ELSEVIER

Decision Support Systems 34 (2002) 253–269

Decision Support Systems

www.elsevier.com/locate/dsw

Structurational analysis of e-government initiatives: a case study of SCO

Paul Raj Devadoss [a,1], Shan L. Pan [a,*], Jimmy C. Huang [b]

[a] *Department of IS, School of Computing, National University of Singapore, S15, 04-11, 3 Science Drive 2, Singapore, 117543 Singapore*
[b] *Nottingham University Business School, Jubilee Campus, Nottingham NG8 1BB, UK*

Abstract

Governments are eagerly looking toward a digital future, but their view is obstructed by the challenges they face in modernizing such vast enterprises. This case study discusses how a government agency developed and implemented an e-procurement system. In particular, the study findings suggest that in the initial stage of any e-government projects, having a tele-cooperation perspective would be useful as it provides a holistic view, focussing on the support of computer-mediated cooperation in a comprehensive sense. We analyse the data using a structurational model, to identify issues in developing this initiative, and construct a framework to analyse future e-government initiatives. We hope to provide a foundation for further discussions on this increasingly important area of research and practice.

Keywords: e-Government; G2B e-commerce practice; e-Procurement systems; Case study

1. Introduction

The nature of government functioning has been undergoing a rapid transformation in the latter part of the 1990s. This is due to the impact of the technological changes that enabled delivery of services over the Internet. The private sector has taken great strides in utilizing these technologies to the development of their functioning. New service industries, better delivery of services and faster, cheaper communication are some of the by-products of the technological revolution. These transformations have created an expectation among citizens for a better delivery of services from government. However, most governments have been very slow or even unprepared for these transformations.

Despite the increasing efforts of adopting web technology in recent years, most government efforts have concentrated on putting up a web page [32]. However, this administrative-focus has gradually changed to become a customer-focus serving citizens and trading partners directly by providing services, information and transactions on-line via the Internet. This has been termed as "electronic government (e-government)", or "electronic commerce" within the context of government services [35].

Implementing such changes, however, is not a simple task. Several governments lack the fundamental infrastructure, organizational culture, understanding and resources for the transformation of the

* Corresponding author. Tel.: +65-68746520.
E-mail addresses: paulraj@nus.edu.sg (P.R. Devadoss), pansl@comp.nus.edu.sg (S.L. Pan), jimmy.huang@nottingham.ac.uk (J.C. Huang).
[1] Tel.: +65-68741556.

0167-9236/02/$ - see front matter © 2002 Elsevier Science B.V. All rights reserved.
PII: S0167-9236(02)00120-3

magnitude that e-governments require. To many governments, this transformation is the start to establishing the basic infrastructure to build a comprehensive e-government. To some, this is also the opportunity to deliver services innovatively, showing the way for other governments.

Singapore is one such government, with a commitment to adopting new technologies and re-engineering processes for the benefit of an efficient functioning of the government. The national information technology policies in Singapore have created a suitable environment for the utilization of information technologies to deliver e-services. In developing an understanding of this pioneering task, this study concentrates on a Government to Business (G2B) relationship in which the development and implementation processes of a government-based e-procurement system are explored. This particular study of G2B e-procurement system does not represent the overall picture of building an e-government, but it aims to bring out the complexities and challenges such initiatives should consider.

Government electronic business (GeBIZ) is the e-procurement system for all government ministries and statutory boards in Singapore, and is one of the showcase e-government initiatives. The nature of the initiative, requiring the involvement of all government agencies and trading partners, allows for a tele-cooperative perspective in the study. The cooperation of these agencies reveals social and organizational factors that need attention during the development and implementation of the project. To bring forth these social and organizational issues, we use a structurational model to analyse the data. The factors thus revealed are then used to construct a framework that can be used to study future e-government initiatives.

The plan of the paper is structured to provide an understanding of the current literature on e-government, followed by a description of the methodology and then the presentation of the case itself. Accordingly, Section 2 describes the literature that is emerging in this new area of research interest, and reviews some of the perspectives proposed by the literature. Section 3 describes e-government efforts in Singapore to provide an overview of the context for the case study. Section 4 explains the methodology for the case study and analysis, providing an understanding of the structurational model. Section 5 narrates the case, and in Section 6, we analyse the data. The framework for studying e-government initiatives is presented in Section 7, followed by research issues for the expansion of study in this important topic and conclusion.

2. Literature review

The Internet has provided a new medium of communication. The impact of this medium on the government is tremendous. From serving as a static website to providing direct citizen services, the transformation of the government has demanded a change of focus from the administration to the serving of the citizenry. The rapid technological changes that have transformed the economy and society are now reaching and transforming the government as well [35]. This governmental transformation is being adopted across the globe.

The introduction of IT in the public sector and the resultant issues are discussed in the public administration literature. The discussions range from micro issues of importance to IT managers in the public sector [6] to the macro national IT infrastructure [9]. The government depository literature follows up with the policy issues in specific sectors, such as the government depositories. The early literature on e-government draws from these rich discussions. However, the emerging picture of e-governments is more than ‘IT in the public sector’. The early discussions in the IS literature involve several issues relating e-government to organizational issues, technology issues, business models, etc. This section discusses the early literature on e-government, providing the literary context to the study.

2.1. Definitions of e-government

A number of definitions for e-government have been offered in the existing literature. For instance, e-government is considered as a guiding vision towards modern administration and democracy [39]. According to them, e-government is concerned with the transformation that government and public administration have to undergo in the next decades. Lawson [21] suggested that e-government is one in which the public service operates in a “one-stop, non-stop” way, does “more for less”, and “power is transferred to people”. Moreover, Tapscott [36] defined e-govern-

ment as an ''internetworked government'', and Nadler and Tushman [28], on the other hand, emphasised that technology is only ''one of the structural materials''. Milford [26] considers electronic government as any way technology is used to help simplify and automate transactions between governments and constituents, businesses, or other governments. Taking a more comprehensive view, Aicholzer and Schmutzer [3:379] saw ''e-government covering changes of governance in a twofold manner: (1) transformation of the business of governance, i.e. improving service quality delivery, reducing costs and renewing administrative processes; (2) transformation of governance itself, i.e. re-examining the functioning of democratic practices and processes''.

2.2. Perspectives of e-government

It is noted in the literature that most of the existing studies are not empirical but rhetoric in nature focusing on the transactional structure of the processes required in the initiatives. This approach allowed for perspectives to be developed based on the different segments of the transaction between the government and citizens/businesses and also within the governments organizational structure itself. In particular, according to Lenk and Traunmuller [22], e-government initiatives can be understood from the following perspectives:

(1) E-business Perspective
(2) Citizen Perspective
(3) Knowledge Perspective
(4) Process Perspective
(5) Tele-cooperation Perspective

The *e-business perspective* considers the use and deployment of information and communication technologies to enhance functioning of the government [31]. The impact of e-business on the public sector is the source of the transformation of the government towards electronic government [40]. The deployment of e-commerce technologies can serve to successfully increase citizens' access to information, and improve functioning of the government [7]. Simply put, studies that adopt this perspective took the definition of e-government to becoming electronic commerce within the government framework [35].

