



E-Commerce in Singapore: Impetus and Impact of Globalization

March 2004

Wong Poh-Kam
&
Ho Yuen-Ping
NUS Entrepreneurship Center
National University of Singapore
14 Prince George's Park
email: bizwpk@nus.edu.sg (Wong Poh-Kam)
email: nechoyp@nus.edu.sg (Ho Yuen-Ping)

*Center for Research on Information Technology and Organizations
University of California, Irvine*

This research is part of the Globalization of E-Commerce Project of the *Center for Research on Information Technology and Organizations* (CRITO) at the University of California, Irvine. The material is based upon work supported by the National Science Foundation under Grant No. 0085852. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



Center for Research on Information Technology and Organizations
University of California, Irvine | www.crito.uci.edu

SUMMARY

- Singapore's overall level of readiness for e-commerce in terms of infrastructure and investment is at par with that of a global sample of 10 benchmark countries.
- Sectoral analysis indicates that the distribution (retail/wholesale) sector is the most ready for e-commerce, while the financial services sector is the least ready.
- International competitive pressure is conceptually delineated into Firm Globalization and Internal Improvements.
 - Operating in a small, open economy, Singapore businesses in these sectors have strong impetus to globalize. Firm globalization arises from global competitive pressure exerted by reliance on foreign markets and global supply chains. Businesses respond to such pressure by maintaining and strengthening their positions in global production networks and markets.
 - Internal Improvement is the response of businesses to direct competition from global counterparts. Businesses face competitive pressure to reduce costs and enhance efficiency.
- For the manufacturing and distribution sectors, firm globalization emerges as a significant influential factor for the decision to adopt e-commerce and the nature of e-commerce activities. The focus of e-commerce activities is less on utilizing online trading mechanisms for efficiency gains and more on leveraging on the global communications and networking potential of e-commerce.
- In contrast to the other two sectors, the financial sector is more driven by the need for internal improvement arising from the competitive threat of foreign entrants as the sector continues to be liberalized.
- The major barriers to e-commerce perceived by businesses are related to privacy, security, and cost issues. Barriers presented by the legal and regulatory framework are also more of a problem in Singapore than in the global sample.
- Official data shows that the rate of growth of e-commerce revenues has accelerated. The manufacturing and distribution sectors report much higher percentages of firms using the Internet for a variety of business functions, compared to the financial sector.
- From the CRITO global survey, it was determined that the Internet is more likely to be used for exchange and integration rather than for transactional and sales purposes.
- The composition of online sales activity in Singapore is heavily weighted towards B2B due to the small domestic market and the dominance of globally oriented firms in spearheading e-commerce.
- Online business has a significant impact, especially in market-based factors related to globalization and market expansion potential, such as widened sales areas and strengthened competitive positions.

INTRODUCTION

The advent and continuing growth of e-commerce has imminent repercussions for Singapore's economy. This paper provides an overview of the diffusion of the Internet and e-commerce in Singapore businesses and the impact of diffusion. The conditions for diffusion are also analyzed, to provide context to the conclusions.

The main data source analyzed is the Singapore dataset for the Global E-Commerce Survey. Sectoral level analysis is conducted to compare diffusion in the three included sectors: manufacturing, wholesale and retail distribution, banking, and insurance and other financial services. By comparing Singapore against a benchmark global sample of 10 countries, trends and patterns unique to Singapore are also identified.

This paper also highlights the role of globalization in e-commerce diffusion. In the Singapore context, it is argued that globalization exerts strong influence by creating conditions and providing motivation for e-commerce. This influence reflects how businesses use the Internet and the types of e-commerce activities they engage in. Ultimately, this has an impact on the globalization potential and performance of businesses.

Conditions for E-Commerce Diffusion

The conditions for e-commerce diffusion are analyzed from the following perspectives:

- Extent of globalization of businesses
- Readiness for e-commerce in terms of Information Infrastructure in businesses
- Readiness for e-commerce in terms of IT investment in businesses
- Environmental and policy factors that encourage or discourage e-commerce diffusion

By synthesizing these perspectives, we obtain an understanding of how e-commerce diffusion has developed as a result of both internal and external dynamic forces. In Singapore, e-commerce has been shaped by the inherently globalized nature of the economy, government policies for e-commerce and sectoral development.

Extent and Nature of E-Commerce Diffusion

The following are included for analysis:

- Extent of e-commerce penetration and level of e-commerce revenues
- Nature of use: marketing, transactional, data exchange etc.
- Level of online activity: online sales, online procurement, online services
- Trends in the e-commerce industry

The analysis here shows that Singapore businesses still use the Internet largely for non-transactional purposes such as advertising and systems integration. However, official data points to rising participation in transactional activities such as online sales and procurement.

Impact of E-Commerce Diffusion

The types of impacts analyzed are:

- Market-based impacts such as market access and sales
- Internal efficiency impacts such as increased productivity or lower costs
- Value chain and distribution channel impacts

- Competition

Singapore businesses report that Internet business has the effect of increasing both the number of competitors and the intensity of competition in their respective industries. However, Singapore firms also experience significant impacts with market-based factors such as widened sales areas and strengthened competitive position.

BACKGROUND AND A PRIORI EXPECTATIONS

Singapore, with its small domestic economy and its heavy emphasis on open trade and global connectivity, presents a unique case study of the development of e-commerce. As a major regional hub for trading, manufacturing, and services, Singapore is poised to leverage on global trends in e-commerce development. At the same time, it has been argued that the Internet and e-commerce revolution will render nations less dependent on their traditional advantages, shifting the focus to information control and technology exploitation. Singapore's economic growth has traditionally relied on its strategic geographic location and transportation infrastructure. The dynamics of its economic potential are likely to be profoundly affected by the development of e-commerce.

Evolution of E-Commerce in Singapore

E-commerce in Singapore is still very much in its infancy, although Singapore does not lag far behind leading countries in e-commerce diffusion. The latest official statistics show that in 2000, 10 percent of Singapore's top companies were engaging in e-commerce activities, a significant increase from 4 percent in 1999 (IDA, 2000). It should be noted that the definition of e-commerce used is very strict and encompasses only transactional activities that require interactive online engagement by businesses.

The roots of e-commerce in Singapore can be traced to the period prior to the advent of the Internet. Since the early 1980s, the Singapore government has played an active role in promoting Infocomm Technology diffusion and development of the Infocomm industry. Promotion of e-commerce appears to be a natural extension of this earlier policy focus on promoting Infocomm usage in businesses and households. As early as 1992, the Intelligent Island Vision released by the National Computer Board laid the foundation for island-wide connectivity through a broadband national information infrastructure. The widely known and used TradeNet system for document exchange was implemented initially over a closed EDI network and is a precursor for Internet based e-commerce. These initiatives predate the emergence of the Internet and may be interpreted as promoting the use of a pervasive information network, a concept which became crystallized in late 1996 with policies targeted at Internet-based e-commerce applications.

In 1996, the Electronic Commerce Hotbed Program was introduced with the aim to develop the e-commerce legal and technical infrastructure as well as e-commerce services. This was followed up by a number of tentative initiatives to kick start internet-based e-commerce, including the formation of Netrust, the first Certification Authority in South East Asia and the Electronic Commerce Policy Committee. In 1998, a more comprehensive Electronic Commerce Master Plan was released. This plan envisioned Singapore as an international e-commerce hub by building upon its existing strengths in trade, financial services, telecommunications and IT services. The plan also aimed to create an e-commerce services

sector and to harmonize cross-border e-commerce laws and policies. The target of the 5-year plan was to attain US\$4 billion in value of electronic transactions through Singapore and to have 50 percent of businesses in Singapore using some form of e-commerce by 2003.

The subsequent implementation of the Masterplan took several forms: direct subsidies to businesses, changes in regulations and policy framework, promotion of e-commerce within the public sector, and promoting the development of supporting telecommunications infrastructure. Recognizing that multinational corporations (MNCs) have their own organizational impetus to self-initiate and spearhead e-commerce diffusion, governmental policy has focused on assisting and facilitating e-commerce growth among local enterprises, with the bulk of programs dedicated to small and medium enterprises. Recent government efforts to promote e-commerce have centered on resolving trust, security, and regulatory issues. The National Trust Council was established in March 2001 to build confidence in businesses and consumers in e-commerce by advocating the adoption of best online practices.

Major changes also took place in the form of accelerated deregulation of the telecommunications industry, the merger of the National Computer Board and the Telecommunications Authority of Singapore forming into the InfoComm Authority of Singapore, and the stronghold of a single monopoly, Singapore Telecoms. These changes were made in response to the rapidly advancing technological developments in Internet and e-commerce, in hopes of facilitating the growth of e-commerce through competition and lower costs, and a streamlined approach to regulating and promoting Internet business.

While it is too early to assess the impact of these initiatives, overall, the broad visions appear to be in the right direction and conducive for e-commerce developments. Data on applications for grants and subsidies indicate rising levels of involvement in e-commerce activities. At the end of March 2001, there were 19,000 small and medium enterprises subscribing to e-commerce services, almost quadruple the figure recorded for April 2000 (SPRING, 2001). This report also cited a separate survey showing that 21 percent of SMEs had e-commerce capability and close to 50 percent of these businesses had online business transactions.

An earlier study (IDA, 1999; Wirtz and Wong, 2001) found that only 8.5 percent of firms in five major economic sectors were already using B2B e-commerce in some form, with another 28 percent expressing interest to do so in the near future. The penetration rate was found to be the highest among electronics manufacturers and freight forwarders, two sectors with a high level of global supply chain involvement. Among companies that had not adopted e-commerce, the most commonly cited reason is that they did not see it as necessary, as observed by 65 percent of businesses.

More recent data point to rising e-commerce sales revenue from both B2B and B2C activities (IDA, 2001). According to these figures, 18 percent of total sales revenue in Singapore companies was derived from B2B e-commerce sales, while 16 percent was derived from B2C e-commerce sales. These figures were higher than equivalent benchmarks in Australia, Hong Kong, South Korea and Taiwan. The wholesale and retail sector reported the largest rise in B2B transaction values in the first three quarters of 2001, rising 68 percent during the 9-month period. In the B2C segment, finance and banking services registered 25 percent growth during the first 3 quarters, and accounted for 62 percent of total B2C sales in the 3rd quarter.

Overview of Sectors

This section presents an overview of the three sectors included in the CRITO Global E-Commerce Survey in the context of their structure and development in Singapore.

TABLE 1. Summary of Sector Overview

| | Manufacturing | Retail/ Wholesale Distribution | Banking/ Insurance/ Other Finance |
|--------------------------|-------------------------------------|---|--|
| Contribution to GDP | 22.1% | 15.6% | 11.0% |
| Value added ^a | S\$32.7 billion US\$18.7 billion | S\$22.7 billion US\$12.9 billion | S\$16.1 billion US\$9.2 billion |
| Number of Employees | 384,000 | 275,600 | 108,700 |
| Percent of Labor Force | 19% | 13% | 5% |

Source: Economic Survey of Singapore, 2001 (Department of Statistics). The Commerce Sector 2000 (Economic Survey Series) (Department of Statistics). Report on Labor Force in Singapore 2001 (Department of Statistics & Ministry of Manpower)

^a Conversion rate SGD 1.00 = USD 0.571

Manufacturing Sector

Manufacturing is one of the key engines of economic growth in Singapore, contributing 22.1 percent to the nominal Gross Domestic Product in 2001, and employing 19 percent of the labor force. Total output of this sector has expanded from S\$76 billion in 1991 to S\$163.7 billion in 2000 before experiencing a reversal in 2001, declining to S\$134.6 billion. To demonstrate the importance of manufacturing in the context of Singapore's economy, 60 percent of Singapore's direct exports in 2000 were from manufacturing.

There are close to 10,000 manufacturing establishments in Singapore, of which more than half employ fewer than 10 employees. Almost 80 percent of manufacturing establishments are Small and Medium Enterprises (SMEs) employing fewer than 200 workers. Manufacturing SMEs employ 37 percent of the manufacturing labor force, but contribute only 14 percent to total manufacturing value added. Many of these smaller manufacturing establishments tend to be focused on domestic markets, whether producing for the domestic consumer market or supporting locally based industries.

In contrast to these SMEs, Singapore's manufacturing sector is also marked by the presence of many world-class MNC operations. There are also a number of large local government-linked manufacturers, such as Singapore Technologies and Sembawang Corporation groups. These operations play a significant role in stimulating new innovations by local supporting industries. They also form a substantial customer base for many SMEs in the manufacturing sector. Additionally, MNCs also facilitate technology transfer to Singapore based subsidiaries.

In terms of output, this sector is dominated by a number of key export-led industries, namely electronics (contributing 38 percent of industrial production in the sector) and chemicals and chemical products (contributing 17 percent). Between them, these two industrial clusters account for 50 percent of net investments in Singapore's manufacturing sector. Recent policy initiatives have targeted three major clusters: electronics, chemicals, and transport engineering. The most recent major initiative is aimed at developing the biomedical science cluster. Policy planners in Singapore have done well to target initiatives at fields with emerging innovations and high growth potential.

The main challenge facing Singapore's manufacturing sector is remaining competitive amidst formidable competition from low cost locations in neighboring regions, particularly China. Its small domestic market and small base of entrepreneurs are also drawbacks. While the sector has successfully advanced away from labor-intensive activities to higher value-added activities, it still lacks the technological sophistication of developed countries. The continued growth of the sector depends on Singapore's ability to capitalize on its structural advantages (such as its compact size, connectivity to global markets and political stability) in order to fully exploit the potential of technology and innovation. In response to such challenges, the Manufacturing Sub-Committee of the Economic Review Committee has recommended a move towards higher value product manufacturing. It advocates an environment where both high and lower end activities co-exist and are closely integrated by multiple IT-enabled functions.

The recommendations of the Manufacturing Sub-Committee are an acknowledgement of the present reality of Singapore's manufacturing sector. There are in essence two classes of manufacturing firms in Singapore. On one end, there are the technologically sophisticated firms, many of which are in the key policy-supported clusters of electronics, chemicals and engineering. Counted among the ranks of such firms are the MNCs and the globalized local enterprises. On the other end, there are the smaller SME manufacturers with lower productivity who engage in more traditional manufacturing activities such as food and beverage, printing and textiles.

Because of this duality in the structure of Singapore's manufacturing, the active use of e-commerce is likely to be led by the MNCs and larger firms. Such firms participate in global value chains and are densely connected to overseas suppliers, customers, logistics and other service providers, as well as their own foreign branches and affiliates. Such manufacturing firms are likely to have strong supply chain links with other MNCs that are equally technologically sophisticated. This scenario presents abundant opportunities for Internet enabled transactions between participants in these global value chains.

The presence of SMEs means that the manufacturing sector as a whole may be less technologically ready for e-commerce. With tighter resource constraints, the spending pattern of SME manufacturers are likely to prioritize key production-related processes rather than on upgrading technology in supply chain functions. Hence, SME manufacturers are far less likely to have network capabilities such as Intranet and EDI. However, SME manufacturers have as much to gain from e-commerce as their MNC counterparts. Many SMEs source from overseas suppliers, particularly in the Asia Pacific region, due to limited natural resources in Singapore. In certain key supporting industries, SME manufacturers are also reliant on MNCs as customers, either directly or indirectly. Additionally, the forces of global and domestic competition are likely to be more strongly felt by SME manufacturers, without the protection of established brandnames or market shares. This necessitates initiatives for market expansion. These factors provide motivation for adoption of e-commerce among SMEs, notwithstanding the lower level of technology readiness.

Retail/ Wholesale Distribution Sector

Wholesale and retail trade is integral to Singapore's economy. Collectively wholesale and retail trade contributed 12.3 percent of the Gross Domestic Product in 2001. There are 18,400 establishments in the retail trade sector, employing 85,600 workers. The wholesale trade sector, comprising some 32,500 establishments, employed about 190,000 workers. Together,

wholesale and retail distribution employs around 15.6 percent of Singapore's workforce and constitute around one third of total establishments in Singapore. The majority of these establishments are very small enterprises, employing fewer than five workers.

