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DIGITAL DELIVERY IN DISTRIBUTION & LOGISTICS

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FOREWORD

In December 2004, this report was presented to the Working Party on the Information Economy (WPIE). It was recommended to be made public by the Committee for Information, Computer and Communications Policy in March 2005.

The report was prepared by John W. Houghton, Victoria University, Melbourne, Australia in conjunction with Graham Vickery of the OECD Secretariat. It is one of a series of analytical reports focusing on economic activities where digital delivery of information-intensive goods and services is increasingly important (see previous studies on health and business services and forthcoming study on travel and tourism) and is an important factor restructuring global value chains. This work benefited from support from the European Commission. It is published under the responsibility of the Secretary-General of the OECD.

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SUMMARY

Distribution and logistics activities include elements of wholesale distribution, auxiliary activities to the transport industry (*e.g*. transport and storage) and a range of transport and delivery related services. As an enabler of other industries, distribution and logistics can be a source of competitive advantage for firms, local and national economies. ICTs play a central role, with e-commerce, e-business solutions and digital delivery making a substantial impact on both logistics producers and users. Because of the diversity of activities within logistics, most of the challenges involved in the adoption of e-commerce, e-business solutions and digital delivery are common to other industries, making developments in logistics of broader relevance across many industries. More importantly, the ICT interface between distribution and logistics and other industries will determine how e-business and e-commerce evolve, and their impacts across the economy.

This report analyses the use of e-commerce (*i.e*. on line purchasing and sales), e-business solutions relating to the operation and management of the supply chain (*e.g*. procurement and the co-ordination of supplies, demand forecasting, the use of on line catalogues and e-marketplaces, etc.) and digital delivery (*i*.e. the sending or receipt of digital products and services) in distribution and logistics. The main focus is on these activities in the transport and wholesale distribution sectors, but their impacts on other sectors that are both users and in-house producers of distribution and logistics services are also considered.

Recent developments in distribution and logistics

Distribution and logistics services are provided by a range of organisations, with market segments structured according to economies of scale or scope, levels of capital investment, specialisation in particular fields of activity and/or vertical markets, firm competencies and the changing demands and structures of users and user industries. *Transport* businesses vary enormously, with specialisation by mode (*e.g*. airlines, shipping lines, railway operators and road transport), by focus of activities (*e.g*. bulk cargo handling versus small package delivery) and by geography (*e.g*. international shipping versus local courier services). *Warehousing and storage* businesses also vary, specialising by location or focus of activity (*e.g*. refrigerated food stores, etc.). Hence, distribution and logistics include a wide range of firm sizes, from one-person operations (*e.g*. local driver delivery) to large multinational corporations (*e.g*. shipping and airline businesses).

Distribution and logistics activities are user driven, responding to the demands of their customers. Logistics services tend to be structured around long-term relationships, based on client trust and built on historical experience with particular service providers. This is particularly true in the higher value-adding segments. Consequently, dynamic market entries and exits are relatively rare outside basic services (*e.g*. couriers and messengers). Rather, increasing demand for integrated logistics services is driving consolidation, as businesses seek to encompass the necessary skills and services within their product offerings.

Nevertheless, distribution and logistics have been evolving rapidly. Recent trends include: globalisation, increased competition and a new focus on logistics strategies and execution; falling distribution and logistics costs; increased outsourcing; consolidation among businesses involved in

distribution and logistics activities, with integration of activities such as transport and storage into full service logistics solutions; and an increasing integration of distribution and logistics into value chains. These changes have many implications, including: shorter order cycles; demands for smaller, more frequent, more reliable deliveries; more varied delivery patterns related to product shelf-life, product customisation, production and retailing strategies and the reliability of short-term forecasting; closer relationships between customers and logistic services suppliers, often with fewer suppliers; outsourcing of logistics to third party logistics managers, allowing firms to share distribution facilities; and greater use of recycling and managed disposal, which has resulted in additional back-haul cargoes (*i.e*. reverse logistics).