The *citizen perspective* describes the end user perspective in the e-government. In a Government to Citizen (G2C) initiative, for example, the citizen acceptance of the electronic delivery defines the success of the initiative. The need to address the concerns of the citizens and provide a safe, easy, accessible transaction is recognized in this perspective. The discussion covers the delivery mode and the concerns in accessing electronic services [22]. A greater discussion on accessing electronic services is found in the government information depository literature, which discusses the problems in providing services solely through the electronic medium [4,8,14,19,20,23,33,34]. In a way, much of the literature suggests using the electronic medium along with the traditional media to provide government services, thus addressing the digital divide partly.

The *knowledge perspective* recognizes workers as a source of knowledge in their respective roles. While redesigning the transactions to the e-government, these workers' knowledge should be adequately utilized ensuring a prevention of knowledge loss. This provides for the continuation of the knowledge that was accumulated over time [22]. A critical issue discussed by Wimmer and Traunmuller [39] involved adequate mapping of domain knowledge to the virtual workspace. Traunmuller and Wimmer [39] discussed the issues in managing knowledge in the public sector, exemplifying aspects of knowledge with respect to the administrative processes and citizens' access to the authorities.

The *process perspective* talks about the utilization of IT to enhance the service delivery efficiency [18,22,38]. In redesigning organizations, the processes have been aided by the workflow management systems (WFMS). However, the coordination of the workflow plays a less important role in the higher echelons such as in a ministry. The other spectrum of the process coordination is collaboration [22], which is discussed in the cooperation perspective. Redesigning the processes will lead to a rethinking of the government and its working [22]. Lenk and Traunmuller [22] pointed out that the challenge lies in the ability to fundamentally redesign the interaction between public administration and citizens (including commercial firms), which is coupled with a reorganization of the business processes within the public administration.

While other perspectives are useful in understanding various parts of e-government activities, this study suggests that the ***tele-cooperation perspective*** provides the most effective means to exploring the initial stage of e-government development. The tele-cooperation perspective deals with the interaction of the various agencies and trading partners involved in a work process. In particular, in the initial stage of any e-government project, having a tele-cooperation perspective would be useful as it provides a holistic view, focussing on the support of computer-mediated cooperation in a comprehensive sense [22]. Often, in the early stage of any e-government project, most independent agencies need to integrate themselves in the process requiring possibly, a change in technology, re-engineering of the process, new job functions, and re-training for the new functions to be performed. Hence a clear understanding of their respective organizational roles is required for a successful interaction of the various organizations in delivery of services.

Specifically, Lenk and Traunmuller [22] considered the role of tele-cooperation as the support of computer-mediated cooperation in a comprehensive sense. The convergence of the services from several agencies to a single interface is the result of cooperation among several organizations, people and processes. The development of a common IT-based network for all the agencies of the government has been the focus of some recent studies [10,16,24] . IT-based network plays a crucial role in e-government, providing the foundations for the deployment of complex services involving all agencies of the government. Though the use of IT-based network in public sector may not necessarily guarantee competitive advantage, they are viewed as primary mechanisms for creating more efficient and better service organizations [30] and overcoming challenges to be encountered in developing e-government projects.

On the other hand, fragmented responsibilities, interruption of processes and absence of cooperation could lead to inefficient provision of services. For example, in an Italian study conducted by Mecella and Batini [24], a government cooperative architecture to improve cooperation among public administrators was examined. Their findings suggest that governments have typically been portrayed as being slow in functioning. Public sector organizations are expected to have the least coordination in the execution of complex transactions.

In other words, our review of literature suggests that implementing e-government projects can be complicated and difficult because of the vast size and bureaucratic nature of a government. Hence, one of the main challenges is, as pointed out by Wimmer and Traunmuller [39], finding a successful way of re-engineering and distributing the administration's knowledge. Specifically, three major organizational challenges faced by initiatives to implement e-government include: (1) guiding principles and problems of restructuring administrative functions and processes; (2) requirements of and barriers to coordination and cooperation within the public administration; (3) the need to organize monitoring of performance in terms of e-government [2].

These challenges, with a focus on organizational coordination and cooperation, could perhaps be partially addressed with the electronic availability of all related information for every public administration involved. However, the overall success of any e-government will have to include an understanding and appreciation of the social interactions with the structures involved in the e-government initiatives. This is our main goal of this study—to provide empirical evidence on the tele-cooperation issues and encounters that were dealt with by an organization in developing a Singaporean e-government initiative.

3. Electronic government initiatives in Singapore

An annual survey by Accenture [1] ranked Singapore second among 22 countries in its e-government initiatives. Singapore has been a keen adapter of new information technologies in its government functioning. The Electronic Commerce Hotbed Programme in 1996 stated an action plan to prepare Singapore to be the hub for e-commerce. This developed into a number of e-government initiatives to serve as examples of the effectiveness of e-commerce, other initiatives to promote a state of the art technical infrastructure, and develop a culture of Internet usage among the public.

From a technical infrastructure perspective, Singapore has an effective national information infrastructure. Government policies are also effective in contributing to the acceptance of information technol-

ogies [9]. Several Internet Service Providers (ISPs) provide reliable access for businesses and the public. Broadband cabling of the whole island was promoted to enable high-speed access to all the services. The government has launched its social training efforts, promoting usage of the Internet by all sections of the society. Community programmes redistribute old computers at low prices, local community centres provide Internet training and access, schools have adopted training materials based on e-learning, and children are encouraged to make use of the Internet in presenting their work among other things. Meanwhile, the government also worked on restructuring the policies and laws to enhance the use of electronic commerce. The legal framework in Singapore was amended to enable a smooth functioning in the light of the technological developments, which required such changes. The electronic transaction laws particularly required changes to enable legal acceptance. The recognition for the Intellectual Property Rights has been emphasised, to enable an atmosphere conducive for electronic commerce development. Electronic transactions were accepted as legal evidence. Tax-related issues were also considered, and commerce laws for import and export were amended.

Along with the efforts to create an atmosphere of e-commerce friendliness in Singapore, the government invested in moving its transactions to the Internet. The web browser is undoubtedly the preferred interface for transacting electronically [26]. A number of services rendered by the government were identified and those services are offered on the web under a consolidated website called the e-citizen portal. These services are grouped based on their nature, and range from birth registration information to job listing. Though this portal does not constitute a complete convergence of all services one may require from the government, this is a beginning with major services being made available.

In this paper, we study one of the showcase initiatives in Singapore, namely, Government Electronic Business (GeBIZ). The electronic procurement system spans all the ministries and statutory boards in Singapore, totalling 150 in all. Each of these ministries and statutory boards has streamlined its procurement system and procedures with the GeBIZ system. When fully functional, GeBIZ is expected to transact 80% of all government purchases. We study the problems in developing and implementing this e-government initiative with a tele-cooperation perspective. This study provides us with an understanding of the issues in unifying the processes in several organizations, and providing a single system of access to all trading partners of the government procurement exercise.

