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Leveraging IT resources and capabilities at the housing and development board

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Abstract

This paper examines how the synergy among IT resources, human resources and business resources can lead to improved organizational performance. This central theme is illustrated using a case study of Singapore's Housing Development Board. The organizing model in the study is derived from the resource-based view of the firm, and includes three main components: IT resources, human resources and business resources. IT resources include technology and applications; human resources include sub-components such as top management commitment to IT, managerial IT knowledge and IT training; and business resources encompass IT planning and integration with strategic planning, IT-based process redesign, flexible organization and cross-functional orientation, and IT-driven interorganizational relationships. The case illustrates how these resources complement each other in improving organizational performance.

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1. Introduction

The resource-based view of the firm has emerged as a promising theoretical framework in the field of strategic management. It stresses on exploiting firm-specific resources and capabilities to generate superior organizational performance (Barney, 1991; Wernerfelt, 1995). Information

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Technology (IT) is an organizational resource that can create substantial impacts at both industry and organizational levels. However, questions concerning the productivity gains and distinct strategic benefits of IT have been raised (Harris and Katz, 1991; Weill, 1992). Moreover, results from studies on the impact of IT on business performance have been mixed (Brynjolfsson, 1993; Brynjolfsson and Hitt, 1996; Santos and Sussman, 2000).

In this paper, we propose and illustrate that IT resources and capabilities can lead to better organizational performance only when leveraged in tandem with complementary business and human resources and capabilities. Our ideas complement the emergent stream of research on IT capabilities that stress the importance of mobilizing and deploying IT-based resources in combination with other organizational resources and capabilities (Bharadwaj, 2000; Sambamurthy et al., 2003). Moreover, much of the literature on the resource-based view has focused on private sector firms that tend to be profit-oriented. Relatively less attention has been paid to how the resource-based view of the firm can be applied in the public sector such as statutory boards and government agencies where service rather than profit is often the goal. Hence, we examine how IT resources and capabilities can lead to better organizational performance by leveraging on a pool of complementary business and human resources in Singapore's Housing and Development Board (HDB), the statutory board responsible for public housing in Singapore.

Although this paper focuses on the experiences of HDB in leveraging its IT, business and human resources, it is important to note that the lessons learned are broadly applicable to both public and private sector organizations. The insights gained from this study are useful to both researchers and practitioners to better understand the need for complementary organizational resources in leveraging IT effectively. Such insights may also provide important avenues for future research in terms of determining appropriate management strategies for enhancing IT and complementary resources. For practitioners, understanding how the resource-based theory can be used to enhance organizational performance will enable them to focus more attention on the types of resources necessary to leverage IT effectively in order to enhance organizational performance.

This paper is structured as follows: Section 2 gives an outline of the resource-based view of the firm and presents IT as an organizational resource. The subsequent sections discuss our model and illustrate how IT resources and capabilities together with complementary human and business resources are utilized in HDB to improve business performance. Implications for IT practitioners are discussed in Section 5

2. Resource-based view of the firm

A large body of research on organizational strategy is based on the industry analysis framework proposed by Michael Porter (1985). According to this framework, the profitability of a firm is largely dependent on the forces in the industry and how the firm is positioned within the industry. In addition, environmental conditions and industry characteristics are assumed to largely shape a firm's strategy and performance. In recent years, an alternative perspective called the resource-based view of the firm has become popular in strategic management (Barney, 1991; Grant, 1991). According to this view, firm-specific resources and capabilities drive the performance of a firm.

The resource-based approach subscribes to the view that a firm is *a collection of resources and capabilities*, and it is these resources and capabilities that determine firm performance. *Resources* are stock of available factors that are owned or controlled by the firm and *capabilities* refer to a firm's capacity to deploy resources (Amit and Schoemaker, 1993). In this paper, we use the terms, resources and capabilities interchangeably to refer to the stock of factors as well as a firm's ability to utilize these factors.

Resources have two important attributes that enhance their strategic value to a firm. These are (i) the uniqueness or, the rarity of the resource, and (ii) inimitability of the resource. If a firm possesses a particular resource or capability that is commonly available to other competing firms, the resource cannot provide any distinct advantage to the firm. Similarly, if the resource is easily acquired or duplicated by competing firms, the firm soon loses the strategic advantage brought about by the resource. Thus, for meaningful strategic advantage(s) to be derived, a resource has to be characterized by a combination of low imitability and high uniqueness.

2.1. IT Resources and capabilities

In our context, we define IT resources to include hardware, software, communications, IT applications and IT personnel. In applying the criteria of uniqueness and inimitability, how does IT fare as a resource that confers distinct strategic advantages? The technology per se, i.e. hardware and software, are hardly unique and inimitable. Over the past few years, information technologies have become widely available to most firms. The idea of competing via proprietary systems has become *passè* as open systems have gained wide acceptance and they offer more advantages over legacy systems. Strategic IT applications provided distinct benefits to firms like American Airlines and Federal Express, but over a period of time, their competitors developed similar systems. Most IT applications and systems are prone to imitation. Even complex software applications like airline reservation systems are available for procurement. A firm which has gained any temporary advantage through IT can quickly lose this advantage if a competitor chooses to perform reverse engineering, or hire any of the individuals involved with the advantaged firm's IT application; or duplicate it through various other means (Mata et al., 1995). Hence, IT resources—hardware, software, applications and personnel, are neither unique nor inimitable.

Mata et al. (1995) listed five attributes of IT resources namely, (i) customer switching costs, (ii) access to capital, (iii) proprietary technology, (iv) technical IT skills, and (v) managerial IT skills. The authors concluded that 'managerial IT skills' is the only attribute that could provide any sustainable advantage from IT. They further argued that IT management skills, which are often distributed heterogeneously across firms, could serve as a source of distinct advantage. This proposition is reinforced by Bharadwaj (2000) findings that firms with high IT-capability tend to outperform other firms on a variety of profit and cost-based performance measures. In other words, although IT resources are neither unique nor inimitable in their own right, a firm can generate superior performance with a *mix* of IT resources and complementary business and human resources.

Drawing upon the resource-based theory of the firm and the works of Powell and Dent-Micallef (1997) and Mata et al. (1995), we present an explanatory model in Fig. 1.