The dominant category in both domestic and foreign wholesale trade is petrol and petroleum products. Aside from this, high trade levels are observed for electronic products, food, beverage, and tobacco products. In the retail sector, high-sales categories, excluding motor vehicles, are departmental stores, furniture, and household equipment.

Wholesalers of industrial and construction equipment formed the largest category (14 percent) of establishment in the wholesale industry. The major players in the wholesale industry are the distribution arms of major manufacturers, mainly foreign MNCs. In the retail industry, establishments like supermarkets, department stores and other grocery stores account for 19 percent of retail establishments. The major e-retailers in Singapore are mainly brick and mortar retailers who have ventured into online selling as an alternative marketing channel. Popular e-retailers on the local scene include those in the supermarkets sector (Cold Storage and NTUC Fairprice), flowers and gifts (Far East Flora and Joaquim), electrical products (Courts) and departmental stores (Metro and Tangs). While a number of purely brick and mortar stores have come online, they do not yet have the market outreach of more established retailers.

Singapore's very small domestic market means that this sector, especially wholesale trade, is reliant on overseas demand. Additionally, 15 percent of retail sales in Singapore are attributable to tourists. This sector is especially vulnerable to global economic trends and saw value added decline in 2001 by 2.8 percent to \$22.7 billion. Downturns in key manufacturing industries and sluggish regional economic conditions affected trade. In recent years, falling visitor arrivals have also led to dropping retail sales.

As a key domestic industry, retail and wholesale distribution is regarded as a barometer of domestic cost efficiency, which in turn is an indicator of Singapore's viability as an investment prospect. Unfortunately, the retail industry in Singapore has been dogged by low productivity. Retail productivity in 2001 was less than a third of that in the manufacturing sector. Mainly, this has been attributed to lack of skills in the retail workforce, poor use of retail space, and sub-optimal supply chain management among retailers. Dampened consumer sentiments due to recent economic uncertainty and lack of innovation in retailing concepts have also drastically reduced retail activity.

The Singapore government, working together with relevant industry players has introduced several initiatives to revitalize the retail sector. The chief initiative is the Retail 21 master plan, which provides a framework for restructuring and reinventing the industry. E-commerce has been identified as a key strategic thrust. Among the initiatives in Retail 21, is the Jumpstart e-Retailing scheme, (replaced in June 2002 with the IT Consultancy project under the Local Enterprise Technical Assistance Scheme) providing assistance to e-enable retailers to compete.

In Singapore, the Internet has been positioned as a viable alternative marketing and distribution channel for the wholesale/retail sector. BookNet (procurement for book suppliers and retailers) and ShopNet (a portal for the grocery trade) are two portals targeted at wholesalers and retailers that were prominently among the pioneering e-commerce projects undertaken in the late 1990s. Other portals have since sprung up and wholesalers/retailers

also have the option of participating in global trading communities. Additionally, the TradeNet e-platform for trade declaration by importers/ exporters has been in existence since 1989.

This sector appears as a natural candidate for successful e-commerce diffusion because e-commerce directly addresses the core business process of the sector. E-commerce has the ability to address both the demand-side issues of distribution and outreach as well as the supply-side issues of procurement and operational alignment with suppliers. This sector is reliant on foreign suppliers. There is also a high degree of interdependency between wholesalers/retailers and logistics/transportation service providers, both in Singapore and overseas. On the demand side, wholesalers are heavily reliant on overseas customers while retailers are also exploring foreign markets. Therefore, the likely motivations for e-commerce adoption are improved supply chain management and expansion of markets, especially abroad. Ample government assistance and the existence of portals and online trading systems have lowered entry costs for online business. For these reasons, we expect that the sector as a whole will be engaging in e-commerce and that both large and small companies are equally likely to be active in e-commerce.

Banking, Insurance and Other Financial Services

The financial services sector has grown in importance in the past decade and plays an important role in Singapore's economic development. It finances other sectors in the economy and also contributes directly to economic development. There are close to 700 establishments in the financial services sector, employing 108,700 people. In 2001, the value added to this sector was S\$16.1 billion, representing an 11 percent share of nominal Gross Domestic Product. Table 2 below shows the composition of Singapore's financial sector.

TABLE 2. Composition of Financial Sector

| Type of Institution | Number of Institutions ^a | |
|-----------------------------|-------------------------------------|--------|
| | Mar 01 | Mar 02 |
| Commercial Banks | 133 | 120 |
| - Local | 8 | 6 |
| - Foreign | 125 | 114 |
| Merchant Banks | 58 | 55 |
| Asian Currency Units | 184 | 169 |
| Representative Offices | 62 | 55 |
| Finance Companies | 11 | 7 |
| Insurance Companies | 151 | 144 |
| Insurance Brokers | 88 | 90 |
| Stockbroking companies | 81 | 79 |
| Investment advisers | 167 | 167 |
| International Money Brokers | 8 | 8 |

Source: Monetary Authority of Singapore Annual Report 2001/2002

a. Double-counting is possible due to multiple functions

In recent years, the domestic financial landscape has seen substantially restructuring. Extensive liberalization continues to take place in key sectors such as retail banking, insurance and stock broking. The Monetary Authority of Singapore was intent on promoting and developing Singapore as a financial center. Financial deregulation has not resulted in a drastic increase in the number of foreign financial institutions. However, the re-designation of status of foreign institutes, especially in the banking sector, has increased access to domestic markets. Foreign institutions are now allowed to engage in a larger range of activities in

Singapore. This has led to a wave of merger, as well as acquisitions among local financial institutions. Mergers have also taken place across hitherto segregated financial industries, although not on a significant scale. These consolidation activities are taking place in response to increasing price competition in the wake of the liberalization measures.

Another consequence of financial liberalization has been increased product offerings and service levels. In the stock broking sector, which has been most affected by liberalization, new and multiple products are now provided on Internet platforms. Increasingly, the potential of the Internet as a front-end platform to facilitate back-end processing is also being recognized.

While the deregulation process is not complete, these initiatives have been deemed successful in enhancing the sector's domestic competitiveness. However, the traditional services driving the sector's success, such as forex trading, have matured and are declining in volume. In September 2002, the Financial Services Working Group of the Economic Review Committee released its recommendations for the future of Singapore's financial services sector. The proposed direction is aimed at seeking and capitalizing on externally focused opportunities. The way to move forward is to position Singapore as a financial services hub for selected global or regional niches. In doing so, it is envisaged that the sector will evolve to be more technological and knowledge intensive. The success of these new strategies would depend largely on the ability of the sector to leverage on Singapore's existing comparative advantage in ICT infrastructure, market structures, and international networks.

This vision still lies in the future. For the majority of financial institutions, the immediate concern lies in increasing operational and cost efficiency to better compete in a liberalized environment. Adoption of e-commerce at the present time will be largely driven by these motivations.

At present, the use of more sophisticated IT is concentrated in larger institutions, particularly in banks and with stockbrokers. E-commerce activities are also focused on these larger institutions that have led the way by introducing Internet banking and online securities trading. In this sector, we expect that the divide between large and small firms will be more prominent than in the other two sectors.

Summary of Expectations

An analysis of Singapore's economic, social and physical infrastructure suggests an environment that is largely favorable for e-commerce development (Wong, 2001). The economy is highly open and competitive, providing both motivation and opportunity for involvement in e-commerce. The structure of the economy is also conducive for e-commerce growth, with a good mix of advanced manufacturing activities and sophisticated financial and business services. Additionally, Singapore boasts a sound information infrastructure, a transparent financial and regulatory framework, and a well-educated workforce.

Globalization as a Driver of E-Commerce Diffusion

Following Gibbs, Kraemer and Dedrick (2002), one potential driver of e-commerce in B2B e-commerce in particular, is international competitive pressure arising from globalization. In this paper, we further delineate international competitive pressure into firm globalization and internal improvements. Firm globalization arises from global competitive pressure exerted by

reliance on foreign markets and global supply chains. Businesses respond to such pressure by maintaining and strengthening their positions in global production networks and markets. This would include integrating with supply chain partners and customers and seeking to expand market outreach. Internal improvement is the response of businesses to direct competition from global counterparts. Businesses face competitive pressure to reduce costs and enhance efficiency and are motivated to engage in e-commerce to achieve these efficiency gains.

Given the openness of Singapore's economy and the dependence on foreign markets and resources, it is envisioned that the main drivers for e-commerce applications will be more heavily weighted towards firm globalization than internal improvements. Factors related to networking and market expansion are expected to feature strong impetus for e-commerce. This should be especially true in industrial sectors that participate in global supply chains and are hence likely to be most motivated by pressure exerted by global customers. Firm globalization is also likely to be a strong motif for local firms that concentrate on the domestic market. E-commerce allows such firms more efficient access to international marketplaces for sourcing and procurement. At the same time, e-commerce provides the potential for breaking into overseas markets either directly or through participation in B2B value chains.

We expect to observe the strong impetus of firm globalization in both the manufacturing and distribution sectors, where there is greater reliance on international sourcing. In the financial sector, globalization as a driver of e-commerce manifests itself more in terms of presenting more direct competition to financial firms. Financial liberalization has introduced foreign competition. In response to this, the financial sector's more immediate concerns are cost reduction and productivity improvement in order to effectively compete with foreign entrants into the playing field. Here, the impetus is not to globalize by reaching out to foreign markets, but to consolidate internal efficiency to cope with increasing global competition.

Government Policy as Enabler of E-Commerce Diffusion

We also expect that the government's active promotion of e-commerce will be recognized by businesses as a factor influencing diffusion, although it is unlikely that government factors will outweigh business concerns.

The government has given substantial incentives to promote e-commerce among small and medium businesses. This could be reflected in a narrowing disparity between large and small firms. As the government has provided ample assistance to equip businesses with the basic capability to conduct e-commerce, we anticipate that there will be relatively small differences between large and small firms in terms of the level of e-commerce readiness. However, it is not expected that this will translate into the same levels of e-commerce adoption and utilization.

Dominance of B2B E-Commerce in E-Commerce Activities

Singapore's trade openness makes it a natural candidate for B2B e-commerce. The preponderance of export-oriented manufacturing activities also makes Singapore an important node in the global production networks. Government policies for sectoral development are also advocating the use of technology for networking and value chain integration. These observations suggest that Singapore is likely to be a very fast adopter of e-

commerce applications that have proven economic value in advanced countries. In particular, it is expected that advanced manufacturing clusters, logistics and transportation industries, and global market oriented business-to-business industries will be the most aggressive in adopting e-commerce applications. With their strong global supply chain links to advanced countries and to other industries, these sectors are also most likely to benefit from e-commerce applications.

On the downside, Singapore's small domestic economy presents considerable barriers for innovating and pioneering new e-commerce technologies with radical global impacts. The lack of a strong content publishing industry here is likely to constrain innovation in e-commerce applications involving mass consumer content publication.

The limited domestic market and the efficient transportation system also mean that Singapore is unlikely to be a leader on large-scale B2C e-commerce applications. These factors, together with the expected dominance of globally oriented industries in spearheading e-commerce applications, suggest that B2B e-commerce will develop at a relatively faster rate than B2C e-commerce.

Types of E-Commerce Activities engaged in

Given the scenario that Singapore firms will be strongly motivated by firm globalization factors, we anticipate that firms will engage in e-commerce activities that widen their global presence. The focus will be less on utilizing online trading mechanisms for efficiency gains and more on leveraging the global communications and broadcasting potential of e-commerce.

There are possible exceptions for those manufacturing sub-sectors that have inherently stable supply chains and customer bases. Another exception may be found in the financial sector. As discussed earlier, we expect financial institutions to be driven by operations and cost efficiency in the use of e-commerce. The expected predominance of B2B activities also suggests that applications for B2B integration and operations will be commonly used.

Impact of E-Commerce on Globalization Potential

Just as firm globalization provides the main impetus for e-commerce diffusion in Singapore businesses in the manufacturing and distribution sectors, it is expected that adoption of e-commerce will positively impact the globalization potential and performance of these businesses. The main areas of performance likely to benefit from e-commerce are those relating to market expansion, external integration and market position.

METHODS

Singapore is one of ten participating countries in the CRITO/IDC Global E-Commerce Survey. This report presents the key aggregate findings for the Singapore data and analyzes trends and patterns in the three sectors included in the study. Where applicable, the report compares the findings observed in Singapore with those of the combined sample of 10 countries. Additionally, information and data were also drawn from official sources and previous studies on e-commerce in Singapore.

Sample Demographics

In total, 202 Internet-enabled establishments from Singapore were surveyed, with equal representation from three sectors: manufacturing, wholesale/ retail distribution, and banking, insurance and other financial services. Weights based on the actual distribution of establishments by employee size in each sector were applied. All results presented in this report are based on the weighted sample, as seen in Table 3.

TABLE 3. Summary of Survey Sample Distribution

| Establishment Size | Unweighted Sample by Sector ^a | | | Weighted Sample ^b by Sector | | |
|--------------------|--|--------------|---------|--|--------------|---------|
| | Manufacturing | Distribution | Finance | Manufacturing | Distribution | Finance |
| 25-99 | 23.5 | 34.3 | 25.4 | 72.7 | 97.0 | 83.0 |
| 100-199 | 19.1 | 11.9 | 19.4 | 10.6 | 2.3 | 7.9 |
| 200-499 | 33.8 | 38.8 | 34.3 | 12.1 | 0.6 | 5.6 |
| 500+ | 23.5 | 14.9 | 20.9 | 4.6 | 0.2 | 3.4 |
| TOTAL | 100 | 100 | 100 | 100 | 100 | 100 |

Source for Weights: IDC, derived from Department of Statistics

Source: CRITO Global E-Commerce Survey, 2002

a. Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

b. Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

Globalization Level in Survey Sample

In keeping with Singapore's open, export-led economy, a high proportion of Singapore companies are globalized (Table 4). More than half the sample firms have establishments abroad and the average Singapore establishment derives 39 percent of its sales income from abroad. As expected, compared to the global sample of 10 countries, Singapore companies appear to be more globalized. In all five indicators included in the survey, Singapore establishments reported higher degrees of globalization compared to the global sample.

In all three sectors, at least half the establishments are part of global companies with a presence outside of Singapore. The banking and insurance sector reported the highest number of establishments abroad, with more than three quarters of these establishments being part of global companies. However, only half of the globalized firms in this sector have their headquarters outside of Singapore. While the manufacturing sector has the lowest proportion of firms with overseas establishments, this sector reported the highest proportion of firms (40 percent) with headquarters abroad. This is indicative of the mix of companies in Singapore's manufacturing industry. There is a relatively high level of foreign ownership and at the same time, many localized companies with a domestic focus.

TABLE 4. Globalization Indicators, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent of companies with establishments abroad | 56.1 | 73.2 | 50.0 | 56.8 | 76.2 | 57.0 | 23.9 |
| Percent of companies with headquarters abroad | 29.8 | 49.1 | 40.3 | 26.3 | 32.3 | 30.8 | 8.5 |
| Percent of companies with sales from abroad | 83.0 | 78.8 | 84.4 | 80.3 | 98.7 | 82.8 | NA |
| Percent of companies that procured from abroad | 80.9 | 86.0 | 88.0 | 81.1 | 53.3 | 81.1 | NA |
| Mean percent of total sales from abroad | 38.9 | 39.9 | 46.9 | 35.7 | 37.9 | 39.0 | 12.1 |
| Mean percent of total procurement spending from abroad | 45.5 | 41.3 | 40.2 | 51.0 | 9.4 | 45.3 | 20.3 |
| Degree affected by competitors abroad ^e | | | | | | | |
| Low | 34.8 | 26.3 | 30.5 | 34.7 | 45.4 | 34.3 | 68.3 |
| Moderate | 31.1 | 24.9 | 17.0 | 38.7 | 15.8 | 30.8 | 15.7 |
| High | 34.2 | 48.9 | 52.5 | 26.6 | 38.8 | 34.9 | 15.2 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact question wording: Using a 5-point scale where 5 is significantly affected and 1 is not at all affected, please tell me how much your establishment is affected by competitors from outside your country. Scores of 1 and 2 were classified as low, a score of 3 as moderate, and scores of 4 and 5 as high.