Drivers and potential for digital delivery in distribution and logistics

Evidence from numerous surveys suggests that the early and primary foci for the adoption of e-commerce, supply chain related e-business solutions and digital delivery are improved customer relationships and enhanced market reach. Cost savings and efficiency improvements have typically been lower in priority of considerations by adopters. Industry dynamics determine whether businesses focus on new customer attraction or the retention of existing customers, with sectors that lend themselves to recurring relations (*e.g*. wholesale and distribution) tending to focus on building revenue from existing customers (Dantuma and Hawkins 2001).

Industries also vary. The initial focus of user industries tends to be on customer relationships, while that of businesses in distribution and logistics related industries tends to be on automating and sharing information up and down the supply chain. For all organisations, there is evidence to suggest that as e-business and digital delivery adoption and use levels rise, attention shifts towards logistics (*e.g*. customer support and supply chain management). Hence, it is likely that e-commerce in logistics and supply chain related e-business solutions will become an increasing focus for on line activities in the next few years.

The essence of effective supply chain management is integration – combining the parts into a whole that functions seamlessly and provides good performance. It is particularly important to ensure that the activities within each step along the chain are well co-ordinated (BTRE 2001). Hence, the major areas of potential and impact of ICTs are: data capture, management, access and presentation; EDI and Web-based data and document interchange; and collaborative support systems.

Adoption and use of digital delivery in distribution and logistics

There is widespread use of e-commerce, but for most it still accounts for a relatively small share of sales and purchases by value. E-commerce activities in the *wholesale distribution* sector are extensive, especially in such areas as pharmaceuticals, motor vehicles and professional and commercial equipment. The adoption of supply chain related e-business solutions and digital delivery is now increasingly common. Collaboration and visibility within the whole supply chain are the main foci for logistics providers and their partners – enabling buyers, manufacturers and service providers to collaborate on such things as demand forecasts and product flow.

Transport businesses tend to be lower/slower adopters than wholesale and distribution businesses, although trucking businesses are using the Web to automate exchanges with shippers and consignees, improve communications, acquire new customers and customise services. That transport and delivery related businesses now appear to be catching up with other sectors, may reflect network issues (*e.g*. that there are now sufficient users and supply chain partners on line) and infrastructure issues (*e.g*. that there is increasing availability of the necessary software). Marked country differences in levels of adoption also appear to reflect network issues, with lower levels of activity primarily reflecting the sense that there is a lack of supply chain partners on line. Hence, those countries with relatively high levels of adoption of the

Internet in business tend to be the most advanced in the adoption of e-commerce, supply chain related e-business solutions and digital delivery in distribution and logistics.

Impacts of digital delivery on distribution and logistics

E-commerce, supply chain related e-business solutions and digital delivery impact distribution and logistics activities in a variety of ways. These include:

- The impacts of the use of e-commerce and digital delivery throughout the economy on logistics activities, in terms of the changing role of distribution and delivery related activities in such areas as B2C e-commerce fulfilment.

- The impacts of the use of e-commerce and supply chain management by the customers of distribution and logistics services on logistics activities and logistics services providers, and

- The impacts of the use of e-commerce, supply chain management related e-business solutions and digital delivery by logistics services businesses on their own activities and services.

Impacts of B2C e-commerce (fulfilment)

Use of the Internet by consumers to buy and sell is changing the role of distributors. There is some disintermediation, with the distribution channel fragmenting to become a one-step link between the on line retailer and the customer. To date, *wholesale distributors* appear to have benefited from the growth of B2C e-commerce – because Internet retail has been most popular in areas where wholesale distribution was already relatively concentrated and consolidated, and because Internet retailers have tended to use existing distributors to handle fulfilment. Nevertheless, there are potential threats. As the scale of on line retail builds, some of the larger players may move their distribution and fulfilment activities in-house. Wholesale distributors may also face disintermediation through competition in fulfilment from small package and overnight deliverers. In some areas, they are also vulnerable to the digital delivery of the products they are currently distributing physically eliminating the need for physical distribution (*e.g*. on line music sales replacing CDs) (Fein 2000).

