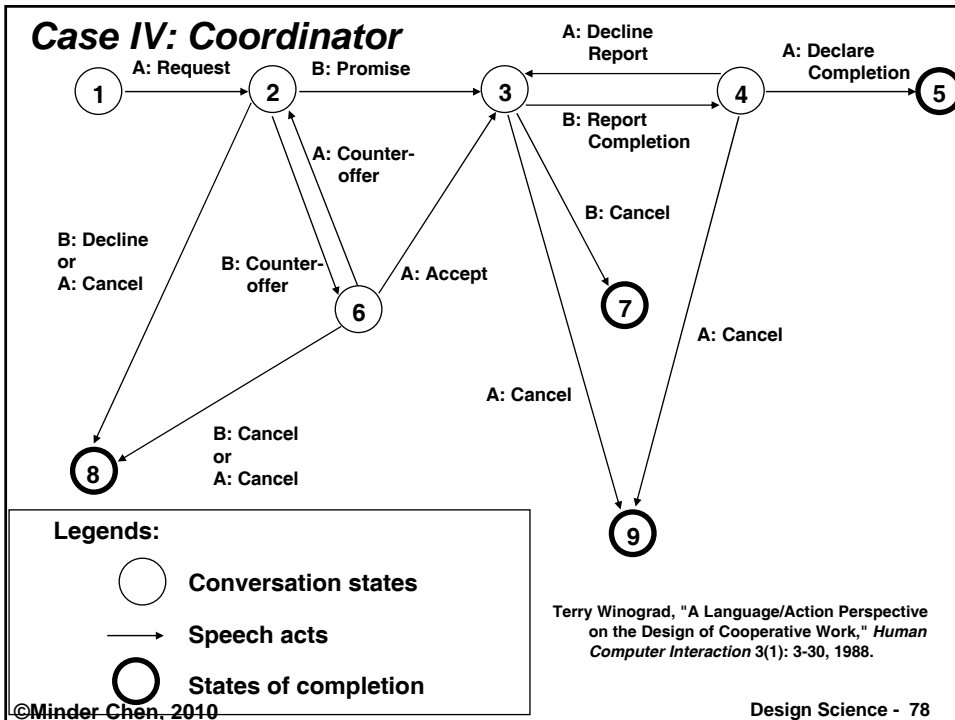
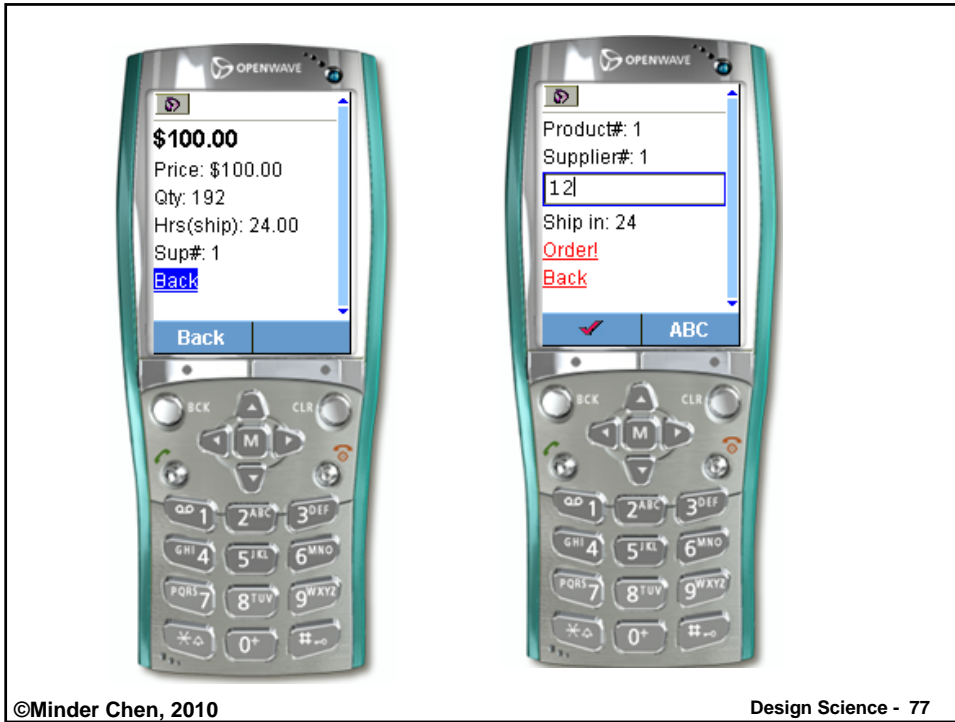
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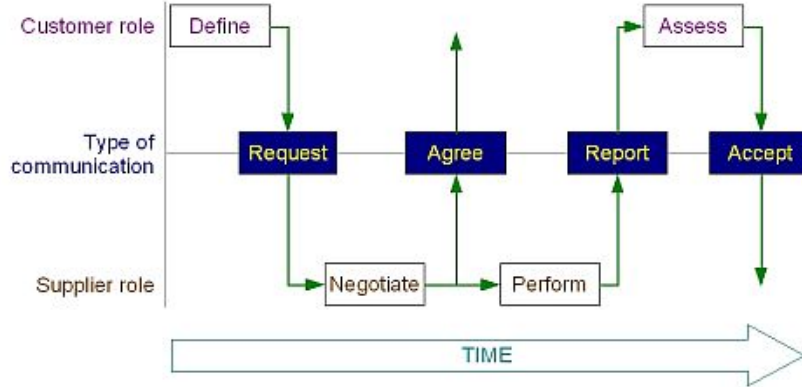


