Journal of Information Science

Towards a strategic information architecture (SIA) and its initial application

Jung-Chi Pai and Gwo-Guang Lee

The online version of this article can be found at:

Published by:
SSAGE Publications

On behalf of:

cilip

Chartered Institute of Library and Information Professionals

Additional services and information for *Journal of Information Science* can be found at:

Email Alerts: http://jis.sagepub.com/cgi/alerts

Subscriptions: http://jis.sagepub.com/subscriptions

Reprints: http://www.sagepub.com/journalsReprints.nav

Permissions: http://www.sagepub.com/journalsPermissions.nav

Research in action

Towards a strategic information architecture (SIA) and its initial application

Jung-Chi Pai

Department of Business Administration, Takming College, Taipei, Taiwan, R.O.C.

Gwo-Guang Lee

Department of Information Management, National Taiwan University of Science and Technology, Taipei, Taiwan, R.O.C.

Abstract.

As e-business strategies have increasingly attracted the attention of industrial managers, information architecture (IA) is considered as an important blueprint for implementing a successful e-strategy. Furthermore, numerous information architectures have been proposed in recent years by researchers. However, these architectures focus on information systems (IS) and information technology (IT) perspectives, but neglect integration with the information management (IM) strategy. As the complexity of IS/IT applications in an e-business environment grows, effective IM strategy should be considered in developing information architectures. This study proposes a strategic information architecture (SIA) that integrates IS, IT and IM strategy while the IM strategy stresses three dimensions of business conditions and capabilities to cope with IS and IT strategy, including organizational structure, managerial activities and information use. The proposed SIA was initially assessed in a large hospital in Taiwan to examine its usefulness. The implications for IS practice and directions for future research are also discussed.

Keywords: strategic information architecture

Correspondence to: roger.pai@msa.hinet.net

1. Introduction

The development of information architecture (IA) was consistently identified as one of the most critical issues facing information systems (IS) executives and academic researchers [1–6]. According to surveys on information systems management issues in the recent decade, the issue of IA remains among the major issues facing IS executives and corporate general managers [7–12]. Pervan's survey [13] pointed out that 'developing and implementing an information architecture' ranked as the most important IS management issue perceived by Chief Executive Officers. Gottschalk's research [4] also predicted that 'developing and implementing an information architecture' will be one of the top four key issues of future studies in IS management around the around in the 21st century.

Researchers have proposed numerous approaches for developing information architectures. Specifically,

with the recent growth in interest in e-business and e-commerce, a number of information architectures that considered Internet technology have been proposed. For example, Pant and Ravichandran [5] developed a framework for e-business information architecture planning that allows organizations to explicitly focus on the unique information management needs faced by e-business. Gardner [14] proposed an information architecture that integrated with XML technologies. However, we found a number of gaps in these architectures. First, the existing information architectures focus on IS and information technology (IT) perspectives, but neglect to integrate the information management (IM) strategy. Second, numerous conventional IAs were developed by some data-driven methodologies such as Business Systems Planning (BSP) or Information Engineering (IE) before the network era. Thus, these IAs were considered as important outputs of strategic information systems planning (SISP) and focus on functional views, but they ignore the cross-department, cross-organization and customer reach functions that are necessary in an e-commerce context. In view of the recent attention given to developing e-business applications in the network era, it would be useful to propose an information architecture that considers these perspectives.

This study proposes a strategic information architecture (SIA) which focuses on integrating the IS, IT and IM strategies. The usefulness of the proposed SIA was further examined in a large hospital in Taiwan. The results of this study will be of interest to industrial managers or IT/IS executives who are developing their IA in an e-business context, and for researchers in the field of information systems planning and management.

2. Theoretical background

2.1. Information architecture

Researchers have proposed numerous definitions for information architecture. Brancheau and Wetherbe [15] defined information architecture as 'a high-level map of the information requirements of an organization.' Niederman et al. [7] indicated that an information architecture is a high-level map of the information requirements of an organization, showing how major classes of information are related to major functions of the organization. They further argued that an information architecture is potentially a basis for building a coordinated, responsive, long-lasting set of business applications. Martin et al. [16] also contended that the

business information architecture must not only define technological components, such as application systems, office automation and communication networks, but also consider all aspects of the information requirements of an organization.

Kim [17] argued that information architecture should encompass 'data' architecture and 'process' architecture to help implement business process reengineering (BPR). He further indicated that data architecture specifies the kinds of information that are required and maintained, while process architecture specifies what an organization does with the information specified in the data architecture.

Segars and Grover [18] indicated that information architecture incorporates the high-level information requirements of an organization, providing for the development of specific data, data flow, applications and process structures. They further proposed an architectural IS planning process. The process includes three levels: conceptual, logical and physical. The conceptual level attempts to understand, articulate and represent the strategic direction of the enterprise and to transform this vision into a set of concrete strategies for IS development. This analysis results in a set of 'enterprise models'. The logical level involves matching information requirements with the functions, processes and tasks identified in the broader enterprise model. Finally, the physical level is concerned with the actual implementation and development of databases, networks, system typologies and applications derived from the sub-architectures formulated at the logical level. The implementation plan should consider components of project scope, development strategy, and organizational impact.