B2C e-commerce can eliminate various steps in the traditional retail chain. Where the on line retailer is a new entrant (*e.g*. Amazon), B2C e-commerce often bypasses retail to become an ‘e-tail’ front end to a warehouse operation, with the core focus behind the Web site being warehouse-based pick, pack and delivery. Where the on line retailer is an established ‘bricks and mortar’ retailer expanding to on line sales, however, warehouse activities can be bypassed, with the pick and pack activities undertaken in existing stores, possibly overnight or during relatively quiet periods for walk-in shopping. Consequently, the impacts of B2C e-commerce on warehousing and storage can vary significantly, and may depend, in part, upon the relative longer-term viability of the two different on line retailer business models.

However, B2C e-commerce brings new delivery demands and calls for new *transport* and delivery business models. These include: the combination and integration of fulfilment activities (*e.g*. pick and pack, delivery, returns, etc.) into fulfilment services; a re-orientation from bulk to small package delivery, with consequent redesign of distribution facilities (*e.g*. moving away from large storage facilities towards smaller distribution and transhipment centres near major roads, airports and/or residential areas); a shift from daytime delivery to business districts to evening and weekend delivery to residential areas (with a range of new traffic routing, vehicle suitability issues and driver demands); more varied delivery patterns, related to product shelf-life, product customisation, production and retailing strategies, etc.; a re-orientation from simple delivery to customer service (*e.g*. carrying, handling returns and providing frontline customer

liaison); and the formation of closer relationships between logistics services providers and their clients, with the tendency for clients to use fewer, more integrated services providers (Euro-CASE 2001).

Impacts of use by customers (supply chain)

The adoption of new production practices (*e.g.* just-in-time, efficient consumer response and vendor managed inventory) and the development of new business models (*e.g.* flexible customisation and build-to-order) are bringing a new focus to distribution and logistics activities. Typically, they involve more information intensive and time critical management of procurement and inventory. Responses among both wholesale distribution and transport businesses vary. Some are becoming 'one-stop' logistics services suppliers, others are becoming more specialised sub-contractors to full-services suppliers and others still are becoming more specialised niche suppliers. These responses depend upon a range of factors, including the businesses' own capabilities, their ability and inclination to consolidate activities and the forces operating in particular supply chains – with changes sometimes imposed from above (*e.g.* efficient customer response in grocery supply imposed by lead retailers) and sometimes the result of organic development among channel partners (*e.g.* customers outsourcing the procurement function to distributors and using networked business systems to reduce inventory and cut costs) (Fein 2000). A further factor is the emerging use of digitally delivered software and IT services to replace or update an increasingly wide array of equipment and services which formerly involved physical delivery or personnel visits.

One-stop logistics services providers are emerging from consolidation in both the wholesale distribution and transport industries. That consolidation is often vertical in nature, with businesses seeking to bring together capabilities and services in combinations previously unavailable. As logistics services have become more integrated into the value chain, logistics providers tend to enter longer-term arrangements with customers, based on multi-year outsourcing contracts governed by service level agreements (Hassall 2001). As a result, the business orientation is increasingly towards service, rather than simply price. Like B2C e-commerce and fulfilment, production practices and business models in client industries (*e.g.* just-in-time, efficient consumer response, vendor managed inventory, flexible customisation and build-to-order) are demanding smaller, more frequent and time sensitive delivery, as well as much greater track and traceability in the system (*i.e.* the 'glass pipeline').

For sub-contractors and niche specialists, there are similar demands for more information about their activities and consignments, integration of information and information systems into supply chain management systems, and responses to the range of changed demands (*e.g.* smaller, more frequent, time sensitive consignments). *Warehousing and storage* is seeing a shift from large scale storage facilities focusing on the exploitation of economies of scale in storage and handling, to more distributed distribution centres focusing on handling rather than storage, with more cross-docking and more information-intensive and information-based pick and pack, track and trace, and load optimisation activities. For *freight transport* businesses, similarly, there is a marked shift to smaller, more frequent and time sensitive deliveries, more information about and tracking of consignments, and more emphasis on service reliability.

