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# The Services Transformation – Multiple Viewpoints

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# SERVICES

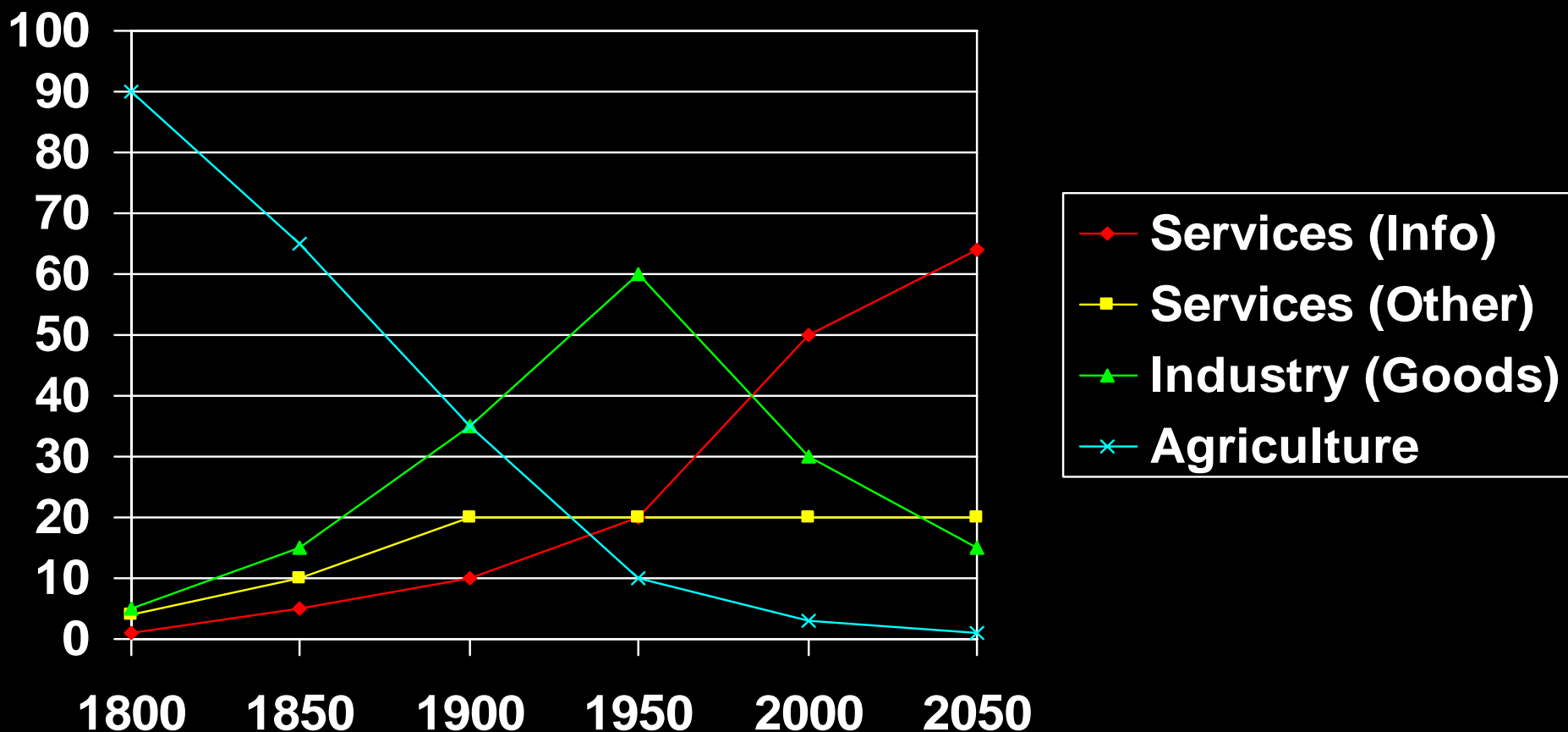


# What are Services

- **Too Many Definitions**
  - ❖ Everything but farming, mining, and manufacturing (former US government definition)
  - ❖ Results delivered directly by a human
  - ❖ Services are anything of value that is massless
  - ❖ Services produce value by actions involving providers and users
  - ❖ Capabilities utilized at point of creation and delivery
- **In practice, services**
  - ❖ Provide capability for immediate use, based on well-defined behavior, inputs and outputs
  - ❖ Are managed to meet quality and other nonfunctional objectives
  - ❖ Are organized to meet overall organizational goals (social, financial, etc.)
- **Bookkeeping is traditionally complex**
  - ❖ By main activity of a firm
  - ❖ By main activity of each individual
  - ❖ By role of each process
- **Reasonable convergence of numbers**
  - ❖ Developed country GDP is >70% Services; developed country GDP >50% information-based services
  - ❖ Developing countries moving rapidly (usually 30-50% Services, smaller percentage information-based)
  - ❖ **Regardless of measure, % is increasing almost everywhere**



