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# The Building of a New Business Ecosystem: Sustaining National Competitive Advantage Through Electronic Commerce

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Despite the high level of interest in the role of governments in building national information infrastructure (NII) as a source of competitive advantage, it is still not clear how major information technology initiatives can help leverage national economies into the global marketplace. In light of the recent rollout of one of the world's largest electronic commerce initiatives, we examine the role of private-public partnerships in the success of such initiative in Hong Kong. Furthermore, we trace the 3 stages of the project—development, implementation, and competitive entrenchment—to identify the difficulties and challenges encountered and how these were overcome. By drawing some comparisons with the Singapore approach, we identify the kind of government involvement appropriate to spur on national competitiveness. We show that in building the NII, the dual aspects of private-sector leadership and government involvement are mutually reinforcing. Government intervention is necessary in creating the initial supply push, whereas the demand pull engendered by the market is critical for leveraging the NII as a platform for national competitiveness. The ramification of the study for other countries is discussed.

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economic impacts (BA01), governments (BC01),  
interorganizational systems (HA07)

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## 1. INTRODUCTION

Over the course of the past decade, much attention in information technology (IT) and government policy research have concentrated on various government initiatives to implement national information infrastructures (NII; e.g., [1–9]). The main focus of attention has been the behavior of governments in NII development projects, be they piecemeal or coherent. The general consensus is that IT will form the platform for competing in the global economy of the future [10]. In particular, electronic commerce (e-commerce) is seen as a significant change agent in transforming the basis for competition between organizations, industries, and economies. As such, how well economies build their IT platform will determine their ability to compete in today's network economy [11]. In recent years, governments have increasingly become aware that their actions can have a profound impact on the nations' potentials for doing business electronically. Conversely, they realize that their actions can also inhibit the diffusion in the use of e-commerce and IT [12]. Countries such as Singapore are often quoted as examples where the government has taken an active participatory role in national computerization and informatization [13–16]. The vision for the economy's NII, its strategies and implementation initiatives, have all been lead by the government [8]. At the other extreme of the spectrum are nations such as New Zealand. Although *laissez-faire* policies have promoted New Zealand to become a heavy user of IT, ranking second behind Australia in the Asia-Pacific region in terms of IT spending as a percentage of gross national product, the cracks have started to appear in its infrastructure [6]. In an international environment where countries are rapidly devising explicit strategies to improve their infrastructure, even the New Zealand government questioned whether some form of government support was in order. Then there are nations such as Australia, whose IT policies have been described as falling in between the two extremes of *laissez-faire* and strong government interventionism [17]. This approach has lead to fragmented and uncoordinated policies.

Although there is recognition that some degree of government intervention or involvement is necessary, the extent to which the private sector should be a formal part of the policy-making process remains an issue for debate. Should governments intervene or should the private sector take the lead? Arguably, IT now has economic, social, and political significance in national policy and governments have a role to play in ensuring that local industry is part of mainstream developments. Both private and public sectors have interrelated and mutually reinforcing goals to achieve through the NII. Yet the balance to be achieved remains a subject of contention. In the United States, for example, the evolution of the NII has been shaped mainly by very large private sector firms whose primary interest is in competitive positioning rather than any attempt to build a unified and coherent NII [2]. Meanwhile, developing nations in the Asia-Pacific region are anticipating that IT-related government initiatives will be a key to economic growth and a springboard to leverage them into the global arena [5]. IT adoption among government bodies is seen as a starting point for encouraging nationwide IT adoption and use, and for demonstrating efficiency and effectiveness.

In this article, we attempt to build on previous research and to generate a model for effective government involvement in the diffusion of a community-wide

e-commerce project through the 3 stages of development, implementation, and competitive entrenchment. In the analysis that follows, we consider the public-private partnership at the initial conception, development, implementation, and entrenchment stages of Hong Kong's electronic trading system. Particular reference is made to the needs of small- and medium-sized enterprises (SMEs) and institutional involvement in promoting adoption [18–20]. We then discuss the impact of the new system on the Hong Kong government, subscribers to Tradelink services, and Tradelink itself. We make a comparison with the Singapore electronic trading system development and implementation project. Finally, we draw conclusions from this research to identify the appropriateness of government involvement in projects of this nature.

## 2. THE CASE OF TRADELINK ELECTRONIC COMMERCE

Within the broader context of the NII, the focus of this study was on one (but critically important) segment of such developments, that of the trading community in Hong Kong. Hong Kong has historically been a center of trading and a gateway to the Far East. With minimal natural resources, the onetime British colony has thrived on its dependency on export and re-export trading [7, 21]. However, rapid economic growth and inflation through the 1970s and 1980s made Hong Kong an increasingly expensive place in which to transact business. At the same time, other neighboring countries such as Singapore, Taiwan, and Thailand, were making significant inroads as global trading hubs. Hong Kong's competitiveness was eroding and the *laissez-faire* principles for which Hong Kong had been known for came under challenge.

