Organizational Transformation Using Electronic Data Interchange: The Case of TradeNet in Singapore

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ABSTRACT: This study illustrates how electronic data interchange (EDI) could be used in conjunction with organizational transformation to generate phenomenal gains in organizational efficiency and effectiveness. It reviews the current literature on information-technology-enabled organizational transformation to identify key variables for measuring organizational change. It employs the case research method to examine TradeNet, a well-established EDI system in Singapore. It discusses how the Trade Development Board (TDB) of Singapore has taken advantage of the TradeNet opportunity to drastically transform its own organizational structure, business processes, business network, and business scope. The organizational transformation that accompanied TradeNet implementation resulted in significant gains for both the public and the private sector in Singapore. TDB and other public-sector organizations gained in terms of increased productivity in carrying out their organizational functions. The trading community, comprising the private-sector organizations, benefited in terms of increased competitiveness. Change-point analyses carried out on annual organizational and performance figures confirmed the productivity increases at TDB. Analyses of the results of questionnaires administered to TradeNet participants

Journal of Management Information Systems / Spring 1997, Vol. 13, No. 4, pp. 139–165

1061–0405 / 1997 $9.50 + 0.00.

confirmed the increased competitiveness experienced by the trading community. Noteworthy lessons from this study, important for EDI implementation, are a willingness to change existing mindset, to institute radical transformation, to leverage knowledge and technology, and to foster win–win situations. This study demonstrates that the use of IT, or EDI in particular, for organizational transformation could lead to phenomenal gains.

KEY WORDS AND PHRASES: electronic data interchange, information technology, organizational transformation, trade administration, TradeNet.

AS A RESULT OF RECENT RAPID ADVANCES IN COMPUTER and communication technologies, information technology (IT) is beginning to have far-reaching effects on businesses. Practitioners and researchers have suggested that IT be harnessed to redesign business processes [5, 13, 16], alter organizational structures and boundaries [6, 20, 22, 30], redefine industry structure and competition [3, 9, 23, 36], and support globalization of businesses [21, 29]. Although IT has been widely recognized as a powerful enabler of organizational innovation, it has not been as fully exploited as it should be. To help managers decide how to exploit IT for organizational advantages requires an in-depth understanding of the effects of IT-enabled organizational transformation. However, existing literature on IT-enabled business transformation [16, 46] is restricted to descriptive and normative frameworks, focuses exclusively on selected internal organizational processes to the neglect of the wider context of the business network [24], and examines the impact of IT on the competitive dynamics solely from the perspective of the focal organization. Attempts to triangulate the evidence with those from other perspectives (e.g., key trading partners, customers, and suppliers) are necessary but lacking. In addition to these shortcomings, the existing literature has a strong bias toward private-sector organizatons. The use of IT for organizational transformation in the public sector has largely been neglected. While lessons drawn from studies using private-sector organizations might be useful, these findings are not necessarily directly applicable to public-sector organizations that face different sets of issues, problems, and challenges [41].

This study attempts to bridge these gaps in knowledge on IT-enabled organizational transformation. Drawing on IT-enabled organizational transformation literature, we systematically and rigorously investigate the effects of TradeNet, a well-established electronic data interchange (EDI) system in Singapore, on the Trade Development Board (TDB), the organization that sponsors it. TradeNet, a well-celebrated success story [39], has strong face validity and is therefore a suitable candidate for research into effects of EDI on organizations. This study departs from current TradeNet literature, which describes the process of and lessons learnt from implementing TradeNet [27, 33] and examines the impact of TradeNet on its participants [42].

Specifically, this study has four objectives. First, it reviews the current literature on IT-enabled organizational transformation and identifies key measures for organizational changes and external relationships. Second, it presents a detailed analysis of

changes made possible and brought about with the use of TradeNet. It discusses how TradeNet has changed the organizational structure, business processes, business network, and business scope of TDB. Third, it empirically assesses the strategic impact of introducing TradeNet. The robustness of its empirical findings is increased through cross-validation of data [2, 4, 49] at two levels. At the first level, quantitative results are supplemented with qualitative ones to provide a richer, context-based interpretation [25, 45]. At another level, findings obtained from a TDB perspective are strengthened and validated with those elicited from the trading community. Fourth, this study provides some resulting managerial implications of these effects.

IT and Organizational Transformation

THERE IS A GROWING BODY OF CONCEPTUAL PAPERS AND CASE STUDIES on IT-enabled organizational transformation in the information systems literature [5, 24, 26, 30, 46, 47]. Most of the studies suggest that the use of IT without concomitant organizational changes was unlikely to yield significant gains in terms of organizational performance. For example, Clemons and Weber [10] found that the London Stock Exchange enhanced its competitive position as an international financial center by making sweeping changes to its structure and strategy and overhauling its established trading practices with an electronic screen-trading system.

The notion that technology could shape an organization is not new. Leavitt [28] has proposed a model of organizational change that could be applied to situations involving technology. But practitioners and researchers have just begun to recognize the potential pervasiveness and radical impact of IT on organizations. New frameworks on how IT could be employed to create and sustain competitive organizations in the 1990s and beyond have been proposed [26, 30, 46]. A common thrust of these frameworks is that IT could influence organizations at multiple levels with varying amounts of benefits. These levels are organizational structure, business processes, business network, and business scope.

Organizational Structure

The impact of IT on organizational structure is multifaceted. Along the organizational boundaries, IT enables tight interorganizational linkages to the point where it is difficult to delineate where the boundary of one organization ends and that of another begins. For instance, electronic links between General Motors and its suppliers effectively bring the operations of its suppliers under GM's control while they remain separate legal entities. Terms given to this emergent organizational structure include strategic networks [20], value-added partnerships [22], negotiated organizations [30], and structure-independent organizations [26].

Within organizations, IT brings about several important changes. First, it whittles away temporal and spatial barriers. It enables organizations to link their geographically separated subunits so that teams of experts working at different locations in different time zones could be quickly brought together to address critical problems.

Location-independent organizations [26] of this nature need neither to physically group people and units together to provide for supervision and coordination nor to choose between centralized or decentralized structures. Second, IT results in a shift in emphasis from organizing by division of labor to organizing by division of knowledge [26, 30]. Functionally defined hierarchies or matrix-based organizations tend to give way to adhocracies or team-based organizations when IT is used to substitute management layers and expedite management tasks. Management control is replaced by management coordination of work, and decision making occurs in teams rather than in hierarchies. Keen argued that team-based organizations capture the realities of work better than traditional hierarchical organizations in a world characterized by increasing knowledge, complexity, and turbulence.

Business Processes

Organizations could employ their IT capabilities to integrate or redesign their business processes [17, 46]. Several authors (e.g., [18]) have emphasized that IT *per se* does not yield significant benefits. Indeed, some studies have demonstrated that organizations that could make effective use of IT to manage interdependent business processes would be more likely to create and sustain competitive advantage [7, 46, 48]. For example, Merrill Lynch succeeded with its Cash Management Account primarily because it could effectively manage its interdependent business processes to pool information from different financial products into an "integrated" product in response to strong market demands [46].