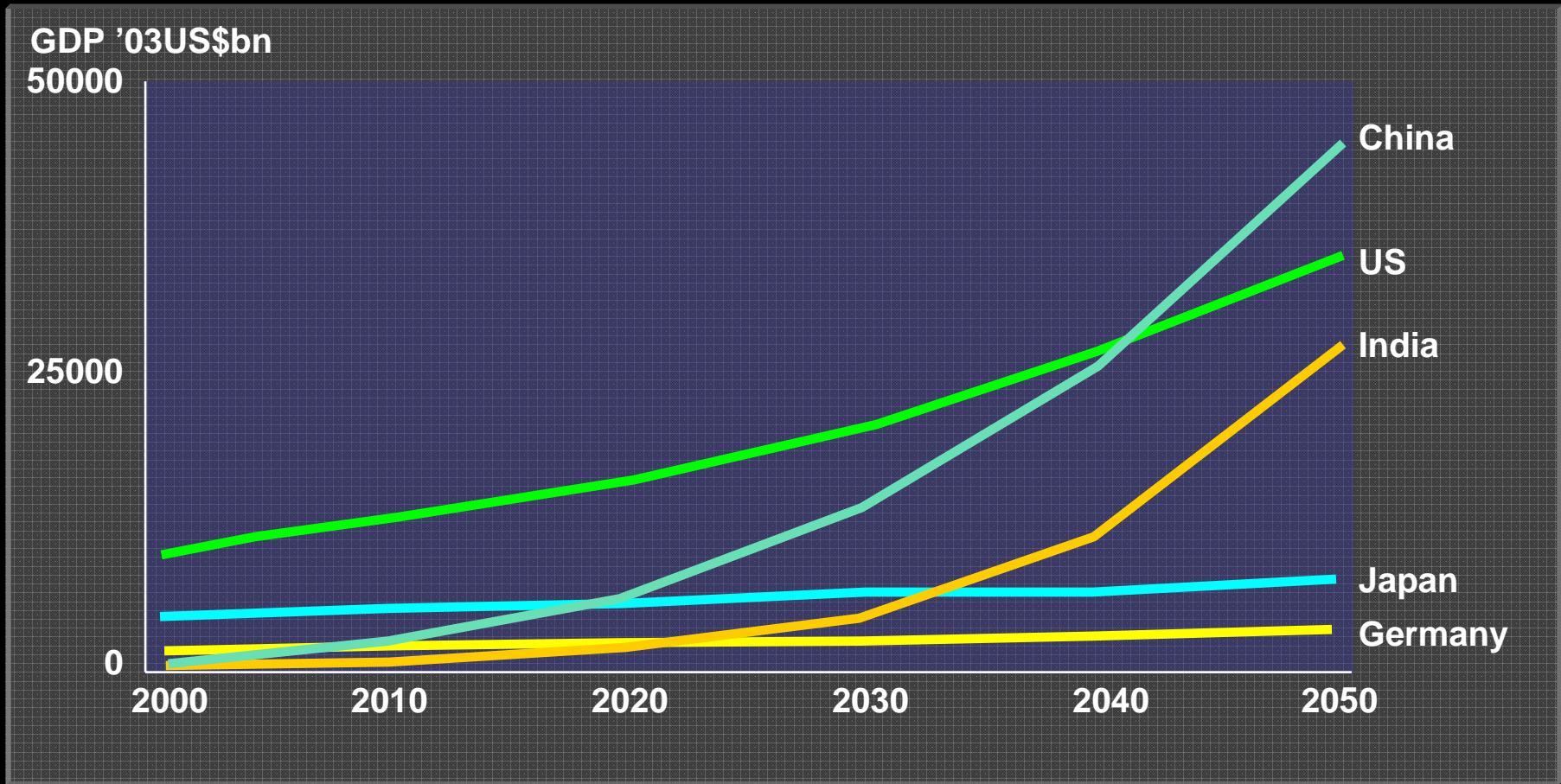
# U.S. Employment Percentages by Sector



Estimations based on Porat, M. (1977) Info Economy: Definitions and Measurement, Augmented with recent data and projections from <http://www.bls.gov/>



# A Changing World And a Growing Opportunity



Source: Goldman Sachs, Report 99



# Aspects of Services

Intention

Business & Social

Measures,  
Goals,  
Incentives

Management

Management & Control

SLAs, Non-Func'l Attributes  
(Security, Performance,...)

Behavior

Implementation & Execution

Functional definition  
Semantics



# Business Service - Examples

- **Customer Management**  
call centers -> market management
- **Surgery**  
local -> tourist -> remote consultation -> tele?
- **Procurement (purchasing)**
- **Human Resources (HR) operations**  
Pension management + Payroll recording + Skills recording  
+ ...  
Holistic staff management
- **Supply chain management**
- **Financial engineering simulation & decision**
- **Information Technology project management**



# Major Changes in Services

- Increasingly information-based
- Increasingly independent of location
  - ❖ NETWORKING
- Increasingly formalized (or describable formally)
- Traditionally direct human involvement, no longer true
- Increasingly automatable and most aspects performed by Information Technology
- Increasingly modularized, divisible, reconfigurable
  - ❖ (Coase's theorem etc.)
- Increasingly Modelable and Composable (services made up of services)
  
- Value webs cross internal and external boundaries of the firm, of the national, of the region
- Granularity spectrum – small and medium companies participate heavily, large suppliers and buyers can shape
- Reconfiguring services in effect creates new business structures, blurs business models
- Shifts are worldwide; transformation rates differ by geography