Additionally, the overwhelming majority of firms in all three sectors derive some sales revenue from abroad. The incidence of this is highest in the finance sector, where 99 percent of firms sell to markets overseas. Even in the distribution sector, which includes the more domestically focused retail sector, 80 percent of firms derived income from abroad. The proportion of firms that buy overseas is also very high, at 81 percent. This proportion is significantly lower in the financial sector (53 percent) compared to the other two sectors, where over 80 percent of firms buy abroad.

Consistent with being the sector with the highest level of foreign ownership, the manufacturing sector also sells more abroad, compared to the other two sectors. The average manufacturing establishment derived 47 percent of its sales from abroad and spent a relatively high 40 percent of its procurement budget overseas. The distribution sector spent 51 percent of its procurement budget overseas, compared to only 9.4 percent for the financial sector.

Due to the high levels of foreign expenditure and earnings in the manufacturing sector, the threat and challenge of foreign competition is most keenly felt in this sector. Thirty six percent of manufacturing establishments believed that they are highly affected by competitors from abroad, compared to 13 percent for the distribution sector and 26 percent for the finance sector.

Overall, Singapore firms are much more likely than establishments in the global sample to perceive that foreign competitors affect them. Only 34 percent of Singapore establishments felt that foreign competitors have no or little effect on them. This figure is almost doubled for the global sample, at 68 percent.

E-COMMERCE READINESS

Information Infrastructure – Use of E-Commerce Technologies

The use of E-commerce technologies in Singapore is centered on Internet based technologies. Singapore keeps abreast with the global sample in terms of usage level for most technologies (Table 5). The two areas in which Singapore falls behind the global sample are the use of EDI (32 percent of Singapore establishments compared to 44 percent of the global sample) and call centers (25 percent compared to 32 percent).

Email is ubiquitous and is used by all establishments except for a minute proportion of manufacturing establishments. Almost 83 percent of Singapore establishments have established their presence on the web with a business website accessible to customers. This practice is seen to be more prevalent among retailers/ wholesalers with 87 percent having websites.

Two-thirds of the establishments have an Intranet, marginally higher than the 63.6 percent reported by the global sample. In Singapore, the use of Intranets is more widespread in the banking and insurance sector (73 percent) and least commonly used in the manufacturing sector (59 percent). Extranets are far less commonly used, with only 31 percent having access to extranets. The retail and wholesale sector again reports the highest level of usage and the manufacturing sector the lowest. Extranets for networking with business partners are more commonly used than those for networking with customers.

The level of Electronic Data Interchange (EDI) usage is relatively low in Singapore compared to the global sample. EDI is most commonly used in the retail/ wholesale sector (43 percent) and least commonly used in the manufacturing sector (16 percent).

The frequency of use of Electronic Funds Transfer (EFT) is almost equivalent across all three sectors, with over 40 percent using this technology. The call center is the least used e-commerce technology featured in the survey. Overall, less than a quarter use a call center. The level of usage is highest in the banking and finance industry (30 percent), and lowest in the retail and wholesale industry (23 percent).

We had hypothesized earlier that government incentives to promote e-commerce in small and medium enterprises may be reflected in relatively small disparity between larger firms and SMEs (as seen in Table 5). Large differences are observed only in the use of EDI, call center and Intranets, and it may be argued that the latter two technologies are more naturally appropriate for the needs and nature of larger organizations.

TABLE 5. Use of E-Commerce Technologies, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent using ... | | | | | | | |
| E-mail | 100.0 | 97.2 | 99.5 | 100.0 | 100.0 | 99.9 | 98.5 |
| Website | 83.2 | 78.6 | 75.3 | 86.6 | 81.1 | 83.0 | 74.1 |
| Intranet | 66.0 | 85.8 | 59.0 | 69.5 | 73.3 | 67.0 | 63.6 |
| Extranet | 31.2 | 37.2 | 12.2 | 43.0 | 13.3 | 31.5 | 32.7 |
| ▪ accessible by suppliers/ business partners ^e | 23.8 | 23.8 | 9.5 | 32.8 | 12.2 | 23.8 | 20.9 |
| ▪ accessible by customers ^e | 19.5 | 28.2 | 6.8 | 28.2 | 10.2 | 20.0 | 17.8 |
| EDI | 31.3 | 60.5 | 16.4 | 43.1 | 20.4 | 32.8 | 44.3 |
| ▪ over private networks only ^e | 15.8 | 31.7 | 5.5 | 24.2 | 4.5 | 16.6 | 19.4 |
| ▪ Internet-based only ^e | 9.2 | 18.1 | 4.4 | 13.9 | 0.5 | 9.7 | 8.4 |
| ▪ both ^e | 5.7 | 10.2 | 6.1 | 5.0 | 11.1 | 6.0 | 15.9 |
| EFT | 42.6 | 46.1 | 46.6 | 40.4 | 47.0 | 42.8 | 43.4 |
| Call center | 24.0 | 34.7 | 26.7 | 22.5 | 30.4 | 24.5 | 32.3 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Percent based on total sample.

Table 6 compares the readiness for e-commerce in the three sectors in Singapore with the three sectors in the global sample. Apart from the ubiquitous email and website provision, and the use of Intranets, Singapore's finance industry lags significantly behind the global sample in all other technologies. The gulf is most pronounced in technologies such as EFT (47 percent versus 62 percent in the global sample) and EDI (20 percent versus 42 percent) and Extranet (13 percent versus 32 percent). As discussed earlier, this sector is primarily concerned with using technology for internal efficiency; hence the high level of usage of Intranets, compared to more externally focused technologies.

Overall, it is observed that Singapore's manufacturing sector lags behind the global sample in most of the technologies. Conversely, the retail and wholesale sector registers higher rates of use for Internet and web-based based technologies vis a vis the global sample. As noted earlier, the dominant presence of SME manufacturers lowers the technological readiness of the sector as a whole. This, to some extent, reflects the bimodal nature of Singapore's manufacturing industry, with both strong global MNC presence as well as small manufacturers with more domestic focus. As seen in Table 5, the use of network technologies such as Intranet, Extranet and EDI is much more prevalent in large manufacturing firms.

TABLE 6. Use of E-Commerce Technologies by Sector^a: Comparison with Global Sample

| Percent using ... | Manufacturing | | Distribution | | Finance | |
|---|---------------|---------------------|--------------|---------------------|---------|---------------------|
| | Sgp | Global ^c | Sgp | Global ^c | Sgp | Global ^c |
| E-mail | 99.5 | 95.5 | 100.0 | 99.9 | 100.0 | 99.2 |
| Web-site | 75.3 | 80.5 | 86.6 | 69.9 | 81.1 | 81.5 |
| Intranet | 59.0 | 63.5 | 69.5 | 63.3 | 73.3 | 66.5 |
| Extranet | 12.2 | 31.4 | 43.0 | 33.4 | 13.3 | 32.4 |
| ▪ accessible by suppliers/ business partners ^b | 9.5 | 18.7 | 32.8 | 21.8 | 12.2 | 21.7 |
| ▪ accessible by customers ^b | 6.8 | 18.5 | 28.2 | 17.0 | 10.2 | 20.8 |
| EDI | 16.4 | 43.0 | 43.1 | 45.2 | 20.4 | 42.2 |
| ▪ over private networks ^b | 11.9 | 29.7 | 29.2 | 38.7 | 19.8 | 30.4 |
| ▪ Internet-based ^b | 10.7 | 27.8 | 18.9 | 22.0 | 14.8 | 27.7 |
| EFT | 46.6 | 40.7 | 40.4 | 42.1 | 47.0 | 62.3 |
| Call Center | 26.7 | 32.6 | 22.5 | 31.3 | 30.4 | 38.6 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^b Percent based on total sample.

^c Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

Table 7 also highlights the large gap in technological readiness between small and large firms in the financial sector. Large financial firms are leading the way and small firms have a fair way to go before they catch up. It is likely that the increasing competition arising from the ongoing liberalization process will drive smaller firms to consolidate or to upgrade their technological capabilities.

The distribution sector exhibits the lowest disparity between large and small firms. This sector has had strong incentives by government policy, both in terms of financial and technical assistance, as well as provision of industry-wide applications such as the TradeNet system and B2B portals such as BookNet and ShopNet.

TABLE 7. Use of E-Commerce Technologies by Sector^a and Size^b:

| Percent using ... ^c | Manufacturing | | Distribution | | Finance | |
|--------------------------------|---------------|-------|--------------|-------|---------|-------|
| | SME | Large | SME | Large | SME | Large |
| E-mail | 100.0 | 96.3 | 100.0 | 100.0 | 100.0 | 100.0 |
| Web-site | 75.0 | 77.2 | 86.7 | 75.8 | 80.6 | 86.7 |
| Intranet | 54.8 | 85.0 | 69.4 | 78.1 | 71.7 | 93.3 |
| Extranet | 8.7 | 33.3 | 43.1 | 34.4 | 9.2 | 58.6 |
| EDI | 9.4 | 61.4 | 43.0 | 56.3 | 18.0 | 58.3 |
| EFT | 47.7 | 39.9 | 40.4 | 48.4 | 44.9 | 75.0 |
| Call Center | 26.5 | 27.8 | 22.4 | 37.5 | 27.5 | 66.7 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^b SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^c Percent based on total sample.

Enterprise Integration Strategy

It had been proposed earlier that Singapore businesses would have the impetus to adopt e-commerce applications in order to forge better links with global supply chain partners and customers. This is expected to be especially true of the manufacturing and distribution sectors, with their high degree of reliance on foreign sources for supplies and on overseas customers. One test of this hypothesis is to study the systems integration strategies of businesses here.

The extent to which Singapore establishments have integrated the internal databases is at pace with that of the global sample (Table 8). In terms of integration with the systems of business partners, Singapore appears to be ahead of the pack. A quarter of Singapore establishments are highly linked electronically with business partners, while the corresponding proportion for the global sample is less than 10 percent.

The extent of both external and internal integration varies greatly among the three sectors. The banking and finance sector is the most well integrated internally, with 45 percent reporting some form of internal linkage and 30 percent reporting high linkage. The least well-integrated sector in terms of internal systems is the manufacturing sector. Almost 60 percent of manufacturing establishments have little or no integration of Internet applications with their internal databases and information systems. This contrasts with 35 percent of wholesalers/retailers and only 25 percent of banking and insurance establishments.

In contrast, the banking and insurance sector in Singapore is the least integrated with external business partners. Only four percent in this sector reported a high external linkage compared to 10 percent in the manufacturing sector and a very high 33 percent in the retail and wholesale sector. We expect that this pattern will correlate with the level of e-commerce activity in terms of sectoral involvement in online sales and procurement activities and in the offering of online services.

The findings here confirm earlier expectations about the impetus to form links with global supply chain partners and customers. Strong external integration is seen in the distribution sector, and to a lesser extent in the manufacturing sector. The extent of external integration among wholesalers/retailers underlines the importance of technology for the core processes of procurement and distribution. Internet technology is used as a means of supply chain management and to align with the processes of critical business partners. The lower level of integration in the manufacturing sector may be attributed to SME manufacturers who have domestic focus and manufacturing sub-sectors with stable traditional supply chains.

The strength of internal integration in the finance sector corresponds with the supposition of this sector's immediate prioritization of cost savings and operational efficiency.

TABLE 8. Enterprise Integration Strategy, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^d | Global ^d |
| Extent to which internet applications are electronically integrated with internal databases and information systems ^e | | | | | | | |
| Percent little to none | 40.0 | 41.5 | 59.7 | 35.2 | 24.8 | 40.0 | 52.5 |
| Percent some | 37.2 | 36.5 | 26.4 | 39.9 | 45.0 | 37.2 | 23.6 |
| Percent a great deal | 22.8 | 22.0 | 13.9 | 24.9 | 30.2 | 22.8 | 23.9 |
| Those of suppliers and business customers ^f | | | | | | | |
| Percent little to none | 48.0 | 42.6 | 66.4 | 38.7 | 64.5 | 47.7 | 72.1 |
| Percent some | 27.2 | 38.5 | 23.6 | 28.6 | 31.8 | 27.7 | 18.3 |
| Percent a great deal | 24.8 | 18.9 | 10.1 | 32.7 | 3.7 | 24.5 | 9.6 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Using a 5-point scale where 5 is "a great deal" and 1 is "not at all", please rate the extent to which your internet applications are electronically integrated with your internal database and information systems. Scores of 1 or 2 are categorized as "little to none", a score of 3 as "some" and scores of 4 or 5 as "a great deal".

^f Exact wording of question: Using a 5-point scale where 5 is "a great deal" and 1 is "not at all", please rate the extent to which your company's databases and information systems are electronically integrated with those of your suppliers and business customers. Scores of 1 or 2 are categorized as "little to none", a score of 3 as "some" and scores of 4 or 5 as "a great deal".

Mobiles and the Internet

The provision of mobile content and services is observed only among a small minority of establishments, as seen in Table 9. Overall, only 12 percent of establishments are already providing such services, with another 17 percent planning to add these within the next year. Compared to the global sample, the proportion of establishments offering mobile services in Singapore is slightly lower than the benchmark level (Table 9). Comparing the three sectors reveals that the manufacturing sector (2 percent) is significantly behind the other two sectors (15 percent for distribution and 21 percent for finance) in terms of mobile services.

Mobile commerce technologies are relatively new and untested. Notwithstanding promotional efforts by the government, most businesses do not yet perceive a requirement for such technologies, nor has a proven business model emerged for mobile commerce. It would appear that mobile services are more likely to be offered by larger organizations that are better able to afford and justify the investment in mobile services.

TABLE 9. Content/Services To Mobile Customers, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent providing or planning to provide mobile content or services ^e | | | | | | | |
| Already available | 11.2 | 18.3 | 1.7 | 14.5 | 21.2 | 11.6 | 13.7 |
| Plan to add within the next year | 16.6 | 14.9 | 16.3 | 17.9 | 9.1 | 16.5 | 18.2 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Today it is possible to access content or services from various mobile devices such as mobile phones and handhelds such as Palms or Pocket PC devices. Does your organization provide or plan to provide content or services that mobile customers can access?

Investment in Information Technology

The intensity of IT investment is expected to be higher in service sectors than in manufacturing. As seen in Table 10, the number of personal computers per employee is highest in the banking and insurance sector and lowest in the manufacturing sector. Similarly, the banking and insurance sector employs the highest proportion of IT personnel, and the manufacturing sector the lowest. On average, expenditure on Information Systems amounts to around 10 percent of total revenue in the distribution and finance sectors, compared to only 6 percent in the manufacturing sector.

TABLE 10. Investment in Information Technology, 2002

| | Establishment Size ^a | | Sector ^b | | | Singapore Overall ^c |
|--|---------------------------------|-------|---------------------|--------------|---------|--------------------------------|
| | SME | Large | Mfg | Distribution | Finance | |
| Number of PCs per employee | 0.47 | 0.18 | 0.3 | 0.5 | 0.9 | 0.4 |
| IT employees as % of total employees | 5.77 | 4.42 | 5.3 | 4.5 | 13.4 | 5.7 |
| Total IS Operating Budget as % of 2001 Revenue | 9.11 | 8.89 | 5.5 | 10.0 | 10.6 | 9.1 |
| Web-based Spending as % of IS Operating Budget | 14.71 | 13.73 | 7.5 | 17.5 | 8.8 | 14.7 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

KEY BARRIERS AND INCENTIVES

This section studies the factors that motivate adoption of e-commerce as well as those that inhibit successful adoption and implementation of e-commerce strategies.