Impacts of use by distribution and logistics service providers (own use)

Many distribution and logistics businesses are extending their reach, enhancing service offerings and growing their businesses as a result of going on line, and a number of specialist on line freight brokers and marketplaces have emerged to allow customers requiring delivery services and transport operators who can supply them to exchange information about their needs and capacities – thus enhancing capacity utilisation and giving SME customers access to volume discounts. However, the increase in reach facilitated by Internet-based commerce and increased information about products and services available could, in theory, lead to a situation where small package deliverers and the re-internalisation of some activities by manufacturers might eliminate wholesale distribution in some industries (Fein 2000, p41-5). Information

brokers, such as traditional freight brokers and freight forwarders, are also threatened by the emergence of specialist on line brokers and marketplaces, which allow customers requiring delivery services and transport operators who can supply them, to exchange information about their needs and capacities, thus bypassing traditional freight forwarders. These players may be existing freight forwarders or related industry players, or they may be new entrants, building on the capacity of new load matching software (Nagarajan *et al.* 2001).

Nagarajan *et al.* (2001) noted that there were major changes taking place within the trucking industry, including: the emergence of 'virtual trucking', consolidation and the emergence of one-stop transportation services, and the exploration of new business possibilities. Increasingly, the provision of sophisticated distribution and logistics services requires a range of information systems, such as vehicle routing and scheduling, track and trace, warehouse management, performance reporting and payment processing, as well as their integration into e-business solutions, e-commerce and digital delivery mechanisms (BTRE 2001). While it is difficult to separate the impacts of e-commerce, the use of supply chain related e-business solutions and digital delivery from those of a range of other forces operating within distribution and logistics (Dantuma and Hawkins 2001), it is clear that, be it as drivers or enablers, they are fundamental to the re-structuring of distribution and logistics activities.

Barriers to digital delivery in distribution and logistics

Organisations face a range of impediments to the adoption of e-commerce, supply chain related e-business solutions and digital delivery in their distribution and logistics activities. Generic impediments, felt by all industry sectors, include: suitability of products or services for on line transactions, internal and external skills availability, infrastructure and implementation costs, concerns over security and privacy, and regulatory barriers. Of somewhat greater concern for both user organisations engaging in supply chain related activities and distribution and logistics businesses are such things as: security and privacy of shared information; equipment, messaging and payments standards; and regulatory difficulties. These issues are magnified in logistics and related supply chain management activities because of their networked nature, and they are doubly magnified when those activities cross international borders, because of both network extension and added complexity

Evidence suggests that there is value in experience, with lack of expertise a greater barrier to those businesses not on line than it is for those already on line. However, experience also brings new problems, with lack of standardisation a greater barrier to those on line than anticipated by those not on line. Differences between countries and industries appear to be related to learning and network development. For example, those not selling on line tend to see the unsuitability of products, lack of customer demand or customers not being ready as the main barriers. Once selling on line, security concerns, logistics and fulfilment issues loom larger. Similarly, in those countries with relatively lower levels of adoption, a higher percentage of enterprises cite barriers, and the barriers most cited tend to relate to customers not being ready.

Because of the networked nature of supply chain management, there are additional difficulties with co-ordination, integration, harmonisation and standardisation. Having users, both upstream and downstream, who are already connected and experienced, and with whom it is possible to integrate systems, is crucial for the successful application of e-commerce, supply chain related e-business solutions and digital delivery of services. Co-operation within industry verticals and along supply chains is essential, and issues relating to privacy, security and compatibility loom large. Harmonisation and standardisation of systems is vital. Another critical issue is data integrity, with the present level of accuracy of data in the system often insufficient to support supply chain integration and the implementation of increasingly data intensive systems (*e.g.* RFID).

Table A. Potential and current status of digital delivery in distribution and logistics

Service Type	*Potential*	*Current Status*	*Policy Issues*
Warehousing & Storage	High	Advanced, and now integrating with track & trace systems, etc.	Mix of regulatory and facilitative issues
Transport (Air, Sea, Truck, Courier, Post, etc.)	Moderate / High	Some advanced areas, but some lagging. Adoption and use now growing. Integration with ITS beginning	Enormous range of related regulatory issues
Services (3PL/4PL, single service, fulfilment, broker, etc.)	Very High	Advanced, but lacking full integration	Framework and enabling conditions crucial

Source: Author's own analysis.