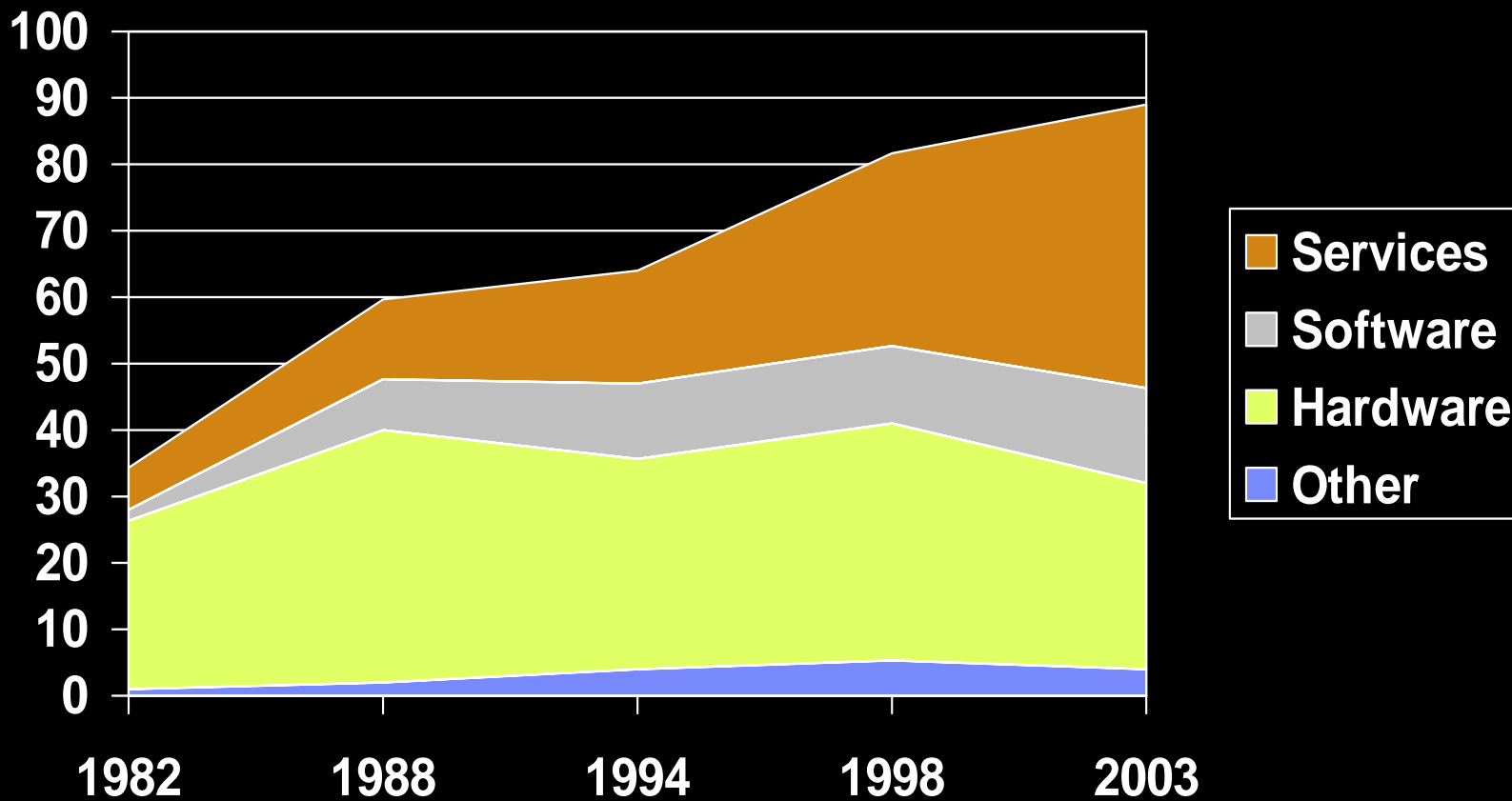
# SSME – Services Sciences, Management & Engineering

- **SSME = application of scientific, management and engineering disciplines to services**
- Services have their own properties and challenges, demanding different approaches to management and engineering, built on particular intellectual bases
- It is time (or late) to focus on these challenges, but they ought to dominate the engineering and management curricula as services represent the bulk of the future global economy.
- The greatest opportunities result from the increasing connection between information technologies and the creation and delivery of services.
- Considerable interest and initial activity in universities



# IBM's Revenue Profile

\$Billion





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# VALUE CREATION



# Value Capture

- **Value created ~ price – cost + externalities**
  - ❖ Multifactor productivity: labor + capital + technology
- **As we capture and subjugate many details into software, value remains in the parts that require human relationships or involve experience and judgment rather than rigorous analysis.**
- **Large value extracted by**
  - ❖ Being early, keeping ahead
  - ❖ Efficiency of scale and community
  - ❖ Unique resources, knowledge, competence
  - ❖ Controlling through rules and law (IP, privacy, standards, regulations)
  - ❖ Controlling through politics and culture (tariffs, buy American, subsidies)