Hay and Munoz [3] contended that IT architecture strategy is based on identification and definition of three levels of IS needs and solutions: strategy, architecture and infrastructure. The strategic level focuses on the structures and values of IS and business strategy, while the architectural level focuses on the identification of conceptual IS architecture based on long-term visions. The architectural level is independent of specific systems implementation platforms. Infrastructure focuses on how the components will perform their roles in the final product.

Gardner [14] indicated that IA addresses key considerations for both the current and future states of information processing. It makes it possible to articulate in common terms the needs of stakeholders. According to Laudon and Laudon, IA is the particular form that information technology takes in an organization to achieve selected goals or functions [19].

Although the term IA has been widely used in the IS community, it has no commonly used definition [2]. However, based on the above, we could understand that development of an information architecture not only encompasses the physical level, but also the strategic level, derived from business strategies. It should also consider future organizational development, especially developing e-commerce applications in the network era.

2.2. Approaches relating to the development of information architecture

Conventional development of information architecture focused on technical levels (i.e. data, technology, communication structures and applications), but it overlooked the organizational perspective. Kim [17] indicated that information architectures are difficult to obtain, implement, and sustain due mainly to the wide range of information required by an organization and the rapidly changing business environment. Numerous business managers and IS strategic planners began to emphasize the establishment of information architectures to prepare for future information requirements. For instance, Boar's mobility framework [20] underlines the flexibility of an established application system. Galliers [21] proposes a scenario-based methodology to establish information architectures. In the following, we describe the technology-oriented and strategic-oriented approaches relating to the development of IA.

2.2.1. Technology-oriented approaches. Conventional methodologies for development of IA are function-oriented approaches, which focus on decomposing a problem by function [17]. Information architectures are established by systematically analyzing survey and interview data. Due to being derived from the data-processing approach and information-system analysis, these information architectures over-emphasize the technological aspects but lack of flexibility to cope with environmental changes. For example, BSP, developed by IBM [22], is designed and implemented from the bottom to the top. This approach first identifies the missions, goals and organizational structure of an enterprise as the basis for analyzing enterprise procedures and the data they require. Then, the identified data is categorized and similar categories are collapsed to establish an information architecture which becomes the foundation for developing application systems. IE, proposed by Martin [23], provides techniques for building enterprise, data and process models. These

models are combined to form a comprehensive knowledge base that is used to create and maintain information systems [5].

2.2.2. Strategic-oriented approaches. This section examines information architectures characterized by their strategic nature. We analyze Boar's mobility framework [20], Wilson's basic approach [24], and Galliers' scenario-based approach [21], as well as Kim and Lee's approach [25]. These approaches are described as follows:

The mobility framework. Boar [20] contended that an enterprise requires information exchanges and architecture to develop flexible applications. He proposed the development of this mobility framework, which emphasizes the importance of mobilization, maintenance, expansion potential, the difficulty of making changes, portability, openness/standardization, individual autonomy, flexibility, the accessibility of data, internal mobility, and various other factors.

The basic approach. Wilson [24] has extended the soft systems methodology (SSM) proposed by Checkland [26] and proposes a new approach for searching information requirements to support required organizational activities, and also a new manner for exchanging information between these activities. Wilson's basic approach includes the following features [24]:

- The identification of information requirements and flows is based on modeling a 'primary task'.
- By taking the existing organizational structure, 'activity-to-activity' information flows are converted to 'role-to-role' information flows.
- Required information systems are then determined, based on an analysis of the performance needs of each of the activities identified.

The scenario-based approach. Galliers [21] proposed the scenario-based approach (SBA) which focuses mainly on dividing the formation and construction of IS strategy into real world and conceptual thinking. 'Real world' focuses on describing the current status of organizations, 'conceptual thinking' focuses on their future requirements. SBA aims to develop flexible information architecture for businesses.

The WCO approach. Kim and Lee [25] proposed new approaches to developing information architectures for world-class organizations (WCO). They used the world-class organization as a framework for formulating business strategies, which an organization's information systems attempt to implement. Furthermore, they attempted to provide some guidelines for developing IS which could enable organizations to become world-class.

Table 1 summarizes the characteristics of the information architectures described above.

As Table 1 shows, some experts or academics clearly defined the level of each requirement, such as the technical and IT infrastructure of the logical and physical levels. However, some IAs only conceptually describe the required characteristics without identifying the actual components embedded in information architectures. Nevertheless, these strategic characteristics are key elements ensuring the efficiency of developing information architectures, and satisfying the required organizational flexibility. By examining and improving the proposed information architectures, we propose a strategic information framework characterized by flexibility that meets organizational requirements in the e-business era.

3. Problems of existing IAs

Typical information architectures were generally created by conventional systems analysis methodologies, but they lack the flexibility to cope with the accelerating pace of information technology and constantly fluctuating business environment. Martin et al. [16] argued that information architecture must be flexible to enable individual decision-making and should consider the long-term development of the organization. Furthermore, although development of information architecture has been extensively studied both in consulting companies and in academic institutions, numerous problems still remain unsolved. Furthermore, rapid advances in Internet and web technology have brought development of IA frameworks that consider electronic commerce and electronic business. For example, Raghunathan and Madey [29] suggested an IS planning framework which focuses on the development of e-business information systems (EBIS),