Emerging issues and challenges

With the ultimate aim, perhaps dream, of reversing the supply chain so that actual rather than forecast demand drives production and shipment, technologies contributing to transparency and immediacy of information and product flows are keenly sought. Radio frequency identification devices (RFIDs) are currently the leading-edge of product tracking, with adoption being driven by major customer demands and falling equipment costs. Take up is rapid, but many challenges remain – with standards, data integrity, integration and consumer resistance (*e.g*. privacy concerns) among the most important. In many ways, the challenges involved in implementing RFID are a microcosm of the broader challenges facing logistics.

Government involvement at the generic, cross-sectoral level focuses on: strengthening the framework conditions underpinning the use of e-commerce, supply chain related e-business solutions and digital delivery; enhancing diffusion of e-commerce and e-business best practice; and ensuring that the business and regulatory environments enable their positive impacts to diffuse widely. At the sectoral level, governments are becoming increasingly aware of the importance of distribution and logistics for a range of economic, environmental and social reasons. At the same time, governments and semi-government agencies are often intricately involved, through the ownership and operation of infrastructure (*e.g*. roads, ports, etc.) and as major in-house producers and users of logistics services (*e.g*. defence procurement). Consequently, there are many points at which government policy and logistics activities intersect and many points of potential leverage.

Developing, monitoring and maintaining a supportive regulatory environment for e-commerce, e-business and digital delivery is already a priority for many OECD governments. Competition policy is vital. Policy makers need to be aware of the effects of e-commerce and digital delivery on competition (*e.g*. possible consolidation) *and* of competition on the adoption and use of e-commerce and digital delivery (*e.g*. possible development of multiple incompatible proprietary systems, promotion of innovation, etc.). One challenge will be to appropriately define 'markets', taking account of the entire supply chain and looking at competition between supply chains as well as at that between firms within supply chains.

There are many cases in which regulation in what might at first sight seem unrelated areas can impact upon distribution and logistics activities. These include: transport, congestion, pollution, urban and land-use planning, product stewardship and producer responsibility (*e.g*. for recycling). While these are outside the scope of this paper, they demonstrate the complexity of linkages and the difficulty of the task facing governments and regulatory agencies. In all these areas, the implications of changed logistics demands, capabilities and patterns created and/or enabled by the use of e-commerce, supply chain related e-business solutions and digital delivery should be considered. Conversely, their impacts as potential enablers or

barriers to the adoption and development of e-commerce and digital delivery in logistics should be taken into account.

More directly, governments can contribute to the further development of e-commerce, the adoption of supply chain related e-business solutions and digital delivery in distribution and logistics through attention to:

- Bandwidth availability and competitive communications costs, by ensuring that communications and media regulation encourage provision of low cost broadband services.
- Working in national and international fora to promote compatibility and interoperability through the development of standards relating to the documents and forms exchanged, product codes, tagging and reading devices. There is also considerable potential for governments to support the development and harmonisation of standards in areas relating to particular logistics technologies, such as radio frequencies allocations for RFID.
- Promoting innovation in government procedures to reduce the time and cost of regulatory compliance in international trade transactions.
- Promoting the sharing of knowledge among groups working towards the harmonisation of national regulation and protocols for information exchange, and the development of standards for open Internet-based systems, efficient customs procedures and consistent liability regulations.
- Addressing a range of privacy, security and confidentiality issues that are fundamental to the digital delivery of distribution and logistics services by, for example, assisting in the development and adoption of systems that allow accessibility and promote collaboration while at the same time ensuring data security, integrity and commercial and personal privacy.
- Addressing concerns relating to security of payments, authentication and the potential for fraud through regulatory, education and awareness initiatives.
- Fostering quality certification and accreditation of service providers, by working with industry and professional organisations to encourage accreditation and continuous professional development.
- Promoting education and skills development (*e.g.* in logistics, supply chain management, ICTs and organisational change management), internal retraining and reskilling in support of business transformation.
- Serving as a role model, by buying and selling services on line, pursuing advanced integrated logistics solutions in government and supporting initiatives that aim to raise the awareness of other organisations to the potential advantages of e-business and digital delivery alternatives, and
- Ensuring a base level of compatibility between, and co-ordination of, logistics related and intelligent transport systems (ITS) initiatives, by helping industry associations and other stakeholders to create the fora and the environment in which co-operation and co-ordination are possible.