Drivers for Internet Use

Singapore establishments are most strongly driven by factors relating to improved networks and market expansion (Table 11). The top driver is improved coordination with customers and suppliers, cited by 68 percent of establishments as a significant factor. The next two most significant factors are market expansion for existing products and services (58 percent) and market expansion into new markets (54 percent). Customer pressure also rated highly on the list of drivers, at 51 percent. The least significant motivating factors are government and supplier related.

These findings are consistent with earlier expectations that Singapore businesses would be most strongly motivated by perceived improvements in networks and markets, especially at a global level. Singapore's open economy necessitates strong links with overseas business partners to ensure complete value chains. The small domestic economy also provides impetus for businesses to seek overseas markets.

Relative to the global sample, Singapore firms are more highly motivated by all the listed drivers. Across all drivers, the reported proportions indicating significance are higher in Singapore than in the global sample. While government factors are the lowest ranked of factors for both Singapore and the global sample, Singapore firms are twice as likely as the global sample firms to find government factors significant in motivating e-commerce adoption. This shows that the active efforts of the Singapore government to add incentives to e-commerce have had some impact on motivating firms to use e-commerce applications.

In order to compare the priorities assigned to individual drivers, rankings based on the percentages reported are analyzed. Overall, it is found that, Singapore establishments broadly mirror the global sample.

There is relatively little difference between large establishments and SMEs in terms of drivers for Internet use, although larger proportions of SMEs report a significance for the top few factors. For both, the top reason is to improve coordination with suppliers and customers. The main difference observed is that SMEs are more likely to be motivated by the desire to expand their markets for existing products and services (59 percent ranking 2nd versus 39 percent ranking 4th for large firms). Large firms are also more likely to be motivated by cost reduction (53 percent ranking 2nd versus 47 percent ranking 5th for SMEs). These differences reflect the priorities of small firms versus large firms. Market expansion is important to SMEs that do not have the established market shares of MNCs. The cost reduction potential of the Internet is attractive to large firms as a means of controlling expenses in large, often multi-location operations.

TABLE 11. Drivers for Internet Use, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent indicating driver is a significant factor ... ^e | | | | | | | |
| Customers demanded it | 51.4 | 52.8 | 32.2 | 64.7 | 25.0 | 51.5 | 36.9 |
| Major competitors were online | 39.5 | 40.4 | 25.3 | 47.3 | 32.3 | 39.6 | 31.3 |
| Suppliers required it | 30.4 | 34.0 | 26.1 | 36.4 | 8.3 | 30.6 | 22.3 |
| To reduce costs | 46.6 | 52.5 | 43.7 | 47.5 | 51.7 | 46.9 | 35.7 |
| To expand market for existing product or services | 59.2 | 38.5 | 51.2 | 64.4 | 38.5 | 58.1 | 47.9 |
| To enter new businesses or markets | 54.9 | 45.6 | 57.9 | 55.7 | 36.7 | 54.4 | 42.0 |
| To improve coordination with customers and suppliers | 68.4 | 56.6 | 63.5 | 72.9 | 48.9 | 67.8 | 43.7 |
| Required for government procurement | 31.9 | 29.0 | 29.7 | 34.8 | 18.8 | 31.7 | 15.2 |
| Government provided incentives | 29.8 | 25.3 | 33.2 | 30.3 | 15.4 | 29.6 | 8.3 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Using a 5-point scale where 5 is "a very significant factor" and 1 is "not a factor at all," please rate how significant each of the following was to your organization's decision to begin using the Internet for business. A score of 4 or 5 was classified as "a significant factor".

As expected, the top drivers for the three sectors vary. The finance sector is more motivated by the cost reduction potential of Internet use, cited by 52 percent of establishments as being significant. The other important factors are improved coordination and market expansion. Customer demand is much less significant in this sector, compared to the other two sectors. These results are in line with the observation that this sector is mainly motivated by the potential of the Internet to enhance cost and operational efficiency. The on-going process of liberalization has presented financial firms with the challenge of providing better service at lower cost. As financial products become commoditized, the differentiating factor for competitive advantage becomes quality and efficiency of service. Technology, for the time being, provides the answer for this immediate challenge.

Firm globalization emerges as a strong motivator for Internet use in the distribution sector. The top driver is improved coordination (cited as significant by 72 percent of establishments), followed by customer demand (65 percent) and market expansion for existing products and services (64 percent). The importance of coordination is not surprising, given the reliance of wholesalers/retailers on supply chain partners to complete execution of their core processes. The strong interdependency between the distribution sector and the technologically sophisticated logistics sector also contributes to the importance of supply chain coordination. There are two possible and separate explanations for the high rankings of customer demand and market expansion motivations. For retailers, the increasing technological sophistication of Singapore provides a push for e-commerce, not only to provide an additional channel for existing target customers, but also to reach potential new customer segments through the e-commerce platform. Additionally, e-commerce is the ideal mechanism for reaching retail

customers overseas. Without releasing actual figures, IDA (2000) reports that B2C sales in Singapore are dominated by overseas consumers. The second explanation pertains to B2B sales transactions, which are likely to be a stronger motivating factor than retail customers. Overseas business customers, particularly from destinations such as USA, Australia, Japan and Hong Kong, are likely to demand the use of e-commerce. IDA (2000) reports that export B2B sales is expected to be higher than domestic B2B sales by 2001.

Improved coordination is similarly the top driver in the manufacturing sector. This is an expected outcome for several reasons: the participation of large manufacturers in global supply chains; the connectivity of smaller manufacturers with MNC customers and foreign suppliers; and the extent of export-oriented manufacturing activities. However, penetration into new markets and businesses is relatively more important here than in the distribution sector. This was ranked second in significance among the list of motivating factors for the manufacturing sector. We see this as reflecting on the higher degree of innovation activity in the manufacturing sector compared to the service sectors. This capability for invention and customization opens potential new markets for manufacturers. Manufacturers are motivated to use the Internet as a platform for penetrating these markets and enabling potential commercialization of new product developments or other forms of product innovations.

Barriers to Doing Business on the Internet

Three factors were perceived to present the greatest barriers to Singapore establishments conducting business on the Internet (Table 12). The issue of privacy and security was the top rated barrier, with almost half the establishments (48 percent), expressing their concerns over this. Cost of setting up an e-commerce site was a close second with 45 percent citing it as a significant barrier. The factor ranked third in significance is the lack of legal protection for Internet transactions (44 percent). Encouragingly, few establishments are impeded by a lack of competency. The two least cited barriers are problems finding suitable expertise and lack of ability to leverage the Internet as part of business strategy.

There are a number of areas where Singapore establishments are more likely to encounter difficulties than the global sample. Singapore establishments are more likely to be deterred by cost issues, such as Internet access cost (34 percent versus 16 percent in the global sample) and cost of setting up an e-commerce site (45 percent versus 34 percent). Relative to the global sample, Singapore establishments are also more concerned with the need for organizational change (38 percent versus 24 percent) and legal issues such as taxation (28 percent versus 17 percent), inadequate legal protection (44 percent versus 34 percent) and laws that do not support e-commerce (35 percent versus 24 percent).

In Singapore, across all three sectors, concern over privacy and security issues was ranked as the top barrier. This wariness of e-commerce transactional technology is present despite the plethora of secure infrastructures and trusted services for e-commerce that are available and heavily promoted in Singapore.

TABLE 12. Barriers/Difficulties, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|---|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent indicating statement is a significant obstacle ^e | | | | | | | |
| Need for face-to-face customer interaction | 38.7 | 31.5 | 38.6 | 39.3 | 31.9 | 38.3 | 33.8 |
| Concern about privacy of data or security issues | 47.4 | 61.1 | 54.9 | 44.4 | 51.5 | 48.1 | 44.2 |
| Customers do not use the technology | 26.9 | 27.4 | 20.3 | 30.9 | 20.3 | 26.9 | 31.4 |
| Finding staff with e-commerce expertise | 20.0 | 20.3 | 15.2 | 22.6 | 18.1 | 20.0 | 26.5 |
| Prevalence of credit card use in the country | 24.6 | 14.2 | 13.6 | 30.2 | 13.5 | 24.1 | 20.3 |
| Costs of implementing an e-commerce site | 46.8 | 18.9 | 49.9 | 43.7 | 42.9 | 45.3 | 33.6 |
| Making needed organizational changes | 38.8 | 27.7 | 32.3 | 42.9 | 23.7 | 38.2 | 23.9 |
| Level of ability to use the Internet as part of business strategy | 21.5 | 27.0 | 18.0 | 21.5 | 33.4 | 21.8 | 24.8 |
| Cost of internet access | 34.1 | 25.8 | 24.5 | 36.0 | 45.9 | 33.6 | 15.1 |
| Business laws do not support e-commerce | 34.9 | 32.2 | 45.7 | 30.6 | 32.2 | 34.8 | 24.2 |
| Taxation of internet sales | 28.5 | 23.6 | 25.3 | 30.3 | 23.6 | 28.3 | 16.5 |
| Inadequate legal protection for Internet purchases | 42.6 | 63.5 | 54.5 | 39.4 | 41.8 | 43.6 | 34.1 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^aSME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^bManufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^cResponses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^dConsists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^eExact wording of question: Using a 5-point scale where 5 is "a very significant obstacle" and 1 is "not an obstacle," please rate how significant the following obstacles are to your establishment's ability to do business online. A score of 4 or 5 was classified as "a significant obstacle".

The barriers presented by institutional factors such as the regulatory environment is most strongly perceived in the manufacturing sector. Inadequate legal protection for Internet purchases ranked second in significance as a barrier in this sector. As this is the sector with the highest overall percentage of foreign sales and purchases, this may be attributed to the lack of a defined regulatory framework in Singapore for cross-border Internet transactions. Similarly, it is observed that the manufacturing sector is also more likely to find existing business laws unfriendly for e-commerce. Forty six percent of manufacturing establishments found this as a significant barrier compared to only 31 percent in the wholesale/ retail sector and 32 percent in the banking and insurance sector.

The concerns of the retail and wholesale trade sector are more likely to be internal to the organization. Cost of implementing e-commerce was rated the second most significant barrier (44 percent) followed closely by the challenge of making organizational changes (43 percent).

In the banking and insurance sector, the most significant barriers apart from security and privacy are cost-related. Cost of implementing e-commerce was ranked second in

significance while the cost of Internet access was ranked third. The cost of Internet access as a barrier is considerably more significant in the banking sector compared to the other two sectors. This sector was previously shown to be the most motivated by the cost reduction potential of the Internet, hence the sensitivity to cost of technology is correspondingly higher.

The issues of cost and the regulatory framework for e-commerce are issues that public policies have been attempting to address in recent times. The deregulation of the telecommunications industry began in early 1990 and was subsequently accelerated in order to keep pace with the rapid advancement in telecommunications technologies. It is hoped that introduction of competition into the Internet and telephony service provision market would result in lower costs for both businesses and consumers. The International Telecommunication Union (2001) reveals that Singapore has the lowest dial-up charges for 30 hours of Internet use, compared to selected Asia Pacific countries. However, for broadband Internet access, which is more applicable to businesses using e-commerce, Singapore does not compare so favorably. ADSL rates in Singapore are shown to be much higher than in the USA (in September 2000, US\$69 monthly for 60 hours of access compared to US\$49.95 monthly for unlimited access). ITU also reports that Singapore's cable modem rates are more comparable to international pricing. These two modes of access, in turn, are cheaper than the more conventionally used leased lines and ISDN. While cable modem is the most affordable form of broadband Internet access, not all businesses are able to opt for this mode of access due to constraints in terms of physical infrastructure. The main modes of broadband Internet access used by businesses are still the more expensively priced XDSL and dedicated leased lines.

The perception of high cost of implementing e-commerce may in part be due to the perception of the high cost of IT services provided by system developers and ASPs. Next to hardware costs, systems and applications development is the highest cost item in implementing an e-commerce system. Apart from the direct costs of implementing an e-commerce site, there are also additional costs arising from using e-commerce. These may include additional administrative, CRM and logistics support to fulfill transactions that are made daily on the Internet.

In anticipation of the legal predicament resulting from electronic transactions, the implementation of the E-Commerce Master plan included several measures to introduce basic legal frameworks to support e-commerce. These include the enactment of an Electronics Transactions Act and key amendments to the Copyright Act, the Evidence Act and the Computer Misuse Act. In addition, a class license scheme was introduced to regulate Internet content, complementing industry self-regulation and public education programs. Taxation laws applied to offline businesses have also been extended to businesses selling over the Internet. However, the real barrier for most businesses is the lack of frameworks for cross-border transactions. Much of the e-commerce transactions with foreign counterparts and the Singapore government is unable to unilaterally enact laws to regulate these transactions. While Singapore has taken tentative steps to harmonize and cross-recognize e-commerce frameworks through bilateral agreements and participation in international fora, this process is a slow one. The pace of change in technology still outstrips the speed of change in international trade laws.

DIFFUSION OF E-COMMERCE

Extent and Rate of Diffusion over Time

The latest available national statistics on e-commerce diffusion at the firm level are published in the Executive Summary of the Survey of E-Commerce 2000, jointly conducted by the Infocomm Development Authority of Singapore (IDA) and the Department of Statistics (DOS). Surveying a stratified sample of 9,000 companies, the survey found that 98.7 percent of companies had access to the Internet. In 2000, 10 percent of Singapore's top companies engaged in e-commerce transactional activities, an increase from the 4 percent recorded in 1999. These figures will differ from those of the CRITO GES data due to differing assumptions and definitions. The Survey of E-Commerce 2000 includes organizations from all industries, not only the 3 specially selected sectors included in the CRITO study. Additionally, this survey defines e-commerce activities strictly in terms of transactional activities completed online. Additionally, the CRITO GES survey sample includes only businesses that at minimum use the Internet for some form of selling, purchasing or supporting of products and services.

Table 13 shows the trend in e-commerce revenues. As expected, the value of B2B e-commerce is much higher than B2C e-commerce. However, the growth rate in B2C e-commerce is expected to be higher than both B2B procurement and B2B sales. For both B2B and B2C e-commerce, large spurts in the growth of e-commerce revenues were observed between 1998 and 1999. By 2000 to 2001, the growth rates in e-commerce revenues have moderated.

TABLE 13. Trend in E-Commerce Revenues

| | 1998 | 1999 | 2000 ^a | 2001 ^b |
|---|---------------|---------------|-------------------|-------------------|
| B2B E-Commerce sales ^c | \$3.2 billion | \$23 billion | \$53 billion | \$62 billion |
| B2B E-Commerce procurement ^c | \$3.1 billion | \$6.2 billion | \$10 billion | NA |
| B2C E-Commerce ^c | \$21 million | \$114 million | \$668 million | \$1.6 billion |

Source: Survey of E-Commerce 2000 (IDA and DOS), Quarterly E-Commerce Survey Q1-Q3 (IDA)

^a Estimate

^b Projection

^c Converted from Singapore dollars using conversion rate SGD1.00 = US\$0.571

Uses of the Internet for Business

Singapore firms are primarily using the Internet for non-transactional activities. The most frequently cited use of the Internet is for advertising and marketing (61 percent). Coming in at a distant second is exchanging operational data with business customers. Transactional activities such as online sales and purchases are the least frequently used (Table 14).