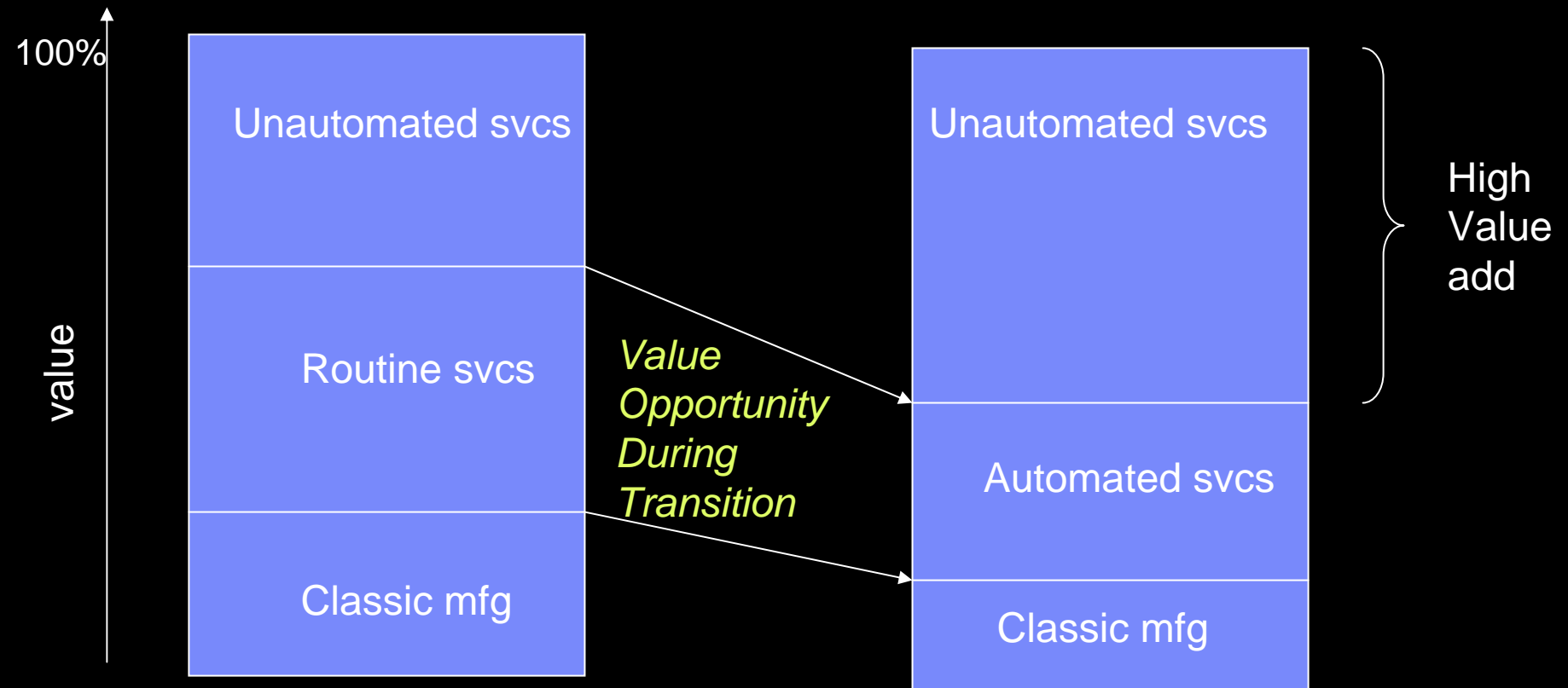


# Where is the Value Added?

- **To the extent that a process can be formalized,**
  - ❖ It can be analyzed and probably optimized
    - And commoditized. outsourced, exported
- **What prevents commoditization?**
  - ❖ Legal or cultural barriers
  - ❖ Physical world constraints (e.g., need for quick delivery of bulky products)
  - ❖ Resource constraints (human capital, finance)
  - ❖ Transaction costs (search, trust, information, startup)
  - ❖ **Significant tacit, uncodified, or incomplete knowledge**
  - ❖ **New and irreplaceable abilities**
- **What justifies higher value and**
  - ❖ Specialized abilities, situational relevance, niche knowledge
  - ❖ Efficiency
  - ❖ Unique capabilities (bottlenecks, control points, etc.)
  - ❖ **Running rapidly uphill (staying ahead of the automation frontier)**
  - ❖ **Innovation (new solutions to old problems, early solutions to new problems)**
- **How to position for success?**



# Automation of Work





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# BUSINESS PROCESS AND ACTIVITIES



# Models and Analysis

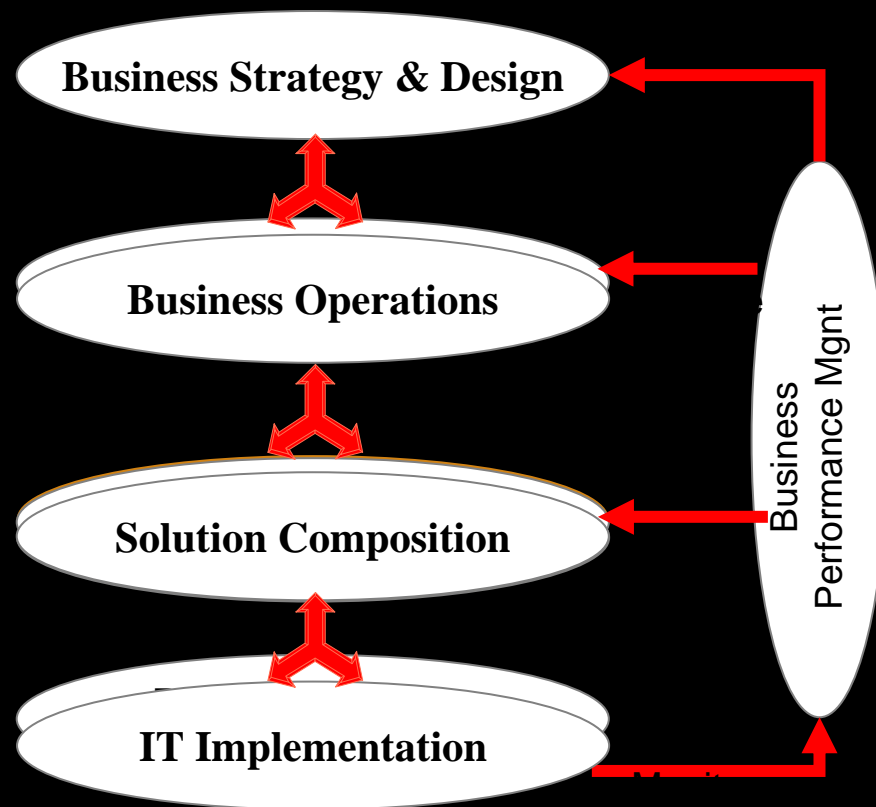
- **Key area of progress is formal modeling of organizations, processes, activities**
- **Different models for different levels (strategic intent vs detailed execution)**
- **Information can be presented graphically, but is represented using languages**
  - ❖ **these can be analyzed, optimized, simulated**
  - ❖ **State of real world system can be compared with model, permitting better control and higher level improvement cycles**