In all these areas governments can play a significant facilitating role, contributing to unlocking the full potential of integrated advanced logistics supported by e-commerce, supply chain related e-business solutions and digital delivery. Because of the generic, enabling role of distribution and logistics, by doing so governments will also contribute to the efficiency and competitiveness of their economies *and* the diffusion of best practice through and across supply chains.

INTRODUCTION

Distribution and logistics operations are shaped by many factors, including the structure of the supply and demand side industries and/or markets, the degree of transportability and durability of the products, and the level of regulatory control over local and national markets. As an enabler of other business activities, logistics can be a source of competitive advantage for firms, local and national economies. ICTs play a central role in what are dispersed and information intensive activities in which e-commerce, e-business solutions and digital delivery can make, and are making, significant impact.

Distribution and logistics processes depend upon ICTs to support the interchange of information among trading partners in the supply chain, the capture and management of high quality source data (*e.g.* track and trace), inter-enterprise co-ordination (*e.g.* EDI and supply chain management) and the collaboration of people (*e.g.* e-mail, conferencing and workgroup systems) (OECD 1996, p10). In turn, ICT-enabled distribution and logistics activities can underpin and drive e-business developments in other industries.

This report begins by defining and scoping distribution and logistics activities. It then outlines the current situation and trends within the wholesale distribution, freight transport and logistics services industries, analyses the drivers and potential for digital delivery and the level of adoption of e-commerce and supply chain related e-business solutions. These sections lay the foundation for an analysis of the impacts of digital delivery, e-commerce and supply chain related e-business solutions on distribution and logistics activities, impediments to their greater use, new challenges and policy issues.

Definitions

Distribution and logistics activities include elements of wholesale distribution, auxiliary activities to the transport industry (*i.e.* transport and storage) and a range of transport and delivery related activities. However, there is no single international definition, with Singapore and the United States the only countries to include logistics in their national industry classifications – in the case of Singapore, 'value added logistics providers' is a subcategory of 'storage and warehousing'; whereas in the case of US NAICS, logistics appears as a consulting service, under 'professional, scientific and technical consulting services' (Schwarzler, 2002).

Discussing transport at the 16th meeting of The Voorburg Group, it was noted that:

Warehousing and distribution services belong to a different industrial classification, however, single contracts integrating elements of transport, storage and distribution are increasingly common. There is also the difficulty of identifying road freight services in relation to other services such as freight forwarding or companies providing a range of inter-modal freight transport. Many large scale freight transport companies consider themselves as "logistics" companies engaged in every aspect of the movement of goods. Such companies are less dependent on just haulage for income and often subcontract significant parts of its [sic] road transport activity (Schwarzler 2002).

It is, in short, becoming increasingly difficult to identifying distribution and logistics, and separate warehousing and storage activities from related transport and value-adding services activities.

Box 1. Indicative NAICS Definitions of Wholesale, Transport & Warehousing

The *Merchant Wholesalers* sector (NAICS 42) includes firms engaged in wholesaling merchandise, generally without transformation, and rendering services incidental to the sale of merchandise. The sector comprises two main types of wholesalers: merchant wholesalers that sell goods on their own account and business-to-business electronic markets, agents and brokers that arrange sales and purchases for others, generally for a commission or fee. Activities include distributors of durables and non-durables.

- *Durable Goods* wholesalers sell capital or durable goods to other businesses. Merchant wholesalers generally take title to the goods that they sell (buying and selling goods on their own account). Durable goods are new or used items generally with a normal life expectancy of three years or more. Durable goods merchant wholesale trade establishments are engaged in wholesaling products, such as motor vehicles, furniture, construction materials, machinery and equipment (including household appliances), metals and minerals (except petroleum), sporting goods, toys and hobby goods, recyclable materials and parts.
- *Non-durable Goods* wholesalers sell non-durable goods to other businesses. Non-durable goods are items generally with a normal life expectancy of less than three years. Non-durable goods merchant wholesale trade establishments are engaged in wholesaling products, such as paper and paper products, chemicals and chemical products, drugs, textiles and textile products, apparel, footwear, groceries, farm products, petroleum and petroleum products, alcoholic beverages, books, magazines, newspapers, flowers and nursery stock and tobacco products.