TABLE 14. Uses of the Internet, 2002

| Percent using the Internet for ... ^e | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Advertising and marketing purposes | 61.3 | 54.3 | 50.2 | 68.8 | 44.3 | 61.0 | 57.6 |
| Making sales online | 29.5 | 31.9 | 29.9 | 30.0 | 26.7 | 29.6 | 29.9 |
| After sales customer service and support | 38.8 | 41.8 | 33.6 | 43.3 | 27.3 | 38.9 | 43.7 |
| Making purchases online | 28.0 | 39.3 | 56.5 | 17.9 | 15.3 | 28.6 | 46.8 |
| Exchanging operational data with suppliers | 43.9 | 62.7 | 46.4 | 48.3 | 22.1 | 44.9 | 48.1 |
| Exchanging operational data with business customers | 50.1 | 58.1 | 52.4 | 52.3 | 37.0 | 50.5 | 50.7 |
| Formally integrating the same business processes with suppliers or other business partners | 40.7 | 43.6 | 39.6 | 45.9 | 16.7 | 40.9 | 33.9 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Does your establishment use the Internet for ...

In most areas of use, Singapore's overall frequencies match those of the global sample. Singapore is more likely to use the Internet for integrating business processes with business partners (41 percent versus 34 percent in the global sample). However, Singapore lags behind the global sample in terms of making purchases online (29 percent versus 47 percent). Businesses here are much more likely to use the Internet for sales activity rather than for procurement, except in the manufacturing sector.

Minimal differences are observed between SMEs and large establishments, except for the Internet functioning as a mechanism for exchange of operational data, where the proportion of users is much higher among large firms. Larger firms, many of which are manufacturing firms, are also more likely to use the Internet to make online purchases (39 percent versus 28 percent of smaller firms).

Apart from the universal application of the Internet for advertising and marketing, the three sectors use the Internet in different ways. The differences between the three sectors confirm earlier expectations. For the manufacturing sector, online purchases are the most frequently mentioned use of the Internet, as would be expected from a sector with a high reliance on foreign supply chains. Fifty seven percent of manufacturers used the Internet for online purchases, compared to only 18 percent for the wholesale/ retail sector and 15 percent for the banking and insurance sector.

For the distribution sector, with its emphasis on supply chain management, the most frequent uses of the Internet were logically the exchange of operational data with suppliers and business customers. Integrating business processes with suppliers and business partners is also ranked highly. The emphasis in this sector is on streamlining back-end supply chain processes rather than making transactions. This lends weight to the hypothesis that e-commerce would be driven by networking and market expansion potential, rather than efficiency gains from online transactions. To an extent, this indicates that the use of Internet in this sector is not yet mature. The Internet facilitates the core processes of distribution but does not directly address them. As seen in Table 15, very few small firms are using the Internet for online purchasing (18 percent versus 30 percent for large retailers/wholesalers). The transactional potential of the Internet, particularly for procurement, has still to be fully exploited. One mitigating factor for this may be that procurement sources for this sector are less technologically advanced. Many Singapore wholesalers and retailers source from Malaysian suppliers, who may not yet be on the Internet platform.

In almost all areas of use, Singapore's financial sector reports frequencies that are very much lower than those of the other two sectors. The top uses of the Internet in this sector are related to sales and customer service. Next to advertising, exchanging information with corporate customers was the most frequently cited use (37 percent) followed by after sales customer service (27 percent). Furthermore, as seen in Table 15, there is a visible divide between SMEs and large firms in this sector. Two conclusions may be drawn about the financial sector in Singapore. First, this sector is among the slowest to use the Internet for business purposes because the smaller financial firms are slow to catch up. For many smaller financial institutions, the Internet is still primarily a tool for advertising and marketing. Among larger firms, the use of the Internet for all forms of business is fairly pervasive. In fact, comparing large firms in the three sectors, the financial sector has the highest proportions using the Internet for all purposes. Our second conclusion confirms the original conjecture that the finance sector would be mainly concerned with improving operational efficiency to gain a competitive edge. This conclusion is due to the high ranking for exchange of operational data with business customers. This is also indirectly related to the issue of globalization; many financial institutions in Singapore process information from overseas corporate clients as a core service.

TABLE 15. Uses of the Internet, 2002 by Establishment Size^a and Sector^b

| Percent using the Internet for ... ^c | Mfg. | | Distrib. | | Finance | |
|--|------|-------|----------|-------|---------|-------|
| | SME | Large | SME | Large | SME | Large |
| Advertising and marketing purposes | 50.3 | 49.3 | 68.8 | 62.5 | 42.0 | 75.0 |
| Making sales online | 30.2 | 28.1 | 30.0 | 30.3 | 24.6 | 51.7 |
| After sales customer service and support | 32.7 | 39.2 | 43.4 | 40.6 | 25.2 | 55.2 |
| Making purchases online | 59.5 | 37.8 | 17.8 | 30.3 | 12.5 | 51.7 |
| Exchanging operational data with suppliers | 43.1 | 66.0 | 48.3 | 50.0 | 19.7 | 53.6 |
| Exchanging operational data with business customers | 51.6 | 57.4 | 52.3 | 46.7 | 34.7 | 67.9 |
| Formally integrating the same business processes with suppliers or other business partners | 38.8 | 44.2 | 46.0 | 32.1 | 14.7 | 46.2 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Exact wording of question: Does your establishment use the Internet for ...

Online Sales

Only around one third, 32 percent, of Singapore establishments engage in direct online sales (Table 16). This is comparable to the 35 percent of firms in the global sample who report having online sales. Of those Singapore establishments that are involved in online sales, more than half engage in both B2B and B2C sales.

The level of online sales activity is still relatively low, as measured by the percentage of total sales that are conducted online (Table 16). Among all establishments (including those that do not engage in online sales), only 2 percent of sales to consumers are conducted online compared to almost 4 percent in the global sample. The activity level is higher for business sales, with 6 percent of sales conducted online, higher than the 4 percent reported in the global sample. Among firms that do online B2B sales, an average of 32 percent of total business sales are conducted online, more than double the 15 percent figure for the global sample. This dominance of B2B sales is attributable to the high level of online sales activity in Singapore's manufacturing and distribution sectors.

In the section on drivers for Internet, we saw that customer demand for businesses to be online was a strong motivator for the distribution sector. This is supported by the figures in Table 16. Participation in online sales is most prevalent in the distribution sector, with 36 percent being involved. Furthermore, this sector also exhibits the highest level of online sales activity among firms engaging in online sales, with 16 percent of consumer sales and 35 percent of business sales being conducted online. The high percentage for business sales supports the suggestion that business customers, and especially overseas customers, are a more telling factor than retail customers in motivating Internet use.

Heavy involvement in global production networks means that there is a marked emphasis on B2B sales in the manufacturing sector. Twenty seven percent of manufacturers conduct B2B sales online. In these firms, an average 31 percent of business sales are conducted online compared to a mere 5 percent of consumer sales.

On the whole, the banking and insurance sector has the lowest level of online sales activity of the three sectors. This is not surprising, given the earlier observation that this sector is the slowest to use the Internet for business. Having said that, it is noted that the banking and insurance sector has the highest proportion of online businesses that offer online payment on their websites. Seventy two percent of banking and insurance firms who engage in online sales provide this service.

As had been anticipated from the earlier analysis of e-commerce readiness in firms of different sizes, larger firms do not boast a much higher rate of online sales participation compared to smaller firms (34 percent for large firms versus 32 percent for small firms) (Table 16). For both large and small establishments, B2B online sales dominate.

TABLE 16. Online Sales, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Type of Online Sales ^e | | | | | | | |
| Percent B2B only | 8.3 | 10.9 | 9.4 | 9.2 | 1.1 | 8.5 | 12.9 |
| Percent B2C only | 6.5 | 6.6 | 0.6 | 8.9 | 8.0 | 6.5 | 7.1 |
| Percent both B2B and B2C | 17.4 | 16.7 | 17.2 | 17.7 | 16.2 | 17.4 | 15.0 |
| Mean percent of total consumer sales conducted online (all establishments) ^f | 2.1 | 5.2 | 0.8 | 3.0 | 2.2 | 2.3 | 3.8 |
| Mean percent of total business sales conducted online (all establishments) ^g | 6.2 | 5.8 | 6.3 | 6.8 | 1.7 | 6.2 | 4.0 |
| Mean percent of total consumer sales conducted online (only those doing B2C sales online) ^f | 11.1 | 31.6 | 4.7 | 15.5 | 9.2 | 12.0 | 18.6 |
| Mean percent of total business sales conducted online (only those doing B2B sales online) ^g | 32.0 | 26.8 | 31.1 | 35.0 | 10.2 | 31.7 | 15.1 |
| Percent of web-sites that support online payment (only those doing online sales) | 22.8 | 71.3 | 9.4 | 24.9 | 71.6 | 25.0 | 33.6 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Percentages are based on the full sample (all establishments). Exact wording of question: Are these online sales to other businesses or to consumers or to both?

^f Exact wording of question: What percent of your establishment's total consumer sales are conducted online?

^g Exact wording of question: What percent of your establishment's total business to business sales are conducted online?

The level of online B2B e-commerce relative to total sales activity is slightly higher among small firms compared to large firms. For B2C e-commerce, on the other hand, the activity level is obviously and significantly higher among large firms. Of the large firms that conduct online B2C sales, almost a third of total sales (32 percent) are conducted online, whereas the equivalent figure for smaller firms is 11 percent.

To shed more light on this, Table 17 compares the level of online sales in SMEs and large companies for each of the three sectors. For B2B sales, there is no difference between SMEs and large establishments in the manufacturing sector. In the financial sector, large firms conduct more B2B sales. This is consistent with the earlier finding that large financial institutions are much more involved in using the Internet for business than small firms. However, we observe the reverse in the distribution sector. Small firms in the distribution sector have relatively higher levels of B2B sales than large firms (35 percent versus 29 percent). Large wholesalers have established higher sales volumes in presumably more extensive markets. Many of these established customer bases may still be more appropriately served using traditional sales mechanisms. An illustration of this is re-exporters that act as distribution agents for products to regional South-East Asian markets. Customers in these less technologically advanced nations may not be ready for completing transactions online.

Whereas, for smaller distributors, more targeted markets may enable a higher degree of sales being conducted online.

In the case of B2C sales, the disparity between SMEs and large establishments is caused mainly by the differences between large and small firms in the manufacturing sector. For small manufacturers, e-commerce is primarily a tool for B2B transactions and no special effort is made to conduct B2C sales online. Hence, we see that even among small manufacturers that do B2C sales, only 1 percent of total consumer sales are done online. In the case of large manufacturers, the Internet may be considered a way of expanding into hitherto untapped consumer markets. Manufacturers of consumer products, such as consumer electronics, may use the Internet to sell directly to consumers. Without the Internet, consumer sales might not be prioritized at all. Therefore, for such firms, the proportion of customer sales conducted online should be high. As we see in Table 17 among large manufacturers who do B2C sales, 52 percent of customer sales are conducted online.

Comparing online B2C sales in the distribution sector, we see that small firms conducted higher percentages of consumer sales online (16 percent in SMEs versus 5 percent in large firms). This is a logical outcome as many of the larger e-retailers in Singapore are established brick and mortar companies that have extended their presence to the Internet. For such firms, the overwhelming majority of sales are derived from traditional sales channels such as retail stores. Among smaller retailers, we are more likely to find businesses that have strategically targeted the Internet as a major sales channel, hence the higher percentage of consumer sales conducted online.

TABLE 17. Level of Online Sales, 2002 by Establishment Size^a and Sector^b

| | Mfg. | | Distrib. | | Finance | |
|--|------|-------|----------|-------|---------|-------|
| | SME | Large | SME | Large | SME | Large |
| Mean percent of total consumer sales conducted online (all establishments) ^f | 0.2 | 5.0 | 3.0 | 1.0 | 1.6 | 8.8 |
| Mean percent of total business sales conducted online (all establishments) ^g | 6.3 | 6.3 | 6.8 | 3.9 | 1.5 | 4.6 |
| Mean percent of total consumer sales conducted online (only those doing B2C sales online) ^c | 1.0 | 51.7 | 15.6 | 5.2 | 7.4 | 19.0 |
| Mean percent of total business sales conducted online (only those doing B2B sales online) ^d | 31.1 | 31.6 | 35.0 | 29.0 | 9.5 | 13.9 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Exact wording of question: What percent of your establishment's total consumer sales are conducted online?

^d Exact wording of question: What percent of your establishment's total business to business sales are conducted online?

Online Procurement

It was shown earlier that Singapore businesses tend to assign less priority to online transactions in their use of the Internet. Outside of the manufacturing sector, the proportion of Singapore establishments using the Internet for making online purchases is relatively lower than the global sample.

Overall, Singapore establishments are less likely than those in the global sample to engage in online purchasing, with 37 percent engaging in online procurement in Singapore, compared

to 51 percent in the global sample (Table 18). As expected, the manufacturing sector has the highest proportion of firms involved in online procurement (58 percent) and the banking and insurance sector has the lowest proportion (21 percent).

On average, among all manufacturing establishments, 7 percent of direct goods are ordered online. Among retailers/wholesalers, 4 percent of goods for resale are ordered online and 6.6 percent of general supplies and equipment are ordered online. For all three procurement items, the percentage ordered online in Singapore is lower than in the global sample.

TABLE 18. Online Procurement, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|--|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent of establishments doing online purchasing | 36.4 | 45.1 | 57.5 | 29.8 | 21.4 | 36.6 | 50.8 |
| Mean percent of money spent for direct goods for production is ordered online (all establishments) ^e | 8.1 | 2.3 | 7.4 | | | 7.4 | 8.3 |
| Mean percent money spent on goods for resale is ordered online (all establishments) ^f | 4.2 | 2.3 | | 4.2 | | 4.2 | 6.8 |
| Mean percent of the money spent on supplies and equipment for doing business is ordered online (all establishments) ^g | 6.8 | 2.3 | 10.9 | 5.7 | 1.1 | 6.6 | 8.3 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Question asked only to those in the manufacturing sector; percent based on all manufacturing establishments. Exact wording of question: What percent of the money your establishment spends on direct goods for production, such as parts and components, is ordered online?

^f Question asked only to those in the wholesale/retail distribution sector; percent based on all wholesale/retail establishments. Exact wording of question: What percent of the money your establishment spends on goods for resale is ordered online?

^g Percent based on all establishments. Exact wording of question: What percent of the money your establishment spends on supplies and equipment for doing business is ordered online?

It is found that large firms are more likely to perform online purchasing (45 percent versus 36 percent in smaller firms). As seen in Table 19, this is caused by the higher incidence of online purchasing among large firms in the distribution and financial sectors. However Table 18 shows that the mean percentage of procurement budget spent on online orders is actually higher in SMEs. This suggests that spending on online procurement is more intense among smaller firms. Table 19 below shows that this is true of both the manufacturing and distribution sectors. We see this as reflective of the more targeted strategies that are available to smaller firms in terms of choosing suppliers.

TABLE 19. Online Procurement, 2002 by Establishment Size^a and Sector^b

| | Mfg. | | Distrib. | | Finance | |
|--|------|-------|----------|-------|---------|-------|
| | SME | Large | SME | Large | SME | Large |
| Percent of establishments doing online purchasing | 59.5 | 45.5 | 29.8 | 30.3 | 19.1 | 51.7 |
| Mean percent of money spent for direct goods for production is ordered online (all establishments) ^c | 8.1 | 2.3 | | | | |
| Mean percent money spent on goods for resale is ordered online (all establishments) ^d | | | 4.2 | 2.3 | | |
| Mean percent of the money spent on supplies and equipment for doing business is ordered online (all establishments) ^e | 12.4 | 0.6 | 5.8 | 2.0 | 0.4 | 9.3 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Question asked only to those in the manufacturing sector; percent based on all manufacturing establishments. Exact wording of question: What percent of the money your establishment spends on direct goods for production, such as parts and components, is ordered online?