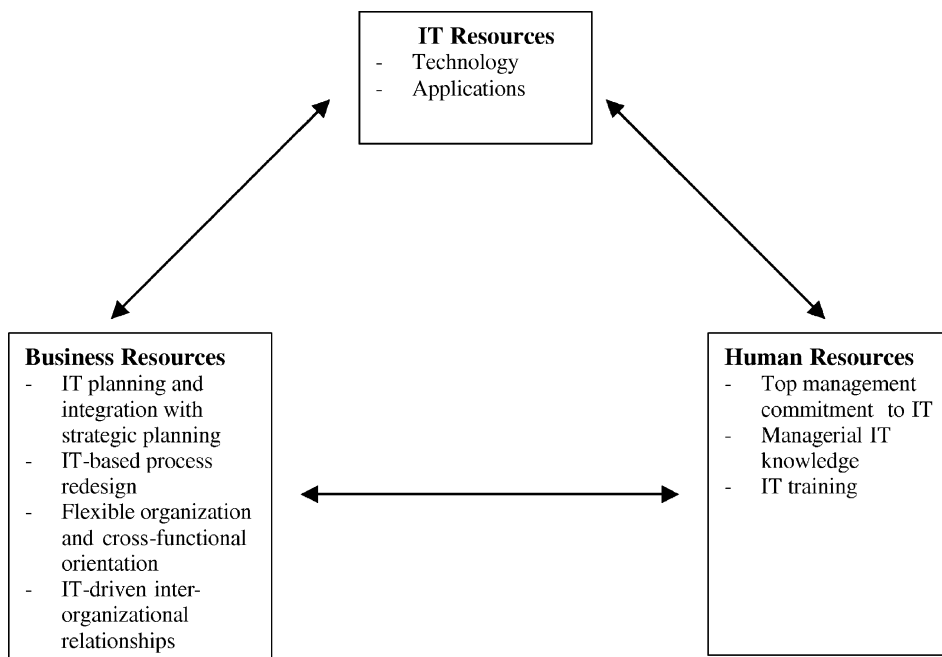


Fig. 1. IT and complementary business and human resources.

The model suggests that IT resources can act in tandem with complementary business and human resources, leading to superior firm performance. The underlying premise of the model is that although firms can have very similar IT resources, it is the mechanisms for combining and utilizing these resources that create any enduring strategic benefit for the firm. Apart from the physical hardware and software assets in a firm, it is the intangible resources and capabilities like IT managerial skills and knowledge, which play a crucial role in enhancing business performance. Such resources and capabilities would be firm specific and be difficult to imitate (Nelson and Winter, 1982). In Section 2.2, we describe the various elements of the complementary business and human resources as depicted in the organizing model in Fig. 1. It should be noted that the resources depicted in the model are used to frame the case of HDB and are not meant to be comprehensive.

2.2. Complementary business resources

Business resources refer to the pool of organizational resources that are essential for successful exploitation of IT resources for improving the business performance. They include the competencies for planning, allocating, coordinating and managing IT resources so that they are channelled effectively to support, enhance or drive the organizational strategy. The increased capabilities of IT and its far-reaching impacts on firms and industries have brought into focus, the need for systematic *IT planning* (Venkatraman and Raghunathan, 1990). Strategic IT planning has become necessary in

identifying opportunities for using IT to support business strategy and to effectively manage the IT function in the firm (Lederer and Sethi, 1996). Firms need to have IT planning systems that can foster creativity as well as exercise control (Raghunathan and Raghunathan, 1991). Apart from resource allocation, IT planning is able to give rise to innovative applications and provide an overall direction for IT management in the firm. The ability to plan the procurement, deployment and usage of IT resources, and minimize IT planning problems (Teo and Ang, 2001) is a critical capability that can significantly contribute to IT success in a firm. Further, the alignment between business and IT strategy has been found to contribute to organizational performance (Cragg et al., 2002; Teo and King, 1997).

IT has been regarded as a key enabler for business *process redesign* in organizations (Hammer and Champy, 1993; Davenport, 1993). IT resources can enable automation, monitoring, analysis and coordination to support transformation of business processes. The ability to integrate IT resources effectively with process reengineering initiatives can lead to radical improvements in organizational performance.

Organizations are increasingly moving from traditional hierarchical structures to more *flexible organizational structures*. With IT, new virtual organizations have come into existence (Benjamin and Wigand, 1995; Upton and McAfee, 1996). IT has provided a new and powerful medium for communication across various levels of organization. With IT resources, *cross-functional teams and ad-hoc structures* could be effectively managed. Technologies like electronic mail, video-conferencing, groupware etc. have enabled individuals from different time and geographical zones to work together. Flexible structures, newer channels of communication and effective team management have all been made possible because of newer IT capabilities.

IT resources not only, can improve internal organizational processes across a firm's value chain, but such benefits can also extend beyond firm boundaries (Bensaou and Venkatraman, 1996; Tarn and Wen, 2002). The Internet, electronic data interchange and networking technologies can help firms forge productive business relationships with its suppliers and customers. Numerous stories of successful IT-based inter-organizational systems confirm the advantages that a fusion of IT resources and complementary *inter-organizational linkages* can provide to an organization (Chatfield and Bjorn-Anderson, 1997; Fredrickson and Vilgon, 1996; Klein, 1996; Johnston and Vitale, 1988).

2.3. Complementary human resources

Human resources and capabilities refer to the personnel and stakeholders employed in an organization, and the knowledge, skills and capabilities they bring to the organization. *Top Management commitment to IT* is a necessary pre-requisite for IT success in organizations (Doll, 1985; Rockart and Crescenzi, 1984). Raghunathan (1992) found that firms in which the CEO headed the IT steering committee performed better. It has been observed that IT investments provide meaningful returns only after a period of time. Apart from its role in championing IT activities in the firm, top management commitment is also essential in ensuring that sufficient investments in IT resources are made over a sustained period of time.

Knowledge is considered to be a significant organizational resource. A significant body of literature on organizational learning and knowledge management emphasizes the creation, accumulation and use of appropriate organizational knowledge. The internal knowledge structures of an organization determine an organization's ability to innovate and adapt to environmental changes. Boynton et al. (1994) used the term '*Managerial IT knowledge*' to represent the 'conjunction of IT-related and business-related knowledge possessed and exchanged among IT managers and business unit or line managers' (p.300). For a successful integration of IT and business, it is essential that business executives in an organization possess relevant IT knowledge while IT executives in that organization possess appropriate business knowledge. IT use in organizations is significantly influenced by the extent of managerial IT knowledge (Boynton et al., 1994). In fact, Teo and King (1997) found that business competence of the IT executive is a key factor that facilitates greater integration between business and IT planning. Hence, managerial IT knowledge is another critical resource that contributes to IT success in organizations.

The effective exploitation of IT resources requires a significant amount of managerial IT knowledge, which can be increased through *IT training*. IT personnel need to receive continuous education on technological developments as well as business-related issues. The ability of an organization to maintain an IT-knowledgeable work force is a key to success in IT.

It is this set of complementary resources and capabilities, which offers most value to an organization. These resources cannot be acquired from the market place, but could only be developed and accumulated over a period of time. They cannot be imitated and thus, can serve as a source of differentiation among firms.