Hammer [16] went beyond the concept of integrating business processes to suggest that maximal benefits from IT should result from obliterating rather than automating existing business processes. Instead of simply being overlaid on existing business processes, IT should be used as a lever to create and design new business processes. In a similar vein, Keen [26] emphasized the need to use IT to simplify work procedures and manage coordination so as to attain competitive advantage. Davenport [13] suggested nine ways with which IT could be employed to redesign business processes. IT could eliminate human labor from business processes, capture business process information, enable parallelism, monitor business process status, improve analysis of information and decision making, coordinate business processes across distances, coordinate tasks between businesses processes, capture and distribute intellectual assets, and eliminate intermediaries from business processes.

Business Network

The business network is the set of exchange relationships between activities of an organization and those of other related organizations in the environment [24]. Kambil and Short [24] provided a role-linkage model to represent and analyze business networks. Roles are distinct, value-added activities undertaken by firms in a given business network. For instance, the traditional roles of an insurance organization combine the three roles of money management, actuarial services, and claims services

within the boundary of the organization through horizontal or vertical integration. Linkages are ways in which organizations could manage interdependencies between roles. These include mechanisms such as *simple market exchange*, *standard linkage*, *specialized linkage*, *customized linkage*, and *mandate*.

The ability of IT to redefine roles of organizations and redesign linkages among organizations in a business network is a source of powerful competitive advantage [38, 47]. This fact has been borne out by results of case studies. For instance, Baxter Healthcare employed IT to redefine its role from an efficient distributor to a prime vendor to an electronic distribution channel to a value-added partner and, in doing so, obtained a continuous source of competitive advantage [38]. As another example, insurance organizations preparing tax returns in the United States have used IT to capture historical tax information for their clients. This transforms their relationships with their clients from simple market exchanges to specialized linkages. Besides improving the level of services provided to their clients, specialized linkages create switching costs for their clients [47].

Business Scope

The idea of using IT to expand or redefine business scope has been around for a decade. Porter and Millar [36] suggested that organizations should leverage IT to expand business scope by providing new services that were previously impossible due to technological limitations, creating derived demand for new products, or selling byproducts of their business operations. Examples of IT-enabled redefinition of business scope abound in the information systems literature. For instance, American Airlines has derived a significant portion of its total revenue from fees generated by its reservation system (SABRE) [18]. Baxter Healthcare has leveraged its Valuelink program to become a materials management consultant to hospitals [48]. Federal Express has exploited its reliable IT platform to manage time-sensitive inventory for organizations such as IBM and Boeing [46].

TradeNet and Trade Administration

THE TRADE DEVELOPMENT BOARD (TDB) WAS SET UP IN 1983 by the Singapore government. Its mission is to develop Singapore as a premier international trading hub by promoting its goods and services overseas, pioneering entry into new markets, attracting international traders to establish a base in Singapore, and advancing its external trade interests. Six years after its inception, TDB had helped diminutive and resource-scarce Singapore climb the ladder of trading nations to become the seventeenth largest importer and exporter in the world [43]. In 1992, TDB managed international trade totaling S$251 billion (approximately US$167 billion) compared with S$102 billion (approximately US$68 billion) in 1983, and about four times the value of the current gross domestic product of Singapore at S$64 billion (approximately US$43 billion) [14]. Therefore, TDB plays a vital role in Singapore's economy and is currently a key public-sector organization.

In order to fulfill its mission, TDB had to administer the international trading system in Singapore effectively and efficiently. International trade is characterized not only by the physical movement of goods across national boundaries but by voluminous paperwork that captures information pertinent to identification, delivery, and governmental control of transported goods. In 1986, TDB processed an average of 10,000 trade declaration documents for imports and exports daily. Owing to an increasing volume of international trade, the paper-based system of processing trade documents was perceived as untenable and exacting too high a price on trading. This has negatively affected the productivity and overall competitiveness of Singapore as an international hub for trading activities.

Paper-Based Trade Administration

Traders had to submit trade declaration documents to TDB for all their imports and exports. These documents allowed TDB to enforce controls to ensure that imported and exported goods satisfied conditions laid down by trade control policies (e.g., health, safety, and other regulatory requirements) and international trade agreements, and that their custom duties had been paid. These documents also allowed TDB to collect, compile, and publish trade statistics reflecting the economic well-being of various industrial sectors in Singapore. Therefore, trade declaration documents constituted the most important information flow in TDB and in several other public-sector organizations related to international trade.

The trade administration process is the procedure whereby trade declaration documents are verified and processed. All imports and exports fall within the categories of noncontrolled items, controlled items, dutiable items, noncontrolled and dutiable items, and controlled and dutiable items. Trade declaration documents for noncontrolled items were processed primarily by TDB. Before submitting the trade declaration documents to TDB for processing, traders had to obtain endorsements/licences from appropriate controlling agencies (e.g., the Pollution Control Department) for controlled items. For dutiable items, traders had to pay duties to and get clearance from the Customs after approval by TDB.

In TDB, counter clerks processing trade declaration documents were inundated with paperwork and bogged down by unwieldy procedures. The trade declaration documents had to be batched for data entry, after which they were assigned to processing clerks to verify if they were accurate (e.g., if the value of goods was computed correctly or if the item codes used were valid) and were appropriately endorsed by the relevant controlling agencies. If a trade declaration document was in order, the processing clerk issued and dispatched a permit to the trader's collection mailbox, and updated the computer database with the permit number. Turning around a trade declaration document took two days for noncontrolled items and four days for controlled or dutiable items on average.

The paper-based trade administration process presented TDB with several dilemmas. Faced with a rapid growth in international trade, TDB would have to continually recruit and train many clerks to cope with an increasing volume of trade declaration

documents. While rapid recruitment and training might help alleviate the problem in the short term, it could never be a viable long-term solution. The processing of voluminous paper documents was labor-intensive and mundane. It affected staff productivity and morale. Moreover, coordination and communication among TDB, controlling agencies, the Customs, and other relevant (sea and air) authorities was difficult because their computer systems were not connected. These organizations maintained their own data, resulting in unnecessary redundancy. All these problems reduced the level of service provided by TDB to the trading community.

Traders going through the paper-based trade administration process experienced inconveniences. They had to raise multiple copies of similar trade declaration documents for submission to different agencies. They had to visit these agencies several times to get approval for trade declaration documents. They had to maintain a group of dispatch staff to run errands to these agencies. They had to monitor the movements of their dispatch staff and submit trade declaration documents. They incurred transportation expenses for their dispatch staff. They had to tolerate delays and uncertainties associated with document approval, leading to slack resources maintained and sacrifice of the service levels to customers. They could not clear their goods quickly, thereby incurring additional warehouse expenses and bank charges.