4. Methodology

4.1. Data collection

The nature of the research topic requires a discussion on the qualitative issues in the development process. To provide an understanding of the issues, interpretive case study was chosen to be the most relevant methodology. Interpretive methods of research are ‘‘aimed at producing an understanding of the context of the information and the process whereby the information system influences and is influenced by the context’’ [37]. The case study was conducted over a period of 6 months at the office of the GeBIZ team, during the summer of 2000. Semi-structured interviews were conducted to gather information on the project first hand. The interviewees were selected from the team’s managers and system developers. Twenty two interviews were conducted during the course of the study with the project managers and system developers, each interview lasting about an hour, on average. Secondary data were collected to supplement the information gathered through interviews. Information on e-government initiatives was also collected from various sources from the government of Singapore.

The interviews were conducted at the GeBIZ team head office, and each session lasted for about 1 to 2 h. The questions were open ended and exploratory in nature. The ‘‘what?’’, ‘‘when?’’ and ‘‘why?’’ types of questions were designed to elicit information on the nature of the project. The interviews were designed to be non-leading, at the same time non-passive. The interviews were taped and transcribed. The interviewees were encouraged to speak openly, to allay any fears due to the recording of the interview.

The issues discussed centred on the background of SCO, the organization developing the project, the benefits of GeBIZ, the implementation of GeBIZ, and other experiences during the course of the project.

The information gathered from the interviews was then studied to pick common issues. Data gathered from the secondary sources was then collated with the interviews to verify available information. Additional information on the project was gathered through Government websites, publications and newspaper articles. The government websites on electronic government were studied to gather information on other e-government initiatives. These sources provided the information to understand the context for the GeBIZ project.

4.2. Data analysis: structurational model

In this study, we use Orlikowski and Robey's [29] framework to analyse the interaction of human action and social structures involved in the development of an e-government initiative in Singapore.

Orlikowski and Robey [29] adapted Giddens' [11] Structuration theory to study the interaction of human action and social structures in information systems. Giddens' work tried to address the debate of whether social phenomena are "subjective" based on human interpretive actions, or "objective" based on social structures. This debate was addressed by Giddens' Structuration theory, arguing that social phenomena were the result of the interaction between human actions and social structures, seeing the two as mutually interacting duality rather than as independent and conflicting elements. As Giddens [11] described, "man actively shapes the world he lives in at the same time as it shapes him." Giddens' identification of the elements of the Structuration theory is represented in Fig. 1.

Giddens describes three dimensions of structures, namely signification, domination and legitimation. These three dimensions interact through the modalities of interpretive schemes, resources and norms, with human actions such as communication, power and sanctions. Orlikowski and Robey [29] discussed the application of Giddens' theory to information systems in greater detail. Jones and Nandhakumar [17] provided a discussion on the empirical evidence for Orlikowski and Robey's [29] framework.

Looking at Giddens' model [11], the separation of the dimensions is purely for analytical convenience, since, in practice, they are closely interlinked. As an illustration, consider the example of travelling to a foreign country. The process of *signification* tells us the need to obtain documents of travel in the foreign country. Our interpretive *schemes* allow us to translate this requirement into the procedures that need to be complied to obtain those documents. The process of applying and obtaining the visa indicates *communication*, a human action. The structures of *domination* tell us that we can enter and travel freely within for a certain period in the foreign country, using the *power* of the travel document, and this travel is limited only by the *resources* available to us. Similarly, structures of *legitimation* explain to us the need and use of travel documents within our country of origin and the foreign country. The *norms* dictate carrying the travel documents when travelling. Travelling without legitimate

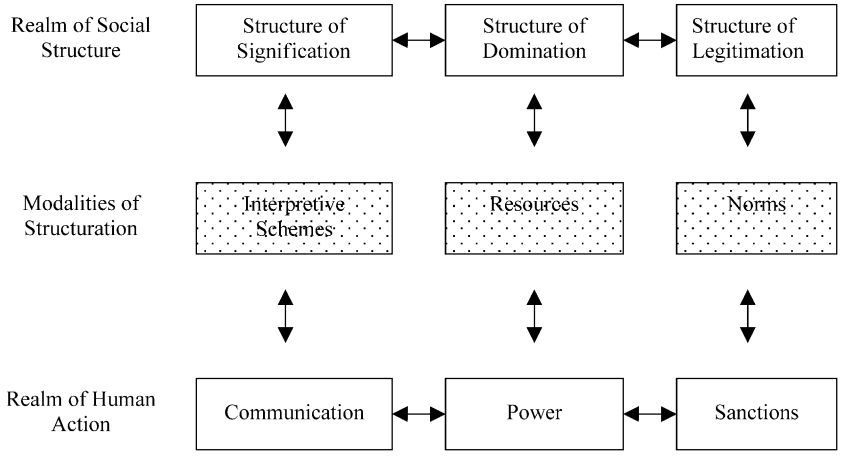

Fig. 1. Giddens' model of Structuration.

Table 1
Orlikowski and Robey's [29] framework based on Giddens' Structuration theory

Realm of social structure	Systems developers are informed by systems development methodologies and knowledge about their organization to build information systems.	Systems developers work within the constraints of time, budget, hardware, software, and authority to build information systems.	Systems developers draw on the values and conventions of their organization, occupation, and training to build information systems.
Modality	Interpretive schemes	Resources	Norms
Realm of human action	Systems developers create meaning by programming assumptions and knowledge into information systems.	Systems developers build information systems through the organizational power or capabilities they wield in their organizational roles.	Systems developers create sanctions by designing and programming legitimate options and conventions into the information systems.

documents would be reprimanded by law, and hence receive *sanctions*. In going through this process every time a person travels, we reinforce these structures. At each step, however, we could oppose and argue the existing structures and the result could be an amended procedure for travel, thus changing the social structure.

The use of Orlikowski and Robey's [29] framework helps to better understand the issues in the process of developing cooperation among the agencies of the government and the human action in this transformation to e-government. In particular, the framework allows for an identification of the process that evolves the structures for e-government and the social actions that shape the process. Orlikowski and Robey's [29] framework based on the different elements of Giddens' theory has been represented in Table 1.

5. The case

5.1. The search for GeBIZ

The Electronic Commerce Hotbed Programme established the legal and technical infrastructure by 1998. The government then worked on promoting electronic commerce among the public and the businesses. As a part of these efforts, several initiatives were launched to showcase electronic commerce. The Ministry of Finance (MOF) along with the Infocom Development Authority of Singapore (IDA) decided to develop a One-Stop Public Procurement Centre. This project was meant to create a system that would eventually deal with 80% of government procurement, and link all the ministries and statutory boards.

MOF and IDA shopped for a suitable software package. After studying the available packages, the MOF and IDA noted the following:

- The available software packages did not cater to all their requirements.
- There were some compatibility problems with the existing platforms.
- Some vendors do not reveal their source code.
- Some vendors were demanding a high price to satisfy all the requirements.

After a careful analysis of these issues, it was decided that the Systems and Computer Organization (SCO) should be invited to present their procurement systems, developed for the Ministry of Defence (MINDEF). MINDEF Internet Procurement Systems (MIPS), and Procurement Information Management Systems (PRIMS-II) were demonstrated to the MOF and IDA.