Various researchers have successfully used the resource-based view to illustrate cases in e-commerce strategy (Montealegre, 2002), alliances (Minshall, 1999), demand chain management (Williams et al., 2002) and the adoption of information systems and technology (Caldeira and Ward, 2003). In a similar vein, Section 3 use the resource-based view to illustrate how Singapore's HDB has successfully exploited its IT resources and capabilities, while leveraging on the complementary business and human resources. Data for the case study were gathered through interviews with relevant persons within HDB as well as through in-house and published materials pertaining to HDB's deployment of IT.

3. Background of the HDB

HDB is the public housing authority in Singapore and functions as a statutory board under the Ministry of National Development. HDB was established in 1960 to meet the acute housing shortage in Singapore. From housing a mere 9% of Singapore's population in 1960, HDB, through its national housing program, currently houses about 85% of Singapore's population. HDB, after meeting its initial objectives of mass building of flats, has over the years expanded its role to provide a host of housing services like planning and developing better quality public housing at lower costs, building commercial, recreational and public premises like shops, gardens and community centers, provision of infrastructure facilities, clearing and reclaiming land for redevelopment, selling and

renting of flats, and estate management and administration. The mission statement and corporate objectives of HDB are summarized in Fig. 2.

HDB is organized into three major groups; namely, Building Group, Estates Group, and Corporate Group. The Building Group is responsible for the physical planning and implementation of HDB's building programs for housing and related activities. The Estates Group manages residential units, and other supporting commercial, communal and community facilities. The Corporate Group, apart from providing routine administrative support, sets various administrative, financial and management guidelines to facilitate effective implementation of HDB's functions and policies.

HDB employs about 5200 employees. Since its inception in 1960, HDB has completed over 900,000 dwelling units and 16,000 shops, and 10,000 industrial workshops. In recent years, HDB has developed new housing programs that are implemented in response to rising and changing public expectations. Under these programs, flats in older estates are upgraded or redeveloped to improve the living conditions of the residents. HDB aims to build housing facilities of highest quality at lowest cost, while satisfying changing customer expectations. The effective use of IT resources and capabilities has been identified as one of key factors contributing to the successful performance of HDB. As the CIO explained:

“In carrying out its role, HDB faces a few major challenges. The volume and variety of transactions we have to deal with is massive. We deal with data on over 650,000 households and close to a million units of property. We also face a unique challenge in having to cater to changes in government policies. All these call for a dynamic environment that can respond promptly and effectively. How do we achieve all these? Strategic exploitation of IT coupled with a robust IT infrastructure and a highly trained IT-enabled workforce is a vital key.”

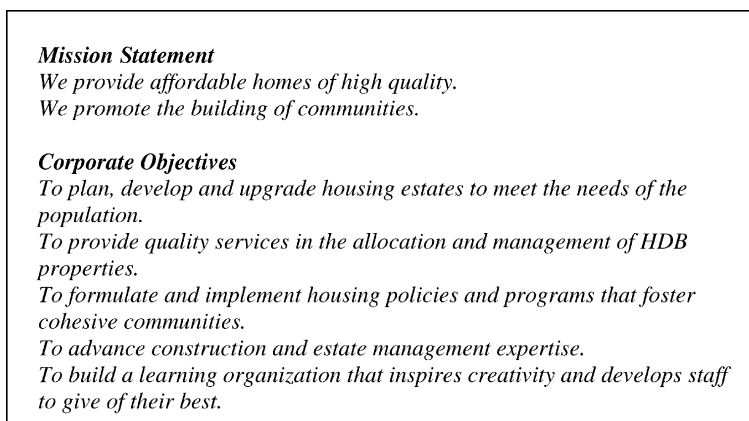


Fig. 2. HDB: mission statement and corporate objectives, HDB: vision and mission.

Missions & Goals

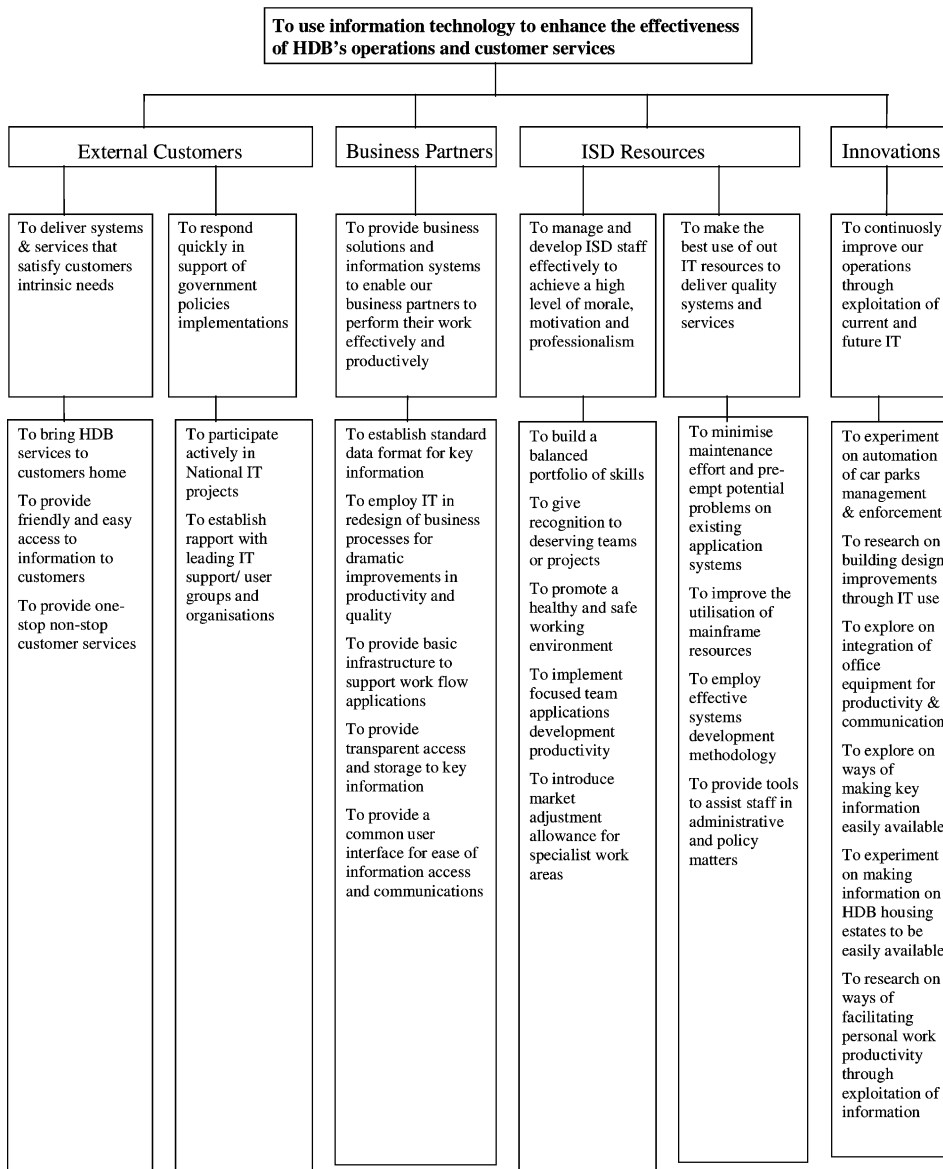


Fig. 2 (continued)

3.1. IT Resources in HDB

In 1982, computers made their debut in HDB with the installation of a mid-range IBM 4341 computer, for managing some primary data processing activities. Today, HDB has

more than a hundred IT applications serving its employees, external customers as well as business partners. In HDB, the personal computer ratio is 1:1 for every senior officer. Table 1 summarizes the major systems in HDB in terms of its impact on external and internal customers.