Table 1
Comparisons of characteristics for information architectures

Level	Characteristics	Information architecture
Technical level	• Definition of the technology infrastructure	IBM 1975 [22]; Martin 1989 [23]; Segars and Grover 1996 [18]; Kim and Lee 1996 [25]; Hay and Munoz 1997 [3]; Tan and Uittenbroek 1997 [27]; Zachman 1999 [28]; Pant and Ravichandran 2001 [5]; Gardner 2001 [14]
Conceptual level	• Definition of the logical architecture	Martin 1989 [23]; Kim 1994 [17]; Kim and Lee 1996 [25]; Segars and Grover 1996 [18]; Hay and Munoz 1997 [3]; Zachman 1999 [28]; Pant and Ravichandran [5]
	• Description of conceptual architecture	Wilson 1990 [24]; Boar 1993 [20]; Galliers 1993 [21]; Kim and Lee 1996 [25]; Zachman 1999 [28]
Strategic level	• Levels of enterprise strategies	IBM 1975 [22]; Martin 1989 [23]; Wilson 1990 [24]; Galliers 1993 [21]; Kim and Lee 1996 [25]; Segars and Grover 1996 [18]; Tan and Uijttenbroek 1997 [27]; Pant and Ravichandran 2001 [5]
	• Consideration of future requirements	Wilson 1990 [24]; Boar 1993 [20]; Galliers 1993 [21]; Kim and Lee 1996 [25]; Hay and Munoz 1997 [3]
	• Consideration of business process reengineering	Galliers 1993 [21]; Kim 1994 [17]; Kim and Lee 1996 [25]; Segars and Grover 1996 [18]
	• Consideration of enterprise mobility	Boar 1993 [20]; Kim and Lee 1996 [25]; Hay and Munoz 1997 [3]; Pant and Ravichandran 2001 [5]
	• Consideration of organizational change	Boar 1993 [20]; Galliers 1993 [21]
	• Emphasis on involving stakeholders in the architectural development	Boar 1993 [20]; Kim and Lee 1996 [25]

providing a three-dimensional coordinate axis to classify the business models and establish an IS architecture for a particular model. However, this framework did not consider the key stakeholders while developing EBIS applications. Additionally, Mckay and Marshall [30] proposed an IS planning framework across strategic business networks which is focused on building up inter-organizational IS and stresses business process redesign across organizations. Although their framework refers to the concept of business process redesign and key stakeholders of partners, customers and suppliers, it ignores the considerations of organizational change. Businesses will face a risk of planning failure if they lack the capacity to change and learn.

These recently proposed frameworks may help business strategic planners to understand how to rapidly create their IA based on Internet and web technology. However, these frameworks appear somewhat normative in that they do not address business and organizational problems involving how to improve organizational conditions and capabilities. Furthermore, while focusing on developing particular IS architecture, these frameworks have neglected the importance of incorporating the organizational perspectives into information architectural development. This may cause problems in the developing process of information architecture, such as an inability to satisfy the requirements of stakeholder groups, creation of IAs that are unable to achieve internal organizational consistency, an inability to achieve the objectives of organizational requirements for change management, or an inability to meet planning objectives.

4. The SIA integrating IS, IT and IM strategies

Early IS/IT applications were developed under a hierarchical organizational structure. Therefore, they cannot cope with rapidly changing environmental changes and organizational requirements. The new IS/IT paradigm makes organizational restructuring feasible. Conventional organizational structures are inappropriate for the current business environment. To use these IS/IT applications, organizations must enhance their capabilities. Alter [31] contended that, although information architecture may seem a technical issue, it is a strategic, managerial view of how an organization operates. Some information-based strategic frameworks have been proposed by researchers. For example, Kim and Lee's new approach

to developing the information architecture for world-class organizations [25].

This study proposes a strategic information architecture (see Figure 1), based on Boar [20], Wilson [24], and Galliers [21] as well as Kim and Lee's work, which focuses on integrating the IS, IT and IM strategies. Specifically, we emphasize the IM strategy which was neglected in previous work. Galliers [21] indicated that efforts should focus on developing flexible information architectures to satisfy changing information requirements rather than on developing specific IS applications. 'Information architecture' must not only satisfy current information requirements, but also future requirements owing to the constantly changing business environment.

As Figure 1 shows, the SIA consists of two axes: the vertical axis – information systems functions and scope – and the horizontal axis – business conditions and capabilities. We further describe them below.

4.1. Information systems: functions and scope

The vertical axis represents IS functions and scope which were evolved from the operational level, through the managerial level and to the strategic level. Information systems have been extended from use at the operational, managerial level to the strategic level. The operational level mainly applies information systems to upgrade the operation efficiency of an organization. The managerial level mainly focuses on applying information systems to supplement the management of an enterprise. This level of application also assists in organizing management strategies, analyses and decisions to improve the overall capabilities of an enterprise. The strategic level aims at improving the compatibility of an organization. The application scope of information technology is transformed from the traditional enterprise-oriented to the user-oriented. Information technology is no longer constrained within enterprises. IS/IT, IS/IT applications, and users/place are described below.