This impetus gave rise to the implementation of the world's largest business-to-business (B2B) e-commerce project: largest in terms of size of the potential number of users and in terms of the number of electronic security keys in issue. The implementation of such a massive project was handled by Tradelink Electronic Commerce, a company formed by 10 major business organizations together with the Hong Kong government as a 10% initial stakeholder. Tradelink, operated under a franchise agreement with the Hong Kong government, was established for the purpose of "contributing towards an improvement in Hong Kong's competitiveness in world markets by simplifying trade procedures through the introduction of new and improved business practices and the use of information technology" ([22], p. 1). The uniqueness of the Tradelink project makes it a model of public-private cooperation [3]. In the broader picture, however, Tradelink was to play a pivotal role in building Hong Kong's NII, starting with the application of electronic document transfer technology to government-related trade documents.

The primary task of the company was to transfer all government-related trade documents from paper submission format to electronic submission format by the end of March 2000. The unprecedented target of bringing on board around 62,000 traders before then seemed immense. However, its success would ensure that Hong Kong would have the critical mass to form a springboard for further e-commerce initiatives, thus projecting Hong Kong's competitive advantage over other trading nations in the region.

## 2.1 Starting on the Right Footing

In 1984, the business community of Hong Kong was alerted to the importance of building a community-wide electronic data interchange (EDI) network and anticipated that EDI would improve the British colony's trading activities. However, initially the government was of the opinion that because the private sector would be the beneficiaries to the EDI project, it should be financed by the private sector. Conversely, the private sector felt that the government was the only independent body that could ensure that the project would be administered fairly for the benefit of all users with a long-term perspective. Hence, interest in the project slowly waned [23].

At around the same time, Hong Kong was transforming from a manufacturing-based economy to a knowledge intensive coordination center [24]. EDI and e-commerce were seen as the key to reinforcing these changes. With the United Nations' announcement of the introduction of EDIFACT, it became clear to many trade service providers that community-wide application of EDI would be an important factor in maintaining Hong Kong's future competitiveness.

In April 1988, under the pressures of prominent private-sector organizations such as China Resources, Hong Kong Air Cargo Terminals, Hongkong and Shanghai Banking Corporation, and Maersk Hong Kong, the government broke from its traditional laissez-faire stance. It announced its intentions to fund, together with the private sector, a HK\$6 million (\$770,000) consultancy assignment, whereby the government acquired a 10% stake in Tradelink, the company set up to manage the private sector funding.

## 2.2 Development Stage

Tradelink and the government embarked on the search, planning, and design of a solution that was to have long-term implications for the company and for Hong Kong's national competitiveness.

Tradelink's organizers believed that a community-wide approach to the project required participation by government documentation services if it was to succeed. This would provide the necessary stimulus for rapid adoption of EDI. In the past, a totally competitive environment provided little incentive for the development of a national approach. Both the government and the private sector felt that the cooperation required from both sides would best be achieved by the granting of an exclusive franchise for the development of government documentation services, including a single interface between government, EDI and virtual access network suppliers, and the trading community. It was argued that such exclusivity would speed the development of the community facilities, with a fully competitive market flourishing around it.

In November 1992, Tradelink entered into an agreement with the government to provide exclusive EDI services for government trade transactions. The agreement set out certain controls, such as the regulated return for shareholders and the government's control on the prices that Tradelink could charge customers. The government also agreed to take up a 30% stake in Tradelink, making it the largest single shareholder. This agreement sealed the commitment of the Hong Kong gov-

ernment to back and participate in the implementation of the Community Electronic Trading Service (CETS).

An operating agreement was signed in March 1994 and the government's shareholding increased to 48%. Effectively, the agreement established Tradelink's major customer: the government. It determined the operation of CETS, service levels, transactions to be handled, and operating procedures between the two parties. The agreement also set a mark for when the 7-year franchise should start, which was to be the date when the first Tradelink service was to be launched.

By 1996, the project was 2 years behind schedule and the company had run into financial difficulties. As the government was convinced of the strategic importance of e-commerce in embracing Hong Kong's competitiveness, it injected an additional HK\$425 million (\$54.6 million) into Tradelink in the form of a loan. The research, planning, and development stage took nearly 10 years.

### 2.3 Implementation Stage

In 1997, Tradelink launched its first e-commerce services, SilkNet and ValuNet. These services were to help the trading community deal with trade documentation more efficiently through the use of an office computer, with fees collected electronically. Users could also receive daily, up-to-date statements of their quota balance and Trade Department notices to exporters by e-mail. Further services were added later, such as issuing of certificates of origin and carrier notifications.

Two major issues needed to be addressed to minimize resistance to adoption and promote demand pull: creating a standard for the written form of the Chinese language and developing a secure infrastructure to prevent unauthorized access to the system. The launch of the bilingual (Chinese–English) trade declaration in March 1999 boosted adoption rates. Despite the British legacy, Hong Kong fundamentally used Chinese as the business medium. This was the first Chinese language EDI document to be introduced in the world. The government stipulated that documents could only be submitted in English or in the traditional Chinese character format.