For its daily operations, HDB uses some of the latest technologies such as interactive TV (INtv), the Internet and groupware. HDB receives up to 6,000 calls a day on

Table 1
Examples of HDB's information systems

System serving	Description	Impact
<i>External customers</i>		
Home-link	Provides 24 × 7 fully automated telephone enquiry services (e.g. sales and resales enquiries, mortgage loan enquiries, upgrading cost enquiries) over the public telephone network	Improves customer service through 24 × 7 service, authentication of callers enquiring on confidential information, fax on demand service, and call transfer service to CSOs
INtv	Provides online updates of flats available for selection	Minimizes customer trips to HDB as information is available through INtv. Eliminates manual updating on notice boards
InfoWEB	Information portal for e-services, online communication and feedback channels, computation programs, etc. that the public can access in addition to a wide range of information about HDB's services	One stop Web portal for customers to conveniently access HDB's information and services 24/7. Acts as virtual sales office and 1-stop marketing portal to facilitate flat buying process. Encourage customer self service, thereby reducing cost
<i>Internal customers</i>		
Customer service portal	Consolidate information found in various databases to provide 1-stop information about customers	Provides quality services to customers and increases work efficiency
Integrated office system	PC-based communication system developed on Lotus Notes	Provides easy access to information. Customizes work flow and reduces time spent on lower value clerical-type activities
Integrated land information system (ILIS)	Centralized property database that provides HDB staff with easy retrieval and representation of various land, building and other spatially-related data	Facilitates town planning, land use studies, estate management, and design work
Computer aided design and drafting (CADD)	Produces 80% of all technical drawings	Two-fold increase in productivity in drafting. Facilitate better designed homes

the 24-hour *Home-link*, an interactive voice-response system which provides 24 × 7 fully automated telephone enquiry services over the public telephone network. The information available includes the following: sales and resale enquiries, mortgage loan enquiries and upgrading cost enquiries.

Through interactive TV, on-line information on flat availability and selection is readily available to customers. The Internet-based *InfoWEB* system offers a wide range of information and services for customers ranging from various enquiries (e.g. legal fees, availability of flats, resale transactions), financial computation programs (e.g. enquiry on maximum loan, monthly instalment) to interactive e-services that allow customers to complete their transactions online in a self-service mode (e.g. application for balloting exercise and commercial properties).

To complement the InfoWEB, a customer service portal was also set up for HDB's Customer Service Officers (CSOs) to access information that will support the handling of customer enquiries on sales and resale matters. The portal provides a 1-stop information source (e.g. customer data, transaction history) for CSOs to deal with various customer enquiries, thereby facilitating customer responsiveness.

HDB has also implemented an Integrated Office System (IOS) on Lotus Notes software. IOS includes an e-mail system, distributed document registries, facilities and time scheduling systems, phone/voice mail facility and also provides links to some external organizations. The technical infrastructure of IOS includes three hub servers, 17 departmental servers, 19 branch servers, 17 Database/Image servers, one communications server, 12 ID servers, one voice server, one OCR server, one optical jukebox, 18 scanners with over 3000 licensed Notes users (Tung and Turban, 1997).

Currently, ISD has completed the consolidation of IOS servers into IBM iSeries. ISD is now managing two hub servers, three communication servers, five database servers, including some Windows NT/2000 Servers. The 17 departmental IOS servers and 22 Branch Office IOS servers (up from 19 in 1996) are still running on the Windows NT/2000 platform. There are more than 6000 Licensed Notes users in HDB. IOS facilitates organization-wide communication among the employees of HDB and also provides shared access to information. With huge technical infrastructure, databases on various procedures, policies and other organizational details are stored in IOS. This enables HDB staff to quickly access the information and provide efficient telephone and counter-services to customers.

HDB has implemented an Integrated Land Information System (ILIS) that is a centralized property database that stores land, building and other spatially related data. ILIS stores a variety of information like building outlines, road alignments, and land boundaries, in both text as well graphical databases. Having almost 75 geographic map layers of data, ILIS helps HDB staff in town planning, land use studies, estate management and design work.

Another key IT application in HDB is the Computer Aided Design and Drafting System (CADD) that helps in producing various drawings. With more than 350 workstations in its premises, HDB is one of largest CAD users in the region. The CADD system has helped HDB gain a two-fold increase in the productivity of its staff.

Apart from these, HDB has successfully installed technologies like robotic cartridge library system, high-speed laser printing, automated mail inserting system and intelligent

environment monitoring system. ISDN and DigiNet data communication lines connect all its branch offices.

3.2. Complementary business resources

3.2.1. IT planning and integration with business planning

The IT planning exercise at HDB is not a one-off exercise, but a continuous process. Plans are reviewed and revised periodically as a response to changing organizational needs and emerging new technologies.

HDB formulated its first IT plan before the mainframe computer was installed in 1982. A team was formed with an IT manager and mid-level managers from all functional units to conduct a thorough IT planning study using the IBM's Business Systems Planning approach. This study laid the blue-print for future IT growth in HDB.

With the advent of micro-computers and the proliferation of PC-based software in the market, HDB saw an opportunity for end-user computing in the mid-80s. An office automation study was initiated in 1985 and various areas where office automation would improve operations were identified. Office automation also paved the way for end-user computing in the organization.

Apart from the office automation study, another strategic IT planning study was also initiated in the same year. Key HDB managers participated in an executive seminar, which launched the next strategic IT plan for HDB. The IT objectives then, were:

1. To obtain HDB top management's directions, information needs and involvement, so that IT plans are in line with HDB's overall plan;
2. To promote end-user computing so that the users will have better understanding on the use of computer in their daily work in their own department; and
3. To convince user-management that managing their data is part of their function.

ITs planning at HDB assumed a new direction with the appointment of a new CIO in 1990. After a massive reengineering exercise for the information systems unit at HDB, the unit started a system of large-scale triennial information systems planning study with annual information systems planning reviews. The first such plan was formulated in 1992.