SCO was established in 1979 as the IT arm of the Ministry of Defence. The overall mission of SCO is to enhance the efficiency and productivity of the Ministry of Defence in key areas such as planning, training, logistics, e-commerce, etc. Its responsibilities centre on building and maintaining in-house systems, managing computer centres, as well as managing MINDEF's Internet and email networks. With a workforce of about 500, SCO has established itself within the

MINDEF introducing IT in the areas of logistics, finance, planning and procurement.

One GeBIZ programme manager recalled, "We were invited to demonstrate PRIMS-II and MIPS to MOF in 1998. After that some follow-up was done. They found that together with PRIMS-II and MIPS they can actually fulfil the 80% of the civil services requirements. From there they decided to move onto conceptualising things for a one-stop public procurement standard (OPPC). The system was subsequently renamed as GeBIZ (www.GeBIZ.gov.sg) in early 1999."

The evaluation of SCO's software dealt with concerns on all aspects of the requirements set for the OPPC. The software was relatively inexpensive, the source code was available, and was already implemented and operated successfully on a smaller scale. Apart from the suitability of the software, SCO's experience in developing and operating the system for MINDEF played a crucial role in the decision making process. MINDEF's implementation of the procurement system had a supplier base of over a hundred vendors.

5.2. GeBIZ system

GeBIZ was developed with three major components. The first component was the GeBIZ Enterprise, which dealt with the purchasing needs of the public sector procurement officers. Non-complex purchases were transacted through this system, including purchases from period contracts. The second component was GeBIZ Partner, which acts as the portal for all government purchasing. Tender information and results are published on this website. The site also allows businesses to trade with the government procurement officers through this portal. The third component is the GeBIZ Professional, which provides a set of supporting functions to deal with some complex trading requirements in the government purchasing.

The GeBIZ Enterprise and GeBIZ Partner components were developed by SCO, and GeBIZ Professional was outsourced from an IT consulting firm. MOF and IDA chose to do this in order to speed up the development and implementation of the system. After months of work in developing the system, GeBIZ was launched in June 2000. Though GeBIZ was only 1 of the 1000 other e-initiatives by the Government of Singapore, it was touted as a showcase project because of the implications it held in demonstrating the advances in electronic commerce in Singapore, and the transition of the Government from the traditional systems to the newer form of government.

GeBIZ Professional was integrated with the GeBIZ Enterprise and GeBIZ Partner towards the end of 2000. With all three components functional, a procuring officer in 1 of the 150 institutions could raise an ITQ through GeBIZ Enterprise, and publish it in GeBIZ Partner once it is approved. Interested partners would then submit their bids through GeBIZ Partner, and it would be channelled back to the procuring officer on GeBIZ Enterprise for further processing. Purchase Orders (PO), tender documents, invoices, revenue tender bidding and other information are exchanged in a similar way between the three components of GeBIZ. After the implementation of GeBIZ Enterprise and GeBIZ Partner, the system was used by 171 agencies with about a thousand user accounts. Trade with 42 partners and over 70 users was carried out (data as of 4th September 2000). The numbers are growing and more trading partners are being added, and the volume of trade is expected to grow with the inclusion of GeBIZ Professional.

6. Case findings: a structurational analysis

The use of Orlikowski and Robey's [29] framework allows us to "sift" the data, and identify issues that are of social structure or human action. Considering the warning sounded by Giddens in "applying" structuration as a whole in research projects, the attempt here is to analyse and use it as a "sensitising device" [12]. The analysis includes the discussion on the social structure and the human action to provide an understanding of these two important layers in the context of e-government. The presentation of the analysis is divided on the segments of the social structure and human action first, and then a further presentation of the interaction among the elements of social structure and elements of human action through the respective modalities. In presenting the analysis, we consider human action and social structure to be

evident at every stage. Hence, the two are presented together with the modality.

6.1. Realm of social structure

The functioning of the government is constrained by the legal and social restrictions that were developed over time as laws and conventions. These social structures can be viewed as the environment in which the government functions. The realm of social structure combines the factors that influence the adoption of e-government, the organizational needs of e-government, the constraints on the government in this transformation and the conventions in current practices of similar nature. These factors describe the structure and the context within which the development of the GeBIZ initiative is set.

SCO is conditioned by the social structures in its functioning. In GeBIZ, issuing an individual purchase order for each delivery location in one order is based on current practice. Ideally, a single purchase order should cater to deliveries to all locations from one order. System developers are influenced by the conventions of the organization, which forms part of the social structure. This serves to illustrate one of the social structures that condition the development of the e-initiative.

6.2. Realm of human action

e-Government transformation is fuelled by the services that are delivered electronically. The realm of human action can be viewed as the input that makes an initiative acceptable to the users, and ensures a constant development of the initiative. The factors involve the capabilities of the development team, the capacity to ensure a smooth development, and planning the enhancements to the initiative. These factors are essential in any initiative to ensure the continued usage and justification for the investment and development of the initiative. Consider the example of issuing multiple purchase orders. The GeBIZ team found it efficient to issue one purchase order that can cater to delivery to all locations arising from that order. This change is to be dealt with a modification in the future versions of GeBIZ. This attempt to change a process for the efficiency of the system arises from the human action to the conventions in the social structure.

6.3. Analysis of elements in social structure and human action

The two realms are brought together with the modalities through which they interact. The interactions are based on interpretive schemes, resources and norms. These modalities provide an understanding of the medium of interaction. Using the example of multiple purchase orders again, the interpretation of the GeBIZ team on the practice and the efficient means of executing current practice can be attributed to the interpretive schemes of the social structures. Hence the example illustrates the functioning of the modalities in their role of bridging the realm of social structure and that of human action. The study of the development of the GeBIZ using this framework enables an understanding of the interaction of information technology and organizations. The next section analyses the case with the social structure and human action through the modalities by which they interact.

Realm of social structure: Systems developers are informed by systems development methodologies and knowledge about their organization to build information systems.

Realm of human action: Systems developers create meaning by programming assumptions and knowledge into information systems.

Modality: Interpretive schemes.

The analysis in this section deals with the organizational and developer knowledge and methodologies that are utilized for the development of the project. While distinguishing guidelines are not available in general, the developers are conditioned by the organizational knowledge in developing the system, drawing on their interpretation of the organizational support and requirements out of this project. Though clear targets were set for the project, the GeBIZ team was exploring new technologies, in line with the government commitment, and trying to implement an innovative, user friendly, sophisticated system handling as many improvements as possible. The importance of team members' knowledge was felt when GeBIZ team members left. The result was delays in module development due to recruitment and re-training of new members.

Singapore is an active participant in the usage of new technologies and re-engineering processes [25]. The government policies have been adapted with the

growth of technology to provide a supportive environment for the adoption of new technologies. This environment meant the GeBIZ development team was able to take on the challenge of providing services that were imaginative. As an informant recalled, "We introduced web-based approval features to allow approving officers to approve procurement-based documents on an online basis, by logging onto GeBIZ enterprise without the restriction of any specific e-mail application." This was because of a problem in transmitting documents from one agency to another because of the inconsistent email servers in the different agencies within the government.