TradeNet-Based Trade Administration

Realizing the negative consequences of a paper-based trade administration system, the Singapore government mandated TDB to embark on an ambitious program to reorganize and automate the trade administration process totally using IT. TradeNet, an EDI linking public-sector organizations and the trading community, would be the center of the new trade administration process. The Swedish Trade Procedures Council [40] estimated the cost of trade administration in Sweden at between 4 percent and 7 percent of the value of goods traded. TDB reckoned that if it could achieve a conservative 1 percent reduction in the cost of trade administration, it would generate a saving of S$1 billion (US$667 million) annually for the trading community.

To enhance the chances of successfully implementing TradeNet, TDB adopted a two-pronged strategy. First, it formed a steering committee comprising chief executive officers of public-sector organizations related to international trade and leaders of trade associations. This helped TDB gain interorganizational perspectives on trade administration issues, secure commitments from all parties, and resolve critical problems. Second, TDB set up a private-sector organization, Singapore Network Services Private Limited (SNS), together with Singapore Telecoms, Port of Singapore Authority, and Civil Aviation Authority of Singapore. The main objective of SNS is to implement and market TradeNet. TDB realized that a private-sector organization, more attuned as it was to market needs and competition, could better ensure the viability of TradeNet and leverage investments in an EDI network by developing other EDI applications.

As targeted, SNS launched TradeNet in January 1989. TradeNet is the first nationwide EDI ever implemented in the world. It runs on an IBM ES 9000 mainframe computer owned and operated by SNS. It links public-sector agencies related to

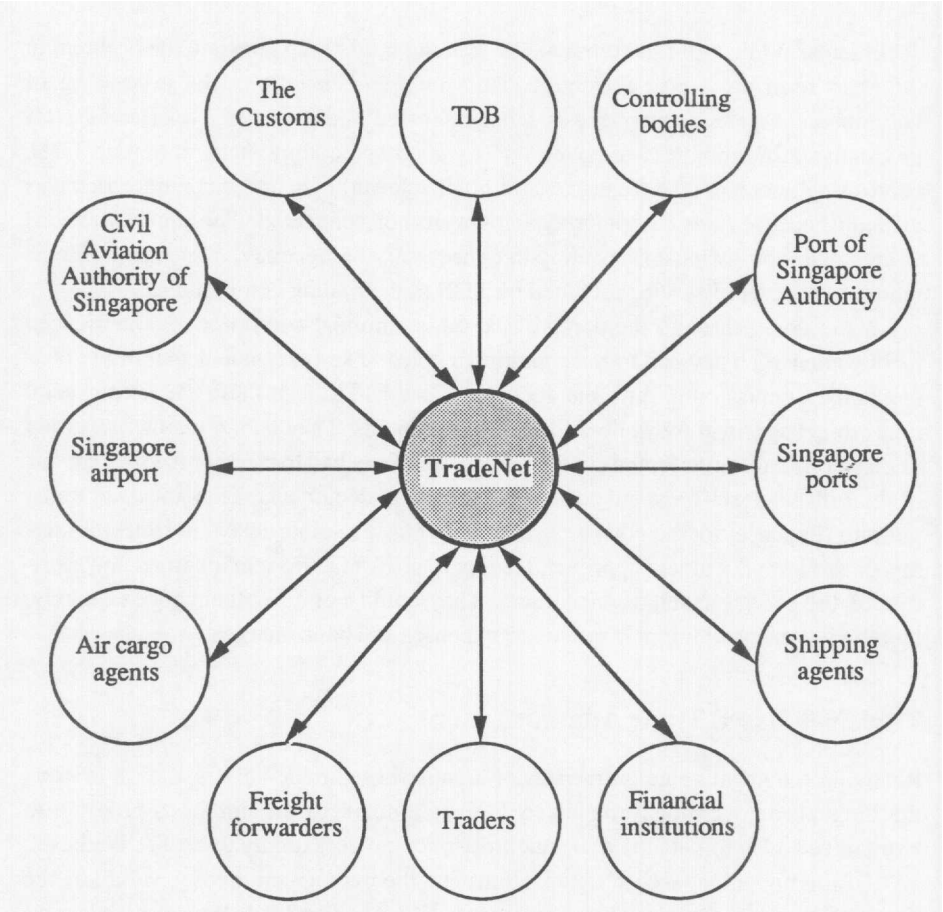

Figure 1. Public- and Private-Sector Organizations Using TradeNet

international trade (e.g., controlling agencies), traders, intermediaries (e.g., freight forwarders, shipping agents, and air cargo agents), financial institutions (e.g., banks), and port and airport authorities (see figure 1). It is connected to international networks (e.g., GEISCO, SITA, and U.S. Customs).

Through its connection with all parties, TradeNet revolutionized the trade administration process and provided value-added services to its participants. When submitting trade declaration documents for imports and exports, traders need neither raise multiple copies nor commute to and from various agencies. Using the computer terminals in their own offices, they are able to provide the trade declaration information through TradeNet, which will then automatically validate them. For trade declaration documents of controlled or dutiable items, TradeNet would "intelligently" route them to the appropriate controlling agencies or the Customs for processing. If these documentations were in order, an approval message with a permit number would be placed in the sender's electronic mailbox. The sender could then retrieve and print it. Document processing fees, network usage fees, and custom duties would be computed automatically and deducted from traders' bank accounts twice a week.

Table 1 highlights differences in the trade administration process before and after TradeNet implementation. An issue worth noting is that the submission of trade declaration documents through TradeNet need not be accompanied by supporting documents (e.g., invoices and bills of lading). TDB places the onus of honestly and accurately reporting information on the traders. However, to prevent abuse, TDB conducts random checks on traders by requiring them to forward supporting documents for their declaration documents within forty-eight hours of the date of approval. Heavy penalties are imposed on offenders who provide false information. "We had to do away with the need for supporting documents," a senior trade documentation manager explained. "We didn't want to overlay the old way of doing things onto the automated system. We won't gain any leverage from the system that way. Faced with scarcity of labor and a government cap on manpower increases in the civil service, we decided to create a compromised system of trust which lets the horses run through the gate but reins them later when necessary."

Besides being a clearinghouse for trade declaration documents, TradeNet is linked to other systems that offer trade information services and to computer systems of major banks to allow electronic payment of processing fees, duties, goods and services taxes, and network usage charges. TradeNet represents a significant electronic integration initiative. It took two years to develop at an estimated cost of S$50 million (US$33 million). By the end of 1992, it has linked TDB with about 30 public-sector organizations and 2,200 organizations from the trading and banking communities. By the end of 1994, almost 99 percent of all trade declaration documents had been processed by TradeNet. TradeNet has a significant impact on the organizational structure, business processes, business network, and business scope of TDB.