The *Transportation and Warehousing* sector (NAICS 48 & 49) includes industries providing transportation of passengers and cargo, warehousing and storage of goods, scenic and sightseeing transportation and support activities related to various modes of transportation. The Transportation and Warehousing sector includes three basic types of activities: subsectors for each mode of transportation, a subsector for warehousing and storage, and a subsector for establishments providing support activities for transportation. Warehousing establishments in this sector are distinguished from merchant wholesaling in that the warehouse establishments do not sell the goods.

- The *Warehousing and Storage* subsector (NAICS 493) includes firms primarily engaged in operating warehousing and storage facilities for general merchandise, refrigerated goods and other warehouse products. These establishments provide facilities to store goods. They do not sell the goods they handle. These establishments take responsibility for storing the goods and keeping them secure. They may also provide a range of services, often referred to as logistics services, and related to the distribution of goods. *Logistics services* can include labelling, breaking bulk, inventory control and management, light assembly, order entry and fulfilment, packaging, pick and pack, price marking and ticketing, and transportation arrangement. However, establishments in this industry group always provide warehousing or storage services in addition to any logistic services. Furthermore, the warehousing or storage of goods must be more than incidental to the performance of services, such as price marking.

Source: US Census Bureau (2004a), *2002 NAICS Definitions*. Available at http://www.census.gov/.

For the purposes of examining the scale of distribution and logistics activities, we refer to the aggregate categories of Wholesale Trade (NAICS 42) and Transportation and Warehousing (NAICS 48-49, particularly NAICS 493 'Warehousing & Storage') for North America, Transport (NACE 60-64, particularly NACE 631 'Cargo Handling & Storage') and Wholesale and Commission Trade (NACE 51) for Europe and their equivalents elsewhere. In the light of classification difficulties, however, the subsequent analysis is founded upon an activity-based rather than an industry-based definition of logistics.

The scale of activities

National statistics indicate the significance of distribution and logistics activities. In the United States, wholesale, transport and warehousing activities (NAICS 42, 48-49) involved some 640 000 establishments in 2002, employed almost 9.8 million people and realised sales of around USD 4 700 billion. Of these totals, wholesaling activities (NAICS 42) employed 6 million and realised sales of USD 4 376 billion, while warehousing and storage (NAICS 493) employed 535 000 people and realised sales of around

USD 12 billion. Activities of agents, brokers and e-markets involved 225 000 people and realised sales of USD 452 billion, accounting for 3.7% of wholesale trade employees and 10% of total wholesale trade sales (US Census 2004) (Table 1).

Table 1. Transport and distribution in the United States, 2002

	Establishments (Number)	*Sales (USDm)*	*Employees (Number)*
Wholesale trade	*438 301*	*4 376 337*	*6 010 889*
Durable goods	262 751	2 085 961	3 404 252
Nondurable goods	143 274	1 838 232	2 381 643
Agents, brokers & e-markets	32 276	452 144	224 994
Transportation & Warehousing	*200 706*	*..*	*3 751 022*
Warehousing & storage	12 123	..	534 768
Partial total	*639 007*	*..*	*9 761 911*

Source: US Census (2004), *2002 Economic Census, Table 1* (http://www.census.gov/econ/census02/advance/TABLE1.HTM).

Partial data for the EU15 suggest that transport activities (NACE 60-64) involved more than 750 000 enterprises in the EU15 in 2000, employed some 3.5 million people and realised turnover in excess of EUR 750 billion. Of this total, cargo handling and storage related activities (NACE 631) employed more than 1 million people and realised turnover of around EUR 235 billion. In 1999, wholesaling activities (NACE 51) in the EU15 countries involved more than 1 million enterprises, employed more than 7 million people and realised turnover in excess of EUR 2 250 billion (Table 2) (European Commission 2003).