The development of this feature entails two important issues. The government was able to provide an environment for the development team to pursue an appropriate interface required for the deployment of a particular feature. In the whole project, several issues such as problems with transfer of documents between systems, problems with replication of data are examples that could be cited as reasons for major delays in the project, yet were solved in time due to the commitment of the organizations in implementing the system. This resolve to develop systems is guided by the government's stated position in favour of such transitions to e-government. Hence, government's stated support of new and innovative use of technology sets an appropriate environment for the development of the e-government initiative.

The development of this feature to approve documents using the web interface overcame the problem of incompatible mailing systems in communicating them to different agencies. This feature is important in the context of tele-cooperation, because of the diverse standards in all the 150 ministries and statutory boards in Singapore. This is a common issue in most organizations. The provision of a common network has been the focus of some recent studies. Such networks will be an advantage in promoting the common standards. The study serves to underscore the importance of a common standard, or the provision of means to communicate work documents irrespective of the users' organizational systems.

The nature of GeBIZ was a first for the government. Hence, transfer of data was an issue that had no previous standards. A GeBIZ informant noticed: "We faced data transfer delay problems, while we were importing data from ministries' information systems databases. One of the reasons for such delays was that, initially we were using Microsoft Access™ for data import purposes, which was not a suitable application for this task. Finally we decided to use another tool called structured query language (SQL) loader to speed up the data (period contracts, charge of accounts, catalogues etc) import process. When data was imported from ministries' information systems into GeBIZ enterprise databases, errors such as data integrity, data type mismatch and record duplication emerged, which were dealt with successfully."

As the recollection illustrates, the lack of existing standards was leading to exploring new ways to complete the task at hand. In the absence of data exchange standards, the GeBIZ team was guided by their knowledge of systems and tools. This is another key feature in the use of tele-cooperation among organizations. A common exchange format for data simplifies the process, while the absence leads to difficulties such as those narrated by the GeBiz team members. This issue brings to focus the need for a proper guideline for format, structure and communication of data between organizations within the government.

Realm of social structure: Systems developers work within the constraints of time, budget, hardware, software, and authority to build information systems.

Realm of human action: Systems developers build information systems through the organizational power or capabilities they wield in their organizational roles.

Modality: Resources.

Analysis in this section addresses the resource constraint in the organization and the development team itself, and the implications that these constraints have on the development of the project. Issues discussed here lead to the understanding of the kinds of resources that the e-government project would require. The resource constraints also deal with specific objectives that have been set down for the project. The purpose is to consider the limits within which the project was to be achieved. The case study serves to provide us with lessons from the experience in Singapore.

The Ministry of Finance (MOF) and Infocomm Development Authority of Singapore (IDA) were planning an e-procurement system for the government. Their search for a ready-made software package led them to believe that no system catered to all their

requirements, and hence invited SCO to develop the system. As one informant revealed, "We were invited to demonstrate PRIMS-II and MIPS to MOF in 1998. After that some follow up was done. They found that together with PRIMS-II and MIPS they can actually fulfil the 80% of civil service requirements. From there they decided to move on conceptualising things for one-stop public procurement standard (OPPC). The system was subsequently renamed to GeBIZ in early 1998."

In the experience of the GeBIZ team, there were several module requirements that forced them to look for software outside their parent organization, SCO. For example, the search for a workflow engine proved to be a difficult task. They were constrained by the cost of one suitable system, or there were code restrictions on one package that made it unsuitable for the GeBIZ project. Hence, the team developed its own workflow engine. While searching for an application server, however, the team was able to purchase a commercially available package, as a team member stated: "We went up to few vendors in November 1997 to select appropriate application server and application tools and finally at the end of November 1997 we succeeded in our search." Another package that was purchased was used to store documents from the workflow engine. The case highlights the importance of the capacity of the development team in identifying and if required developing appropriate software for the success of the project, within the constraints of the project.

There were problems with the implementation of the system when the GeBIZ team tried to integrate their system with the ERP packages implemented in individual organizations. As one project manager stated, "During interfaces requirement study ERP vendors realized that integration of GeBIZ with the ministries' ERP-based systems is a complicated task, because each procuring institution/ministry is using different ERPS. For example, procuring institutions such as Nanyang Polytechnic, Singapore Tourism Board and Land and Transport Authority use Oracle Financials™. On the other hand Trade Development Board, NUS, Revenue Authority of Singapore and Economic Development Board are using SAP™, and Civil Defence is using PeopleSoft™."

The deployment of e-government initiatives requiring the tele-cooperation of diverse systems requires a careful study. The GeBIZ team explored these systems and developed GeBIZ to integrate with all of these ERP packages existing in the ministries and statutory boards. Implementing a single system was not acceptable during the early days of ERP implementation, as an informant stated: "One of the reasons due to which different ERPS were adopted by different ministries was because each ERP vendor was charging differently in the past. Another reason was that the MOF did not want to monopolize a specific vendor."

In the quest for a unifying system for the development of tele-cooperation, issues such as the monopoly of specific software vendor should be dealt with. While it is infeasible to consider scrapping the existing systems, the solution was sought in developing the new systems to function with the existing systems. Therefore, an important aspect of the development and implementation of an e-government initiative of this nature involves working with several systems within the government.

A GeBIZ Program Manager spoke on one of the fundamental issues in tele-cooperation among government agencies, "GeBIZ is a generic system used by all the ministries. Therefore, it cannot be customized according to the requirements of each ministry's user. Further, when procuring users use GeBIZ they compare the features of their in-house procurement based systems with GeBIZ. One of the reasons for this comparison is that each ministry has customized its in-house procurement system according to its own business requirements. For example, at ministries the normal procurement practice is that if a procuring user raises the purchase request, their in-house procurement based system automatically routes the purchase request to the concerned approving officer for approval. You don't need to tell the system to which approving officer the purchase request is to be sent. Whereas in case of GeBIZ you have to tell the system to which approving officer you want to send the purchase request for approval."

The cooperation of the organizations involved in the implementation of the system plays a key role in the acceptance and usage of the system. Through a unified procurement system, the organizations had to re-engineer their procurement processes. This is a constraint that is imposed on their functioning by the nature of this project, namely, tele-cooperation. This cooperation is the result of the common sharing of

goals in making the procurement process efficient and acceptable to the procurement users, and vendors participating in the project. The experience of the GeBIZ team illustrates the importance of working with the procedural constraints of current functioning of the organizations within the government.

Realm of social structure: Systems developers draw on the values and conventions of their organization, occupation, and training to build information systems.

Realm of human action: Systems developers create sanctions by designing and programming legitimate options and conventions into the information systems.

Modality: Norms.

This section deals with the norms that guide the development and implementation of the project. In the absence of preset guidelines, the systems developers are guided by the systems that are developed previously, and continue to develop the guidelines through the project. The knowledge shared across the development over time is redeveloped to evolve into the newer norms in the case of new technologies or user requested system features. The GeBIZ team encountered several such instances, and we document some of their experiences in this discussion.