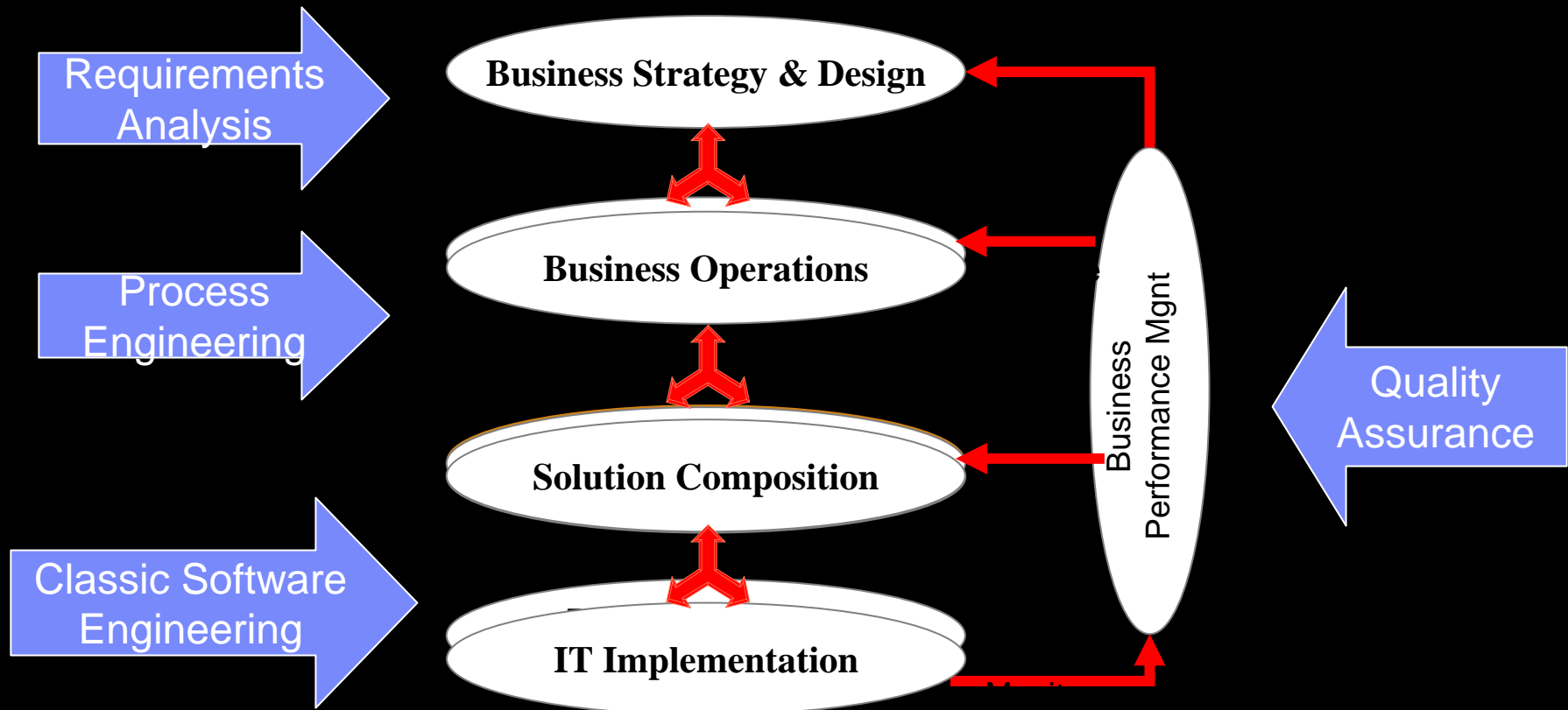
# Business Processes ~ Computational Services

- **Processes have well defined interfaces and behaviors**
  - ❖ Even though they are (usually) performed by people
  - ❖ Contractual and customary expectations of cost, quality, reliability
  - ❖ Can be internal or external to an organization
- **Services have well defined computational interfaces, inputs, and outputs**
  - ❖ Service Level Agreements can define performance, quality, cost/penalty
  - ❖ Can be built out of other services
- **Convergent modeling**
  - ❖ We use UML for both
- **Partially automated translation**
  - ❖ Natural mapping between defined process and IT realization, supported by tools
  - ❖ Optimization, Simulation