Security was another major issue for users and a critical factor in their consideration of whether to adopt the new system. To address this, Tradelink developed a security module based on the public–private key infrastructure (PKI). The application of such a security module to a user base as large as Tradelink's was unprecedented. Tradelink played a significant role in bringing to the attention of the government the importance of having an appropriate legal regulatory framework to ensure users' confidence in e-commerce. The establishment of a certification authority became a cornerstone to that framework. Within that framework, Tradelink laid down stringent requirements relating to identification and authentication of documents through a proven public key security module. In December 2000 there were approximately 150,000 keys in issue, making the Tradelink system easily the largest e-commerce system in the Asia-Pacific region, if not the world. The government endorsed Tradelink's PKI even before its announcement that the Hongkong Post would be appointed the public certification authority at the end of 1998.

Other issues affecting adoption required attention and planning at the implementation stage. Of particular concern was the fact that over 90% of Hong Kong's traders were SMEs with little or no experience in, or knowledge of, computer tech-

nology. Most of Hong Kong's traders were involved in outward processing trade. Although they might employ very few staff in Hong Kong, some had manufacturing operations in China. They were mainly family run and adopted the traditional way of doing business, being too comfortable and reluctant to change. Their attitude hindered the adoption of e-commerce. Hence, the government stressed the significance of the provision of acceptable solutions to provide EDI services to non-users of computers before it would agree to a schedule for closing government document collection counters. A hub-and-spokes structure was designed to accommodate the large majority of SMEs whose trading volumes were small. The service centers acted as spokes to help noncomputerized traders in Hong Kong enjoy the many efficiency and productivity benefits of e-commerce. The service centers would validate the details on paper documents, convert the data to EDI format, then forward the documents electronically to the government.

The general population lacked awareness and appreciation of what e-commerce was and the role that it could play in the business community. In addition to trade exhibitions and television advertisements to promote Tradelink's cause, the company negotiated with a number of vocational teaching establishments to incorporate training in the use of Tradelink products into their curriculum. A customer service hotline was established to provide service from 7 a.m. to 11 p.m., 7 days a week, to deal with queries and problems users had.

Tradelink and the government worked together to ensure that the barriers to adoption would be minimized. Having accomplished a workable infrastructure, the cutoff dates set by the government for the closing of paper applications counters for quota licenses by the end of 1998 and trade declarations by the end of March 2000 seemed realistic and achievable. Thereafter, all documents were to be submitted electronically. The closure of government counters was seen as crucial for Tradelink to succeed. Making adoption compulsory was the only means to achieve the "critical mass" needed to ensure low cost transactions.

In addition, a strong customer service team that was responsive to customer enquiries and problems was one of the deciding factors for many SMEs. On a typical day, the company's hotline received between 3,500 to 4,000 calls. Many of the calls from SMEs were to deal with simple technical problems, oftentimes not directly associated with Tradelink's service applications. Frequently, technicians were required to make on-site visits to ensure efficiency in resolving user problems.

Tradelink also worked with the government to ensure that costs for SMEs would be kept to a minimum. Software was offered free of charge. Annual fees and first time registration fees had been reduced. From time to time, the company offered very significant incentive programs to attract the SMEs. For example, during the first months of the launch of the certificate of origin applications service, users needed only to pay the government fee, not the Tradelink service charge. In the first 2 years of the trade declaration electronic service, Tradelink operated a "Weekend Program," which meant that documents could be submitted on weekends at the rate of HK\$2.00 per documents as opposed to the normal HK\$11.90 per document. A comparison of user costs based on paper submissions and electronic submissions is shown in Table 1.

The Internet-based versions of SilkNet and ValuNet were introduced with the launch of the Web site, [www.tradelink.com.hk](http://www.tradelink.com.hk), in February 2000. This enabled

**Table 1**  
**User Costs of Submitting Government Related Trade Documents**

<i>Service</i>	<i>Cutoff Date for Paper Submissions</i>	<i>Charge</i>			<i>Total (Electronic)<sup>a</sup></i>
		<i>Government (Paper)<sup>a</sup></i>	<i>Government (Electronic)<sup>a</sup></i>	<i>Tradelink<sup>a</sup></i>	
Restrained textiles export license application	December 31, 1998	216	141	75	216
Trade declaration	March 31, 2000	13	0.5	11.9	12.4
Production notification	February 27, 2000	49	34	15	49
Certificate of origin	September 24, 2000	110	95	15	110

<sup>a</sup>Given in Hong Kong dollars, HK\$7.80 = \$1.00.