The GeBIZ project required users to accept a redefinition of some terms. For example, some user organizations felt ''reservation of funds'' and ''commitment of funds'' are the same, while others believed they were not. This led to user discontent pertaining to the usage of the system. One project manager recalled, ''The users of procuring institutions do not realize the importance of GeBIZ e-procurement system and they compare their existing in-house procurement systems with GeBIZ, with respect to the flow of procurement based documents. But the reality is GeBIZ is more than their existing in-house procurement systems, which are still not fully integrated with ministries' and supplier's information systems. As a result, they have to perform a lot of manual work, whereas GeBIZ will provide procuring users and suppliers, fully integrated e-procurement based services at one place. So we always tell the users that GeBIZ is evolving over time. So with the passage of time, improvements will be introduced to GeBIZ system in order to meet the user requirement.''

The discussion is useful in highlighting the commitment to a constant redevelopment process. The diverse nature of the organizations leads to diverse meanings for similar phrases relating to their functioning. Such diversity needs to be addressed carefully by the developers. The knowledge embedded in the system has to be gathered carefully, since the system is shared across organizations through tele-cooperation. The project manager's comments brought assurance to the users, allowing room for further development, and an opportunity for user's feedback. This ensured user support for the project and even a flow of request for additional features. ''We have introduced a supplier performance tracking feature to GeBIZ Enterprise that helps both parties track the status of the deliveries. Based on that, we then evaluate the performance of our suppliers, keeping in view their order fulfilment time and quality of items delivered by them to procuring institutions. Subsequently, we decide whether suppliers' contracts should be renewed or terminated.'' There were also requests to make information available to vendors using Short Message Service (SMS). This discussion illustrates the importance of the commitment to continuously enhance the features and the system, and customize the system to the user requirement.

The GeBIZ team also encountered problems in ensuring a smooth connectivity with their users. There were some network problems to be sorted out. One manager stated: ''This kind of problem occurred a few times as procuring agencies such as statutory boards or ministries try to access GeBIZ, they were unable to connect to the GeBIZ server. This is perhaps because firewalls and hardware (proxy server, IP screening routers etc) of these procuring institutions were not configured to acknowledge GeBIZ even though it is on the same network segment acknowledged by the Infocomm Development Authority (IDA).'' At other times, there were policy restrictions, as another manager experienced: ''One of our big vendors also faced connectivity problems. This time it was not because of their inexperience with our specifications, rather it was due to security restrictions set up in their network.'' There were also concerns about the use of the encryption software, which is controlled by the US laws, and embargoed in some countries, particularly European countries that constitute a significant part of the vendors for the Government of Singapore.

The problems experienced by the GeBIZ team were related to the organizational set up. While

encryption issues are still being worked out, due to the nature of those problems, the solutions being out of the control of the development team, other security issues, were addressed. Several organizations have security policies that restricted access to outside networks. In this tele-cooperation-based initiative, an important issue in access to the system was addressed. Hence, in developing an e-government initiative requiring tele-cooperation among several organizations, an important task is to address the security concerns of all participant organizations.

"We often face resistance from users in their GeBIZ enterprise usage. For example, when they use GeBIZ enterprise they seem quite confused about procurement and approval rules. They frequently communicate with GeBIZ centre asking for rules to procure or approve. When they communicate with GeBIZ team, sometimes they agree or disagree with them and insist on changing rules. Because they find it complicated, for example when users raise P.R/ITQ they ask us for rules to approve it, we tell them the exact rules for approval. When they find the rules complicated, they tell us to change the rules for which we have no authority." The experience recounted here by the GeBIZ project manager pinpoints a problem the GeBIZ team dealt with. The importance of educating the users as to the functioning of the team within the norms of the project is essential. The project team does not control the rules for procurement. They develop a system to aid in the procurement process. The tele-cooperation perspective reveals this interesting problem. The introduction of a common system for diverse organizations leads to removal of specific customized system. This new system requires possibly greater effort to route documents, and greater information to manage the workflow. This information which could have been embedded in prior local procurement systems frustrates users, making them feel that the system is complicated, as revealed by the GeBiz team. Developing a system as customized as a system for one organization would be practically impossible in the early stages of GeBiz development. Therefore, an important lesson here is to consider educating the users in the purpose of the teams involved in developing an e-government initiative in relation to the organizations participating in the initiative.

The user involvement in learning the new system plays a significant role in the success of the initiative. The GeBIZ system was a first with the purpose of serving a large number of organizations within the Singapore government. Hence, user training was given importance. The GeBIZ team developed a standalone prototype as well as a dummy website for users to learn the system. This enhanced user understanding of the system, and was an advantage when the system was implemented fully. In the case of the workflow engine problems, developing a diagnostic web page reduced the workload on the help desk in dealing with the queries for problems with the workflow system. One manager recalled, "Our helpdesk monitors a workflow diagnostic web page to see if any cases are suspended. Further, some of the problems are reported by the users, so we do some troubleshooting and re-trigger the suspended cases." From the experiences of the GeBIZ team, user training and diagnostic tools play an important role in the understanding of the system and continued usage.

An important aspect of considering the analysis of norms in this section involved the use of past experiences to guide the development of norms. A private consulting firm developed GeBIZ Professional. The experiences of the GeBIZ team helped guide the development of the GeBIZ Professional. One informant recalled, "We were planning to introduce replication between Professional and Partner. But we have decided to call it off. So we proposed the consultants do not use replication in case of Professional, because we are already facing replication problems in the case of Enterprise and Partner. Since by introducing replication in Professional things will become more complicated." However, in some circumstances achieving common ground in development was not easy. "For example, we often exchange our proposals with each other and decide how the system would integrate at the end of the day. But many times our propositions mismatch due to reasons such as different database schema, applications and dissimilar platforms. For example, we are using J2EE and they are using Delphi and this mismatch results in a deadlock. To resolve this situation we suggested that the consultants apply their proposal and see the impact of the change and then apply ours. If users are happy with their changes, then they are implemented on a permanent basis."

The discussion illustrates an important lesson for an e-government initiative. The GeBIZ team shared their knowledge of a certain problem with the private consultants. This reduced the possibility of problems recurring in implementation of GeBIZ Professional. Also, the non-sharing of common standards was possibly due to the lack of guidelines for the development of such projects. The experiences should lead to setting of norms that the GeBIZ team could expect from all modules that the system would have in the future. This experience indicates that the outsourced government IT projects could be enhanced by the experiences of internal IT development, providing a compatible, user-friendly system.

7. An e-government transformational framework

The framework provides a means to integrate the elements in a coherent manner. However, it has to be understood that some of the issues discussed in this analysis contain elements from more than one category. For example, the non-availability of a suitable workflow engine is due to resource constraints such as lack of sufficient funds to purchase commercially available engines. The human action to this was to develop a workflow engine, and this is discussed under the system developers' interpretive action through the knowledge of the organization.

However, the analysis of the case is to be understood in the context of e-government with the framework serving the purpose of identifying the issues that are involved in the development of this project, and the issues relating particularly to the tele-cooperation perspective. This is served well in this case, with the ready identification of several issues that can be categorized as belonging to the e-government structure, developer knowledge and user participation. These three layers define the major participants in the initiative, and the factors that they influence most in their respective roles (Table 2).