4.1.1. Information systems and information technology. IS functions define three evolving phases for information systems and information technology. They are data processing (DP), management information systems (MIS) and strategic information systems (SIS). In the DP era, information systems were developed under hierarchical organizational structures and focused on efficiency of transaction processing and process automation. With a growing need for integration, both for cross-functional requirements and for
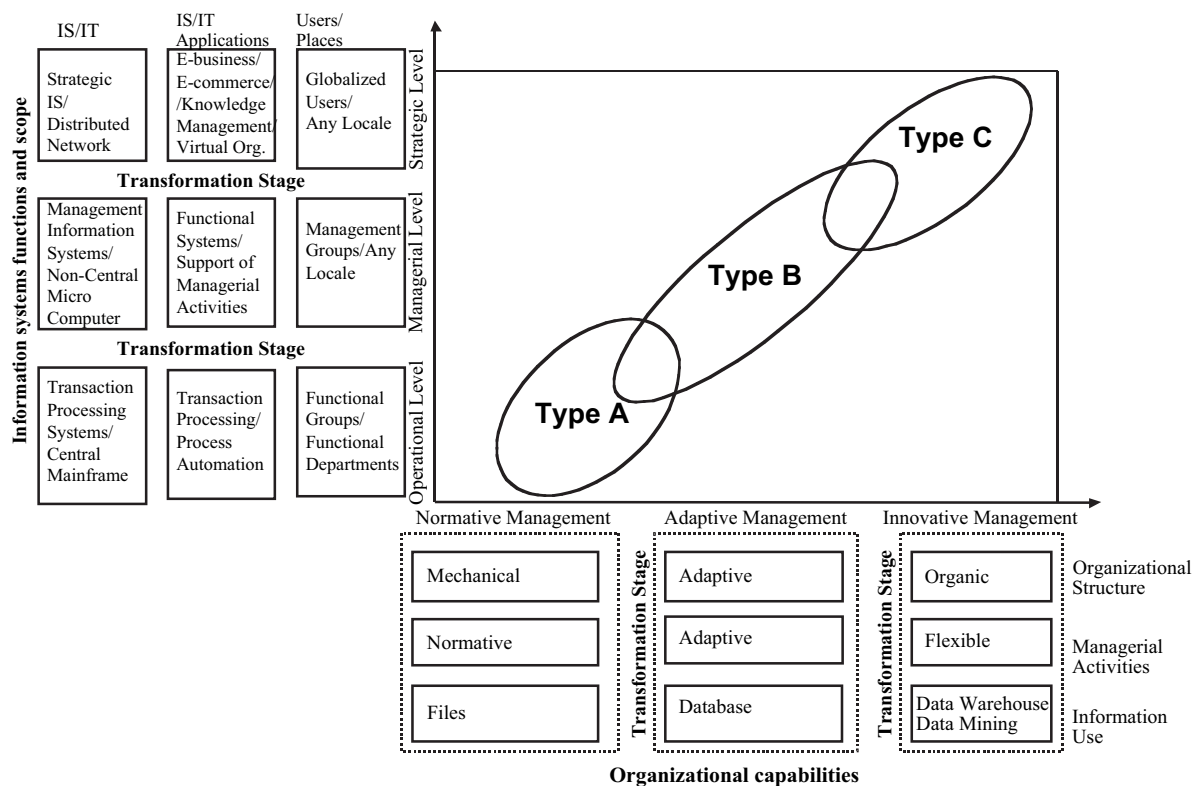
Fig. 1. The SIA integrating IS, IT and IM strategy.

managerial information requirements, managerial-oriented information systems were developed. Organizations enhanced horizontal connections and departmental integration by the supplement function of the information system. Since IS/IT has developed rapidly and has been applied in a distributed network, organizations can develop cooperative, autonomous, and organic types of organizational structure. Moreover, they can also develop flexible management.

Applegate [32] described the evolution of information technology in four eras including 'the central-processing era', 'the non-central processing era', 'the distributed network era', and 'the omnipresent upcoming era'. Table 2 compares the four eras by main technology, main function, typical user, operation locality and application level.

Based on the Applegate's framework this study categorizes IS/IT into three types of relationships: data processing/central processor, management information system/non-centralized microcomputer, strategic information system/distributed network (including the non-structure network in the future).

4.1.2. IS and IT applications. The development of information systems has gradually moved towards the strategic-oriented. In the data processing (DP) era, information systems focused on an 'efficiency' perspective. Numerous ISs were developed to improve operational efficiency in an organization. In the MIS era, business has focused on developing functional systems, such as production, marketing, finances, and human resources systems. Specifically, as distributed networks develop, numerous IS/IT applications related to e-business strategies have been widely developed in many organizations. For example, enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM) and knowledge management systems (KMS).

4.1.3. Users and locale. Network applications allow an enterprise's ability to acquire information to extend from within the enterprise itself to an inter-enterprise scale. Facilitated by the rapid development of the Internet, the strategic implementation of information systems now extends to personal users. Restated, any

Table 2
The evolution of information technology

	Central-Processing	Non-Central Processing	Distributed	Future
Main Technology	Mainframe/Mini Computer	Personal Computer	Client Server Network	Non-Structured Network Technology/Personal Portable Technology
Main Function	Automated Working Process	Promoting Individual or Group Productivity	Enterprise Organization and Production Transformation	Creating Values
Typical User	Computer Specialists	Computer Technocrats	Employers/Employees as Computer Literate	Everyone
Operation Locality	Computer Center	Desk	Many Locales	Everywhere
Application Level	Operational	Managerial	Strategic	Strategic

Source: amended from Applegate's framework [32].

individual can store or obtain information on the Internet, free of geographical constraints. Based on Boar's mobility framework which includes inside company, inter-company, and personal users, we propose 'globalized and personal users vs any locale', 'enterprise stakeholders vs enterprises in any locale', and 'the internal functional stakeholders of enterprises or technical personnel vs enterprise departments'.