^d Question asked only to those in the wholesale/retail distribution sector; percent based on all wholesale/retail establishments. Exact wording of question: What percent of the money your establishment spends on goods for resale is ordered online?

^e Percent based on all establishments. Exact wording of question: What percent of the money your establishment spends on supplies and equipment for doing business is ordered online?

Diffusion of the E-Commerce Industry

Very little official data exists on the e-commerce industry in Singapore, especially information on the structure and composition of companies in this industry. The closest proxies are found in the Survey of E-Commerce 2000, which measures the revenue generated by companies that provide e-commerce infrastructure and e-commerce services. These are presented in Table 20 below.

TABLE 20. Revenue Generated by E-Commerce Industry

| | Revenue Generated (US\$ million) ^c | | | | Growth Rate (%) | | |
|-------------------------------------|---|------|-------------------|-------------------|-----------------|-------------|-------------|
| | 1998 | 1999 | 2000 ^a | 2001 ^b | 1998-1999 | 1999 - 2000 | 2000 - 2001 |
| Internet Infrastructure | 71 | 142 | 353 | 436 | 100.0 | 149.2 | 23.5 |
| Internet Application Infrastructure | 134 | 299 | 324 | 685 | 123.5 | 8.4 | 111.6 |
| Internet Intermediary | 10 | 88 | 323 | 1256 | 805.9 | 267.5 | 288.7 |

Source: Survey of E-Commerce 2000 (IDA and DOS)

^a Estimate

^b Projection

^c Converted from Singapore Dollars using conversion rate SGD1 = US\$ 0.571

We observe that the greatest boost in revenues is found in the Internet Intermediary Services sub-sector. Between 1998 and 2001, revenues generated are expected to multiply by several orders of magnitude from \$17 million to an astounding \$2.2 billion. This is clearly the boom sub-sector of the e-commerce industry. Internet intermediary services are those that facilitate interaction of transacting parties. Examples of organizations in this sub-sector include web portal providers, online B2B marketplaces, online brokerages, travel agents and online advertisers.

Companies offering Internet Application Infrastructure services saw revenues doubling in 1999 before slowing to a growth rate of only 8 percent in 2000. However, improved expectations by companies in this sub-sector have boosted the projection for 2001 to more than double the revenue level in 2000. This sub-sector encompasses firms that develop software applications that enable online business such as search engines, payment software and web databases. Also included are the Internet and e-commerce consultants.

By 2001, the Internet Infrastructure Services sub-sector is expected to generate the most modest level of revenue in the e-commerce industry. This sub-sector is one that experiences the steadiest and most predictable growth, which may be partially attributable to the small and stable number of firms involved. Examples of Internet Infrastructure services are hosting services, network services and end-user networking equipment.

The most successful e-commerce firms in Singapore are foreign financed B2B ventures in the Internet Intermediary sub-sectors. These firms, examples of which include Asia-Links and Eastman Chemicals, operate regional e-commerce hubs and marketplaces in Singapore. Four leading players in electronic procurement and marketplace technology are also headquartered in Singapore: Ariba, Ecvision, CommerceOne and Free Markets. There are more B2B exchanges in the offing, creating the potential for Singapore to be a hub for virtual marketplaces with global reach.

IMPACTS OF THE INTERNET AND E-COMMERCE

Impact of Online Business

The most significant impacts of conducting business online are market-based (Table 21). Singapore establishments reported improvement in competitive position (50 percent reported experiencing an impact in this area) and widened sales areas (cited by 47 percent) as the top two impacts of business online. Doing business online also had a considerable impact on the way that businesses interact with external parties. Forty-five percent feel that customer service was improved and 44 percent experience improvement in coordination with suppliers.

The areas with the least impact are those relating to internal efficiency and cost reduction. Reduction of inventory cost was experienced to a great extent only by 21 percent, reduction in procurement cost is experienced by 32 percent, and improved efficiency of internal processes experienced by 35 percent. While 40 percent report that staff productivity has increased, as many as 32 percent feel that online business had little or no impact at all on this area.

While a relatively high 42 percent experience an increase in international sales due to conducting business online, only 31 percent feel that overall sales had increased. Businesses without global markets are less likely to feel the positive impact of online business on sales performance. Coupled with the finding on widening of sales area, this suggests that online business in Singapore is most effective for broaching overseas markets.

TABLE 21. Impacts of Doing Business Online, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|---|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent indicating high impact ^e | 34.6 | 46.4 | 35.5 | 34.3 | 39.5 | 35.1 | 33.9 |
| Internal processes more efficient | 34.6 | 46.4 | 35.5 | 34.3 | 39.5 | 35.1 | 33.9 |
| Staff productivity increased | 40.0 | 38.8 | 40.6 | 40.7 | 33.7 | 39.9 | 27.2 |
| Sales increased | 30.1 | 40.3 | 26.4 | 34.5 | 18.5 | 30.6 | 20.5 |
| Sales area widened | 47.1 | 44.6 | 35.0 | 55.5 | 28.5 | 47.0 | 31.4 |
| Customer service improved | 44.9 | 38.8 | 51.2 | 43.1 | 36.3 | 44.6 | 34.8 |
| International sales increased | 42.5 | 39.9 | 42.6 | 46.9 | 13.2 | 42.3 | 19.5 |
| Procurement costs decreased | 31.8 | 44.5 | 24.7 | 38.4 | 16.7 | 32.4 | 17.7 |
| Inventory costs decreased | 19.9 | 35.1 | 26.3 | 17.8 | 22.4 | 20.7 | 14.0 |
| Coordination with suppliers improved | 43.3 | 50.3 | 42.5 | 47.1 | 23.4 | 43.6 | 29.8 |
| Competitive position improved | 49.2 | 54.9 | 51.3 | 51.2 | 33.1 | 49.5 | 29.8 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Using a 5-point scale where 5 is "a great deal" and 1 is "not at all", please rate the degree to which your establishment has experienced the following impacts since it began using the Internet for business. A score of 4 or 5 was classified as "high impact".

Online business has a greater degree of impact on Singapore firms than firms in the global sample. Across several factors, greater percentages of Singapore firms report significant impact compared to the global sample. In terms of the ranking of impact areas, Singapore firms are more likely to experience market-based impacts (widened sales areas and strengthened competitive positions) while firms in the global sample are more likely to enjoy the benefits of improved efficiency and customer service.

The variations among the three sectors reflect the unique characteristics and circumstances of each sector. For the manufacturing sector, firms are highly integrated with global production networks, as witnessed by the high proportion of sales (47 percent) and procurement (40 percent) that are transacted with overseas markets. E-commerce is a means for maintaining and strengthening their positions in these networks. Effective deployment of e-commerce should result in manufacturers enjoying a stronger position in the value chain, with enhanced links to both customers and suppliers. The findings support this, showing that more than half of manufacturers have improved their competitive position (51 percent). Customer service (51 percent) and coordination with suppliers (43 percent) have also improved as a result of doing business online.

The firm globalization impetus for the distribution sector relates to both supply and demand concerns. On the one hand, a high reliance on overseas suppliers (51 percent of procurement budgets is spent abroad) encourages the use of online means for improving alignment with supply chain partners, especially overseas partners. Simultaneously, Singapore's small domestic market means that many distributors (57 percent) already have an overseas presence or sell abroad (80 percent). E-commerce presents an opportunity for these firms to cast the net even wider into regional and global markets, improving both market reach and foreign

revenues. The survey results verify that the top impacts in this sector are widened sales area (56 percent), coordination with suppliers (47 percent) and an increase in international sales (47 percent).

Online business appears to have made the least impact on the banking and insurance sector, with much lower percentages reporting a significant impact. This is consistent with this sector being the slowest to adopt e-commerce technologies and to use the Internet for business purposes. The concerns of this sector are driven by the internal improvement impetus of global competition. Effective deployment of e-commerce should result in enhanced productivity and streamlined processes. Table 21 shows that the top impacts are in more efficient internal processes (40 percent), improved customer service (36 percent) and an increase in staff productivity (34 percent).

The Internet as a Distribution Channel

Two views of how the Internet is used as a distribution channel are prominently highlighted (Table 22). Forty seven percent of establishments that are selling online felt that the Internet competes directly with their traditional distribution channels. A sizeable proportion, 37 percent view the Internet as another means of addressing their traditional distribution channels.

TABLE 22. How Establishments Use the Internet to Sell Products and Services, 2002

| Percent indicating Internet used to ... ^e | Establishment Size ^a | | Sector ^b | | | Total | |
|---|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Address new markets only | 0.3 | 11.4 | 1.6 | 0.1 | 6.8 | 0.9 | 15.3 |
| Address traditional distribution channels only | 38.4 | 16.2 | 32.5 | 37.0 | 51.9 | 37.3 | 44.1 |
| Compete directly with traditional distribution channels | 46.9 | 58.1 | 38.2 | 50.4 | 40.1 | 47.4 | 27.4 |
| Replace traditional distribution channels | 14.3 | 14.3 | 27.7 | 12.4 | 1.2 | 14.3 | 13.2 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Which of the following statements best characterizes how you are using the Internet to sell products and services.

How organizations view the role of the Internet in distribution channels differ by sectors. In the manufacturing sector, three different views received substantial support: Internet addresses traditional channels (32 percent), Internet competes with traditional channels (38 percent) and Internet replaces traditional channels (28 percent). In the banking and insurance sector, more than half believe that the Internet enhances their traditional channels and another 40 percent believe that it competes with traditional channels.

The question of distribution channels is of particular interest in the retail and wholesale sector where the primary activity is trade and distribution. The impact of the Internet here strikes at the core of this sector's activities. Half the wholesale/retail establishments felt that the Internet competes directly with their traditional distribution channels. Another 37 percent felt that the Internet addresses and augments traditional distribution channels only. There was little support for the view that the Internet would replace the traditional channels.

In Singapore there are very few organizations that view the Internet primarily as a means of establishing new distribution channels in new markets. Overall, less than 1 percent of organizations hold this view, compared to 15 percent in the global sample. Singapore firms are much more likely than the global sample to view and use the Internet as competing with their traditional channels. This lends support to the observation put forward by Liang (2000) that Singapore e-commerce operators do not adopt management approaches drastically different from the conventional approach. They regard e-commerce operation as an extension of present business practices and are not aware of the need or potential for a shift in strategy. This shows e-commerce still evolving and in a relatively immature stage of development in Singapore.

Singapore businesses may also be reluctant to use the Internet primarily for new markets due to the additional costs involved in supporting and servicing these new markets. Functions such as logistics, customer support, and financial processing must be addressed to align to the needs of the new markets. If not already in place, the cost of developing systems for these supporting functions may negate any revenue gains from new markets.

Effect of Online Business on Value Chain

Very few establishments reported a decrease in the number of distribution channels and suppliers as a result of doing business online (Table 23). Around one third of companies felt that their value chain has been augmented with more distribution channels and suppliers. Compared to the global sample, establishments in Singapore are more likely to have experienced an increase in the number of suppliers. However, they are less likely than the global sample to have observed an increase in the number of distribution channels.

Of the three sectors, the retail/wholesale sector is the most likely to have increased the number of distribution channels since it started doing business online (reported by 36 percent versus 27 percent for manufacturers and 28 percent for banking and insurance firms). This is consistent with the earlier finding that retail/wholesale firms regard the Internet as additional channels that compete with traditional channels.

TABLE 23. Impacts of Doing Business OnLine, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|---|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent indicating | | | | | | | |
| Number of distribution channels increased | 32.3 | 42.9 | 26.5 | 36.3 | 28.5 | 32.8 | 40.2 |
| Number of suppliers increased | 32.4 | 48.6 | 42.0 | 31.7 | 18.4 | 33.2 | 29.9 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Please indicate whether the following have increased, decreased or stayed the same in your establishment since it began using the Internet for business.

Impact of Online Business on Competition

As reported by Singapore firms, online business results in heightened competition by introducing more players into the playing field. Thirty-eight percent indicate that the number of competitors has increased since they began doing business online while 46 percent feel that the intensity of competition has increased (Table 24).

The heightened number of competitors and intensity of competition is most keenly sensed in the manufacturing sector. More than half the manufacturing firms in Singapore, 52 percent, believe that the intensity of competition has increased since they embarked on online business. The banking and insurance sector is the least likely of the three sectors to feel the impact of increased competition, both in terms of intensity and in number of competitors. As this sector has been the slower to use e-commerce for business purposes, the impact on competition is more diffused and affects a lower proportion of firms. Compared to the other two sectors, the financial sector is relatively small in terms of number of establishments, and is subject to stricter rules governing entry and operations. Therefore, the number of competitors is affected more by the regulatory environment and less by the mode of business practices.

TABLE 24. Impacts of Doing Business Online, 2002

| | Establishment Size ^a | | Sector ^b | | | Total | |
|------------------------------------|---------------------------------|-------|---------------------|----------|---------|------------------------|---------------------|
| | SME | Large | Mfg. | Distrib. | Finance | Singapore ^c | Global ^d |
| Percent indicating ^e | | | | | | | |
| Number of competitors increased | 38.7 | 20.9 | 40.6 | 40.7 | 12.1 | 37.9 | 27.9 |
| Intensity of competition increased | 45.6 | 58.3 | 52.4 | 45.2 | 34.3 | 46.2 | 41.5 |

Source: CRITO Global E-Commerce Survey, 2002

Notes ^a SME (small and medium sized establishments) are those with 25-250 employees; large are those with more than 250 employees.

^b Manufacturing includes all establishments classified as SIC 20-39; distribution includes wholesale and retail (SIC 50-54, 56-57, 59); finance includes banking and insurance (SIC 60-65).

^c Responses were weighted based on the total number of establishments by employee size within the sector for each country. Survey sample sizes for Singapore by sector are 68 establishments in manufacturing, 67 in wholesale & retail distribution, and 67 in banking & insurance; by size are 105 establishments classified as SME and 97 as large.

^d Consists of weighted survey responses in 10 countries combined: United States, Mexico, Brazil, Germany, France, Denmark, Singapore, Taiwan, China and Japan. "Global" sample sizes by sector are 743 in manufacturing, 701 in wholesale/retail distribution, and 695 in banking & insurance; by size are 1,088 establishments classified as SME and 1,053 as large.

^e Exact wording of question: Please indicate whether the following have increased, decreased or stayed the same in your establishment since it began using the Internet for business.

CONCLUSION

Summary of Main Findings

The conditions for e-commerce diffusion are analyzed from the following perspectives:

- *Extent of globalization of businesses:* Singapore is acknowledged as one of the world's most open economies, with a high level of dependency on foreign markets. Singapore businesses are more globalized than the global sample.
- *Readiness for e-commerce in terms of Information Infrastructure in businesses:* The level of readiness for e-commerce is found to be at par with the sample. The distribution sector is the most technologically ready, with relatively little disparity between large and small firms. The level of readiness in the other two sectors is somewhat lower, due to the lower technology adoption rates among small firms.
- *Readiness for e-commerce in terms of IT investment in businesses:* IT expenditure averages around 9 percent of total revenue. The distribution sector reports the highest level of IT investment and exceptionally high levels of web-based spending.
- *Environmental and policy factors that encourage or discourage e-commerce diffusion:* Government policies for e-commerce and sectoral development urge businesses to embrace the concept of a networked market space. The strongest drivers for e-commerce in the manufacturing and distribution sectors are related to networks and market expansion. The financial sector is most motivated by improved internal efficiency. The major barriers perceived by businesses are related to privacy, security, and cost issues. Barriers presented by the legal and regulatory framework are also more of a problem in Singapore than in the global sample.

The underlying infrastructure and investment conditions in Singapore are conducive for the development of e-commerce. Size is not a significant differentiating factor, for the most part, as both small and large firms are equally equipped to embark on e-commerce activities. Sectoral differences suggest that wholesalers/retailers are the most ready for e-commerce, while manufacturers are most ready for B2B transactions involving integration with other businesses.