The overall information systems plan at HDB has two components-Information Systems Plan (ISP) and Information Systems Work Plan (ISWP). ISP is a macro-level plan, which provides an overall framework for IT applications at HDB. ISWP is an annual plan, which deals with project planning and management, and resource planning at the information services department (ISD). The annual IT planning exercise is conducted with the participation/involvement of all functional departments. Various technology and application requirements are identified and prioritized. With this exercise, a work plan that forms the basis for the allocation of IT resources is mapped out. This work plan in turn, helps the ISD in its resource planning and internal work-allocation.

A charge-back system is implemented in HDB. Under this system, the ISD budget is funded entirely from budgets of the functional departments. At the same time, each unit in the ISD takes responsibility for the budget that it has been allocated to. This helps to

ensure that adequate financial resources as well as accountability are provided for the IT projects.

In HDB, the IS plan is directly derived from the business plan. The former is revised and reviewed according to changes in the latter. Being a public sector housing organization, the business goals of HDB are largely determined by the evolving priorities of government and the changing needs of the public. HDB has five-year business plans that are reviewed and revised annually. These business plans are revised and updated based on real-time data such as those from annual customer and partner surveys.

These business plans serve as guidelines for IT plans. For example, in 1993, HDB formulated its mission statement. In response to the new business vision, the ISD came with its mission: *'to use IT to enhance the effectiveness of HDB's operations and customer services'*.

3.2.2. IT-enabled process redesign

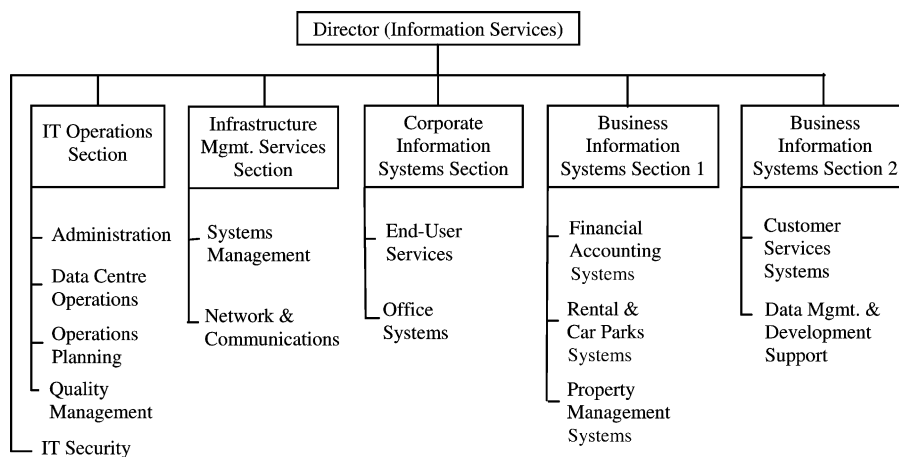
HDB has been actively using IT to improve many of the organizational processes. This is illustrated in the redesign of the following three key processes in HDB: application and flat allocation, customer complaint tracking and responding, and re-engineering of the IT function.

HDB has numerous schemes for its customers to procure or rent its industrial or residential properties. A typical application process involves the following steps. An interested customer submits his application to HDB. The application is evaluated and if it is approved, the successful applicant selects the property and makes the necessary payment to HDB. The application process has some drawbacks such as its complexity and (several months) long duration. For instance, successful applicants had to frequent HDB premises in order to be informed of the selection status. To address these drawbacks, several IT-based services have been introduced by HDB to better manage the way customer applications are handled and flats are allocated. One such service is the InfoWEB, which makes a variety of relevant information, such as answers to frequently asked questions as well as interactive services (e.g. enquiry on availability of flats for selection, e-application for balloting exercise and Build-to-Order system) available to the public. Note that the InfoWEB also acts as a virtual sales office and one-stop marketing portal to facilitate the flat buying process for customers. This system also helps in handling and responding to feedback received from customers. Another service is in the use of interactive television (INtv), to provide up-to-date information (e.g. flat or shop-space selection status) to customers.

Tracking and responding to customer complaints is a critical business process of HDB. These complaints, which come in the form of phone calls, letters or press reports, could pertain to HDB housing or general facilities such as parks and car parks. The task of responding to these complaints begins with the sending of summarized complaints to the concerned functional departments via facsimile. Concerned departments coordinate and communicate with one another to investigate the complaints and draw up an appropriate response to the customer. The entire process thus spans several departments, and requires intense communication as well as coordination among employees from these departments. This process was cumbersome, time-consuming and considerable efforts had to be made to ensure a timely and satisfactory response.

To re-engineer its customer complaint tracking process, HDB implemented an on-line customer complaint-tracking module as part of its IOS (which has several databases seamlessly integrated into it). This application ensures that records of complaints and negative feedback are filed, stored and passed on to relevant departments. It also keeps track of replies from the departments, generates detailed analyses and reports, and archives the information for future retrieval.

With increased complexity in its operations, the demand placed on the IT function was also increased. To cope with this increasing complexity, HDB decided to re-engineer its IT function. Hence, steps were taken to completely alter the structure of the IT department in HDB. The CIO flattened the structure, which became process-based, and introduced a new team of professionals in the ISD. The entire set of IT processes was streamlined with the introduction of project teams, formalization of job responsibilities and introduction of project management techniques and methodologies. In the structural arrangement prior to the re-engineering of the IT function, ISD had four broad levels, namely, the CIO, sections, units and teams. However, teams were not well defined and IT staff members were assigned to multiple teams and projects. This resulted in multiple reporting relationships, often causing conflicts among different projects as well as teams. This loosely defined structure was reorganized as shown in Fig. 3. The IT department is re-divided into six sections, namely, operations, technical services, development support, corporate information systems, and business information systems Sections 1 and 2. Each section is divided into units, which are divided into teams, with each IT staff member reporting to only one superior. Decision-making is decentralized to the team-level, with the team leaders being responsible for the entire project assigned to them. To streamline systems design and development activities, HDB introduced several new methodologies, tools and techniques. It currently uses an enhanced system development methodology,



Note: Wef 1 July 2003, the designation of CIO was changed to Director (Information Services) to be consistent with designations used in the civil service.

Fig. 3. Organization chart (wef 1 July 2003).

which includes a system development checklist bundled with various procedures and standards. Documentation has also been re-emphasized with the allocation of additional manpower to this activity. To strengthen its efforts to re-engineer its IT function, changes in performance appraisal and training activities were introduced. This was followed by appropriate changes in HR policies and procedures for the IT staff. All these steps ensured a smooth re-engineering of the IT function at HDB.

3.2.3. Flexible organization and cross-functional orientation

HDB places high emphasis on cross-functional teams.

“A prominent characteristic of HDB as an organization is its high degree of internal dependencies and linkages. A crucial requirement for excellence in HDB is therefore teamwork.”—CEO, HDB

Unlike any public sector organization which is typically characterized by bureaucracy and rigid layers of organizational hierarchy, HDB, through its IT systems, has made it possible for individuals from different departments and branch offices to coordinate their activities together. The IOS, built on Lotus Notes groupware system, connects the entire organization across all levels and divisions. It provides a means for staff to communicate with one another and to work in teams.