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Commitment Management Protocol



<http://coevolving.com/blogs/index.php/archive/conversations-for-action-commitment-management-protocol/>

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ActionWorks from Action Technology

Grounded in Theory, Successful in Practice: The Action Closed-Loop Business Interaction Model

After years of studying human interaction, Action Technologies, Inc. founders Terry Winograd Ph.D. (Stanford) and Fernando Flores Ph.D. (UC Berkeley) mapped every state and act in which people can work together. Based on their exhaustive research, they developed the closed-loop business interaction model (set forth in their 1993 book, *Understanding Computers and Cognition*) that is at the heart of our company's solution. Action Technologies holds 6 patents on its technology, which has earned 14 industry awards in the last three years. The solution coordinates interactions between an individual or group making a request (the customer) and the recipient of that request (the performer) in four phases.



http://www.actiontech.com/library/documents/ATI_Overview.pdf

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Threats to Design Science Research

- **Build a better mousetrap, and the world will beat a path to your door.**

Your worst nightmare

- There is a commercial product like yours.

Potential Issues

- Limited technical capabilities
- Limited technical resources
- Commercial interests and IP

Competitors

- CS academic researchers
- IT industry research labs and products development teams

Risk Mitigation in Design Science Approach

- **Conduct literature review**
- **Evaluate commercially available products**
- **Build applications based on a deeper understanding of the problem domain**
- **Apply the emerging technology in new areas**
- **Integration of several technologies**

Suggestions and Conclusions

- **Keep track of emerging technologies and business problems.**
- **Play with the new technologies to get a feel.**
- **Inspire by real world problems.**
- **Be creative and make a difference.**
- **Use the best tools to improve your research productivity.**
- **Take a long term view / Establish a long-term program.**
- **Collaborate with colleagues.**
- **Base the design on appropriate theories.**
- **Evaluation of the system built is almost a must.**
- **It is very challenging, but it is also very rewarding.**
- **Reach for global visions and local relevancy.**

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Conclusions

- **There is no such a thing as a paradigm, we need to adapt with the changing time & technologies.**
- **System building is a creative process for the betterment of human organizations.**
- **We can make bigger impacts to the society by building innovative systems that solve challenging problems.**

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- design science research in information systems and technology, <http://desrist.org/> An International Conference since 2006.

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