Methodology

THE CASE RESEARCH METHOD IS APPROPRIATE WHEN THE PHENOMENON under investigation is broad and complex, when the existing body of knowledge is insufficient to permit the posing of causal questions, and when the phenomenon cannot be studied outside its context [4]. The phenomenon of IT-enabled organizational transformation meets all three conditions. First, IT has the potential to alter many different aspects of organizations. Its impact is usually wide-ranging and intricate. Second, the current body of literature on IT-enabled organizational transformation is mainly conceptual and anecdotal in nature. Causal research hypotheses could not be formulated and tested on the basis of such knowledge. Third, the ways in which IT could alter organizations are likely to be closely intertwined with the business context and environment. Given these considerations, the case research method was deemed the most appropriate vehicle.

This case study was carried out from 1993 to 1994. Several major steps were taken during data collection. First, documents were collected on the paper-based and TradeNet-based trade administration process, and on TDB organization, functions, and services. Observations were made of how different types of trade declaration documents were processed by TradeNet. Second, an individual two-hour interview

Table 1. Changes in Trade Administration Process due to TradeNet

Feature	Pre-TradeNet	Post-TradeNet
Trade documents		
Noncontrolled items	Multiple copies	Single copy
Controlled items	Multiple copies	Single copy
Dutiable items	Multiple copies	Single copy
Supporting documents	Required	Only for random checks
Counter clerks	Process all documents	Process few documents
Serving counters	More than 20	Less than 5
Supervisors	Batch documents	Step eliminated
Data entry clerks	Key data for documents	Step eliminated
Document validation	Manual	Automated
Feedback provision	Phone, mail	Electronic messages
Document approval	Documents with permit numbers	Electronic messages with permit numbers
Office attendants submission/distribution	Handle document Step eliminated	
Distribution mailboxes	One per trader	Electronic mailboxes
Fees collection		
Document processing	Revenue stamps	Bank accounts deduction
Custom duties	Checks	Bank accounts deduction
Network usage	Not applicable	Bank accounts deduction

was carried out with each senior TDB manager and senior trade clerical officer involved in the processes, and with each TDB and SNS member of the TradeNet implementation team. These interviews focused on eliciting information about the paper-based and the TradeNet-based processes, the TradeNet development and implementation, and the TradeNet impact on TDB. This process of triangulating information collected from documents, observations, and interviews increased the validity and reliability of the information elicited [49]. We were thus able to create a preliminary pre-TradeNet and a post-TradeNet image of TDB and the trade administration process.

Third, two authors separately analyzed the interview data and the documents obtained to create a pre-TradeNet and a post-TradeNet picture of TDB and the trade administration process. Where the two authors disagreed, a third author reviewed pertinent information and helped the two authors arrive at consensus. In unresolved situations, meetings with key interviewees were arranged to resolve all misunderstandings [19]. To further ensure the accuracy of the pictures created, we gave a summary of the pre-TradeNet and post-TradeNet situations to TDB for verification. Fourth, we collected TDB annual reports documenting their key organizational figures and performance indices. Two important productivity indices were computed for each year from 1986 to 1992: trade volume handled per document clerk and processing revenue earned per document clerk. Change-point analysis [37] was then performed for each index to ascertain objectively the impact of TradeNet on TDB.

Finally, questionnaires were used to gather satisfaction, efficiency, and effectiveness information from TradeNet participants. These participants were selected from a directory maintained by SNS. Among the 2,200 TradeNet participants in 1993, 1,145 had begun using TradeNet in or prior to 1991. Questionnaires were sent to these 1,145 participants because it was felt that they had used TradeNet long enough to be able to assess its impact on their business operations. Thirty-five questionnaires could not be delivered due to changes in addresses. Among the remaining 1,110 questionnaires, 210 useful responses (19 percent) were obtained and analyzed. To check for any possible response bias, the early (n = 111) and late respondents (n = 99), determined by a cutoff date of three weeks after mailing, were compared based on two possible mediating demographic variables: size (number of employees) and timing of adoption (month/year of adoption) of TradeNet. No response bias was detected (size: chi-squared = 0.41, p = 0.52; timing of adoption: chi-squared = 1.43, p = 0.23). Hence, results from these questionnaires can help unravel the impact of TradeNet on its participants. These results complemented those from the change-point analyses because they assessed TradeNet's impact from a different perspective. Both sets of results were important to TDB because an EDI such as TradeNet must benefit both its sponsor and its participants to remain viable in the long term.

Variables Reflecting Organizational Structure

Organizational structure reflects the flow of work and communication through the organization [31]. Variables such as unit grouping, unit size, job specification, reporting mechanism, control mechanism, and communication mechanism constitute basic elements of organizational structure [31, 32, 44]. Unit size is measured by the number of employees within that unit. Unit grouping is the aggregration of work functions, positions, and individuals into work units. Reporting mechanism represents the creation of formal connections between different positions or units. Control mechanism is the means by which the unit ensures the quality of inputs and outputs and the effectiveness of the work process. Communication mechanism refers to the formal and informal channels used for communicating information. Lucas and Baroudi [30] suggested that these variables could be altered by IT to create more efficient and effective organizational forms. Thus, these variables were adopted to determine changes in organizational structure. Information on these variables was mainly gathered from documents and interviews (e.g., TDB organizational charts and functions and TDB annual reports). Changes in organizational structure due to TradeNet were then tabulated and confirmed with TDB employees.

Variables Reflecting Business Processes

Bakos and Treacy [1] suggested that IT affects the efficiency and effectiveness of an organization primarily through improving the information-processing capacity of their business processes. Galbraith [15] defined information-processing capacity of organizations as the number of inputs used, the number of outputs produced, and the level

of task performance. Hence, these variables were chosen as measures to assess changes in business processes. For the case of the trade administration process, inputs are the trade volumes and inquiries handled; outputs are the number of various types of service requests processed; and task performance is objective and perceptual assessments of performance from the TDB management perspective. Information on these variables was obtained from documents (e.g., TDB organizational charts and functions, and TDB annual reports), interviews, and observations. Changes in business processes due to TradeNet were then summarized and confirmed with TDB employees.

Variables Reflecting Business Network

Important aspects of the business network of an organization are the linkages or exchange relationships between the activities of the organization and those of other organizations in the network [24, 31]. In the course of fulfilling its organizational objective, TDB is engaged in exchange relationships with many public- and private-sector organizations (see figure 1). Linkages among organizations are manifested in the frequency, complexity, and the time horizon (one-time or long-term nature) of the transactions, and the existence of the relation-specific investments and adaptive behaviors that are required to carry out those transactions. In this study, the focus is on linkages between TDB and those public- and private-sector organizations. These linkages were used to determine changes in business network. Information on these linkages was obtained from documents (e.g., TDB organizational charts and functions, and TDB procedures for trade administration), interviews, and observations. A model of linkages [24, 47] was developed. Changes in business network resulting from TradeNet were then summarized and verified with TDB and SNS employees.