“Our workgroup computing systems have made a great impact on the organization, touching almost all staff. They now have better and more convenient access to information, and they can communicate with one another more effectively as well.”—CIO, HDB

HDB also provides its staff with flexibility in their operations. This culture is initiated by top management and is prevalent throughout the organization.

“As far as my working style is concerned, I leave people a lot of room. I cannot put a tight string around anyone otherwise that person will lose his initiative very quickly and then we will not be maximizing his potential.”—HDB Chairman

HDB has laid high thrusts on open communication among its staff members. The stress on open communications was realized through effective implementation of quality circle teams where ‘members always listen to each other and no one should close his mind to the contributions of others’. On the communication style in the organization, a functional executive said: ‘If there are disagreements, they are discussed openly to avoid misunderstanding and unhappiness. Otherwise, such things would affect the ability of members to work as a team.’

3.2.4. IT-driven inter-organizational relationships

HDB has taken advantage of the Internet to interact and provide information to its customers. It has established the HDB InfoWEB where a wide range of information on the organization, and its products and services are provided. The Web also contains a section

on frequently-asked-questions where customers can find answers to their queries. InfoWEB has not only been acting as an information base but also as a medium of interaction between HDB and its customers. Through InfoWEB, customers can send their requests for services, provide feedback, and participate in the Quality Service feedback program using their own personal computers.

Another interesting application that has resulted in greater customer convenience is the use of INtv to display the status of flat availability. As discussed earlier, INtv has resulted in greater convenience for the customers.

HDB has implemented systems that are directly linked to those in other organizations (e.g. Singapore Power and Inland Revenue Authority of Singapore) so as to improve its customer services. For example, because of its computer link-up with the Central Provident Fund (CPF) board, customers can authorize HDB to retrieve relevant CPF information on their behalf during transactions. This has resulted in significant savings in time and effort for the customers. Another similar facility that is offered to customers is the on-line enquiry at HDB counters for property tax information.

3.3. Complementary human resources

3.3.1. Top management commitment to IT

Past research has frequently emphasized the importance of top management support and commitment in any development and implementation process, e.g. total quality management (Black and Porter, 1996), case tools (Orlikowski, 1993) and expert systems (Guimaraes et al., 1996). Hence, it is not surprising that the top management at HDB has played an active role in supporting and participating in all major IT initiatives. As the CIO remarked:

“ISD staff can never work alone. All successful IT implementations are backed by strong commitment from our top management and our user department management, as well as support from IT users and IT support staff in the departments.”

3.3.2. Managerial IT knowledge

One of the greatest strengths of HDB is its knowledgeable manpower. More than half of the employees has served the organization for more than 10 years, with an average 16 years of service. This has helped HDB to accumulate a rich pool of experience and expertise. IT training has been an integral part of staff development in HDB and has ensured that employees in user departments have adequate IT skills and knowledge. The total investment in training including other functional training and general development programs amounts to about 4% of payroll.

With rapidly changing IT environment, it is vital to maintain a knowledgeable workforce that is in tune with technological advancements. Apart from technical knowledge, it is also the business knowledge of the IT workforce that leads to effective IT implementation in organizations. While generic training on technological developments are available in the marketplace, it is firm-specific training on IT and business issues that

can be beneficial. This is what HDB has done to ensure that its IT staff is well educated about various business issues.

At HDB, the employees are well trained in both their core areas of work as well as other functional areas.

“HDB’s vision is to excel as an organization that provides quality housing and quality services. A competent and versatile workforce is vital to meeting this challenge. And to prepare our staff, we are totally committed to providing relevant and systematic training.”—CEO, HDB.

3.3.3. IT training

HDB has implemented a five-year comprehensive IT training strategy. Under this strategy, different kinds of training are provided for different levels of employees. For example, (i) general IT training for all employees, which exposes them to personal productivity applications like word-processing, presentation software and email and correspondence; (ii) operational IT training which is given by individual departments on specific job-related application systems that are to be used by employees; (iii) specialist IT training for the purpose of equipping IT staff with the latest IT knowledge.

HDB organizes an IT trend seminar annually whereby experts and industry leaders are invited to come and share their experiences and latest developments with HDB’s IT staff. This seminar helps HDB staff to keep abreast of the latest IT trends. Another similar annual IT conference is also conducted for the rest of the HDB staff. To promote the use of PC-packages among its employees, HDB introduced a staff proficiency certification scheme in 1990. Though this scheme was a voluntary one, more than 1500 employees have participated in the scheme between 1990 and 1995. HDB has also established a Learning Centre in its ISD department, where multimedia-workstations and course materials are provided for the IT staff.

4. HDB versus the private sector

It is important to recognize the distinct IT management challenges in public sector firms like HDB. A range of factors commonly seen as differentiating the public sector firms from the private sector could potentially impact their IT usage and IT capabilities (Cats-Baril and Thompson, 1995; Danziger and Andersen, 2002; Willcocks and Mark, 1989). Public sector organizations tend to be less market-driven as compared to private firms. Being less market-driven tends to make public firms less efficient with low incentives for productivity and efficiency. They are usually more cautious, risk-averse and more bureaucratic. Public firms are also governed by rules and sanctions of the public policy agencies and the state. These inherent differences between public and private firms yield distinct challenges for managing IT resources and capabilities in public sector. This often results in the intended benefits of IT being not realized in the public sector (Northop et al., 1990). Bretschneider (1990) examined over 1000 public and private firms and presented a list of five potential differences that could affect the IT management capabilities in these firms. First, public

sector IT managers are faced with greater levels of interdependence across organizational boundaries than those in private firms. Second, public sector IT executives must contend with higher levels of red tape. Third, public and private sector firms tend to follow different criteria for making their IT procurement decisions. Fourth, IT planning in public firms tends to be more concerned with extra-organizational linkages than with internal coordination. Finally, public sector firms tend to place the IT director lower in their organizational hierarchy than private firms. Therefore, public sector firms like HDB operate in more constrained environment and are faced with more challenges in exploiting IT resources and capabilities.

Being a public sector firm, HDB was also faced with similar challenges from external and internal environments. However, HDB seems to have made impressive gains in exploiting its IT resources and capabilities. Table 2 proves a comparison between HDB and the private sector. HDB, by virtue of being a statutory board has the advantage of being a non-profit organization compared with the private sector which is mainly profit oriented. This non-profit nature of HDB enabled it to focus its attention on providing services to its customers rather than being concerned about growth in profitability. Further, the budget, given by the government, is more dependent on the demand for HDB flats than economic conditions. In fact, during periods of downturn, the budget could be maintained or increased to stimulate the local construction economy. In contrast, the budget for organizations in the private sector is more dependent on profitability and economic conditions, and may tend to be smaller than HDB (which is responsible for nationwide housing).

