Business Information Systems I

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Abstract

This course offers a methodology to align IT design decisions with business goals. It introduces the concept of IT architecture, classifies key IT design choices, and examines how these choices impact IT architecture from both a software and infrastructure perspective. The course explores IT architecture within the manufacturing, utilities, and financial services sectors, focusing on both internal and external organizational processes along the industry value chain (e-business). It also equips students with the tools to analyze organizational requirements, with a particular emphasis on executive information systems, including the use of Key Performance Indicators.

Building on the concept of IT architecture, the course outlines a functional map of Enterprise Resource Planning systems, distinguishing between core and extended functionalities. It traces the evolution of information systems over time and highlights how ERPs have emerged through an ongoing process of functional integration. The course begins with a review of organizational theory from an information perspective, providing a framework to understand the organizational changes driven by ERP implementations. It then delves into the core functional areas of ERP systems, such as accounting and finance, operations, and management and control. The course will feature lectures and case study discussions to reinforce these concepts.

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CHAPTER 1

Introduction

1.1 Definitions

Definition (*Technology*)**.** A technology represents a process that a given organization can perform, together with all the resources needed to perform the process.

Definition (*Techincal system*)**.** A technical system represents a set of machines supporting a given technology.

Definition (*Information system*)**.** An information system is a set of coordinated processes producing an information output and executing information processing activities.

Definition (*Information technology architecture*)**.** An information system is a technology, an IT architecture is a techncial system supporting a given information system.

For a long time, there has been an ongoing debate about how technical innovation influences organizations. A well-established set of beliefs links technological advancements to organizational change, shaping how companies adapt and evolve:

1. *Efficiency over effectiveness*: technological innovation primarily enhances efficiency rather than improving overall effectiveness. It streamlines processes but doesn't necessarily guarantee better decision-making or outcomes.

2. *Economies of scale*: as technology advances, businesses can scale operations more efficiently, reducing costs per unit as production increases.

3. *Larger optimal size*: the minimum viable size of an organization tends to grow with technological progress, as larger entities can better leverage new systems.

4. *Increased specialization*: automation and sophisticated systems often lead to a workforce that is more specialized, with employees focusing on narrower, highly technical roles.

5. *Tayloristic perspective*: the traditional view, inspired by Taylorism, assumes that an optimal organizational structure exists.

6. *Limited focus on group work*: early studies largely ignored the impact of technology on teamwork and collaboration, focusing instead on individual efficiency.

7. *Greater bureaucracy and formalization*: as technical systems evolve, so do organizational rules, procedures, and levels of bureaucracy, making work more structured but also more rigid.

8. *More complex management*: with increased technology comes greater managerial complexity, requiring leaders to navigate intricate systems, regulations, and workflows.

1.1.1 Information processing

Emerging in the 1960s and 1970s, the information processing perspective transformed how organizations viewed technology. As IT became widespread within businesses, it led to a fundamental shift in traditional beliefs about the impact of technical innovation. Key changes included:

- A radical shift in management principles, as technology was no longer just a tool for efficiency but a driver of decision-making and strategy.

- Unlike earlier views, IT wasn't just about automation (it processed information, the most critical resource for managerial processes). Since managerial processes shape decision, it processed information, the most critical resource for managerial processes.

- This shift created both virtuous and vicious cycles: when information systems were well-integrated, they improved decision-making, coordination, and adaptability. However, poor implementation or information overload could lead to inefficiencies, miscommunication, and bureaucratic bottlenecks.

As organizations embraced IT and information processing became central to management, three major theoretical approaches emerged: decision theory, transaction cost economics, and agency theory.

1.2 Decision theory

Galbraith's Decision Theory (1973-1977) is based on the idea that organizations function as open systems, constantly interacting with their environment. A key challenge they face is uncertainty, which defines the conditions in which they operate and reflects their ability to predict market demand. Several factors contribute to uncertainty, including market dynamism, the number of suppliers, variations in market requirements, and the level of innovation.

1.2.1 Bounded rationality

Bounded rationality refers to the cognitive limitations of individuals in processing information. Since no single person can handle all the necessary data for decision-making, cooperation becomes essential. Through cooperation, individuals and organizational units develop specialized roles, which, in turn, create interdependencies in information flow. To function effectively, organizations must manage these interdependencies, as coordination is crucial for overcoming individual cognitive constraints. This need for coordination is the fundamental reason organizations exist. Information technology plays a vital role in this process, serving as a tool for organizing and managing information beyond individual capabilities.

1.2.2 Hierarchy

Hierarchy is a coordination mechanism based on command and control, where decision-making authority is centralized rather than delegated. It forms the foundation of many companies and institutions, ensuring the structured flow of information within an organization. To manage uncertainty effectively, hierarchies rely on two main types of information systems: vertical and horizontal.

Vertical information systems Vertical systems manage the flow of information along hierarchical lines, reinforcing structured decision-making. However, they have limitations when dealing with environmental uncertainty. As uncertainty increases, exceptions arise, creating the need for more planning and control mechanisms. These exceptions lead to additional information processing demands, often requiring information to flow upward toward higher hierarchical levels for resolution.

Horizontal systems In contrast, horizontal (or lateral) information systems facilitate direct communication between units at the same hierarchical level. These systems improve coordination by enabling decision-making at lower levels, reducing the reliance on top-down control. With a higher degree of delegation, horizontal systems enhance flexibility and responsiveness in dynamic environments.

1.2.3 Summary

Organizations can address environmental uncertainty in two main ways:

1. They can increase their information processing capacity by implementing vertical and horizontal information systems.

2. They can increase slack resources, such as maintaining warehouses or creating independent organizational units based on the divide et impera (divide and rule) approach, as seen in divisional structures.

However, the decision theory framework has its limitations. It assumes that hierarchies are the only coordination mechanism, overlooking market-based coordination as a viable alternative when hierarchies become inefficient. Additionally, it considers environmental uncertainty as the primary challenge, ignoring behavioral uncertainty caused by opportunistic individual behavior, which can also undermine hierarchical effectiveness. Transaction cost economics seeks to address these shortcomings by providing a broader perspective on coordination and uncertainty management.

1.3 Transaction cost economics

Williamson (1975) introduced the concept of transaction cost economics, which examines the costs associated with coordinating economic exchanges. In its simplest form, a transaction occurs when a customer receives a product or service from a supplier in exchange for payment. Transactions represent one of the oldest and most fundamental ways for individuals and organizations to cooperate, as they enable objectives that go beyond individual or organizational rationality.

A key function of transactions is to reduce behavioral uncertainty by mitigating opportunism. In market systems, individuals produce goods and services for themselves and maximize the benefits of their own efficiency. However, achieving coordination often requires executing transactions, which come with an associated transaction cost.

The total cost of a coordination mechanism is the sum of production costs and transaction costs. Market systems tend to have low production costs because individuals and firms operate efficiently. However, transaction costs remain low only under conditions of perfect competition, where market frictions such as information asymmetry, bargaining difficulties, and enforcement issues are minimized.