The factors in each of these three categories constantly interact, enabling a continuous development of the system, as well as enhancing maturity of the e-government through tele-cooperation. These factors can be represented in an organizational layout as shown in Fig. 2.

Table 2
Factors revealed by the Structurational analysis

e-Government structure	(1) Government support for use of technology (2) Standards for tele-cooperation (3) Guidelines for data exchange (4) Create an atmosphere of trust, addressing security concerns
Developer knowledge	(1) Development and interconnection of systems (2) Need to work with procedural constraints (3) Commitment to continuous development (4) Enhance outsourced development integration with in-house systems
User participation	(1) User education on objectives (2) User training in the new systems (3) Diagnostic tools to assist users

The framework presented in this paper is a first step towards analysing some of the fundamental requirements for a transition to e-government. These issues are intended as an indicative guideline to the development of further strengthening structures to make the transformation acceptable. The *e-government structure* involves the policies on the transformation to e-government, intention to make available resources for the e-government initiatives, the choice of projects for the transformation, the organizational support for the new systems and the continued development of common standards and guidelines, made available to all projects related to e-government.

The *developer knowledge* plays a key role in translating government intentions into actions understandable and acceptable to the user community. The developer knowledge is the accumulation of systems knowledge, organizational knowledge, knowledge from operating with the given resource constraints and the input from the users on the implementation of the project. It serves to represent the government intentions through the development of systems acceptable to user agencies, as well as systems capable of optimizing the processes for the users. The developer

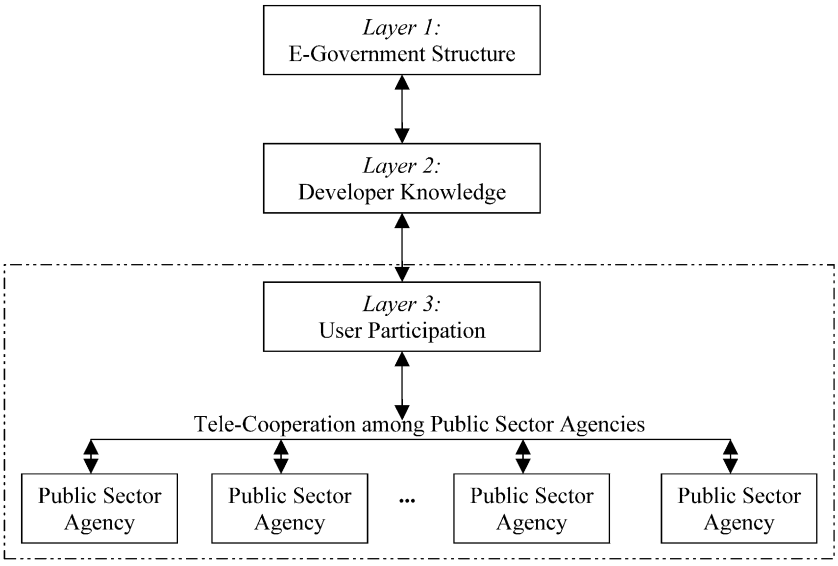

Fig. 2. Representation of the e-government transformational framework.

knowledge also plays a key role integrating the agencies through tele-cooperation systems. The developed systems need to be organized and coherent. It is also important to continuously develop and refine standards for consistency throughout the government. The knowledge of these standards through several initiatives will be channelled to the government, thus establishing the e-government structure and continued development of this structure in tune with the technological advances and capacity of the government to embrace those technologies. Outsourced development [3,5,13,27] could benefit from the in-house developer knowledge and help deploy compatible systems throughout the e-government.

The *user participation* is the input from the users on the usage and acceptance of the system. This input is communicated to the systems developers, who in turn use that knowledge to contribute to the development of the system and to the development of the e-government structure. The key factors in this layer are targeted towards system acceptance and enhanced participation in the overall transformation of the government. e-Government represents a committed transformation on the part of the government. This involves re-training the public sector agencies to share the tele-cooperation perspective of the government in the transformation to the e-government.

8. Future research

In this study, many issues were discussed from a tele-cooperation perspective. However, there are additional issues that require further study. For example, research into the dynamic relationships between government and private sector organizations would make available a clearer understanding of the implications of dealing with the government electronically. In other words, businesses will have to adapt their infrastructure to the requirements of the governments, which can be particularly significant in the context of small and medium scale enterprises.

On the other hand, the framework proposed also needs to be tested on a G2C initiative, where the user participation and their communication with the systems developers will be the key issues. The role of government in e-government initiatives requires a closer study. Singapore is a small country with one government donning the roles of the federal and state governments. This changes the nature of the issues that are of importance to the government [6]. Finally, with this form of government increasingly being accepted around the world, the implications of information structure and access for analysis and evaluations too will form some of the softer issues that will be of interest to researchers.

9. Conclusions and implications

In presenting an in-depth case study on the transformation of a traditional government to the e-government, we have concentrated on the factors contributing to the development of an e-government initiative. From a tele-cooperation perspective, we found that the human and social factors interact at every level, and hence, using the structurational model was found to be useful. For example, the use of Orlikowski and Robey's [29] model has made it considerably easy in identifying some of the factors, and this enabled tracing them to the origin in terms of social structure or human action. However, due to the contextual sensitivity of the analysis—complexity of human intention and the subtlety of social constraint [12], we suggest that the use of Orlikowski and Robey's [29] framework should be conditioned with caution. In other words, we subscribe to the view that Structuration analysis should not be seen as a rigid methodology, but as a "so- phisticated approach with which to explore the rich diversity of the development and use of information systems in organizations" [17].

Empirically, the study provides an insight into the early transformation to e-government in Singapore. The issues discussed in this study were derived from the experiences of the GeBIZ team to demonstrate the efforts made by government organizations in this transformation. We identified the factors that make an e-government initiative possible. Government's support and clear national information technology policies [15] made it possible for the GeBIZ team to function effectively. The GeBIZ team in turn creates knowledge by way of identifying effective systems to handle the development of such a system, and they take input from the users to continue the development of the system. This cycle is an ongoing process, with knowledge being created by different development teams across several projects within the government.

Finally, based on the findings, we have developed an exploratory framework for future examination of e-government initiatives. We developed the framework by employing issues made evident with the use of the structurational model. They were then grouped to present a meaningful insight into the functioning of the entities involved, such as the government, the developers, and the users, and the interconnection of all these participant entities with respect to the e-initiative itself. While this framework helps to classify the factors involved with the e-government initiative, it could also be used to understand the impact of such initiatives on the government and the participant entities over time.

Acknowledgements

The authors wish to acknowledge the contribution made by Zulfiqar Ahmad Khan in the research. We are also grateful to Systems and Computer Organization (SCO) for the generous support of this study. This study was partially funded by the academic research grant of National University of Singapore.