Variables Reflecting Business Scope

The business scope of an organization could be altered in two ways. First, the emphasis on each principal business activity of the organization could change. Second, new business activities could be created [36, 46]. Therefore, changes in organizational and division-level mission statements and investments in new subsidiaries due to TradeNet were used to gauge changes in business scope. Information on these variables was taken mainly from documents (e.g., TDB organizational charts and functions, and TDB annual reports). Changes in business scope arising from TradeNet were then drawn up and confirmed with TDB employees.

Analyses of TradeNet Impact

USING ON THE INFORMATION GATHERED, THE ORGANIZATIONAL STRUCTURE, business processes, business network, and business scope of TDB before and after TradeNet implementation were summarized and analyzed to assess how TradeNet had transformed TDB. The information for the year 1988 was used to represent the pre-TradeNet situation in TDB because it was just prior to TradeNet implementation. The

information for the year 1992 was used to represent the post-TradeNet situation in TDB because that was the latest information available at the time of this study. To ascertain the impact of this organizational transformation, performance indices for TDB for the years 1986 through 1992 were analyzed using change-point analyses. Trade volume and revenue figures for all the years were adjusted for inflation using 1986 as the base year [14]. Results of questionnaires returned allowed TradeNet impact to be analyzed from the trading community perspective.

TradeNet Impact on Organizational Structure

TradeNet alters the organizational structure of TDB in two major ways. First, the Trade Administration Division was restructured into the Trade Operations Division comprising the Import and Export Office, Statistics Audit Unit, Regulatory/Enforcement Unit, and Trade Procedures Development Unit. This reorganization stems mainly from the change in control enforcement policies following TradeNet implementation. Prior to TradeNet implementation, controls over the trade administration process were carried out by rigorously examining trade declaration documents and supporting documents to ensure that there was no fraud and that trade statistics were accurate. This mode of control task relied heavily on a large homogeneous work force performing common roles. Following TradeNet implementation, this largely homogeneous task became differentiated. Four major activities emerged: trade declaration documents processing, trade statistics auditing, trade regulations enforcement, and trade procedures development. The Import and Export Office focuses on the few complex trade declaration documents and assists traders unfamiliar with TradeNet. The Statistic Audit Unit scans TradeNet outputs and investigates suspicious trade declaration documents to ensure the accuracy of trade statistics. The Regulatory/Enforcement Unit acts upon detection of trade malpractices and assists in the prosecution of errant traders. The Trade Procedure Development Unit assesses trade policies and fine-tunes policies and procedures on a regular basis.

Second, the Computer Information Services Department and the Trade Information Services Unit were shifted out of the Trade Administration Division as independent units. The successful launch of TradeNet created an awareness of information and IT as key corporate resources. Thus, a new Trade Information and Investment Services Division was formed. Efforts have been made to further exploit IT to improve its services. Globalink, an online database with a comprehensive range of global trade and market information, has been made available. TradeNet has also been increasingly used to collect, compile, analyze, and distribute accurate trade information. TradeNet's successful implementation was a catalyst for exploiting IT to disseminate and exchange trade information.

Following TradeNet implementation, trade administration has been transformed from a control into a facilitative process. Aspects of organizational structure of TDB altered by TradeNet include unit size, unit grouping, job specification, reporting mechanism, control mechansim, and communication mechanism. The impact of TradeNet on the organizational structure of TDB is summarized in Table 2.

Table 2. Changes in Organizational Structure of TDB due to TradeNet

Variable	Pre-TradeNet	Post-TradeNet
	Unit grouping	
Trade Documentation and Procedures	1 large unit	4 small units
Information Services	Homogeneous function	Specialized functions
	Control purpose	Facilitation purpose
	Trade Administration Division	Trade Information and Investment Services Division
	Supporting role	Strategic role
	Unit size	
Trade Documentation and Procedures	144 staff	38 staff
	Job specification	
Trade Documentation and Procedures	Repetitive (e.g., data entry)	Creative (e.g., fraud detection)
	Stressful (e.g., handles all documents)	Tolerable (e.g., handles fewer documents)
	Labor-intensive	Technology-intensive
	Control focus	Speed focus
	Hands-on	Hands-off
	Reporting mechanism	
Trade Documentation and Procedures	Larger control span	Smaller control span
	Supervision for clerks	Supervision eliminated
	Control mechanism	
Trade Documentation and Procedures	Manual input control	Automated input control
	Input control before document approval	Input control after document approval
	Communication mechanism	
Public sector	Phone, mail	Electronic messages
Trading community	Phone, mail, documents	Electronic messages

TradeNet's Impact on Business Processes

After a review of its business processes, TDB realized that if TradeNet were to be successful, changes in business processes must be revolutionary rather than evolutionary. TDB needed to alter not only its internal business processes but also those of other public-sector organizations involved. When redesigning its internal business processes, TDB focused on changing the existing mindset and providing integrated services. Historically, the role of trade administration was to exercise control over imports and exports. TDB and other public-sector organizations were mandated to enforce controls. To make major improvements, TDB realized it needed a fundamental rethinking of the trade administration process. Mere automation of existing procedures would not lead to drastic improvements. Hence, TDB convinced all related parties of

the need to adopt a facilitative rather than a control perspective. TDB did away with the need to provide supporting documents upon submission. It implemented automated processing and conducted random checks on traders when necessary. It passed the responsibility of policy compliance on to traders.

TDB used TradeNet to integrate its services to the trading community. Annually, it serviced many inquiries on trade regulations, trade opportunities, customs rates, and other subjects. With TradeNet, TDB saw an opportunity to provide a common front for its plethora of information services. TDB now integrates TradeNet with other systems to process trade declaration documents, provide trade information services, and collect payment for TradeNet services and customs duties. Additionally, TradeNet's repository of data is used to generate Singapore's trade statistics in a timely fashion.

Besides redesigning its internal business processes, TDB took advantage of the government mandate to influence all related parties to alter their business processes. First, it redesigned the way in which traders interact with public-sector organization. Prior to TradeNet implementation, traders had to commute to and from several agencies to obtain approval for trade declaration documents on controlled or dutiable items. The automated processing and routing capabilities of TradeNet provide a one-stop, twenty-four-hour service where traders can submit their trade declaration documents and obtain approval without leaving their offices. Second, TDB secured commitment from all related parties to retrieve and process trade declaration documents for controlled and/or dutiable items on a regular interval of two to four hours. This commitment implied a fundamental change in how these public-sector organizations operated.

With TradeNet implementation, the information-processing capacity of TDB for the trade administration process increased significantly. Table 3 tabulates the inputs, outputs, and task performance characteristics of the trade administration process before and after TradeNet implementation. It depicts the impact of TradeNet on the business processes of TDB.