# Analyzing & Managing a Business



# Analyzing & Managing a Business

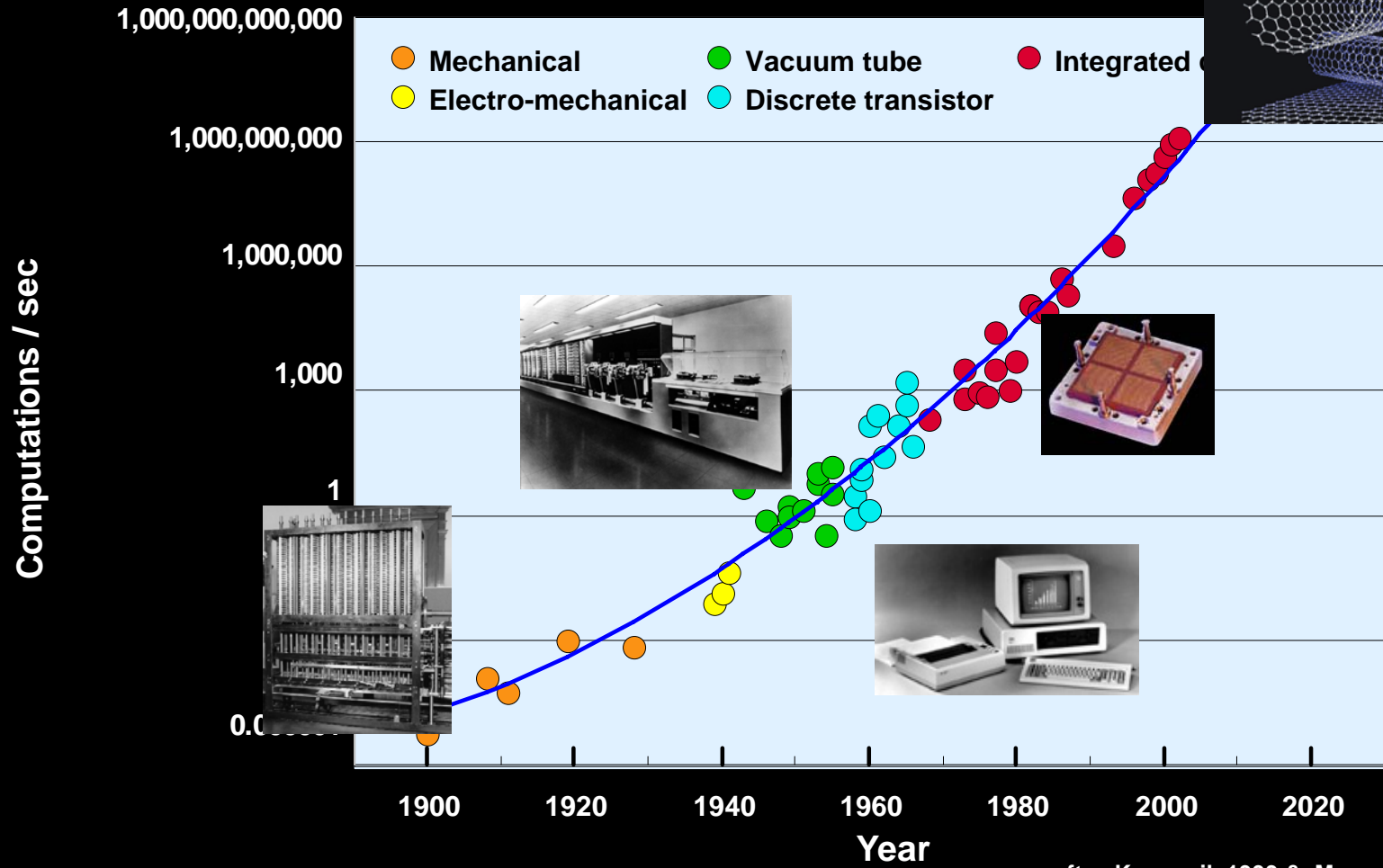




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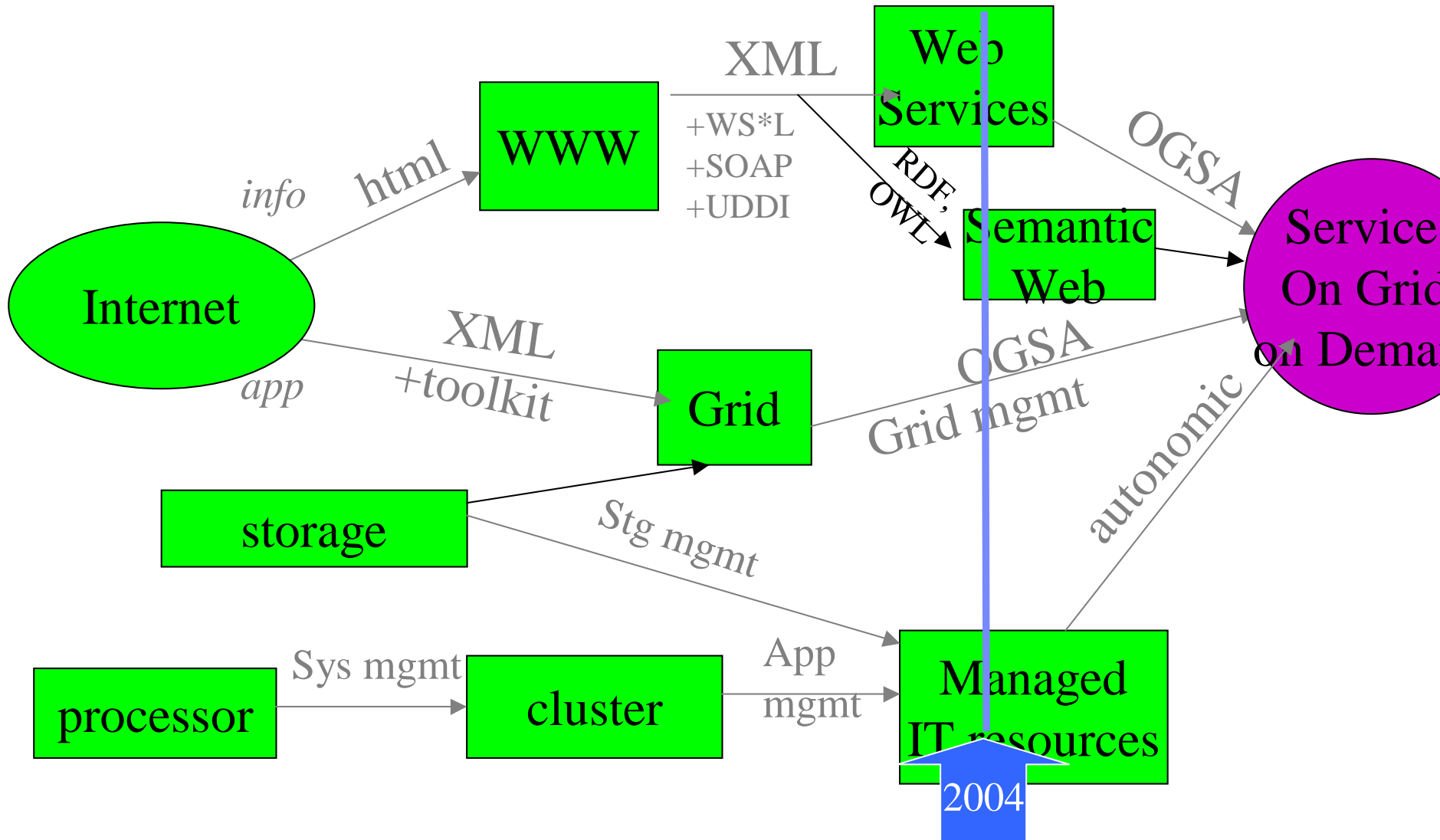
# IT-ENABLED AND IT-DOMINATED SERVICES