4.2. Organizational capabilities

The horizontal axis represents organizational conditions and capabilities. Businesses must evaluate the current organizational readiness while introducing new IT and IS. This paper proposes three different evolving stages of business capabilities, namely 'normative', 'adaptive' and 'innovative'. We describe organizational structure, managerial activities and information use in these three stages as follows.

4.2.1. Organization structure. This paper proposes three types of organizational structure corresponding to the three evolving types of organizational capability, including mechanical, adaptive and organic structures. Mechanical structures resemble the traditional pyramid style of an organization. Different segments of the organization are related in a rigidly regularized fashion. The adaptive organizational style, such as project, matrix, and working-group style, increases horizontal connection and departmental integration, and regulations resemble principles. The organic type of organization is cooperative and autonomous.

Commands are not given as instructions, and the boundary between employer and employee is blurred.

4.2.2. Managerial activities. Wilson [24] considered that, while analyzing information requirements, one should emphasize information requirements derived from the activity model. Meanwhile, Galliers [21] focuses on the development of every possible activity model which is scenario-based. Furthermore, by analyzing key participants and stakeholders, the 'procedure and structure' can be modified. By considering both managerial activities and organizational structure, this study differentiates normative, adaptive and flexible types of managerial activity. The normative type is conditioned by fixed rules and procedures; while, after acquiring sufficient information, the adaptive type can adjust managerial activities. This adaptation makes employees more autonomous, and facilitates communication between the employer and the employee. In turn, both roles commonly envision flexible management.

4.2.3. Information use. According to different eras of information system development, the information application can be categorized into files, databases, data warehouses, and data mining. In the conventional period of data processing, medium or large-scale mainframes stored enterprise information as a file system. For instance, central mainframes commonly employed IBM's VSAM. In these early file-oriented applications, data was typically not formally defined outside of the programme. The redundancy, inconsistency, and

inflexibility that resulted from these file-oriented applications eventually led to the acceptance of database management technology based on the three-schema architecture, including external models, conceptual models and internal models [33]. In the period of the management information system, the information most commonly used by an enterprise is stored in a database to develop the information system of the enterprise. The database technology has been developed from the network and hierarchical style of earlier days to a relational style. Nowadays, relational database management systems (RDBMSs) are widely used in businesses and are also used for developing data warehouses and data mining.

4.3. The fitted and non-fitted situation of the SIA

In Figure 1, type A, B and C are the fitted situation of SIA. Type A shows the operational IS functions and scope. Type B represents organizational capability which must move toward adoptive management when information systems have reached management level. Type C emphasizes the strategic IS applications which must cope with innovative management. Specifically, the web and Internet applications have been broadly developed and have increased business competitiveness. Therefore, organizations must readjust their internal capabilities such as organizational structure, managerial activities and information use. The capabilities of an enterprise must be compatible when IS functions and scope change from operational level to managerial level, or management level transforms into strategic level. For instance, if an enterprise intends to transform from type A to type B, the organizational structure must be adjusted from the mechanical style to the adaptive one. Additionally, its managerial activities need to be shifted from normative to adaptive. This organization also needs the capability to develop database applications to integrate the organizational requirements coming from different functional departments. Furthermore, it could develop data mining and data warehouses to enhance its capabilities for information use. If this enterprise cannot meet these requirements, it stays in the transitional period. Figure 2 shows one of the non-adaptive situations in strategic information architectures. Despite the IS/IT functions and scope being upgraded to a strategic level, this enterprise has insufficient capabilities. This incompatibility leads to the insufficient promotion and implementation of the developing information architecture. Therefore, an organization must develop organic management to establish strategic information architecture suitable for its needs.

Earl [34] indicated that the main information strategy of strategic IS/IT planning is to develop information policy and architecture. Previously, while designing
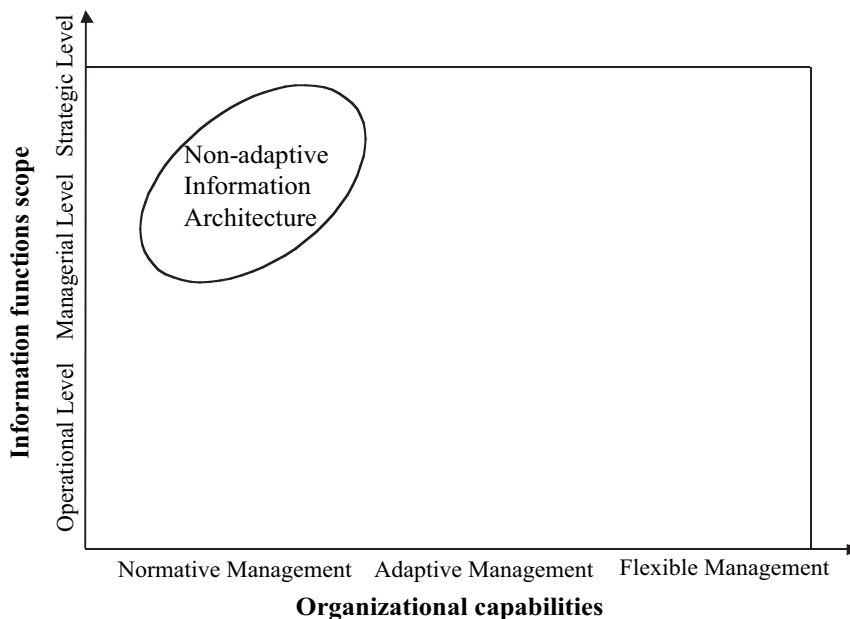