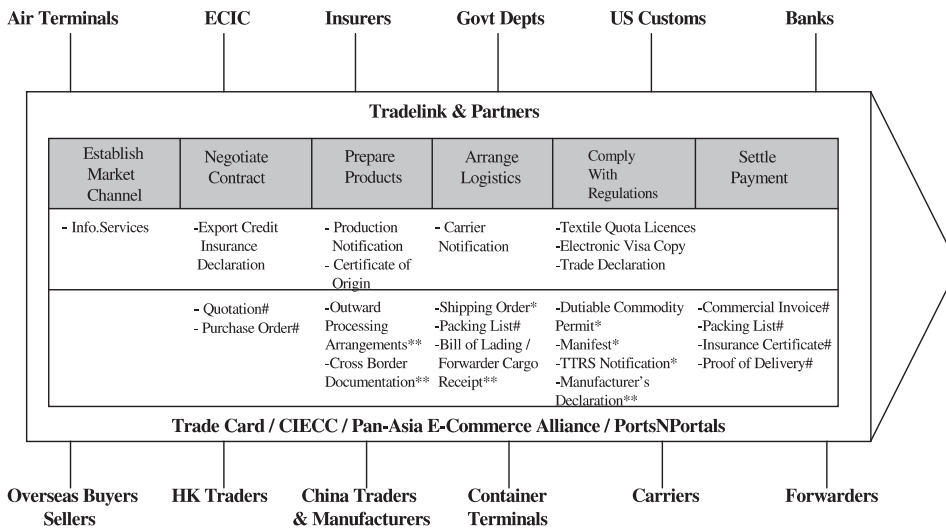
Tradelink to have tailor-made information for individual user companies by providing information, such as a daily update of the quota balance from the Trade Department, through the Internet. The age of Internet commerce provides a new medium through which companies can get closer to their customers. To compete successfully, companies need to be agile to respond to the ever-increasing and ever-changing needs of customers. Many leaders in Internet commerce have reported significant volumes of sales through the Internet placed by SMEs [25]. For the Hong Kong environment with its unusually large number of SMEs, an Internet based EDI/e-commerce infrastructure would be well received. Basic customer service and technical support functions provided online would help to lower service and support costs. Speed-to-market would be a competitive advantage for Hong Kong based companies whose trade cycles would be significantly shortened. The potentials for a fully integrated value chain would be immense. Vertical integration with global and national e-commerce service providers in the supply chain would improve efficiency and generate benefits for all parties.

In 1999, Tradelink began to see profits. Tradelink handled 544,373 export licenses for restrained textiles and 15,614,906 trade declarations in 2000. This translates to 92% of all government trade document submissions, whereas the remaining 8% go through the service centers. By 2000, the company showed profits of HK\$100 million on revenue of HK\$229 million. Of the HK\$425 million loan from the government, Tradelink used only HK\$203 million. By September 2000, the company had paid off all of its loans. By February 2001, the company had successfully subscribed over 51,000 users, which represents about 80% of the shrunk trading community of Hong Kong that has been shaken by the Asian economic crisis in the late 1990s.

#### 2.4 Competitive Entrenchment Stage

For Tradelink, the sociotechnical web is founded on its customer base. Up until the end of 1998, there was no proper institutional mechanism in Hong Kong to extend e-commerce/EDI services beyond what had been agreed to between the government and Tradelink, thus presenting very limited value-added service. With the introduction of the carrier notification service in early 1998, a number of freight forwarders and carriers, such as airlines and shipping lines, were brought





**Figure 1.** Tradelink’s role as an e-commerce magnet in international trade transactions. ECIC = Export Credit Insurance Corporation; \* = confirmed development schedule (with government/other service providers); \*\* = under scoping/consideration; # = TradeCard services.

on board. Indeed, Tradelink estimated that it had captured around 70% to 80% of the freight forwarding market. As Tradelink embarked on a strategy of interconnectivity with other e-commerce service providers, its network became of greater value to its user base.

Tradelink realized at an early stage that it would be impossible for the company to tackle the challenge of applying e-commerce to the whole trade cycle effectively on its own. Instead, the approach would be to establish a network of strategic alliances with value-added network service operators and other trade service providers. Tradelink embarked on a mission to shape a community-wide e-commerce infrastructure that would enhance the overall efficiency of the independent, industry-based networks that flourished through the 1990s. Figure 1 shows the new ecosystem that it is building through the formation of alliances and partnerships with local and regional organizations. The broader range of services now offered through Tradelink are discussed following. As a result of these alliances and joint ventures, Tradelink is pulling together the various players in the trading cycle.

**2.4.1 Arena Transportation.** In 1999, Tradelink underwent a pilot project with Arena Transportation Community Network, a company that provided electronic access to all parties involved in trading [26]. Through the Arena Web interface, it was possible to create a complete set of trade documents, send and receive them from a trading partner as well as easily manage all documents related to current and past business activities. It was hoped that by interconnecting with Arena, Tradelink would extend the service offering to its users.

**2.4.2 Traxon Asia.** The next project to undergo pilot testing was an alliance project with Traxon Asia. Traxon operated an international electronic network for

coordinating transactions between freight forwarders, air cargo terminals, and airlines. Its objective was to provide e-commerce services to the air cargo industry. Traxon was very successful and by 1998, 94% of air cargo volume lifted out of Hong Kong was coordinated by Traxon [27]. The alliance with Traxon would allow Traxon's subscribers to use Tradelink's services and vice versa.

**2.4.3 CIECC.** In September 1999, Tradelink signed an agreement with the China International Electronic Commerce Center (CIECC), an organization formed with the intention of providing e-commerce services to China such as quota licensing and certificate of origin issuing services. The agreement marked the commencement of the testing phase of interconnectivity between Tradelink's system with that of CIECC's. Once interconnectivity was established, CIECC was able to provide access to Tradelink's services for its customers in Hong Kong.

