



Journal of Applied Sciences

ISSN 1812-5654

science
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Toward an IT-driven Organizational Structure Design Model

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Abstract: Information and Communication Technologies (ICT) have generally been adopted and applied in organizations. Furthermore, they deeply affect not only organizational operations but also industrial integration/cooperation. Considering the influence of ICT on organizational/inter-organizational structures helps to present a more detailed picture of future organizational or inter-organizational development. Frameworks and models of structural design by Mintzberg, Malone, Yates and Benjamin, Barrett and Konsynski and Lucas and Baroudi were selected and discussed in this study. In addition, this research incorporates studies on the influence of ICT on organizational structure by Rockart and Short, Palmer, Lipnack and Stamps and Shih. Through the in-depth use of ICT, the ultimate virtualization may lead to a new form of organizational structure. This study proposes a flexible synapse network in an organization and an inter-organization value network that incorporates not only conventional organizational design parameters but also ICT-driven innovations. This structure is characterized by a side-by-side coordination relationship between organizational functions, the blurring of boundaries and partnerships with other organizations through agents.

Key words: Organizational structure, organizational design, IT-driven

INTRODUCTION

The purpose of organization is to exercise enterprise activities efficiently and effectively and to achieve organizational vision. Analyzing an organization from its structural design provides rich information about its culture and business operations, moreover, it generates concrete insights into organizational change. Mintzberg (1979) analyzed four types of contingency factors—the organization itself and its members, the distribution of power, the environment and the technical system—that affect the organizational design of positions, superstructure, lateral linkages and decision-making systems. “Fitting design to the situation” results in five configurations of organization structures, i.e., a simple structure, a machine bureaucracy, a professional bureaucracy, a divisionalized form and an adhocracy (Mintzberg, 1979, 1980; Lam, 2004). Mintzberg's organization design framework presents relevant parameters and scope that determine an organization's structure. Since the presentation of this framework, there has been little variation in the types of organization structure. This stabilization may be attributed to a stable environment; in other words, the concepts and

technologies that people relied on in operating organizations has not fundamentally changed. However, the influence of the development of ICT extends into daily operations through inheriting and disseminating ideologies by adoptions of ICT (Lee and Sawyer, 2002).

Postmodern organizations are small in size, have little complexity and adopt a flexible structure. Furthermore, frequent communication and cooperation between units enables these organizations to cope with swift internal and external changes (Bergquist, 1993; Drucker, 1977). In addition to inner efficiency, modern organization theories also emphasize market efficiency (Malone *et al.*, 1987; Whinston, *et al.*, 1997). A flexible structure and market efficiency are facilitated by the proper use of ICT. Leavitt and Whistler (1958) predicted that information technology would have the greatest impact on middle and top management; Orlikowski (1992) mentioned the duality of IT, where business strategy determines the adoption of IT and, vice versa, the application of IT influences the organizational structure. Keen (1991) stated that a mature IT capability enables intra and inter-organizational connectivity, thus, increasing the degree of freedom in business. The increasingly relevant role of ICT is evident in new designs of organization structure.