Fig. 2. One of non-fitted situations in SIA.

information architecture, businesses always focused on technical architectures such as data, communications, systems, and technology, but ignored global operational architecture. Therefore, incompatibilities arise between information architecture and global organizational requirements. This study suggests that the development of information architecture not only must integrate technical architecture but also must decide by vertical axis/functions and scope of IS and horizontal axis/business qualifications and capabilities. Only in this way can a strategic information architecture be constructed which simultaneously meets all of the enterprise goals. Galliers [21] indicated that information which may play a key role in shaping the future needs to be collected. Furthermore, an information system must be flexible to adapt to the changes that an enterprise inevitably faces. In this study, the intersection of the strategic framework is the transformation stage when businesses should collect data and information. Accumulating information is necessary because information as such is necessary, regardless of unpredictable changes in the future.

5. Case study: an initial application

This section describes the background, IT used, IA development, and the initial application of the proposed SIA in a large hospital (called KS Hospital) in Taiwan. Data collection was conducted by personal interviews with stakeholder groups relating to IS/IT activities, including Chief Information Officers (CIOs), IS planners and systems developers.

5.1. Case background

The case is a large hospital in Taiwan. It has about 14,000 employees, and five sub-branch hospitals. The administrative center, located in Taipei, is responsible for human resources, accounting, procurement, medical administration, nursing administration and information management of sub-branch hospitals, and possesses the critical power in organizational strategic decision-making. Most critical decisions were made by directors of the administrative center. Regarding IS management, the MIS department in KS Hospital is in command of the administrative center and in charge of IS planning, development and maintenance, with about 80 IS/IT professionals such as CIOs, systems analysts, programmers, database administrators, systems engineers, network engineers and operators. Before 1999, most of the hardware systems were

underlying the IBM mainframe and mini-computers, and most of the information systems applications were developed in procedural languages (including COBOL, RPG and ASSEMBLER) and VSAM file systems. To solve the year 2000 problems, rightsizing was launched in 1997.

During 1999 and 2000, the IT infrastructure switched from centralized (mainframe model) to distributed (client-server model) architecture, and computer applications were developed replaced by object-oriented languages (including Visual Basic and Oracle Developer 2000) based on a graphic user interface. Relational database management systems (Oracle and IBM DB2) were substituted for the hierarchical database (DL/I) to manage the high- volume data occurring within the hospital. In recent years, owing to the rapid progress of Internet and web technology, the computer applications based on Internet technology have been developed to enhance competitive advantages, for example, on-line registration systems in Internet and intranet systems.

5.2. IS functions and organizational capabilities of KS Hospital

The IS function in KS hospital has gradually moved into strategic level. Transaction processing systems (TPSs) are the basic business systems that serve the operational level of the KS Hospital. The typical TPS applications in KS Hospital consist of outpatient systems, inpatient systems, order systems, payment systems and registration systems. Management information systems serve the management level of the KS Hospital, providing managers with reports or with on-line access to the organization's current performance and historical records. The typical MIS applications consist of finance, accounting, purchasing, human resource, and health-care systems. Strategic information systems change KS Hospital's goals, operations, products, and services to help them gain an edge over other hospitals. The typical SIS applications in KS Hospital consist of on-line registration in Internet and intranet systems. Such applications enable the hospital to gain more competitive edge than other hospitals. In essence, the hospital is a kind of non-profit organization; providing better service and efficient operation would enhance the organization's competitiveness.

With respect to the organizational conditions and capabilities, most of the managerial activities and operations are normative since there exist a well-established system and rules in KS Hospital. Regarding the organizational structure, it remains hierarchical in
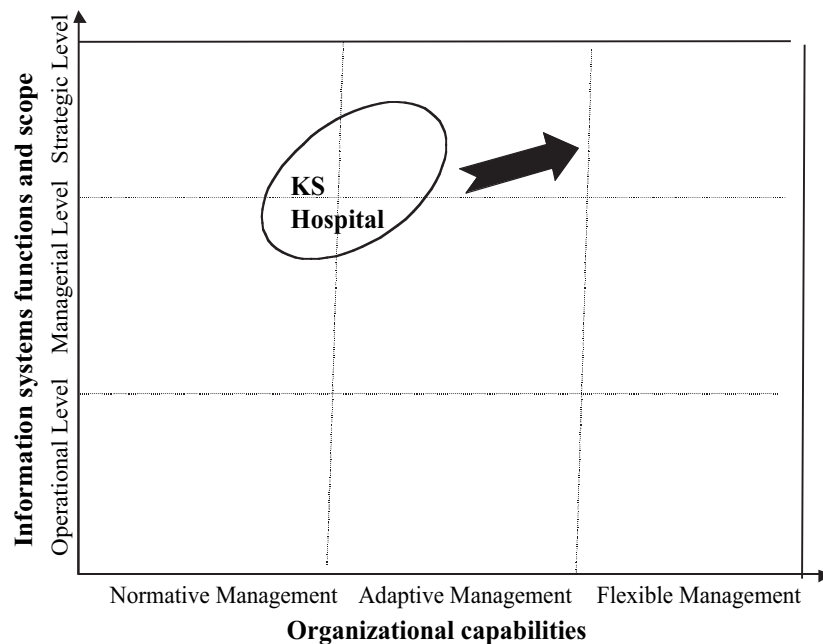
Fig. 3. Current development of KS hospital's information architecture.

its administrative center and sub-branch hospitals. Furthermore, despite the KS Hospital possessing high-maturity capabilities for the file and database applications, the novel technology related to data management such as data mining and data warehouses must be enhanced. Figure 3 shows the current development of IA in KS Hospital; although the IS function has reached the strategic level, organizational capabilities still stay between normative and adaptive management.