**2.4.4 TradeCard.** TradeCard ([www.tradecard.com](http://www.tradecard.com)), a B2B, e-commerce transaction enabler focused specifically on cross-border trade, was conceived as a new payment alternative for international trade [28]. It provided a solution that was easier to use than a letter of credit, more secure than open accounts, and available for one flat fee per settled transaction. TradeCard's aim was to increase the volume of cross-border trade and lower the cost of transactions.

In March 2000, TradeCard announced its worldwide service launch in Hong Kong, in partnership with Tradelink. The latter agreed to develop a direct marketing program to promote TradeCard as a new international trade settlement tool to the Hong Kong trading community. In addition, TradeCard provided a call center for TradeCard customers. The partnership did not require additional headcount for Tradelink. The revenue generated from the partnership (30% of the TradeCard transaction fee) was sufficient to offset the operating costs.

**2.4.5 C&T.** The Hong Kong government awarded Computer And Technologies Holdings (C&T) a contract to build and operate an electronic tendering system that was launched in April 2000. Later in the year, C&T was keen to extend the system to commercial use and approached Tradelink to tap into its large customer base. Tradelink saw this as an additional service for its subscribers. Furthermore, Tradelink's digital certification system enabled users to enter a tendering process within legal and secure parameters.

**2.4.6 Asia E-Commerce Alliance.** In June 2000, Tradelink initiated talks with Taiwan's TradeVan and Singapore's Singapore Network Services (SNS) to form the Asia E-Commerce Alliance. The intention was for all parties to add strength to their individual networks and to add value to customers. By the end of 2000, the Alliance had 5 members: Tradelink, TradeVan, SNS, KTNNet (Korean) and CIECC. The sixth member was likely to be from Japan. Initially, the Alliance focused on 3 main projects with the following aims:

- To facilitate cross-border transactions by promoting intraregional trading. In early 2001, tests were already underway for electronic transmission of commercial invoices, packing lists, and a host of other documentation.

- To address the security issue through creating a mutual recognition of digital certificates such that, for example, a Hong Kong trader using a Tradelink digital signature would be recognized and accepted by a trader in Taiwan. Recognition implied that there be sufficient legal status for all parties concerned to base their commercial activities on. With variances in the degree of recognition among the certification authorities' operations of the 5 areas, adjustments and compromises had to be made. One way to overcome these differences was to set a common standard, the lowest common standard acceptable to all 5 parties. This would entail the formation of a policy authority that would delve into the individual policies employed in each member country.
- To create a pan-Asia portal. The initial idea was to form a database of company profiles and products offered. Free Web hosting services were a possibility, as this would allow customers to display their company and product information on the portal. This would create a very sizable market in which traders wishing to buy or sell in the region would be able to search and access corporate information. The next step in building this B2B platform would be to link with similar portals in Europe and the United States. The Alliance hoped that the portal would attract large buyers such as General Electric to create initial and sustained user value.

Being the initiator of the Alliance, Tradelink played a leading role in the direction of the Alliance. Tradelink anticipated that the success of the 3 initial projects, which should see results by early 2002, would demonstrate a very powerful and formidable alliance.

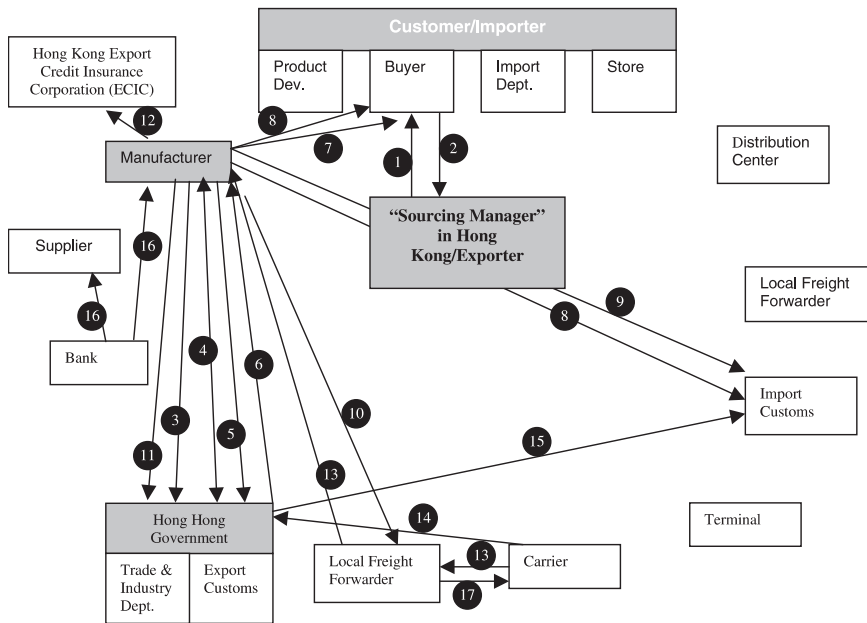
Undoubtedly, Tradelink's most valuable asset is its user base and the electronic network that brings all parties in the trading network together. It is no wonder that many organizations are keen to partner with Tradelink to tap into those assets. However, the company maintains strict criteria for entering into an alliance or partnership. At the minimum, it has to ensure that the additional services create value for its users.

