Systems Approaches to Information Systems

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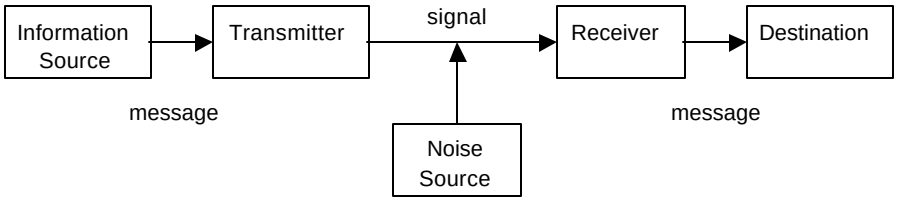
Introductory Definitions

- Data – unstructured or raw facts
- Information – data processed to make it useful in decision making
- Communication - to transmit information, by speech, writing, signal, …

from Information, Systems and Information Systems, by Checkland and Holwell

Mathematical Theory of Communications

- Developed by Claude Shannon, 1949



Source – Develops information in form of message
Transmitter – Encodes message, into a signal, a format acceptable to communication channel
Channel – Path by which message is transferred from Source to Destination
e.g. telephone wire, fiber optics, air (sound wave)
Receiver – Accepts signal from transmitter and decodes it into back into message
Destination – Accepts message from transmitter

- concept used to create and optimize most modern information systems
  bandwidth, relays, transmitting and receiving, processing

Definitions of Information Technology (IT) and Information Systems (IS)

- Information Technology - focused mainly on computer hardware and communication equipment and the transfer of information between them
  - Interested in microelectronics, software, telecommunications
- Information Systems – intersection of aspects of information technology and social & behavioral sciences

Two Methods for Handling

- Hard Systems Approach –
  - adoption of Herbert Simon's management ideas to IS field
    - scientific approach to management of system, *The New Science of Management Decision, 1960*
    - founded on goal seeking nature of organizations, control theory, systems engineering, …

- Soft Systems Methodology (SSM) –
  - learning organization approach championed by G. Vickers
  - implementation and management of information system exhibits adaptive behavior

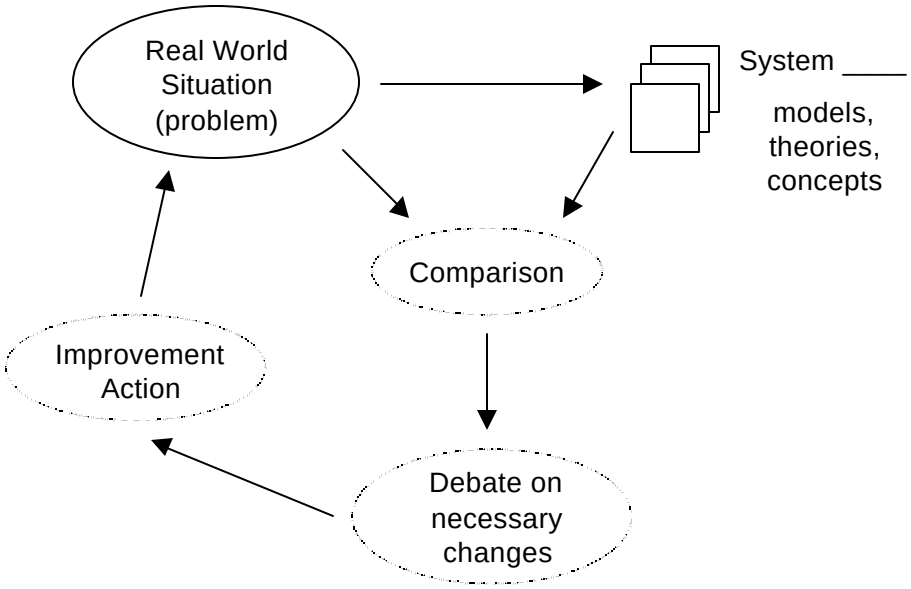
Hard Systems Approach

- Problem Definition
- Data Collection / Gap Assessment (information is received from the IS in this stage)
- Creating Alternative System Solutions
- Assessing Possible Outcomes
- Selecting System Solution
- Implementing System Solution (information for change may be released to IS at this stage)
- Monitoring System

reductionist by design

"Each problem generates sub-problems, until we find a sub-problem that we can solve. We proceed until, by successive solution of such sub-problems, we eventually achieve, our goal – or give up." Simon, 1960

Soft Systems Methodology



Difference Between Hard and Soft Approaches

Hard Systems Approach	*Soft Systems Methodology*
- social entities achieving goals	-social entities managing relationships
- information system aids pursuit of goals	- information system helps interpret world, helps to manage relationship
- assumes a systemic world	- assumes a process of inquiry will shed light on a world that is capable of systemic organization
- research focused on hypothesis investigation	- research focused on the pursuit of insight and understanding
- quantitative when possible	- more qualitative

(presenter and class expressed reservations on some of the comparisons made by this table from, Information, Systems and Information Systems, by Checkland and Holwell)

Examples Information System Development

- Hard Systems Approach
  - Design of corporate / public Information Systems
    - telephone networks, radio broadcasting, cable TV , corporate networks
  - Design of traditional control systems
    - chemical plants, utilities, …
  - Wiring systems in product design
    - electronics, computers, automobiles, …
- Soft System Methodology
  - Development of corporate Intranet Systems
  - Implementation of lean production systems
  - Evolution of communication technologies

Example of Information Systems for Electric Utilities

- Prior to 1920
  - Electric utilities were run locally
  - Information/Control system controlled single plants
- 1920 -1990
  - Electric utilities organized into grids (networks)
  - Necessitated broader control, centralized command center for optimization of many plants as whole system
    -broader system level optimization, during periods of low load, efficient plants stay open , least efficient plants are cycled down
  - Introduction of new techniques to help balance loads all which require control and monitoring (information systems to operate)
    - local shut down of customer air conditioning during periods of high load, for lower rates

    - use of storage of power during periods of low load, water pump storage
    - shut down manufacturing facilities during high load periods, in return for lower rates
- 1990 –
  - Deregulation of utilities, new small entrants
    - Again monitoring and control systems to monitor who's electricity is whose,
    - Utilities forced to share transmission capability
  - Integration of large networks, sharing of transmission
    - Utilities can sell power to customers 1000s of miles away, requires monitoring and control
  - creation of emergent behaviors challenges traditional control
    - flow of power in path clockwise around lake Erie between utility networks
    - problem Ohio power companies at times get electricity for free due to flow and trading
    - considering solution of phase offset to force power flow in counter clockwise path

Future Challenges for IS

- Introduction of new models of communication
  - independent agent models can better optimize flow of information on internet
  - similar to traffic flow in transportation systems
- Impact of rapid evolution information technology
  - research/model development much slower than changes in technology
- Challenges emergent behavior of information systems
  - Deregulation of communications and utilities
  - intellectual property concerns on the internet
  - old economy vs. new economy business models