5.3. Recommendations for KS Hospital

Based on the above section, we could understand the IT infrastructure of KS Hospital is well established, and the development of information systems has shifted from closed and centralized mainframe systems to opened and distributed client-server architecture, and is more flexible than before. Despite the IS function of the KS Hospital making a critical breakthrough, however, the hospital should switch toward flexible management to develop its organizational structure, managerial activities and capability for information use to cope with the rapid progress of IT. In particular, with the rapid progress of the Internet, the development of information systems in numerous businesses is not limited to internal use, but increasingly switching

toward external customers. Consequently, the management activities based on IS/IT, such as knowledge management, business process reengineering, customer relationship management and supply chain management, are necessary for organizations. Especially, knowledge management is the most important managerial activity for hospitals since hospitals are knowledge-intensive organizations; numerous knowledge workers possessing diverse backgrounds and expertise exist in hospitals, such as doctors, nurses, medical technical staff and managers. The hospital will enhance its competitiveness if their tacit and explicit knowledge [35] are managed effectively by IS/IT applications, and mechanisms of knowledge sharing and transfer are used to improve efficiency and effectiveness. Owning to the e-mail systems and intranet are well established and available to all, the communication and coordination are restricted to typical organizational levels in hierarchical. This promote the organizational development's move to an organic structure rather than a merely hierarchical one, for example, a project-oriented or team-based structure. Networks and Internet can further help achieve interactive learning and establish a learning organization. Additionally, to accommodate the constant change of political, economic and social environments, the organization may consider using the techniques of data

mining and data warehouses to provide decision-making information for high-ranking executives. This may also enhance the capability for information use. The KS Hospital now possesses a well-established network infrastructure; it could move toward being an electronic hospital based on knowledge management with the help of Internet, intranet and digital technology.

6. Implications for IS practice

IA has been considered a useful IS planning and implementation tool, particularly for organizations which position information technology as a strategic tool [36]. The normative model concerning IA can be seen in the numerous IS planning theories and literature such as BSP, IE and Method/I. The prosperous development of the Internet has helped transform the conventional trading model. The rapid development of e-commerce best supports the argument presented here. The constant transformation of IS/IT results in an organization re-evaluating its current information applications. While developing the strategic application, an enterprise needs to consider both technological and organizational perspectives. Particularly, it must evaluate its own conditions and capabilities while constructing a suitable information architecture. This paper considers the future development of information architectures, and argues that information architectures have to be flexible enough to satisfy the future needs of an organization. We also propose a flexible framework for developing the strategic information architecture for businesses to satisfy their information requirements.

Furthermore, numerous differences exist in planning between the manufacturing and service sectors. Manufacturing enterprises focus on production-oriented systems planning, based on value chain analysis, and thus supply chain management and enterprise resource planning are key considerations in systems development. On the other hand, the service sector focuses on customer-oriented systems planning; therefore, customer relationship management, based on data mining, and knowledge management are key considerations for enhancing service quality. This shows that differences in industry may result in differences in the development of information architecture for business. At present, a comprehensive framework or theory which clearly defines all the tasks necessary to the development of IA is lacking. The proposed SIA provide a valuable reference for IS practitioners while developing their information architectures for organizations.

7. Conclusions and future research

This article contends that the development of IA should consider three perspectives, including IS, IT and IM. The proposed SIA consists of two axes – IS function and scope, and business capabilities to evaluate the development of information architecture. The continued changes in IS/IT lead to a re-evaluation of information use in organizations. Businesses must take into account considerations of both technical and organizational perspectives while developing strategic level systems. Furthermore, organizations must take into account business conditions and capabilities while creating an information architecture.

In contrast to past studies related to IA focusing on IS and IT perspectives, this study emphasizes that IM strategy should be integrated into the development of information architectures. Specifically, with the recent growth in interest in e-business and e-commerce, the IM strategy is viewed as an effective means of implementing a successful e-strategy. We also emphasize three dimensions of business conditions and capabilities to cope with IS and IT strategy, namely organizational structure, managerial activities and information use. Moreover, organizations may need to assess their core organizational capabilities when developing their information architecture. In conclusion, this research makes a valuable contribution to research on IS and provides a valuable reference for IT practitioners who are initiating strategy planning exercises in e-business and e-commerce in the network era.

However, this study has several limitations due to its limited focus. First, it does not aim to provide a normative model (including multiple phases and steps) for conducting the development of IA, but rather presents a social-technical framework specially focused on exploring the fit between development of IS/IT and business capabilities while developing IA. Future research could develop a framework for developing information architectures based on the proposed SIA. Second, numerous contextual factors may influence the development of IA. Future studies could also investigate the effects of contextual factors on the development of information architecture, such as culture, management style, task structure, role, and norms.