Moving beyond the core services of government trade document submissions, Tradelink aims to build a B2B platform that addresses services along the whole supply chain, including the order fulfillment process, validations, production, settlement, logistics, and so on. Figure 2 shows a typical example of the parties involved in an export process along with the trade documentation that are currently under development or are now delivered electronically by Tradelink's network.

The dependence on government documentation as a source of revenue is likely to diminish over time. Future alliances and partnerships would focus on those processes and services along the supply chain. With these developments, Tradelink had to strengthen its business development team to grasp business opportunities as they arose

## 2.5 Impact

Various government departments and subscribers have realized substantial benefits in using Tradelink's services. Within the affected government departments,



Number	Trade documents/Processes	Description
1	Quotation	A quotation is issued following a request for quotation.
2	Purchase Order	Once agreement has been reached on price, quantity etc, a purchase order is issued.
3	Applying for export quota	The exporter (usually the manufacturer or the sourcing company) will apply to the government for the update of the available quota balance.
4	Submitting quota	Once the quota balance has been ascertained, the exporter will submit its quota application to the Trade Department.
5	Applying for export license	The exporter must apply to the government for an export license.
6	Issuing export license	An export license is issued by the government.
7	Commercial invoice	When the order is ready for shipment, the seller will prepare a commercial invoice.
8	Packing list	The packing company that prepares the order for shipment (here, we have assumed this to be the exporter/manufacturer) will issue a packing list to the importer, which may also be required by import customs.
9	Certificate of origin	Some countries require that imported goods must be accompanied by certificates of origin that state the place of manufacture/production of the goods.
10	Carrier notification	The approved quota license has to be advised to the freight forwarder/carrier involved in shipping of the goods.

Figure 2 (Continued).

Number	Trade documents/Processes	Description
11	Production notification	Manufacturers must notify the government before commencing the production of restrained textile products.
12	Export credit insurance declaration	Policyholders with ECIC are required to submit their Export Credit Insurance Declaration to ECIC.
13	Bill of lading (B/L)	The B/L is issued by the carrier as evidence that they have received the shipment and have agreed to transport it to the destination at the price agreed upon.
14	Submitting export manifest	The government requires that all air and ocean carriers lodge cargo manifests.
15	Quota license sent to import customs	The approved quota license must be sent to the import customs.
16	Submitting letter of credit (LC)	A LC is submitted to the exporter's bank who ensures that the terms and conditions of the trade are satisfied before payment is released to the importer's bank.
17	Shipping order	Instructions to carriers with consignment details.

**Figure 2.** The electronic delivery of trade documents through the Tradelink network.

business process reengineering and systems integration took place. For example, the Trade Department's export license function saw a substantial trimming down of its license processing section and the savings amounted to HK\$16 million (over \$2 million) per annum. When trade declarations were fully transferred to electronic, further substantial savings were realized. In 1997, the government estimated that the economic benefits could amount to HK\$8.6 billion (\$1.1 billion) a year when EDI would be widely adopted in Hong Kong for handling all transport, commercial, and financial transactions. For the government alone, realizable staff savings of 256 posts by 2000 were mentioned [29]. A further saving of 308 posts could also be achieved through avoiding staff increases required to cope with the growth in workload anticipated.

Electronic document submissions cost the users no more than before. Apart from the initial capital cost for computer hardware and software, the government passes its savings back to users by way of reduced government charges. In 1998, the government raised the minimum cost of paper submissions from HK\$5 to HK\$13 (\$1.70) each, whereas electronic transactions were reduced from HK\$5 to HK\$0.50. This generated savings of HK\$6.9 million (\$0.9 million) per annum for export license transactions alone. With respect to trade declarations, the anticipated savings on 15 million declarations per annum would amount to HK\$22.5 million (\$3 million).

Competitive entrenchment for subscriber companies can be achieved through several means, such as improved efficiency, cost reduction, extension of global reach, and perhaps more important, interconnectivity with other e-commerce service providers, clients, customers, and suppliers. In 1999 and 2000, Tradelink contacted a small random sample of subscribers to find out whether there were any savings or improvements in business efficiency having adopted the electronic system. Its findings are summarized in Table 2. Quantifiable savings include reduced staffing costs and reduced document processing time.