# \$1000 Buys



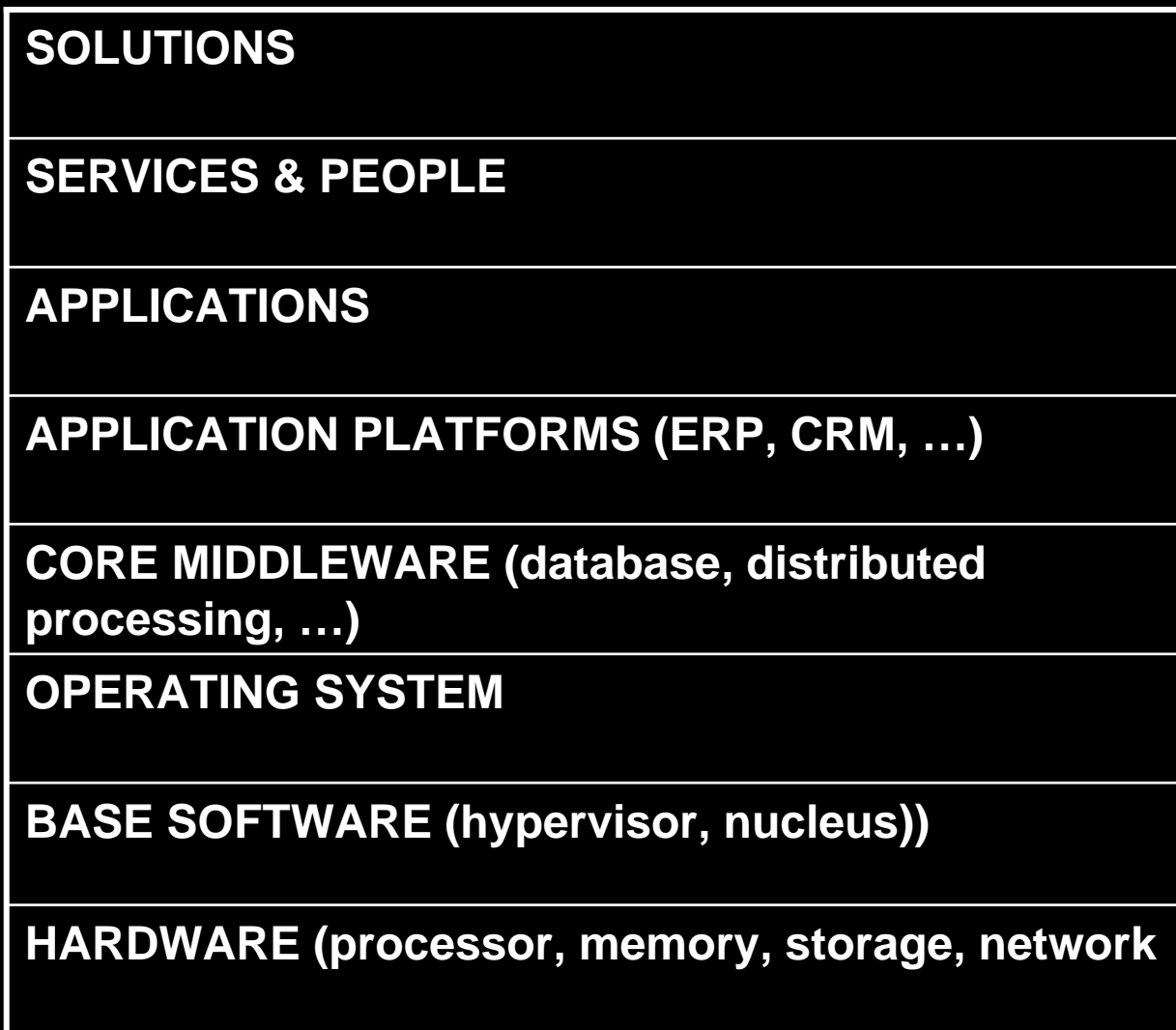
after Kurzweil, 1999 & Moravec, 1998

# Evolution and Convergence of Technologies





# A Simplified Stack



**Security**

**System management**

**Tools**



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# BOUNDARY CONDITIONS



# Boundaries

- **Enterprises**
  - ❖ **Budget, culture, Coase**
- **Nations**
  - ❖ **Regulation, investment, resource constraints**
- **Continents**
  - ❖ **Transport and network costs**
- **Disciplines**
  - ❖ **Economics, politics, computing, management, ...**
- **Cultures**