The structure of Singapore's economy, with its openness, dependency on trade, and its small domestic market, necessitates a global approach among businesses. Additionally, government policies for sectoral development encourage globalization and IT enabled links are advocated. Globalization presents a strong motivating factor for businesses in Singapore to embark in e-commerce.

The following were analyzed to study the extent and nature of e-commerce diffusion:

- *Extent of e-commerce penetration and level of e-commerce revenues:* Official data shows that the rate of growth of e-commerce revenues has accelerated. The financial sector is the slowest to use the Internet for business purposes. The manufacturing and distribution sectors report much higher percentages of firms that use the Internet for a variety of business functions, compared to the financial sector.
- *Nature of use: marketing, transactional, data exchange etc:* The Internet is more likely to be used for exchange and integration rather than for transactional and sales purposes. Less than 30 percent of establishments use the Internet for online sales or purchases, while over 40 percent use it to exchange data or integrate business processes with business partners.
- *Level of online activity: online sales, online procurement:* Overall, the participation rate in online sales among firms in Singapore is at par with the global sample (37 percent versus 35 percent). However, the composition of online sales activity in Singapore is heavily weighted towards B2B. Compared to the global sample, Singapore has a lower level of online activity in terms of consumer sales (2 percent versus 4 percent), but a higher level in terms of B2B sales (6 percent versus 4 percent). Singapore firms are less likely to engage in online procurement activities than the global sample
- *Trends in the e-commerce industry:* Revenues generated by companies providing e-commerce services have multiplied by almost five times between 1998 and 2000. The Internet Intermediary services sub-sector is projected to experience the most dynamic expansion.

As had been surmised earlier, Singapore firms are more likely to use the Internet for non-transactional purposes such as advertising and systems integration rather than engaging in online transactional activities. The level of B2B activity is significantly higher than B2C activities, as conjectured from the small domestic market and the dominance of globally oriented firms in spearheading e-commerce.

While fewer firms in Singapore's manufacturing sector are technologically ready compared to other sectors, online activity is conducted at greater intensity, resulting in a level of online activity comparable to the wholesale/retail sector. In almost all forms of online activities, the banking and insurance sector lags behind the other two sectors.

The types of impacts analyzed are:

- *Market-based impacts such as market access and sales:* These are the most significant impacts felt by businesses engaging in e-commerce. Fifty percent of businesses reported experiencing a great deal of impact in terms of improvement in competitive position and 47 percent cited widened sales areas.
- *Internal Efficiency such as increased productivity or lower costs:* These are the areas with the least impact on businesses. Cost reduction was experienced by less than one third of firms and large proportions believe that online business has had no impact at all on improving internal efficiency. However, for the financial sector, internal

efficiency impacts were the most strongly felt, due to different underlying motivations and ways of using e-commerce.

- *Value chain and Distribution Channel:* Singapore businesses view the Internet as either competing directly with existing distribution channels or as another means of addressing these traditional channels. One third of businesses report that their value chain had been augmented by increased numbers of distribution channels and suppliers.
- *Competition:* Thirty-eight percent of businesses believe that online business had increased the number of competitors in their industries, while 46 percent felt that the intensity of competition had heightened. However, as mentioned earlier, half the businesses believe that their competitive positions are significantly improved as a result of doing business online.

Consistent with the motivating factors driving involvement in e-commerce, the impact of doing business online is different in the three sectors. For manufacturers and distributors, the impact of online business is most keenly felt in areas relating to the markets and networks of businesses. For financial institutions, the impacts are strongest in internal processes and productivity.

Online business modes are not drastically changing value chains as traditional distribution channels are being maintained. E-commerce has not yet reached the maturity of replacing existing channels or addressing new markets. The positive impact of e-commerce diffusion on competitive position suggests that e-commerce reinforces existing comparative advantages.

Implications

The impetus of firm globalization is a strong motivator for firms to improve networking with global business partners and to expand markets through e-commerce. As such, firms with a global orientation will spearhead the adoption of e-commerce applications in Singapore. Firms with a domestic focus may globalize indirectly by participating in e-commerce value chains established by globalized firms. We expect that the diffusion of e-commerce in Singapore will continue to take place in this manner: highly globalized firms will lead the way for slower adopters by creating opportunities and niche roles in the value chain.

However, this is far from being a phenomenon where large firms are path setters for SMEs. In the manufacturing sector, the level of online B2B sales in SMEs is at par with large firms; and the level of online B2B procurement is much higher in SMEs than in large firms. In the distribution sector, SMEs have higher levels of online activity for both procurement and sales. As e-commerce penetrates further into Singapore businesses, this may necessitate a shift in strategy towards promoting SMEs and entrepreneurial start-ups.

The pace and manner of e-commerce diffusion is likely to continue to differ across different sectors. Due to differing characteristics, the various sectors have different motivations for e-commerce and different levels of readiness. We do not expect convergence in e-commerce diffusion across sectors in the near future. In particular, the financial sector is still finding its feet amidst ongoing liberalization. It remains to be seen if smaller firms in this sector are able to catch up with the large financial institutions that are already active in e-commerce.

While the globalization impetus promotes e-commerce diffusion, the reliance of Singapore businesses on global partners may also constrain e-commerce growth. The extent of e-commerce diffusion in Singapore is affected by the uneven development of e-commerce in major overseas suppliers and customer markets. While some of Singapore's key trade partners are more e-commerce intensive (Australia, USA, South Korea, Japan), others are still very much in the infancy stages of e-commerce development (South East Asia). Presently, we see Singapore businesses as mainly responding to the "push" exerted by suppliers and customers. They will use e-commerce in markets and networks where e-commerce capabilities have been established. Apart from a small number of global and regional market leaders in the advanced manufacturing clusters, Singapore firms are not in the position to "pull" global partners into using e-commerce. This is a vulnerability that is addressed by strategizing towards flexibility and agility in technology adoption and exploitation. Singapore businesses are unlikely to lead the world in innovating or adopting radical innovations but are able to match other nations in the adoption of more established technologies.

The prevailing e-commerce model for Singapore is integration and exchange with supply chain partners and business customers. Consumer transactions are a very small part of the equation. The small domestic market has already led to the failure of a number of online retailers during the dotcom fall-out in 2000-2001. In fact, it was the focus on B2B trading that buffered Singapore from the dramatic collapse of the dotcom industry. Given that globalization is a major driver for e-commerce adoption, B2B activities will continue to dominate B2C activities.

The globalization impetus does motivate Singapore businesses to sell to overseas consumers, particularly to neighboring countries where geographic distance is less of a factor for logistics and transportation considerations. In fact, IDA(2000) reports that the majority of B2C sales by Singapore businesses are to consumers from Malaysia, Thailand, USA and Japan. However, we believe that reaching out to overseas consumer markets will be much less significant than expanding overseas markets for business customers and suppliers. Stumbling blocks for overseas B2C sales include the cost of logistics support, uncertainties over after sales support and execution of exchange and refund policies. Another substantial difficulty lies in the lack of cross-recognized legal frameworks governing these B2C sales, not only in terms of e-commerce laws but also laws governing contracts, sales and consumer protection.

Internet use for businesses will continue for purposes of promotion and communication. The use of the Internet for transactional purposes will not become widespread until confidence in secure infrastructures has been boosted through efforts such as those by the National Trust Council. This translates into demand for specific types of applications and services provided by the e-commerce industry. Applications that enable networking and information exchange will experience greater demand and usage than applications that enable online transactions.

Online business is unlikely to revolutionize the dominant business models of most firms in the near future. The bulk of both transaction value and volume are conducted off-line using traditional modes and channels. The strongest impact of e-commerce at the firm level is to induce and intensify competition. Businesses will need to respond by differentiating themselves from other businesses that are adopting similar e-commerce practices. The use of e-commerce in itself is no longer sufficient to maintain a differentiating competitive edge. Businesses need to find ways of using e-commerce applications that enhance the quality of service to customers and suppliers.

There is a relatively high level of e-commerce activities in the manufacturing and distribution sectors, particularly in B2B coordination and data exchange. This suggests Singapore's strength in physical logistics has positively enabled the development of e-commerce. Additionally, there are numerous initiatives to locate global and regional e-commerce hubs in Singapore to take advantage of its ideal location and superior infrastructure. Contrary to suggestions that e-commerce renders such advantages irrelevant, the impact of e-commerce in the near future is to reinforce Singapore's advantages in physical transportation and its strategic location. In the long run, as Singapore continues to build its capabilities as an information processing hub, it is possible that physical transportation economics will be of less importance in defining Singapore's economic position.

REFERENCES

- Burn, J. M. and Barnett, M. L. 2000 . Emerging Virtual Models for Global e-commerce - world wide retailing in the e-grocery business. *Special issue on Global E-Commerce, Special Millennium Issue of Journal of Global Information Technology Management* 3(1): 18-32.
- Gibbs, Jennifer, Kraemer, Kenneth L. and Dedrick, Jason. 2002. Environment and Policy Factors Shaping Global E-Commerce Diffusion: A Cross Country Comparison. Center for Research on Information Technology and Organizations, University of California, Irvine <<http://www.crito.uci.edu/GIT/>>
- Infocomm Development Authority of Singapore (IDA). 1999. *Business-to-business e-commerce survey 1999 summary findings*, IDA <<http://www.ida.gov.sg/>>
- Infocomm Development Authority of Singapore (IDA). 2000. *Executive summary on Survey of E-Commerce 2000*, IDA <<http://www.ida.gov.sg/>>
- Infocomm Development Authority of Singapore (IDA). 2001. *Quarterly E-Commerce Survey Q1 – Q3 2001*, IDA <<http://www.ida.gov.sg/>>
- Infocomm Development Authority of Singapore (IDA). 2001a. *Survey of Infocomm Usage in Households 2000*, IDA <<http://www.ida.gov.sg/>>
- International Telecommunication Union. 2001. *The e-City: Singapore Internet Case Study*, ITU <<http://www.itu.int/>>
- Liang, Thow Yick. 2000. *The E-Landscape: An Unexplored Goldmine of the New Millenium*. Singapore Management University Office of Research and Doctoral Education, Research Paper Series 2000-002
- Singapore Department of Statistics. 1999. *The Grocery Trade in Singapore, 1987-1997*. DOS
- Singapore Productivity and Standards Board (SPRING). 2001. *SPRING annual report 2000/2001*, SPRING <<http://www.spring.gov.sg/aboutus/>>
- Wirtz, Jochen and Wong, Poh Kam. 2001. An empirical study on internet-based business-to-business e-commerce in Singapore. *Singapore Management Review* 23 (1): 87-112
- Wong, Poh Kam. 2001. *Globalization and E-Commerce: Growth and Impacts in Singapore*. CRITO. Research report submitted to CRITO, November.

APPENDIX: Industry Sub-sector Case Study

Wholesale and Retail Distribution: Grocery Trade

Introduction

The grocery trade is part of the fast moving consumer goods industry. Players in the grocery trade include retailers who sell directly to consumers, as well as manufacturers and distributors of grocery products. While this case study will focus primarily on grocery retailers, the scope covered will encompass both retail (B2C) and supply management (B2B) issues.

Singapore has the most developed food retail market in South-East Asia. Singapore's per capita expenditure on food products is US\$1,500. By comparison, the next highest country - Malaysia, only has a per capita food expenditure of US\$448.

Trends in the retail sector explain the appeal of the grocery sub-sector for e-tailing. In 2001, the retail sector generated sales of SG\$27,131 million (US\$417 million) and 23 percent of this was accounted for by hypermarkets and supermarket sales. The top two revenue earners in the retail sector are supermarkets, NTUC Fairprice and Cold Storage Singapore. Additionally, Singapore's convenience-oriented consumers have shown a growing preference for modern retail concepts, moving away from small neighborhood shops towards the one-stop convenience of supermarkets and hypermarkets. It appears as if the Internet would be the next logical step for shoppers.

Key Processes in the Grocery Sub-Sector

In this case study, two sections of the grocery trade value chain are of interest: downstream retail distribution and upstream supply and procurement. These address both the B2B and B2C aspects of the trade.

Key processes in the downstream chain are product presentation, order processing, order fulfillment and customer service and support. Processes in the upstream value chain are procurement, storage and warehousing, transportation, and inventory management. For the grocery trade, effective upstream processes are of particular significance due to the perishable nature of many grocery products. There is a high degree of interdependency between retailers, manufacturers and distributors, and third party logistics providers.

Background and Evolution of the Grocery Sub-sector and Processes

According to the Department of Statistics (1998), there are around 2,500 grocery outlets in Singapore. Grocery retailing in Singapore is conducted through three main distribution channels. The first channel comprises the small general provision shops, market produce shops and stalls in wet markets that are abundantly found in the Housing Development Board (HDB) estates. These small retailers account for 67 percent of the grocery outlets in Singapore and are usually frequented by HDB dwellers that form 85 percent of Singapore's population. In the middle of the grocery spectrum are the mini markets that offer a wider range than the HDB shops and usually the comfort of air-conditioned settings. Mini-marts form 27 percent of grocery retail establishments. At the other end of the spectrum are the

large supermarkets and the most recent market entrant, the hypermarkets. While they account for only 6 percent of grocery retailers, supermarkets and hypermarkets dominate the market share. The Internet as a distribution channel for grocery retailing is a relatively recent phenomenon.

The Department of Statistics' study of the grocery retail trade in 1998 is the latest available analysis of trends in this sector. The study revealed that supermarkets recorded an average turnover of 12 percent over 10 years from 1987 to 1997 and contributed more than 60 percent of total grocery turnover in 1997, increasing market share significantly from 37 percent in 1997. The rise of large supermarket chains has led to a decline in neighborhood provision stores, with market shares eroding from 48 percent to 21 percent.

Brick and mortar supermarket chains in Singapore target different market segments using location as the differentiating factor. Jason's and Tanglin Marketplace are located in prime city areas and target the affluent expatriate community. Cold Storage targets middle and upper income consumers through stores in large shopping centers and near private housing estates. NTUC Fairprice, Singapore's largest supermarket chain, is located in HDB estates and serves the grocery demand of the middle and lower income groups. However, with the Internet, the constraints of geographic location are diminished and the retailers are able to reach consumers that do not have easy access to their physical stores.

Development of E-Grocery in Singapore

Around a dozen local grocers have set up shop in cyberspace. This ranges from major supermarket chains such as Cold Storage and NTUC Fairprice to small specialist traders such as spice sellers physically located in Little India. Cold Storage was the first online grocer in Singapore, setting up its online store in 1997. Cold Storage's foray into e-grocery was one of the pioneering projects in the pilot program promoting business use of the broadband Singapore ONE network. Since then, other market players such as NTUC Fairprice and Econ Minimart have embarked on their own online retailing ventures.

E-grocers such as Cold Storage, NTUC Fairprice and Econ began as physical stores selling groceries through conventional means. This is true of most of the e-grocers in Singapore. These grocers have traditionally offered home delivery services and their online stores leveraged on their existing expertise in fulfilling orders made by customers not physically present in their stores. Selling online is seen as an extension of the home delivery system, with orders being taken over the Internet rather than by traditional means of telephone or faxes.

However, in recent times, two other types of e-grocers have emerged. In 1999, FreshDirect entered the playing field as the first grocer that only sold online. FreshDirect is an entrepreneurial start-up that regards itself as a niche player focusing on fresh fruit produce. It positions itself as being different from the big traders like Cold Storage and NTUC Fairprice, emphasizing freshness of its products and personalized service. By not having a physical store, FreshDirect hoped to save on rental and other overheads and to direct these savings to enhancing the level of service delivered to customers.