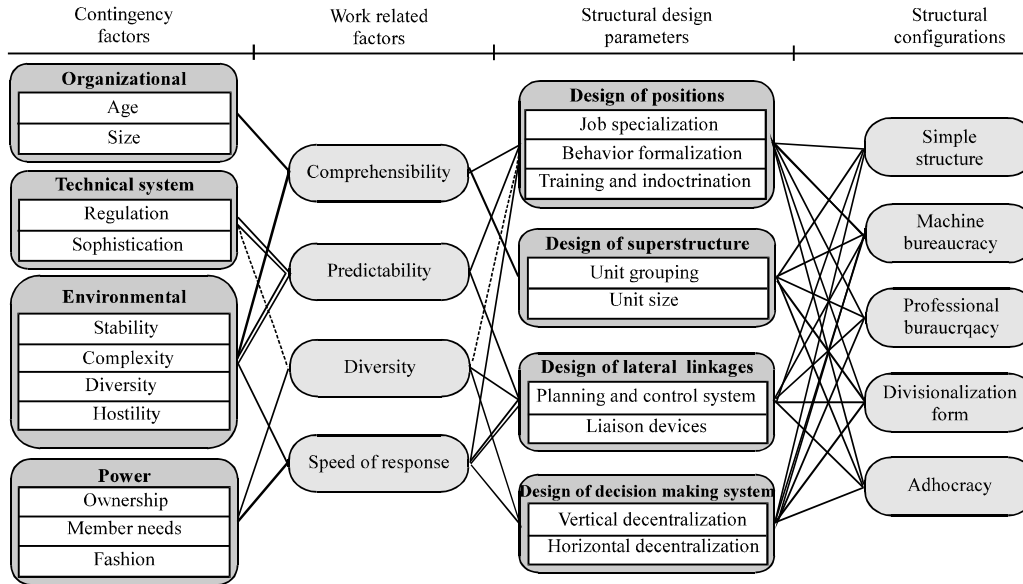


Fig. 1: Basic organization design model (adapted from Mintzberg, 1979)

MATERIALS AND METHODS

In a literature review, a researcher collects existing data and records and objectively analyzes and evaluates the data. Based on the data, a researcher is able to summarize and rebuild the development of a social phenomenon, thereby becoming able to predict future developments (Babbie, 2004).

Literature review and dialects were used in this research to show the course of change and development of organizational structures, particularly alongside the development of information and communication technologies. Through a dialectic process, describing the interaction and resolution between multiple paradigms or ideologies, this study was able to merge point and counterpoint into a compromise or synthesis.

The study collects various frameworks and models of organization structure and integrates the essence in every framework through dialectical discussion. This integration induces the restructuring of intra- and inter-organizational relationships and demonstrates new considerations in organization structure design. The consideration of new variables results in a virtual model of future organizational structures.

ANALYSIS AND DISCUSSION

Malone *et al.* (1987) proposed an analytical framework illustrating the historical change in market structure from hierarchies to markets. Although, ICT evidently decrease coordination costs, organizations will rationally choose to coordinate workflows using supply and demand forces through external transactions rather

than through controlling and directing these workflows through managerial hierarchy. Malone *et al.* (1987)’s framework steered the trend of organizational transition; however, this framework lacked comprehensive explications of various inter-organization relationships and resulting changes in intra-organizational coordinating mechanisms.

Cross boundary inter-organizational information sharing:

First, the development of network technologies not only decreased coordination costs between enterprises but also blurred organizational boundaries by connecting them through Information Sharing Systems (IOS) (Byrd and Turner, 2001; Dreyfus and Iyer, 2006). Barrett and Konsynski (1982) defined five levels of participation for firms in an IOS: Remote I/O Node, application processing node, multi-participant exchange node, network control node and integrating network node (Table 1). Participation levels rise with increases in participant responsibility, cost commitment and complexity of the operating environment. At the level of the integrating network node, the participants establish transparent application linkages and integrate other participants and applications in real time.

Barrett and Konsynski’s framework provides feasible coordination modes facilitated by ICT, which enable easy communication between firms. The relationship between organizations actually surpasses simple commercial transactions in electronic markets; business units will integrate with outer partners in the value chain through this type of relationship (Bakos and Brynjolfsson, 1993; Malone, 1987).

Table 1: Five levels of participation in IOS (Barrett and Konsynski, 1982)