References

[1] A.L. Lederer and V. Gardiner, The process of strategic information planning, *Journal of Strategic Information Systems* 1(2) (1992) 76–83.

[2] S. Wang, Modeling information architecture for the organization, *Information and Management* 32 (1997) 303–15.

[3] G. Hay and R. Munoz, Establishing an IT architecture strategy, *Information Systems Management* 14(3) (1997) 67–9.

[4] P. Gottschalk, Studies of key issues in IS management around the world, *International Journal of Information Management* 20(3) (2000) 169–80.

[5] S. Pant and T. Ravichandran, A framework for information systems planning for e-business, *Logistics Information Management* 14(1&2) (2001) 85–98.

[6] D. Pimchangthong, M. Plaisent and P. Bernard, Key issues in information systems management: a comparative study of academics and practitioners in Thailand, *Journal of Global Information Technology Management* 6(4) (2003) 27–44.

[7] F. Niederman, J.C. Brancheau and J.C. Wetherbe, Information system management issues for the 1990s, *MIS Quarterly*, December (1991) 475–99.

[8] J.C. Brancheau, B.D. Janz and J.C. Wetherbe, Key issues in information systems management: 1994–95 SIM delphi results, *MIS Quarterly* 20(2) (1996) 225–42.

[9] R.T. Watson, G.G. Kelly, R.D. Galliers and J.C. Brancheau, Key issues in information systems management: an international perspective, *Journal of Management Information Systems* 13(4) (1997) 91–115.

[10] H. Chou and S. Jou, MIS key issues in Taiwan's enterprises, *International Journal of Information Management* 19 (1999) 369–87.

[11] P. Gottschalk, Key issues in IS management in Norway: an empirical study based on Q-methodology, *Information Resource Management Journal* 14(2) (2001) 37–45.

[12] R.M. Samik-Irahim, *Key Issues in Information Systems Management: Indonesia 2001*. Available at: http://rms46.vlsm.org/1/22.html (accessed 11 May 2002).

[13] G. Pervan, How chief executive officers in large organizations view the management of their information systems, *Journal of Information Technology* 13 (1998) 95–109.

[14] J.R. Gardner, Information architecture planning with XML, *Library Hi Tech* 19(3) (2001) 231–41.

[15] J.C. Brancheau and J.C. Wetherbe, Information architecture: methods and practice, *Information Processing and Management* 22(6) (1986) 453–63.

[16] E.W. Martin, D.W. Dehayes and J.A. Hoffer, *Managing Information Technology: What Managers Need to Know* (Macmillan Publishing Company, Singapore, 1991).

[17] B.O. Kim, Business processing reengineering: building a cross-functional architecture, *Journal of Systems Management* December (1994) 30–5.

[18] A.H. Segars and V. Grover, Designing company-wide information systems: risk factors and coping strategies, *Long Range Planning* 29(3) (1996) 381–92.

[19] K.C. Laudon and J.P. Laudon, *Management Information Systems: Managing the Digital Firms* (Prentice Hall, London, 2003).

[20] B.H. Boar, *Implementing Client/Server Computing: a Strategic Perspective* (McGraw-Hill, New York, 1993).

[21] R.D. Galliers, Towards a flexible information architecture: integrating business strategies, information systems strategies and business process redesign, *Journal of Information Systems* 3 (1993) 193–213.

[22] IBM Corporation, *Business Systems Planning: Information Systems Planning Guide* (IBM, 1975). [GE20-0527-4]

[23] J. Martin, *Strategic Information Planning Methodologies* (Prentice-Hall, New Jersey, 1989).

[24] B. Wilson, *Systems: Concepts, Methodologies and Applications* (Wiley, Chichester, 1990).

[25] B.O. Kim and S.M. Lee, Logistics information's role within an IT systems architecture in a world-class organization, *Logistics Information Management* 3 (1996) 19–26.

[26] P.B. Checkland, *Systems Thinking, Systems Practice* (Wiley, Chichester, 1981).

[27] D.S. Tan and A.A. Uijttenbroek, Information infrastructure management: a new role for IS manager, *Information Systems Management* 14(4) (1997) 33–41.

[28] J.A. Zachman, A framework for information systems architecture, *IBM Systems Journal* 38(2&3) (1999) 454–69.

[29] M. Raghunathan and R.M. Madey, A firm-level framework for planning electronic commerce information systems infrastructure, *International Journal of Electronic Commerce* 4(1) (1999) 121.

[30] J. Mckay and P. Marshall, Conceptualising information systems planning across strategic business networks, *Journal of Global Information Management* 9(2) (2001) 23–33.

[31] S. Alter, *Information Systems: a Management Perspective* (Addison-Wesley, New York, 1992).

[32] L. Applegate, *Managing an Information Age* (Harvard Business School Publishing, 1995)

[33] ANSI X3 SPARC/DBMS, *Study Group Report* (American National Standards Institute, Washington, 1975).

[34] M.J. Earl, Experiences in information systems strategic planning, *MIS Quarterly* 17(1) (1993) 1–24.

[35] I. Nonaka, A dynamic theory of organizational knowledge creation, *Organizational Science* 5(1) (1994) 14–37.

[36] K.P. Periasamy and D.F. Fenny, Information architecture practice: research-based recommendations for the practitioner, *Journal of Information Technology* 12(3) (1997) 197–205.