In addition, the scale of HDB operations is predominantly local and nationwide (although HDB Corp was established to also tap opportunities to export its expertise overseas) while that for the private sector could be local, regional and/or global. Consequently, HDB has few, if any competitors locally compared to private sector organizations. Although there are private developers, they tend to compete on the higher end of the market as HDB predominantly focuses on providing affordable housing for Singapore citizens.

HDB also has the inimitable advantage of easier access to government databases compared to the private sector. This has enabled HDB to provide 1-stop services on its

Table 2
HDB versus the private sector

Characteristics	HDB	Private sector
Organization type	Non-profit oriented	Profit-oriented
Budget	Given by government, generally large	Depend on profitability, relatively smaller
Scale of operations	Predominantly local	Local, regional and/or global scale
Links to government databases	Easy to establish/justify	More difficult to establish/justify
Competitors	Relatively few	More competitors
Accountability	Public	Shareholders
Motivation for computerization	Government-push plus business needs	Competitor-push plus business needs

InfoWEB as discussed earlier. In contrast, it is often more difficult for the private sector to justify linkages to government databases. Being a public sector organization may make HDB more susceptible to complaints if its services are unsatisfactory. Consequently, HDB emphasizes customer satisfaction and carries out periodic customer feedback surveys. In contrast, poor services by a private organization may affect a smaller segment of the population.

The motivation for HDB to leverage IT is in line with the government's vision of Singapore being an Intelligent island where e-government services are available 24/7. HDB's policy is to adopt technologies that serve business needs rather than adopting technology for technology sake. In contrast, the motivation to leverage IT in the private sector is often driven by competitor push coupled with business needs.

The above comparisons indicate some similarities and differences among HDB and private sector organizations. While some of the above factors may give HDB an advantage, it is important to recognize that the private sector may also have other advantages that HDB does not have e.g. private sector organizations may be less susceptible to public scrutiny.

5. Conclusions

This study uses the resource-based view of the firm to examine IT deployment at HDB. It demonstrates how HDB leverages on its IT resources and capabilities together with complementary business and human resources, to manage IT effectively. An examination of these resources provide researchers and practitioners with a better understanding as to why HDB is successful in deploying IT to serve its business needs. Specifically, IT resources alone are unlikely to be responsible for HDB's success in IT management. Such resources must be complemented with both business and human resources. Further, by establishing sound IS management practices and institutionalizing them (e.g. systematic systems development process and regular IS planning process), HDB is able to leveraged its resources more effectively.

In terms of business resources, the development of ISP and ISWP enables more effective alignment of IT with business needs. This facilitates IT-enabled redesign of key business processes to better serve customers and enhance productivity. Consequently, HDB becomes more flexible and more responsive to changing needs, thereby fostering closer relationships within various departments in HDB and also between HDB and its external customers.

Such deployment of business resources would not be possible without complementary human resources. Of key importance is top management commitment to IT as well as managerial IT knowledge. Such commitment and knowledge are enhanced through systematic IT training so that every staff in HDB is IT-literate. This facilitates closer partnership between business and IT functions, thereby contributing to more effective deployment of IT to serve business needs. This finding is consistent with [Dehning and Stratopoulos \(2003\)](#) research that found that managerial IT skills are important in facilitating sustainable competitive advantage.

It is evident that the holistic approach to IT management (encompassing IT resources and complementary business and human resources) enables HDB to deliver systems that

are aligned with business needs, thereby enhancing productivity and enabling better services to customers. This holistic approach to IT management serves as important lessons for other organizations. IT is basically an enabler. It is how you leverage IT together with other resources that determine its impact and the value generated. An interview with HDB staff on why HDB is successful also highlights the importance of close relationships with users, and the presence of a systematic system development process that helps to minimize bugs in systems. Developing quality systems that serve business needs is crucial as it builds credibility for the IS department as well as forge closer links between IS and business units. Further, although HDB has no major competition (as competitors tend to focus on higher end segment), it often acts like a competitive firm in leveraging its resources to directly support its organization's mission. The strong entrepreneurial leadership of the CIO (in terms of willingness to explore new ideas) coupled with strong support from top management may also help to explain HDB's success.

As an indirect, if not direct, result of this holistic approach to IT management, HDB has won a number of national and international awards, which stand as a testimony to its architectural, engineering and development capabilities. In 1991, HDB was presented the prestigious World Habitat Award in the developed country category by United Nations, for its development of Tampines New Town. In 1994, HDB won the Asian Management award for outstanding development management. At the national level, HDB has won numerous awards, for example, the Best Buildable Design award and Construction Excellence award from the Construction Industry Development Board, National Quality Control Circle awards, and the Singapore Quality Award that recognizes the organization's commitment to quality excellence.

In the area of IT, HDB was the recipient of the prestigious National IT awards from the National Computer Board (NCB), Singapore in 1996. In that same year, HDB also won the award for excellence in IT training from NCB. Earlier in 1995, HDB had attained ISO 9001 certification for its in-house information systems development efforts. Further, in March 2002, the CIO, Alex Siow was named IT Person of the year by the Singapore Computer Society in recognition for his leadership in the use of IT within HDB and promoting IT certification within the industry. Hence, HDB serves as a role model to both private and public organizations in the successful deployment of IT. With its excellent track record coupled with a highly committed management team, HDB is poised to attain world class standing in its ability to provide affordable housing to the citizens of Singapore.

In summary, this paper contributes to existing literature in two ways. First, it illustrates the application of resource-based theory in a public sector organization. Previous research has focused more on the private sector. In doing so, this paper also illustrates that the importance of complementary business and human resources in leveraging IT resources is applicable to both public and private sector organizations. Second, this paper illustrates how HDB leverages the three types of resources, namely, IT resources, business resources and human resources, for better organizational performance. Insights gained from the HDB's experience enable researchers and practitioners to better understand and focus their attention on complementary resources necessary for leveraging IT effectively. This will

result in better management of scarce resources through facilitating alignment and exploiting synergies among various types of resources.