References

[1] Accenture (2001), http://www.accenture.com.
[2] G. Aicholzer, R. Schmutzer, Organizational challenges to the development of electronic government, Proceedings from 11th International Workshop on Database and Expert Systems Applications, Springer, New York, 2000, pp. 379–383.
[3] D. Bartholomew, The future of snail mail, Information Week 34 (6) (Dec. 1995) 36.
[4] P.E. Bucy, Social access to the Internet, The Harvard International Journal of Press/Politics 5 (1) (2000) 50–61.
[5] B. Caldwell, Outsourcing megadeals, Information Week 34 (4) (Nov. 1995) 24.
[6] L.S. Caudle, L. Sharon, L.W. Gorr, E.K. Newcomer, Key information systems management issues for the public sector, MIS Quarterly 15 (2) (Jun. 1991) 171–188.
[7] A. Csetenyi, Electronic government: perspectives from e-commerce, Proceedings from 11th International Workshop on Database and Expert Systems Applications, Springer, New York, 2000, pp. 294–298.
[8] A.M. Duncan, Depository libraries, the Internet, and the 21st century, Journal of Government Information 23 (4) (1996) 217–225.
[9] P. Ein-Dor, M.D. Myers, K.S. Raman, Information technology in three small developed countries, Journal of Management Information Systems 13 (4) (1997) 61–90.
[10] P. Galindo, Electronic government: from the theory to the action, Proceeding from 11th International Workshop on Database and Expert Systems Applications, Springer, New York, 2000, pp. 319–323.
[11] A. Giddens, Profiles and Critiques in Social Theory, Macmillan, London, 1982.
[12] A. Giddens, Structuration theory and sociological analysis, in: J. Clark, M. Modgil, S. Modgil (Eds.), Anthony Giddens: Consensus and Controversy, Falmer Press, London, 1990, pp. 297–315.

[13] M. Gordon, T.P. Walsh, Outsourcing technology in government: owned, controlled, or regulated institutions, Journal of Government Information 24 (4) (1997) 267–283.
[14] B. Grimley, Service without the seams, Government Executive 29 (10) (1997) G19.
[15] V. Gurbaxani, K. Kraemer, J.L. King, S. Jarman, J. Dedrick, K.S. Raman, C.S. Yap, Government as the driving force toward the information society: national computer policy in Singapore, Information Society 7 (2) (1990) 155–185.
[16] J. Hornfeldt, M. Heumann, W.P. Wilson, CommBridge—an enterprise application integration architecture for electronic government, Proceedings of the 23rd Annual Conference on Local Computer Networks, IEEE Computer Society, Los Alamitos, California, 1998, pp. 270–277.
[17] M. Jones, J. Nandhakumar, Structured development? A structural analysis of the development of an executive information system, in: D. Avison, J.E. Kendall, J.I. Degross (Eds.), Human, Organizational, and Social Dimensions of Information and Systems Development, North-Holland, New York, 1993, pp. 475–496.
[18] K.L. Kraemer, J. Dedrick, Computing and public organizations, Journal of Public Administration Research and Theory 7. (1) (1997) 89–112.
[19] Z. Lan, S. Falcone, Factors influencing Internet use—a policy model for electronic government information provision, Journal of Government Information 24 (4) (1997) 251–257.
[20] M.S. Laskowski, The impact of electronic access to government information: what users and document specialists think, Journal of Government Information 27 (2) (2000) 173–185.
[21] G. Lawson, NetState, Demos, London, 1998.
[22] K. Lenk, R. Traunmuller, Presentation at the IFIP WG 8.5 Working Conference on Advances in Electronic Government, (Feb. 2000) (Zaragoza).
[23] W.B. Mcconnell, New wine in old wineskins, Journal of Government Information 23 (3) (1996) 217–225.
[24] M. Mecella, C. Batini, Enabling Italian e-government through a cooperative architecture, Computer, (2001) 40–45.
[25] J. Mechling, Reengineering government: is there a 'there' there? Public Productivity and Management Review 18 (2) (1994) 189–197.
[26] M.H. Sprecher, Racing to e-government: using the Internet for citizen service delivery, Government Finance Review 16 (5) (2000) 21–22.
[27] A.R. Myerson, Life After General Motors: Day 1 at EDS, New York Times, (10 June 1996).
[28] D. Nadler, M. Tushman, Competing By Design: The Power of Organizational Architecture, Oxford Univ. Press, New York, 1997.
[29] W.J. Orlikowski, D. Robey, Information technology and the structuring of organizations, Information Systems Research 2 (2) (1991) 143–169.
[30] B. Rocheleau, Prescriptions for public-sector information management: a review, analysis, and critique, American Review of Public Administration 30 (4) (Dec. 2000) 414–435.
[31] P. Schubert, U. Hausler, E-government meets E-business: a portal site for startup companies in Switzerland, Proceedings of the 34th Hawaii International Conference on System Sciences, IEEE Computer Society, Los Alamitos, California, 2001, pp. 1700–1708.
[32] A.C. Seavey, Final thoughts on interesting times, Journal of Government Information 23 (4) (1996) 515–520.
[33] A.J. Shuler, Civic Librarianship: possible new role for depository libraries in the next century? Journal of Government Information 23 (4) (1996) 419–425.
[34] K. Stierholz, US government documents in the electronic era: problems and promise, Collection Management 21 (1) (1996) 41–56.
[35] J.S. Stratford, J. Stratford, Computerized and networked government information, Journal of Government Information 27 (3) (2000) 385–389.
[36] D. Tapscott, Digital Economy, McGraw-Hill, New York, 1996.
[37] G. Walsham, Interpreting Information Systems in Organizations, Wiley, Chichester, 1993.
[38] R.T. Watson, B. Mundy, A strategic perspective of electronic democracy, Communications of the ACM 44 (1) (2001) 27–30.
[39] M. Wimmer, R. Traunmuller, Trends in electronic government: managing distributed knowledge, Proceedings from 11th International Workshop on Database and Expert Systems Applications, Springer, New York, 2000, pp. 340–345.
[40] M. Wimmer, R. Traunmuller, K. Lenk, Electronic business invading the public sector: considerations on change and design, Proceedings of the 34th Hawaii International Conference on System Sciences, IEEE Computer Society, Los Alamitos, California, 2001, pp. 1709–1718.

Paul Raj Devadoss is a PhD candidate at the Department of Information Systems at the School of Computing in the National University of Singapore. His PhD research is a study on e-governments and the organizational structures and issues involved in this transformation of governments.

Shan L. Pan is Assistant Professor in the Department of Information Systems of School of Computing at the National University of Singapore. His primary research focuses on the recursive interaction of organizations and information technology (enterprise systems), with particular interests on issues related to work practices, cultures and structures from a knowledge perspective. Some of his previous works have been published or are forthcoming in IEEE Transactions on Engineering Management, Communications of ACM, Information and Organization, European Journal of Information Systems, and Decision Support Systems.

Jimmy C. Huang is Lecturer in the Strategy and Information Technology Group at the Nottingham University Business School. Prior to joining the Nottingham University, he was the lecturer in the Department of Management Studies at the University of Aberdeen. He is an associate member of the Innovation, Knowledge and Organizational Networking (IKON) research group based at the University of Warwick. His research focuses on the process of cross-functional knowledge integration underlying organization wide project implementation. He has published some articles on this subject in journals including Communications of ACM, European Journal of Information Systems, Journal of Decision Systems, and Journal of Information Technology Management.