<ul style="list-style-type: none"> • Level 1: Remote I/O node: Participants have the simplest and least costly role, i.e., data input and output, in an IOS. Travel agencies are playing the remote I/O node role in their IOS with American Airlines. Low or limited cost does not suggest that the IOS is easy to engage, as the use of a terminal may cause a major change in internal procedures • Level 2: Application processing node: A Level 2 participant develops and shares a single IOS application such as an order processing system. This participant is responsible for the design, development and maintenance of the application. Operating system complexity is determined by the degree of integration between incoming queries or transactions and the participant's internal system. Costs are usually dependent up on the scope of the application offered • Level 3: Multi-participant exchange node: Participant develops and shares a network interlinking itself with any number of lower-level participants with whom it has an established business relationship. Peer information exchange nodes in IOS all belong to level 3. The responsibility, cost and complexity are significantly increased compared to level 2 • Level 4: Network control node: Level 4 participant plays the control role, and support multiple, diverse applications. This participant has complete responsibility for network maintenance and development. The participant may offer IOS for a profit and consequently is highly vulnerable to competition from other firms offering similar networking services • Level 5: Integrating network node: This participant is best defined as a data communication/data processing utility that integrates any number of lower-level participants and applications in real time. The participant shares an infrastructure with lower-level participants. Therefore, a level 5 participant faces significant problems related to security and responsibility
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Table 2: Conventional and IT design variables (adapted from Lucas and Baroudi, 1994/Mintzberg, 1980)

Class of variable	Conventional design variables	ICT design variable
Structural	Definition of organizational subunits Determining purpose, output of subunits Reporting mechanism Linking mechanisms Control mechanisms	Virtual components Electronic linking
Work Process	Staffing Tasks Workflows Dependencies Output of process Buffers	Technological leveling Production automation Electronic work flows
Communications	Formal channels Informal communication/collaboration	Virtual components Electronic communications Technological matrixing
Inter-organizational relations	Make vs. buy decision Exchange of materials Communication mechanisms	Electronic customer/supplierrelationships Electronic customer/supplierrelationships Electronic linking

Intra-organizational coordination: Malone *et al.* (1987) framework presents communication changes between firms and trends in market mechanisms. In fact, an organization's adoption of ICT will influence not only other organizations in the value chain but also the processes and coordinating mechanisms within the organization. By decreasing coordination costs, ICT overcome the limits of hierarchical structure and makes non-hierarchical structures practical (Malone and Rockart, 1991).

ICT brings new design variables into the organizational structure that are based on the independence of time and space, real-time responses and broad distributions of ICT. Lucas and Baroudi (1993) considered three classes of ICT variables and compared them with conventional organization designs (Table 2).

Therefore, virtual components, production automation, electronic workflow, electronic communication, technical matrixing and electronic customer/supplier relationships are all taken into the framework of organization structure design. Accordingly, four types of organizational structure, i.e., Virtual Organization, Negotiated Organization, Traditional

Organization and Vertical Integration Conglomerates, emerged (Lucas and Baroudi, 1993). Among them:

- Traditional organizations use ICT to improve business process efficiency but not reform organizational structures
- Virtual organizations use ICT as communication and negotiation tools, making operations and processes more flexible. Examples of such organizations are virtual teams (Lipnack and Stamps, 2008), virtual offices (Hoffmann *et al.*, 2004) and cybernetic corporations (Martin, 1996)
- Negotiated organization is a lateral alliance in an industry. ICT addresses quality and maintenance difficulties and makes this strategic organization workable. The use of an information infrastructure among allied organizations helps to achieve sur/petition in the markets (De Bono, 2003)
- Vertical Integration conglomerates use Business-to-Business (B2B) and Business-to-Customer (B2C) connections using ICT. The integration influences internal operation and controls and yields new co-opetition models. Under the e-business roadmap,

cross-department information systems are built for daily operations to meet objectives related to efficiency and electronic commerce markets (Kalakota and Robinson, 2000)

Based on these discussions, this study proposes an IT-driven organizational structure depicting new intra and inter-organizational relationships.

IT-driven organizational structural model: This research is based upon Mintzberg (1979, 1980) structure, considering not only conventional parameter-based organizational design variables but also Lucas and Baroudi's (1994) ICT-driven variables. Using a reasonable design structure, integrating the concept of contingency and considering design variables that are sufficiently complete, this research offers a brilliant configuration of future organization. ICT are taking communications and negotiations beyond time and space limitations and facilitating a virtual organization structure. In the future, virtualization will make wider and more flexible operation modes available to organizations. Its characteristics include.