**Table 2**  
**Reported Savings and Improvements by a Sample of Tradelink Subscribers**

<i>Company</i>	<i>Size</i>	<i>No. of Documents Submitted</i>	<i>Savings/Improvements</i>
Pak Tak Knitting & Garment Factory	5000+ <sup>a</sup>	20 to 30 customs declarations per day, plus quota licenses, certificates of origin and production notifications	Greatly improved document management
Tec-Hill Company	\$150 million annual sales	Not available	Notable improvements in employees' work attitudes and job satisfaction; trade document submission processing staff reduced from 3 to 1; using TradeCard service has improved profits by 20%
E-Shing Embroidery & Garment Factory	400+ <sup>a</sup>	Up to 200 quota licenses per month	Convenience and improved efficiency; saved the cost of employing one messenger
Freudenberg & Wilene	600+ in Asia only <sup>a</sup>	1000 customs declarations per month	Improved efficiency
United Parcel Services, HK	350+ <sup>a</sup>	200+ customs declarations per day	Document processing time has been reduced to as little as 20 s per document
Starlight International	8000+ <sup>a</sup>	Hundreds of customs declarations per day	Full time shipping staff reduced from 9 to 5
Seiko Instruments (HK)	5700 <sup>a</sup>	1,000-1,500 customs declarations per month	Full time shipping staff reduced from 5 to 3; Improved job satisfaction of sales and services team
Perry Garments		30 export license applications; 10 trade declarations and 20 production notifications per day; plus certificates of origin	Document processing speed has improved by 1.5 times; trade document submission processing staff reduced from 5 to 2
TAL Apparel	16 000+ <sup>a</sup>	Not available	Trade document submission processing staff reduced from 2 to less than 1 full time staff; significantly reduced the amount of late lodgement penalty charges
Motorola Semiconductors HK	14 7000 <sup>a</sup>	Not available	Trade document submission processing staff reduced from 5 to 3
PMS International (Far East)	41 in Hong Kong only <sup>a</sup>	100+ customs declarations per month	Saves time and cost of a courier

<sup>a</sup>Number of employees.

### 3. A COMPARISON OF TRADELINK AND TRADENET

The successful and speedy development and implementation of TradeNet, the Singapore equivalent of Tradelink, has often been charted as a model case for building national information infrastructure. However, the size and complexity of the Tradelink system has been understated, and the approaches of the two governments to achieving a national competitive advantage have been quite different. These differences are discussed under the headings of idea origination, ownership of the systems, development, implementation, and competitive entrenchment.

#### 3.1 Idea Origination

The idea for TradeNet originated in the 1980s when the Committee on National Computerization (CNC) was commissioned by the Singapore government to make recommendations on how the island state could make use of IT. The CNC report concluded that Singapore should pursue a world leadership role in the use of IT. With this, the NCB was established under the Ministry of Finance to develop programs for building an IT society. TradeNet was one of these programs. The primary objective was for TradeNet to cut costs and speed up the turnaround time for trade and customs documentation. The government felt sure that without public section push, the project would not materialize. The Trade Development Board (TDB) was charged with coordinating and bringing together all the parties involved in trade, particularly the government bodies. Consensus was reached among all parties that an electronic trading system would be beneficial for ensuring Singapore's future competitiveness.

The initiation of the TradeNet system and the Tradelink system were markedly different. The Singapore government was the driving force of TradeNet, whereas the Hong Kong government left it to the private sector to create the demand for an electronic trading system.

#### 3.2 Ownership of the Systems

TDB, the Civil Aviation Authority of Singapore, the Port of Singapore Authority, and Singapore Telecom—all quasi-government organizations and the key players in the project—decided that SNS be formed to own and operate the TradeNet system. Pearleen Chan, former deputy general manager and head of the Government Computerization Project at NCB, was appointed chief executive officer of SNS. The shareholders of the company are the same four quasi-government agencies, the TDB being the major shareholder with 55%.

By comparison, Tradelink is owned by a consortium of organizations that are major players in the private sector. The Hong Kong government increased its shareholding in the company from 10% to 45%, thus demonstrating the government's increasing awareness of the significance of the project for Hong Kong's competitiveness. It was during the development stage in 1996 that a former government official was hired to manage the company. Furthermore, management and operation of the system has been conferred on Tradelink by way of a franchise agreement with a term of 7 years.

### 3.3 Development

A TradeNet steering committee was formed to oversee 3 subcommittees that coordinated activities among the maritime community, the air community, and the government bodies during the systems development stage. The reports of the 3 subcommittees formed the blueprint for the TradeNet system. The mandate was for the system to be operational by early 1989.

As for systems development, the task was simplified by the fact that IBM© already had an internal EDI system in place located in Florida, which was relocated to Singapore and modified to form the TradeNet system. The original system had 1.25 million lines of assembly code, of which 3000 were altered in the modification process. Other components of the system were written within 6 months. The total cost of the system has been estimated at \$33 million. Decisions were made quickly that reflected the consensus and commitment of all the main players in the project, not least that of the government. In fact, Pearleen Chan commented that the project would not have succeeded without the initial Government Computerization Project and the various computer systems that were in place in the government departments and agencies, which had simply to be hooked onto the TradeNet system [14].

Tradelink, on the other hand, took 9 years from 1988 when the government decided to acquire 10% stake in the company, to 1997 when the first electronic service was launched, to develop its core system. However, the project was much more complex than TradeNet in that the system was developed from scratch and for a wider user base.

### 3.4 Implementation

In terms of setting closure dates for paper document submissions, time scales for profit generation, formulating incentive schemes for SMEs, and modeling the hub-and-spokes configuration for nonadopters, the two systems were very similar. TradeNet was launched on January 1, 1989 as the first nationwide EDI trading system in the world. By the end of the year, nearly half of the trade documents for sea and air shipments were handled by TradeNet. The date set for the mandatory use of electronic submissions was brought forward to early 1991. By the 2nd year of operation, SNS was generating revenues from subscription and usage fees that exceeded its operating costs. In Singapore, SMEs were offered tax write-offs for the purchase of hardware, whereas in Hong Kong incentives to encourage SME adoption were designed by Tradelink without government aid. Those who do not subscribe to the network have the choice of lodging trade documents at service centers or TDB offices.