The other type of e-grocer in Singapore is the food manufacturer and bulk food distributor that venture online to sell in smaller quantities to consumer markets. In January 2001, Singapore Food Industries (SFI) launched its online supermarket. SFI was established in

1973 by the Ministry of Defense to improve the food distribution system to Singapore's Armed Forces. Through the years, SFI evolved from supplying raw rations to the Armed Forces and other government agencies to operating food processing plants that it has acquired or invested in as part of its global expansion venture. In doing this, SFI had developed deep capabilities that placed it in a strong position to enter the retail business. SFI's director of corporate services, Ms. Ang Lee Nah said, "We have the infrastructure to process and deliver the food – for example, 72 trucks, cold storerooms and so on." Rather than setting up physical stores, SFI's e-mart website was seen as the most appropriate way of penetrating the direct retail market, given the product range and logistics capabilities of SFI.

There have also been efforts to build infrastructures to aid the development of the local e-grocery market. Two touchscreen e-grocery kiosks have been incorporated into the design of The Floravale, a residential estate in Singapore. Using these kiosks, residents are able to order groceries electronically from Singapore Food Industries. The cost of building and maintaining these kiosks are run by SFI who regard this infrastructure as expanding the accessibility of their online grocery store. Pidemco Land, the developer of The Floravale project is exploring the feasibility of extending the e-grocery kiosk facility to other executive and private condominiums in its management portfolio.

Development of Supply Chain Processes in the Grocery Sub-sector

A number of significant developments have taken place in the supply chain processes of the grocery sub-sector in Singapore. These concern both the large and small grocery retailers.

One major development in the grocery retail trade is the dominance of large supermarket chains in terms of market share. Prior to the advent of these large multiple retailers, small retailers were heavily reliant on wholesalers and manufacturers for all supply chain processes. As pointed out by Burn and Barnett (2000), the emergence of larger retail operators has enabled the use of more efficient methods of distribution. Over time, large retailers have become less dependent on wholesalers and deal directly with manufacturers, both foreign and local. For example, Cold Storage deals directly with major suppliers such as Procter & Gamble and Unilever without going through a third-party wholesaler.

At the same time, the method of delivery has also become more efficient as large retailers internalize warehouse management by operating their own warehouses rather than relying on third party warehousing. Previously, wholesalers and manufacturers would make deliveries of an assortment of products to individual retail outlets. As larger retailers now have their own centralized warehouses, manufacturers deliver large amounts of a particular product in each delivery run to the centralized warehouse. As a result of having its own centralized warehouse, the retailer has incorporated the wholesaling and transportation function into its own internal processes. In Singapore, large supermarket retailers such as Cold Storage, NTUC Fairprice and the hypermarkets all have their own centralized warehouses.

Another major development in the grocery trade has been the Efficient Consumer Response (ECR) movement for enhancing supply chain efficiency. ECR is a set of strategies for getting companies across a supply chain to work closely together to serve their consumers better and at a lower cost. Examples of ECR techniques are category management and continuous replenishment, which is particularly important in the grocery trade due to the short lifespan of products' shelf life. The challenge of ECR is to improve customer choice, satisfaction and

service, while at the same time achieving reduction in costs, including costs of holding inventory and physical assets. There is a delicate balance to achieve to avoid out-of-stock situations and delay in deliveries.

ECR was introduced by Wal-Mart in the United States in the 1990's and has since found a foothold in both Europe and Asia. In Singapore, the ECR initiative was launched in 1998 with the formation of the Efficient Consumer Response Council of Singapore (also known as ECR Singapore). This is a private sector initiative comprised of suppliers, manufacturers, distributors and retailers in the grocery and fast moving consumer goods sector. The ECR initiative in Singapore is aimed at all market players, regardless of size.

In Singapore, the ECR movement has identified three main thrusts for improving supply chain efficiency in the grocery and FMCG trade. The first of these is standardization of categorization codes and supply chain processes. The Singapore Article Number Council is a board member of ECR Singapore and has spearheaded efforts for the adoption of the EAN.UCC System (European Article Numbering and Uniform Code Council) that enables manufacturers, distributors and retailers worldwide to align operations by standardizing the way that products, services, transport units and locations are identified. Standardization enables partners in a supply chain to enjoy increased productivity and economies of scale due to better compatibility and interoperability of their systems and processes.

An example of successful standardization in Singapore is the Pallet Standardization project. A 12-month pilot study was carried out with participation from four companies (Grocery Logistics of Singapore, Unilever Singapore Pte Ltd, YHS (Singapore) Pte Ltd and LHT Holdings Ltd) to demonstrate the benefits of using the ECR standard pallet. These four pilot study companies reported substantial benefits, with an average internal rate of return at one-and-a-half-times of the financial investment in the standardized pallet system. Apart from facilitating physical coordination, the standardized pallet streamlined business communications, especially electronically transmitted transportation information. ECR Singapore estimates that when adopted industry wide, 200,000 standard pallets could be used and \$5 million in savings achieved annually in the grocery industry.

The second thrust of Singapore's ECR movement is cluster development. This approach aims at creating a community of enterprises comprising all partners in the supply chain. Products and services flow seamlessly through this community, underpinned by strong relationships and partnerships whether formal or otherwise. The Business Upgrading through Inter-Linkages Development (BUILD) Program in Singapore is an example of a cluster development initiative.

BUILD encourages leading globalized companies to mentor and help smaller suppliers and distributors to upgrade their capabilities. Multinationals such as Asia Pacific Breweries, Procter & Gamble, and Nestle provide technical assistance to small mini-markets and convenience store operators in areas such as category management and inventory management. The SME retailers gain by improving their efficiency in product display and stock monitoring and replenishment. The multinationals benefit from having more efficient and reliable distributors for their products. This results in a theoretical win-win situation for all involved.

The final thrust of the ECR movement is the role of government in reducing frictions in the grocery trade's supply chain. This includes reviewing rules and regulations that potentially hamper or prolong the process of procurement and distribution.

Factors Influencing Diffusion of E-Commerce in the Grocery Trade

Physical Infrastructure

Singapore's small size is a boon to e-grocers. With all parts of the island easily within driving distance, delivery planning is made much easier and costs of delivery can be kept to a minimum. The high-density clustered housing that is typical of the majority of Singapore's residential estates also allows for much greater delivery access.

Internet Culture

IDA (2001a), in the Survey of Infocomm Usage in Households 2000, reveals that 6 in 10 households in Singapore own at least one computer and over half of households have Internet access. Benchmarked across a number of countries such as the USA, Australia and Ireland, Singapore's home PC ownership and Internet penetration rate is the highest. Forty-two percent of the population age 15 and above are Internet users. This translates to around 1.3 million Internet users in Singapore, with most accessing the Internet from both home and work. This suggests a large base of potential customers for e-grocers.

However, while there is high awareness of online shopping (81 percent), only 16 percent of Internet users have actually engaged in online shopping. A later survey (as yet unpublished) revealed that those that shopped online mainly used the Internet for purchase of cinema tickets and digital products. Purchase of physical products such as groceries has not reach a critical mass yet.

Sources of Procurement

Either directly or indirectly, Singapore grocery retailers rely on global sources for products, especially fresh produce. Commercial agriculture and fishery is practically non-existent in Singapore. Depending on bargaining and purchasing power, grocery retailers have several options for sources of procurement. They may source directly from MNC manufacturers or purchase from wholesalers and distributors. Local retailers may source for global products through locally based wholesalers and distributors, or they may opt for direct contact with the overseas supplier.

To provide more choices to the consumers, multiple sourcing is favored above single sourcing. However, multiple sourcing presents complications in communication and supplier relationship management. This is more so if retailers choose to multiple-source from overseas suppliers.

E-commerce has been touted as a way to allow retailers, especially small retailers, greater flexibility in managing multiple and global sourcing. The Internet may be used as a platform for formation of purchasing consortia to increase bargaining power with larger suppliers. E-commerce systems address issues of supplier communication and coordination in instances of geographically distant suppliers.

Government Policy

The grocery retail sector has been the subject of several targeted government programs to promote the use of technology and electronic commerce. In 1996, ShopNet was launched as part of the Electronic Commerce Hotbed Program. ShopNet is an industry-wide B2B solution designed for small retailers in HDB estates, with an initial focus on grocery retailers. The ShopNet solution facilitates B2B e-commerce for small retailers who are unable to set up full e-commerce systems on their own.

Retailers using ShopNet are able to select products from the National Electronic Product Catalogue (NEPC). The NEPC is an electronic register of popular products available in the Singapore market place. It is a repository of product data and digitized images of products made in Singapore and overseas and serves as an infrastructure where trading partners can obtain, maintain or exchange information about products, services or parties/locations in a standard format using electronic means. It is accessible via the Internet and ensures the integrity of data needed for e-commerce transactions by providing a standardized record of product data.

Through its championing of the ECR concept, the government has also encouraged grocery retailers to adopt e-commerce practices to streamline their supply chains. Additionally, as part of a wider program to promote online retailing, the IT Consultancy project under the Local Enterprise Technical Assistance Scheme provides financial and technical assistance for retailers to become e-enabled for online selling.

E-Commerce Readiness

Large grocery retailers such as the supermarket chains are among the most technologically ready businesses in Singapore. Even large retailers without online stores minimally employ EDI technology for procurement, given the large range of products involved and the degree of interaction with MNC manufacturers as major suppliers. Most of the large retailers have their own websites, advertising special events and promotional offers, as well as providing a forum for consumer feedback via email.

The ShopNet solution has brought technology to the smaller HDB grocery retailers. ShopNet enables small retailers to conduct POS scanning, inventory control, and EDI for procurement using EANCOM messages. Access to the National Electronic Product Catalogue gives these small retailers vital product information to make procurement decisions. Additionally, the ShopNet system allows retailers to track product movement through a sales analysis module. Retailers are also able to standardize their product codes and symbols to deal with other trading partners such as suppliers and logistics providers.

Diffusion of E-Commerce

Diffusion of e-commerce in the grocery sub-sector occurs in both upstream and downstream processes, but the activity level is higher in the upstream B2B value chain. While large retailers and some smaller grocers use the Internet for advertising, very few have taken up the challenge of setting up online stores.

For online grocers, the Internet intervenes mainly in the processes of product presentation, order taking, and order fulfillment. Not all online grocers in Singapore accept payments online, citing lack of confidence in security infrastructure. In fact, Cold Storage, the pioneering e-grocer in Singapore has not implemented an online payment mechanism to this day.

The capability of the Internet to log information on website click-through patterns presents e-grocers with fascinating options for category management. For instance, by analyzing the most popularly purchased or viewed products, a retailer can reorganize its web catalogue presentation for maximum impact.

Using the Internet for taking orders means that a grocer stays “open 24 hours.” While conventional telephone orders are only accepted during office hours, fax and Internet orders may be made at any time of the day, although fulfillment does not take place until the next working day. This places an onus for the online grocer to ensure continual operation of its site and to have appropriate backup and contingency plans in case of technical failure.

The degree of sophistication in processing orders differs greatly between different online grocers. In a smaller niche e-grocer like FreshDirect, the volume of orders is small enough for processing to be done manually. The small volume and perishable nature of fruits also mean that FreshDirect does not maintain any inventory and practices immediate sourcing upon order confirmation. The use of the Internet does not need to extend to the order processing stage. A retailer like SFI’s e-mart with larger sales volumes and established logistic capabilities, links Internet orders to its inventory systems.

Online grocers invariably emphasize the importance of order fulfillment for their continued survival and success. In an interview with the Straits Times published on April 11, 2000, Mr Wee Liang Pin, general manager of SFI said, “... the fulfillment factor is very, very important. Once you disappoint an online customer it is very hard to win him back.” The trend for order fulfillment among e-grocers has been to organize a centralized distribution center for picking, processing sales documentation, and dispatch of orders. For larger retailers, this centralized distribution center would be a warehouse or an extensively stocked outlet. Smaller e-grocers doing same day supply delivery and order dispatch would similarly have a central location for packing orders and generating sales invoices.

E-commerce applications for supply chain processes are more diffused in the grocery sub-sector. All large grocery retailers use EDI for procurement from the large manufacturers of processed food and packaged consumer products. The establishment of the National Electronic Product Catalogue and ShopNet has also allowed for easier electronic procurement. From its humble beginnings in 1996 with 8 retailers participating in the pilot study, by late 1999, 200 retailers and around 40 suppliers were participating in ShopNet.

For grocery retailers, the main process which the Internet features most prominently is procurement. Grocery retailers prefer to maintain a multiple-sourcing strategy to provide more variety to consumers. An electronic product catalogue that centralizes information on suppliers is ideal for retailers to make informed purchase decisions. At minimum, retailers that participate in online trade directories (such as fnbsingapore.com) and B2B portals (such as eBizAsiaLink.com) have access to opportunities presented by global suppliers.

The fast moving nature of grocery products requires efficient replenishment, and finding the balance between high supply and minimum inventory. Effective communications between retailer and supplier is needed so that information precedes the movement of products. Linking technologies such as bar-coding to e-commerce systems allows these communications to be handled electronically, reducing processing time.

The other supply chain process that the Internet has a strong impact on is management of logistic functions such as warehousing and transportation. E-commerce has been the enabling technology that made possible the use of standardized codes as promoted by the ECR movement. This has allowed for integration of back-end systems in retailers and logistics suppliers.

Impact of E-Commerce Diffusion

Efficiency

Undoubtedly, using the Internet has increased the efficiency of the grocery sector's supply chain, especially in terms of coordination with supply chain partners. Delivery, processing time, and mistakes are reduced. As an example, for perishable goods requiring refrigeration, e-commerce enables communication between all parties involved in the supply distribution system. These include manufacturers, storage providers, transportation providers, distributors and retailers. By coordinating the activities of these parties using e-commerce, the movements of the perishable products are done in a manner that reduces increases in temperature, hence prolonging the shelf life of the product.

In terms of interaction with customers, the Internet provides a cost-effective and efficient method of communicating with customers. Both Cold Storage and SFI e-mart reported the ease of access to consumer feedback via the web. In the case of SFI e-mart, observation of purchase trends logged online plus monitoring consumer feedback collected through the website led to introduction of profitable product lines in their online supermarket.

Sales and Profitability

While online grocers are able to reach more customers and provide them with greater flexibility and convenience, they have not necessarily been profitable. Cold Storage is one online grocer that set up its online venture with full knowledge of the likelihood of negative profitability. The online store is seen as providing an additional channel for consumers to access Cold Storage products. Accompanying this additional channel is the need to support logistics and human resources for coping with the additional sales volume. These have been very expensive in Cold Storage's case. Sales volume from online orders has yet to reach a critical mass to offset the high logistics costs involved in order fulfillment.

Industry Structure and Competition

The impact of online business on the grocery sector's structure has not been earthshaking, given the small number of online grocers. However, online business has introduced players such as FreshDirect and SFI e-mart, a departure from the other online grocers who also have physical retail outlets.

SFI e-mart's entry into online retailing has indeed provided stiff competition to the large grocers such as Cold Storage and NTUC Fairprice. Within two months of e-mart's launch in early 2000, it had 1,700 customers shopping online. By the end of 2001, e-mart had 29,000 registered members and had achieved a year-on-year revenue growth rate of 28 percent with sales totaling S\$2.8 million (US\$1.6 million). This compares favorably to Cold Storage Online, which had a membership base of over 40,000 by end of 2001.

Online business has provided the opportunity for non-brick and mortar retailers to enter the e-grocery business. Companies and individuals with strong relationships with grocery suppliers can easily employ e-commerce technologies to set up shop. Having an existing physical retail presence is not a prerequisite. In Singapore, SFI e-mart is an example of a purely online grocery retailer with market size and transaction volumes that rival the large grocers such as Cold Storage and NTUC Fairprice. However, there is unlikely to be another large-scale market entrant, as SFI had the unique benefit of building up capabilities as a multiple distributor through the years as a supplier to the Singapore Armed Forces. Many of the purely online traders to enter the e-grocery market will likely be small niche players such as FreshDirect.