In-depth usage of ICT: ICT is used to provide various and flexible operation and decision models. Networked organizations use ICT to share goals, knowledge, tasks, decisions, responsibility, recognition, performance and priority (Rockart and Short, 1991).

Flexible supply systems: A virtual organization is a temporal supply network that is integrated to respond to market opportunities. Organization members share skills, costs and distribution channels and form a competitive group (Palmer, 1996).

This flexibility is also evident in virtual teams. The team is organized like a “pizza”, which treats hierarchies, bureaucracies, networks and teams as components (Fig. 3). Components communicate laterally, but not vertically; therefore, there will be no command lines, but groups will be interconnected by the organizational mission (Lipnack and Stamps, 1997).

Blurring organizational boundaries: ICT re-constructs organizational boundaries (Rockart and Short, 1991). When an organization is able to obtain resources and services from outer partners easily, directly and in a real-time manner, these partners form a cooperative system that mimics a larger organization. Boundaries are not strictly defined when IOS helps to exchange information and link business processes.

Networked protocols and net-brokers: Networked organizations use an organization protocol to integrate communications and interactions between business units (Shih, 2000). This type of organization is referred to as an Internet organization and operates a business virtually. Highly networked organizations command higher market shares and profits than their less networked counterparts (Schweer *et al.*, 2011).

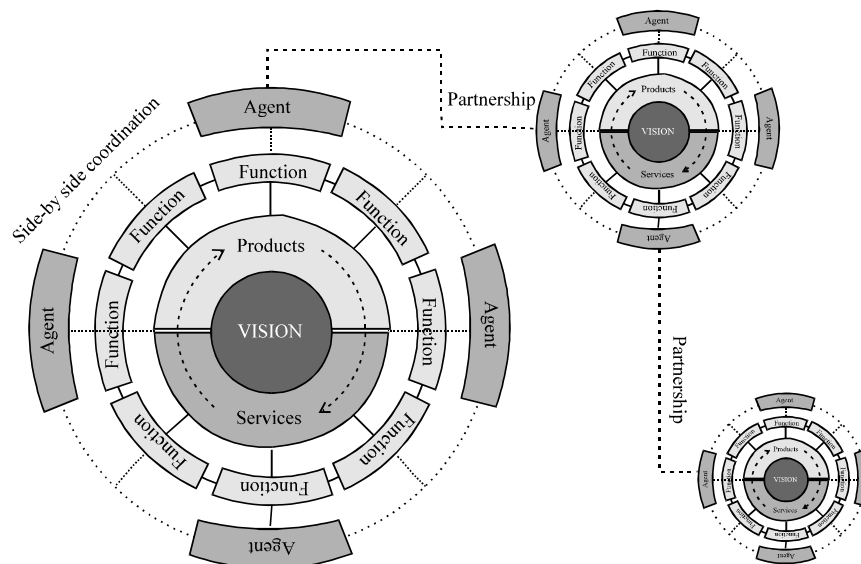


Fig. 2: Ring-matrix organizational structure-virtualized value system

According to Rockart and Short (1991), Palmer (1996), Lipnack and Stamps (2008) and Shih (2000), intra-organizational communication structures change along with new communication mechanisms. In networked organizations, business and functional units use parallel and shared communicative channels. Therefore, control and command processes may flexibly adapt to changes in environmental context. Based on the communication infrastructure, intra-organizational coordinative cost decreases as quality improves. All units within an organization are connected with outer partners, reinforcing services and productions outsourcing.

Vertically integrated virtual organization integrates not only production processes but also supportive functions. Full integration produces a value network rather than a value chain. To summarize, future organization structures are characterized by a flexible synapse network within an organization and a supply network with outer partners.

CONCLUSION

The implications of ICT application cannot be ignored in future organizational designs. The in-depth use of ICT contributes to a flexible supply system, the blurring of organizational boundaries and the emergence of networked protocols and net-brokers. Structures within and between organizations change into flexible synapse networks and value networks.

The depiction of future organizational structures in this study helps managers in practice to develop an efficient business process through the application of ICT; in addition, it elicits more imagination about virtual organizations that may be further developed.

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