Tradelink and TradeNet operates on both Windows© and the Internet platform. Similar and significant cost and time savings have been reported by users of both systems.

Today Singapore is the 16th largest trading nation in the world (compared to Hong Kong's 10th position), with total trade volume exceeding \$90 billion. TradeNet processes around one half million trade declarations a month, covering a user base of about 2600 subscribers. These are small figures when compared to Tradelink's average monthly trade declaration submissions of over 1.3 million, and a user base of over 51 000.



### 3.5 Competitive Entrenchment

Both Tradelink and TradeNet have been quick to leverage their respective networks to support a wider community of users, thus extending their services beyond government related trade documents. However, the focus and strategy of both have been different.

Since TradeNet was launched, the government has used it as the springboard for further building the national information infrastructure. Through partnerships with various government departments and industry associations, SNS has developed systems and networks that provide electronic services for entire communities of users, such as MediNet for linking hospitals, clinics, drug and equipment stores, the Ministry of Health, and the Central Provident Fund. Within a short space of 3 years, the network of users was extended to include over 30 public-sector organizations and 2200 commercial organizations. Singapore's holistic strategy for building a technology-driven "intelligent island" was government driven and managed.

Tradelink has focused firmly on extending its network to user communities along the supply chain, leaving the sociological electronic infrastructure to the government. With the expiration of the franchise in 2003, Tradelink's plan was to develop a viable business that would satisfy its shareholders and customers. The government has played a minor role beyond agreeing the systems and services linking traders to the various government departments.

Although the Hong Kong and Singapore approaches have been significantly different through the stages of conception to development to implementation to operation, the outcome of both have been to build ecosystems that provide the basis for national, regional, and global interconnectivity.

## 4. CONCLUSIONS

This study highlights an approach to government involvement in e-commerce and NII development projects that impinge on national competitiveness. It took Tradelink over 10 years to bring together the centerpiece of e-commerce to a business community consisting of mainly small- and medium-sized trading companies. Its experience serves to highlight a number of issues: the significance of government involvement in projects of this nature; the balance between the public and private sectors' involvement, which would create the most favorable environment for adoption and use; and the various ways in which the government and Tradelink can influence adoption.

The interaction between the public and private sectors throughout the project draws attention to the need for a form of partnership to create the dynamics of supply-push and demand-pull forces for projects of this nature to succeed. Without government intervention, especially in creating the initial supply push, market forces would seem to fail to achieve the framework required for leveraging national goals. Through comparison of Tradelink and TradeNet, we can identify how the two different approaches both require, to a greater or lesser degree, some form

of government involvement. In Singapore, the transformation has been much more holistic given that the government orchestrated and took ownership of the project at the outset. In Hong Kong, the government gave the initial push, leaving Tradelink to carve out for itself a viable business strategy for the future.

The government's involvement in the 3 stages of the project serves to highlight certain appropriate modes of influence and regulation. At the development stage, government direction and support are essential, not only to create the push in research and development, but also in reassuring the private sector of the significance of e-commerce and NII for competing globally. At the early stage it is also necessary for the government to establish the technical standards on which developments are to follow.

At the implementation stage, a major factor that encourages demand pull in the private sector is the government's stipulation that the appropriate government departments would take the first step in adopting the innovative services. Capturing the government's commitment ensures consistency in technical developments of a coherent system, setting standards on which other e-commerce and EDI services would be developed and integrated. Government commitment to certain standards, such as language and security protocols, is also imperative for enticing user trust. Without a robust regulatory framework, trust—a prerequisite for mass adoption—cannot be achieved.

The third stage, which we have called *competitive entrenchment*, sees the emergence of a new global business ecosystem where business transactions across corporate, industry, and national boundaries are conducted with an increasing degree of speed, openness, and transparency. The government's involvement at this stage is minimal as the network of systems finds new strength by extending beyond government trade-related documentation. The success of companies in the future will largely depend on their ability to leverage the existing and new technological infrastructure to find new ways of cooperating with their partners to provide customers with a wide range of related, value-added services [30].

The adoption of e-commerce will increasingly affect the ability of service economies to compete in the global marketplace. As markets are becoming more interdependent, the effective management of the entire supply and demand chains will lead to more efficient trade among nations. As such, the coordinating role of the global trading hubs becomes significant in trade facilitation, both regionally and internationally. In today's global marketplace, supply and demand are matched from different corners of the world. Having the right infrastructure in place creates the necessary platform for competitiveness, allowing the business community to overcome trade barriers and reach new markets. The economy that stands to gain the most is one that uses such infrastructure to minimize costs and shorten time, thus providing value to the customer.

In recent years, governments and organizations such as Tradelink and the Pan-Asia E-Commerce Alliance have been working together to agree on a set of guidelines and regulations to minimize the variances in standards and regulations of the different nations, thus removing the barriers to building a global ecosystem [31]. The role of governments in mapping out the regulations that will govern this new ecosystem will likely increase, and further research in this area will be necessary.

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