TradeNet's Impact on Business Network

TradeNet has altered the exchange relationships between TDB and other involved organizations. With the launch of TradeNet, TDB assumes the roles of trade facilitator and EDI proponent. As a trade facilitator, TDB seeks to improve the trade administration process to benefit the trading community. Moreover, it provides additional information services and relevant investment information through integrating TradeNet with other systems. Its subsidiary SNS increases the reach of local organizations by connecting TradeNet with international networks. As an EDI proponent, TDB together with SNS transfers knowledge and experience from its TradeNet project to other potential areas for EDI applications. For example, they are working closely with the trading community to develop a comprehensive EDI to support the entire trading cycle. TradeNet has transformed TDB from a regulatory body to a value-added partner of the trading community.

Table 3. Changes in Business Processes of TDB due to TradeNet

Variable	Pre-TradeNet	Post-TradeNet
	Input	
Annual trade volume	S$178bn (US$119bn)	++S$251bn (US$167bn)
Annual trade inquiries	45,000	++58,000
	Output	
Documents processed	4.0 million	= 4.1 million
Document status inquiries	Available after manual search	*Available online
Online information services	Some (e.g., no flights, vessel schedules)	+Comprehensive
Trade statistics data	Entered by clerks	*Captured at source
Document processing revenue data	Sales of revenue stamps	*Captured during processing
	Task performance	
Documents processed per document staff	27,397	++105,263
Trade value in documents processed per document staff	S$1.22bn (US$0.81bn)	++S$6.59bn (US$4.39bn)
Processing revenue per document staff	S$63,836	++S$465,131
Turnaround time for:		
Noncontrolled items	Normally 2 days	++Normally 15 minutes
Controlled items	Normally 4 days	++Normally 4 hours
Dutiable items	Normally 4 days	++Normally 4 hours

Indicators of effects and directions: ++large improvement, +improvement, = no change, *not applicable.

TradeNet modifies existing linkages and adds new linkages between TDB and all parties concerned with international trade. Prior to TradeNet implementation, linkages between TDB and public-sector organizations (e.g., controlling agencies, the Customs, port authorities, airport authorities) and banks are standard because they represent the governance of standardized transactions where neither party commits substantial relation-specific investments. Linkages between TDB and traders are mandated and standardized as TDB specifies the rules by which traders prepare and submit trade declaration documents. When TradeNet was conceptualized, it was realized that success would depend on a commitment from all related parties to allocate time, effort, and resources to the project. For instance, to use TradeNet effectively, traders must allocate resources for software, hardware, training, and business process refinement. Likewise, to ensure effectiveness, public-sector organizations must commit substantial resources to revamping outmoded procedures, software, hardware, and communications equipment. Thus, with the launch of TradeNet, linkages between TDB and these parties were transformed from standard to customized because heavy relation-specific investments and adaptive behaviors had been committed to govern frequent, specialized, long-term transactions.

TDB formed strategic alliances with Singapore Telecoms, Civil Aviation Authority of Singapore, and Port of Singapore Authority to set up SNS to develop and market TradeNet. New linkages between TDB and these parties arose as a result of TradeNet implementation. Table 4 presents the linkage mechanisms between TDB and other organizations before and after TradeNet implementation. It highlights a shift toward customized linkages and shows the impact of TradeNet on the business network of TDB.

TradeNet's Impact on Business Scope

Before TradeNet implementation, TDB assumed the sole role of a regulatory body. It did not invest in subsidiaries or associated organizations. As a consequence of TradeNet implementation, TDB began to invest outside its organizational boundaries. It presently has four subsidiaries and an interest in five associated organizations. Three of its subsidiaries and one of its associated organizations are directly involved in EDI-related businesses. The learning acquired from TradeNet implementation and its successful launch convinced TDB that EDI is a potential strategic investment. Its subsidiary, SNS, has chalked up revenues of S$20 million (US$13 million) in 1992 through aggressive development and marketing of EDI applications and services [34]. Riding on this impressive record, TDB is currently pursuing more ambitious plans for EDI-related businesses.

Table 5 highlights the TDB subsidiaries and associated organizations involved in EDI-related businesses. Given that these subsidiaries and related organizations were conceived as a consequence of TradeNet implementation, Table 5 could be interpreted as the impact of TradeNet on the business scope of TDB.

TradeNet's Impact on Efficiency and Effectiveness

TradeNet has transformed the organizational structure, business processes, business network, and business scope of TDB. However, its actual impact on TDB and the trading community could be objectively assessed only by using performance figures. Given that TradeNet is a government initiative and TDB is a public-sector organization, appropriate performance figures could be adapted from the public administration literature. Swiss [41] suggested a *chain of outputs* concept as a way to analyze and monitor government programs. He described the *chain of outputs* as "a diagram of expected outputs for a program; it begins with the most immediate, localized effects and proceeds, step by step, to the broader societal impacts" (p. 139). Thus, the contribution from government initiatives could be determined from two perspectives: efficiency, which focuses on the process and the competency of performing these initiatives (internal perspective), and effectiveness, which measures whether these initiatives have achieved their intended objectives (external perspective).

The objective of TradeNet is to enhance the efficiency of the trade administration process and thereby to raise the overall competitiveness of the trading community and improve the community's satisfaction with the trade administration process. Thus, from an efficiency perspective, TradeNet's impact could be assessed using measures

Table 4. Changes in Business Network of TDB due to TradeNet

Organization	Pre-TradeNet	Post-TradeNet
Traders	Mandate, standard	Mandate, customized
Controlling agencies	Standard	Customized
The Customs	Standard	Customized
Port of Singapore Authority	Standard	Customized
Civil Aviation Authority of Singapore	Standard	Customized
Singapore Telecoms	None	Customized
Airlines	None	Customized
Banks	Standard	Customized

Table 5. Changes in Business Scope of TDB due to TradeNet

Organization	Principal activities
Singapore Network Services (55% owned by TDB)	Develops and operates EDI locally for all sectors of the Singapore economy
Singapore Information Services (100% owned by TDB)	Develops EDI-related information systems for the business community Distributes trade information to the business community
Network International (100% owned by TDB)	Develops and markets EDI overseas Provides systems knowledge, technical expertise, and consultancy
Cargo Community Network (44% owned by TDB)	Operates cargo community system to facilitate movement of cargo

such as trade volume handled and processing revenue earned per document processing staff. Data for these two constructs were collected and summarized from 1986 through 1992. Change-point tests [37] performed on both constructs showed that there had been a significant change in trade volume handled per document processing staff ($W = 22$, $p < 0.01$) (see Table 6) and processing revenue earned per document processing staff ($W = 22, p < 0.01$) (see Table 7) after the year 1989. Since TradeNet implementation was the only major event affecting trade administration that year, these results confirmed that TradeNet was the main factor responsible for the efficiency gains. This big impact of TradeNet could be attributed to its early widespread adoption by the trading community. By the end of 1990, 1,300 traders who accounted for 92 percent of trade declaration documents had adopted TradeNet. This widespread adoption allowed TDB to drastically cut down its document processing staff and close down manual processing counters without compromising its level of service to the trading community.