References

- Amit, R., Schoemaker, P.J.H., 1993. Strategic assets and organizational rent. *Strategic Management Journal* 14 (1), 33–46.
- Barney, J., 1991. Firm resources and sustained competitive advantage. *Journal of Management* 17 (1), 99–120.
- Benjamin, R., Wigand, R., 1995. Electronic markets and virtual value chains on the information superhighway. *Sloan Management Review* 36 (2), 62–72.
- Bensaou, M., Venkatraman, N., 1996. Inter-organizational relationship and information technology: a conceptual synthesis and a research framework. *European Journal of Information Systems* 5 (2), 84–91.
- Bharadwaj, A.S., 2000. A resource-based perspective on information technology capability and firm performance: an empirical investigation. *MIS Quarterly* 24 (1), 169–196.
- Boynton, A.C., Zmud, R.W., Jacobs, G.C., 1994. The influence of IT management practice on IT use in large organizations. *MIS Quarterly* 18, 299–318.
- Bretschneider, S., 1990. Management information systems in public and private organizations: an empirical test. *Public Administration Review* 50 (5), 536–545.
- Brynjolfsson, E., 1993. The productivity paradox of IT. *Communications of the ACM* 35, 66–67.
- Brynjolfsson, E., Hitt, L., 1996. Paradox lost? Firm level evidence on the returns to information systems spending. *Management Science* 42 (4), 541–558.
- Black, S.A., Porter, L.J., 1996. Identification of the critical success factors of TQM. *Decision Sciences* 27 (1), 1–21.
- Cats-Baril, W., Thompson, R., 1995. Managing information technology projects in the public sector. *Public Administration Review* 55 (6), 559–566.
- Chatfield, A.T., Bjorn-Anderson, N., 1997. The impact of IOS-enabled business process change on business outcomes: transformation of the value chain of Japan airlines. *Journal of Management Information Systems* 14 (1), 13–14.
- Cragg, P., King, M., Hussin, H., 2002. IT alignment and firm performance in small manufacturing firms. *Journal of Strategic Information Systems* 11 (2), 109–132.
- Danziger, J.N., Andersen, K.V., 2002. The impacts of information technology on public administration: An analysis of empirical research from the golden age of transformation. *International Journal of Public Administration* 25 (5), 591–627.
- Davenport, T., 1993. *Process innovation: reengineering work through information technology*, Harvard Business School, Boston.
- Dehning, B., Stratopoulos, T., 2003. Determinants of a sustainable competitive advantage due to an IT-enabled strategy. *Journal of Strategic Information Systems* 12, 7–28.
- Doll, W.J., 1985. Avenues for top management involvement in successful MIS development. *MIS Quarterly* 9, 1735.
- Fredrickson, D., Vilgon, M., 1996. Evolution of inter-organizational information systems in industrial distribution: the cases of Luna and Pappersgurppen. *European Journal of Information Systems* 5 (1), 47–61.
- Grant, R.M., 1991. The resource-based theory of competitive advantage. *California Management Review* 35 (3), 114–135.
- Guimaraes, T., Yoon, Y., Clevenson, A., 1996. Factors important to expert systems success: a field test. *Information and Management* 30, 119–130.
- Hammer, M., Champy, J., 1993. *Reengineering the corporation: a manifesto for business revolution*, Harper Collins Publishers.
- Harris, S.E., Katz, J.L., 1991. Organizational performance and information technology investment in the insurance industry. *Organization Science* 2 (3), 263–295.
- Johnston, H., Vitale, M., 1988. Creating advantage with inter-organizational information systems. *MIS Quarterly* 12, 153–166.

- Klein, S., 1996. The configuration of inter-organizational relations. *European Journal of Information Systems* 5 (2), 92–102.
- Lederer, A.L., Sethi, V., 1996. Key prescriptions for strategic information systems planning. *Journal of Management Information Systems* 13 (1), 35–62.
- Mata, F.J., Fuerst, W.L., Barney, J.B., 1995. Information technology and sustained competitive advantage: a resource-based analysis. *MIS Quarterly*, 487–505.
- Minshall, T., 1999. A resource-based view of alliances: the case of the handheld computer industry. *International Journal of Innovation Management* 3 (2), 159–183.
- Montealegre, R., 2002. A process model of capability development: lessons from the electronic commerce strategy at Bolsa de Valores de Guayaquil. *Organization Science* 13 (5), 514–531.
- Nelson, R., Winter, S., 1982. *An Evolutionary Theory of Economic Change*, Harvard University Press, Cambridge, MA.
- Northop, A., Kraemer, K., Dunkle, D., King, J., 1990. Payoffs from computerization: lessons over time. *Public Administration Review* 50 (5), 505–514.
- Orlikowski, W.J., 1993. CASE tools as organizational change: investigating incremental and radical changes in systems development. *MIS Quarterly* 17 (3), 309–340.
- Porter, M.E., 1985. *Competitive Advantage*, The Free Press, New York.
- Powell, T.C., Dent-Micallef, A., 1997. Information technology as competitive advantage: the role of human, business and technology resources. *Strategic Management Journal* 18 (5), 375–405.
- Raghunathan, T.S., 1992. Impact of CEO's participation on information systems steering committees. *Journal of Management Information Systems* 8 (4), 83–96.
- Raghunathan, B., Raghunathan, T.S., 1991. Information systems planning and effectiveness: an empirical analysis. *Omega* 19 (2/3), 125–135.
- Rockart, J.F., Crescenzi, A.D., 1984. Engaging top management in information technology. *Sloan Management Review* 25 (4), 3–16.
- Sambamurthy, V., Bharadwaj, A., Grover, V., 2003. Shaping agility through digital options: reconceptualizing the role of information technology in contemporary Firms. *MIS Quarterly* 27 (2), 237–264.
- Santos, B.D., Sussman, L., 2000. Improving the return on IT investment: the productivity paradox. *International Journal of Information Management* 20 (6), 429–440.
- Tarn, J.M., Wen, H.J., 2002. Exploring organizational expansion modes and their associated communication system requirements: consolidation and complementation. *International Journal of Information Management* 22 (1), 3–26.
- Teo, T.S.H., Ang, J.S.K., 2001. An examination of major IS planning problems. *International Journal of Information Management* 21 (6), 457–470.
- Teo, T.S.H., King, W.R., 1997. Integration between business planning and information systems planning: an evolutionary-contingency perspective. *Journal of Management Information Systems* 14 (1), 185–214.
- Tung, L.L., Turban, E., 1997. Lotus notes applications and impacts at the housing development board (HDB) in Singapore. *Human Systems Management* 16 (1), 53–61.
- Upton, D.M., McAfee, A., 1996. The real virtual factory. *Harvard Business Review*, 123–133.
- Venkatraman, N., Raghunathan, T.S., 1990. Strategic management of the information systems function: changing roles and planning linkages. In: *Advances in Strategic Management*, Jai Press Inc..
- Weill, P., 1992. The relationship between investment in IT and firm performance: a study of the valve manufacturing sector. *Information Systems Research* 3 (4), 307–333.
- Wernerfelt, B., 1995. The resource-based view of the firm: ten years after. *Strategic Management Journal* 16 (3), 171–174.
- Willcocks, L.P., Mark, A.L., 1989. IT systems implementation: research findings from the public sector. *Journal of Information Technology* 4 (2), 92–103.
- Williams, T., Maull, R., Ellis, B., 2002. Demand chain management theory: constraints and development from global aerospace supply webs. *Journal of Operations Management* 20 (6), 691–706.