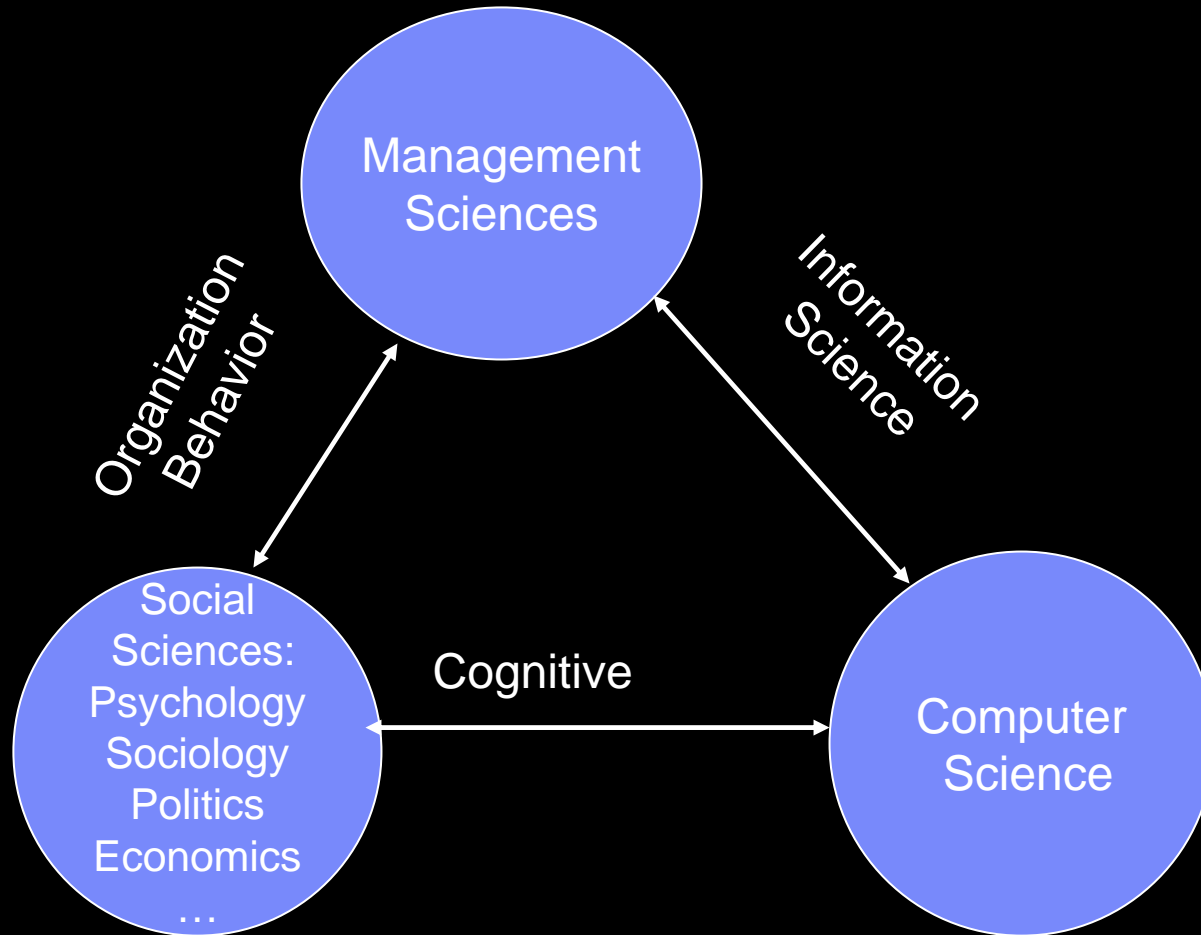


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# INNOVATION



# Research Fields





# Some Ripe Areas for Innovation

- **Role of people in these models**
  - ❖ Models that combine formal processes and ad hoc human nature
  - ❖ Not just as resources and units of production and cost
  - ❖ Valued extrinsically (judgment, intuition, complex knowledge)
  - ❖ Valued intrinsically (society and economy exist for people)
- **Role of knowledge**
  - ❖ Capture and formalization
  - ❖ Ontologies, frameworks, information bases and knowledge sets
  - ❖ But this is hard
  - ❖ Tacit vs explicit knowledge, importance of context and framing
  - ❖ What remains has irreplaceable value
- **Unpredictability**
  - ❖ What aspects are currently hard to predict, which are fundamentally unpredictable?
  - ❖ Stochastic modeling
  - ❖ Chaos or similar



# Innovation Opportunities: Information & Management Sciences

- **Business Strategy Analysis and Modeling**
  - ❖ Understanding the components of a business and its environment, modeling most salient attributes and ways the organization behaves
  - ❖ Modeling, simulating, visualizing the behavior of the value web (supply chain on steroids)
  - ❖ Component Business Models
- **Business Process Modeling and Transformation**
  - ❖ New approaches to modeling business processes – formalized models and tools
  - ❖ Using those models to analyze and then improve techniques
  - ❖ Tools for transforming those methods to corresponding IT implementations, based strongly on Service Oriented Architectures
- **Business Performance Monitoring**
  - ❖ Based on those models, implement multiple feedback loops – at business, operational, and execution levels



# Innovation Opportunities: Information & Management Sciences

- **Use of Analytics & Optimization**
  - ❖ Rapid progress due to new computing resources, better algorithms, and direct connection to customer needs
  - ❖ Apply to
    - ❖ processes
    - ❖ people
    - ❖ scheduling
    - ❖ inventory
  - ❖ Scope: within a firm, across a value web
- **Collaboration: Supporting People at Work**
  - ❖ Social networking analysis
  - ❖ Support for informal but essential business activities – the ways knowledge workers function in a business environment



# Examples: Application to Classic Management Disciplines

- **Accounting**
  - ❖ Value of processes, knowledge
  - ❖ Dominant importance of people, organization, and culture
- **Information Systems**
- **Management**
  - ❖ Risk management
  - ❖ Etc. etc.
- **Operations and Supply Chain**
  - ❖ Running services
  - ❖ Reaching of the entire value web
  - ❖ Implications of decision speed and execution risks
- **Organization**
  - ❖ What changes to structure due to tempo, digitization, information intensity
  - ❖ Differing future roles of CEO/CMO and COO/CIO (etc.)
  - ❖ Internationalization, re-sourcing
- **Strategy**
  - ❖ IT investment choices
  - ❖ Business Process opportunities
  - ❖ Redefining the landscape



# Curriculum Lag

- **Reality:**
  - ❖ most students will work in service industries
  - ❖ Most will work in leadership and/or collaborative roles
  - ❖ Much of work will be unstructured
- **Training**
  - ❖ Focus on physical objects or individual persons
    - Physical and biological sciences
    - Engineering
    - Medicine, etc.
  - ❖ Solo learning and course exercises and examinations in structured environment
- **Much of education system is out of sync with future experiences and needs**
  - ❖ Need for change in modality and content
  - ❖ Opportunity to educate for change and innovation without downgrading to training



# Knowledge and Service Bases of Growth and Wealth

- **Growth areas are information-based**
  - ❖ Bioinformatics
  - ❖ Evidence-based medicine
  - ❖ Nanotechnology
  - ❖ ICT
- **Services (growing as % of economic value worldwide, >70% in US, EU).**
  - ❖ Physical contact (plumbing, hairdresser, hamburgers)
  - ❖ Relationship (doctor, politician, financial advisor)
  - ❖ Knowledge-based (programming, IT outsourcing)
  - ❖ Automated (grid-carried web services; service-oriented architectures, etc.)
- **Efficiency growth comes from**
  - ❖ Learning curve, scale
  - ❖ Process understanding and optimization
  - ❖ Use of information technology, and benefiting from rapid improvements