From an effectiveness perspective, TradeNet's impact could be gauged by measuring the competitiveness (effectiveness, efficiency) and the satisfaction of its participants. Two surrogate constructs for competitiveness were used: efficiency and effectiveness. Satisfaction with the process is operationalized using satisfaction with TradeNet features and satisfaction with TradeNet price (see the appendix). Questions

Table 6. TradeNet's Impact on Trade Volume Handled

Year (time period)	Trade volume (S$ billion)	Document processing staff	Volume per staff (a)	Rank of (a)	Rank sum (W_t)	$\lvert 2W_t - t(N+1)\rvert$
1986 (1)	123.0	144	0.85	7	7	6
1987 (2)	136.6	109	1.25	5	12	8
1988 (3)	177.5	146	1.22	6	18	12
1989 (4)	192.0	112	1.71	4	22	12
1990 (5)	216.0	67	3.22	3	25	5
1991 (6)	237.2	58	4.09	2	27	6
1992 (7)	250.6	38	6.59	1	28	0

t = Time period; W_t = Wilcoxon rank-sum; N = Number of observations; $N = 7$ for this test; K = Maximum $|2W_t - t(N+1)|$; $K = 12$ for this test; $W = W_t$ at K; $W = 22$ for this test.

Table 7. TradeNet's Impact on Processing Revenue Earned

Year (time period)	Processing revenue (S$ million)	Document processing staff	Volume per staff (a)	Rank of (a)	Rank sum (W_t)	$\lvert 2W_t - t(N+1)\rvert$
1986 (1)	5.83	144	0.04	7	7	6
1987 (2)	6.58	109	0.06	6	13	10
1988 (3)	9.32	146	0.06	5	18	12
1989 (4)	15.18	112	0.14	4	22	12
1990 (5)	17.83	67	0.27	3	25	5
1991 (6)	17.55	58	0.30	2	27	6
1992 (7)	17.68	38	0.47	1	28	0

t = Time period; W_t = Wilcoxon rank-sum; N = Number of observations; $N = 7$ for this test; K = Maximum $|2W_t - t(N+1)|$; $K = 12$ for this test; $W = W_t$ at K; $W = 22$ for this test.

soliciting feedback on the turnaround time for trade declaration documents were also included in the questionnaire and administered to TradeNet participants through a mail survey.

The questions were subjected to both construct validity testing using principal component analysis with varimax rotation [11] and reliability testing using Cronbach alphas [12]. As seen in Table 8, factor analyses provided evidence of construct validity for the questions. Each construct was then subjected to the reliability test. The results showed that, with the exception of the effectiveness construct which had a Cronbach's alpha of 0.64, the rest had Cronbach's alphas exceeding Nunnally's [35] criterion of 0.7 for reliability (see Table 8). Hence, results on effectiveness must be interpreted with caution.

The score for each construct was computed by averaging the scores of all questions measuring it. Separate t tests were conducted at a 1 percent level of significance to compare the scores for each construct with the neutral value of 4. The results indicated that respondents experienced increased efficiency and effectiveness with the use of

Table 8. Results of Construct Validity and Reliability Assessments

Question	Factor 1	Factor 2	Factor 3	Factor 4
Feature satisfaction Q1	0.80			
Feature satisfaction Q2	0.87			
Feature satisfaction Q3	0.79			
Feature satisfaction Q4	0.77			
Feature satisfaction Q5	0.67			
Effectiveness Q1		0.58		
Effectiveness Q2		0.79		
Effectiveness Q3		0.84		
Price satisfaction Q1			0.91	
Price satisfaction Q2			0.91	
Efficiency Q1				0.59
Efficiency Q2				0.86
Efficiency Q3				0.79
Eigenvalue	4.60	1.70	1.43	1.25
Variance explained	35%	13%	12%	10%
Cumulative variance explained	35%	48%	60%	70%
Corresponding construct	Feature satisfaction	Effectiveness	Price satisfaction	Efficiency
Cronbach's alpha	0.87	0.64	0.89	0.72

TradeNet. They were also satisfied with the TradeNet features and the usage price (see Table 9). Thus, TradeNet has contributed to the trading community's competitiveness and resulted in greater satisfaction with the trade administration process. Results from the questions on turnaround time also corroborated evidence obtained from TDB (see Table 3). For noncontrolled items, 80.2 percent of respondents reported an average turnaround time of less than fifteen minutes for trade declaration documents. For controlled items and dutiable items, respectively, 81.8 percent and 90.8 percent of respondents reported an average turnaround time of less than four hours for trade declaration documents. Other studies [33] have shown that TradeNet participants have achieved increased productivity of 25–30 percent. Indeed, it appears that TradeNet has benefited both public (e.g., TDB) and private (e.g., traders) organizations.

Although TradeNet has benefited its participants in general, it also presents some potential problems. First, as TradeNet becomes inevitably interconnected with other networks, it also becomes more open to external attacks from remote locations. With the country's entire trade transacted on only one network, a collapse of TradeNet would bring dire consequences. Hence, as usage of TradeNet increases and as TradeNet becomes an integral part of the trading environment, the responsibility of operating and maintaining TradeNet becomes an onerous task for SNS and other public-sector organizations. Second, the use of TradeNet resulted in the loss of intimate knowledge on trade policies, regulations, and document processing proce-

Table 9. TradeNet Impact's on Competitiveness and Satisfaction of Trading Community

Construct	Mean (scale: 1–7)	*t* statistic	*p* value
Satisfaction with TradeNet features	5.70	29.65	< 0.01
Satisfaction with TradeNet price	4.43	4.55	< 0.01
Efficiency	5.15	13.53	< 0.01
Effectiveness	4.52	7.90	< 0.01

dures by TDB processing staff due to task automation. One senior trade officer explained, "Through repeated processing of trade declaration documents, we used to remember, say, what codes corresponded to what item descriptions, what were the controlled items, etc. Now, everything seems transparent." Thus, in the event of a major computer glitch, the switch to manual processing would be difficult, if not impossible. Given these potential problems, SNS and other public-sector organizations have invested in a comprehensive disaster recovery plan to ensure TradeNet's smooth functioning. Ironically, these potential dangers of using TradeNet also underscore its importance.

Conclusion and Lessons Learned

TRADENET HAS DRASTICALLY TRANSFORMED THE TRADE ADMINISTRATION PROCESS in Singapore. Before its implementation, the process was focused on control and was fraught with problems, including slow turnaround time for all types of trade declaration documents, inefficient interorganizational communication, inconsistent versions of the same information in different public sector organizations, and more. Since the productivity of the trading community is contingent on the speed of approval of their trade declaration documents, an inefficient trade administration system meant a lowering of their productivity and probably a lowering of the competitiveness of Singapore as an international hub for trading activities. Following implementation of TradeNet, the process shifted to a facilitative focus. The processing time for all types of trade declaration documents was greatly reduced. TDB offers a plethora of services through TradeNet to raise the productivity of the trading community. Communication and coordination between TDB and other public-sector organizations have also been streamlined. Had TDB not transformed itself in the process of TradeNet implementation, these benefits would not have been realized. Table 10 summarizes TradeNet's effects on TDB's organizational structure, business processes, network, and scope.

This study suffers from a few limitations. As a single case study focusing only on TDB, it lacks analytical generalizability and omits analysis of TradeNet's impact on other government agencies and the trading community industry structure. Future research can address these limitations by considering multiple cases when analyzing EDI impact, exploring the ramifications of EDI impact at the industry level, and

Table 10. Overview of TradeNet's Impact on TDB

Construct	Pre-TradeNet	Post-TradeNet
Organizational structure	Large homogeneous unit	Small specialized units
Business processes	Low information-processing capacity	Increased information-processing capacity
Business network	Standard linkages	Customized linkages
Business scope	No EDI-related subsidiaries	Four EDI-related subsidiaries

considering a case study design that analyzes EDI impact on both sponsoring and participating organizations.

Despite these limitations, this unique case study offers an indepth understanding of the impact of EDI on a sponsoring organization and helps build a theory of IT-enabled organizational transformation. Also, although the TradeNet implementation and the trade administration process transformation were carried out with a government mandate under unique circumstances, this case provides four important lessons likely to be valuable in many other situations. They are: change existing mindset, institute radical transformation, leverage knowledge and technology, and foster win–win situations.

Change Existing Mindset

It is the willingness to change the existing mindset that helped TDB succeed in transforming the trade administration process. Throughout the TradeNet implementation, TDB continually challenged the traditional wisdom and assumptions about how the process should proceed. When TDB realized that TradeNet would de-homogenize the work functions of the large trade administration unit, it was willing to restructure itself into four smaller specialized units and to redeploy several unnecessary staff to other units, despite how painful these decisions were. Even in external areas where TDB felt a fundamental change would be necessary, it actively solicited the support of other related public-sector organizations and eventually coordinated the implementation details. In addition, TDB prepared its own staff for the new operating environment by redesigning their job specifications and equipping them with adequate knowledge through training. All parties involved changed their existing mindset and contributed to TradeNet's success.

Institute Radical Transformation

TDB did not simply overlay an EDI on top of the existing trade administration process. Instead, it reviewed its organizational structure, business processes, business network, and business scope thoroughly to identify all necessary changes. Where beneficial, radical changes were instituted. Examples of major transformations included the restructuring and integration of information services and the redesigning of TDB

interactions with other public-sector organizations and the trading community. Had TDB restricted itself to making minor internal changes, the benefits of TradeNet implementation would have been minimal. This finding is consistent with that of another study [38], carried out in the private sector. Short and Venkatraman studied Baxter Healthcare and noted that its Analytic Systems Automatic Purchasing (ASAP) system resulted in major benefits due to its radical organizational transformation.

Leverage Knowledge and Technology

TDB invested heavily in EDI infrastructure when implementing TradeNet. It leveraged this big investment through its subsidiary, SNS, which exploits the infrastructure to develop other EDI applications and offer value-added network services. This strategy allows SNS to reap economies of scale and network externalities advantages to lower operating costs and increase profits. Besides leveraging infrastructure, TDB transfers its newly acquired knowledge and experience to other key trading areas with potential for application of EDI technology. Through its new subsidiary, Network International, TDB exports its knowledge and experience by providing EDI consultancy services to public- and private-sector organizations overseas. While it is still too early to see results, the aftermath of such leveraging of knowledge and technology has the potential for huge payoffs.

Foster Win–Win Situations

A key objective of TradeNet implementation was to foster a win–win situation for all parties involved. This objective had been attained with the rapid turnaround time for the processing of trade declaration documents. TDB and other public-sector organizations gained in terms of increased efficiency in carrying out their work functions and reduced costs. They increased their information-processing capacities by shifting the trade declaration documents processing from a labor-intensive practice to a technology-intensive approach. Since TradeNet, the processing capacity of trade declaration documents is no longer constrained by the number of trained personnel. The trading community benefited in terms of increased competitiveness resulting from faster handling of cargoes. Furthermore, their increased satisfaction with the process accords due recognition to all trade-related public organizations for their commitment to excellence in public service. This fostering of a win–win situation is critical to TradeNet's long-term viability. Johnston and Vitale [23] suggested that all participants of an interorganizational system, such as an EDI, should be given adequate and continual incentives to participate if the system is to survive.

The case of TradeNet demonstrates that IT in general, and EDI in particular, could be harnessed to achieve great improvements in organizational efficiency and effectiveness. Results of this study reinforce those of earlier studies [7, 8, 38] which showed that benefits arising from the use of IT could be amplified if IT implementation were

accompanied by suitable organizational changes. In addition, these findings extend those of earlier studies, based mainly on the private sector (e.g., [38]), to the public sector. While the traditional use of IT for organizational automation has led to marginal gains, the innovative use of IT for organizational transformation could lead to phenomenal gains.

Acknowledgment: We gratefully acknowledge the support of TDB and SNS for this study.

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APPENDIX: Constructs Assessing Competitiveness and Satisfaction of Trading Community

Construct	Questions							
Effectiveness		Strongly disagree						Strongly agree
	1. TradeNet greatly increases the number of our customers.	1	2	3	4	5	6	7
	2. TradeNet allows us to make better decisions when handling trade declaration documents.	1	2	3	4	5	6	7
	3. TradeNet allows us to make better decisions in allocating resources to business operations.	1	2	3	4	5	6	7
Efficiency		Strongly disagree						Strongly agree
	1. TradeNet greatly improves our process of handling trade declaration documents.	1	2	3	4	5	6	7
	2. TradeNet greatly improves our process of exchanging trade declaration documents with other organizations. 1	2	3	4	5	6	7	
	3. TradeNet greatly reduces our costs of handling trade declaration documents.	1	2	3	4	5	6	7
Feature satisfaction		Strongly dissatisfied						Strongly satisfied
	1. We are very satisfied with the reliability of TradeNet.	1	2	3	4	5	6	7
	2. We are very satisfied with the availability of TradeNet.	1	2	3	4	5	6	7
	3. We are very satisfied with the functions of TradeNet.	1	2	3	4	5	6	7
	4. We are very satisfied with the usage ease of TradeNet.	1	2	3	4	5	6	7
	5. We are very satisfied with the response time of TradeNet.	1	2	3	4	5	6	7

Price satisfaction	1. We are very satisfied with the TradeNet processing fees charged by controlling and taxation agencies.	1	2	3	4	5	6	7
	2. We are very satisfied with the TradeNet processing fees charged by SNS.	1	2	3	4	5	6	7