Table 2. Transport and distribution in Europe, 2000

	Transport			*Cargo Handling & Storage*			*Wholesale*		
	Enterprises	*Turnover EURm*	*Employees*	*Enterprises*	*Turnover EURm*	*Employees*	*Enterprises*	*Turnover EURm*	*Employees*
Austria	11 552	..	..	1 003	7 559	24 000	17 804	72 168	192 550
Belgium	13 536	33 037	197 600	2 137	12 019	40 100	42 175	135 424	220 374
Denmark	14 372	..	132 800	1 320	4 642	20 000	22 733	73 504	176 800
Finland	23 177	13 999	112 800	1 145	3 368	17 500	16 443	41 000	82 946
France	91 350	124 744	1 010 900	6 471	42 019	235 500	160 873	477 122	970 557
Germany	73 791	131 796	..	10 066	48 945	..	..	..	1 213 405
Greece	..	..	..	..	..	..	..	..	..
Ireland	4 120	..	44 800	541	1 565	6 800	5 361	20 150	56 344
Italy	161 862	99 434	884 200	15 672	30 120	217 800	407 875	295 139	1 015 231
Luxembourg	953	..	16 500	111	320	1 500	2 953	7 018	12 499
Netherlands	23 510	..	..	3 815	5 639	57 300	54 305	224 274	431 243
Portugal	19 691	..	136 300	1 417	2 904	25 500	49 310	58 982	266 319
Spain	215 967	68 121	714 700	12 448	21 691	133 600	177 932	241 844	879 431
Sweden	30 815	35 025	209 800	2 454	10 520	40 300	42 227	84 144	217 000
UK	65 250	184 781	..	10 062	41 894	228 400	119 972	523 267	..

Note: Wholesale data for 1999.

Source: European Commission (2003), *Energy & Transport in Figures 2003*, European Commission, Brussels; and Eurostat (2002) *Distributive Trades Statistics*, Cat KS-NP-02-009-EN-N, European Commission, Brussels.

In Japan, it was estimated that total logistics costs in 1998 were YEN 47 trillion (USD 359 billion), or approximately 9.5% of GDP (TEKES 2001). Wholesale and retail distribution (SIC 50-54, 56-57 and 59) accounted for around 12% of Japan's GDP in 2001, and for 32% of the labour force (Tachiki *et al.* 2004, p9). In Canada, total revenues of logistics firms were estimated at CAN 50 billion (USD 36 billion) in 2002, around 8% of total services GDP, and employment in logistics related firms 400 000, with a further 480 000 employed in in-house logistics activities (Strategis 2004a). In Australia, freight logistics activities represented approximately 9% of GDP or AUD 57 billion (USD 33 billion) in 1999-2000. Of these activities, approximately AUD 31 billion (USD 18 billion) were performed in-house. The remaining AUD 26 billion (USD 15 billion) represented those activities undertaken by the freight logistics industry as services to the business community, of which AUD 23 billion (USD 13.4 billion) was for services provided by transport logistics suppliers (BTRE 2001). Annex Tables A1, A2 and A3 show employment, production and value add for the wholesale & retail and transport & storage sectors in OECD countries on a consistent basis for the years 1990 to 2002. They reveal the scale of transport, storage and distribution activities.

Because there is no agreed definition of logistics, estimates of the scale of activities vary. Logistics related expenditures are estimated to be equivalent to around 10% to 12% of GDP – 11% in North America, 12% in Europe and 9% in Australia (Bowdler, *et al.* 2002, p10). As a share of sales, logistics costs have been falling – in Japan, from more than 10% in 1975 to less than 7% in 2002 (JILS 2003), and similar drops have been noted elsewhere (Strategis 2004a). The largest share of distribution costs by function is transport (*e.g.* 61% in Japan). The other elements are: storage (18.4%), handling (10.2%), packaging (5.25%) and management (5.25%) (JILS 2003). Elsewhere, estimates of the share of transport are somewhat lower – *e.g.* 46% in the United States, 41% in Europe (Rushton, *et al.* 2000) and 42% in Canada (Strategis 2004a).

The scope of activities

An activity-based view of distribution and logistics brings into sharper focus the range of activities involved, the importance of related information flows and the many potential points of impact for e-commerce, e-business applications and digital delivery.

Strategis (2004a) suggested that logistics is the process of planning, implementing and controlling the flow and storage of goods and services and related information from the point of origin to the point of consumption. Supply chain management provides supervision and direction for the various parts of the distribution system, including production scheduling and inventory control, transportation, warehousing, wholesaling, retailing and brokerage. In this study, distribution and logistics refers to the movement of goods and services from suppliers to customers. It includes all of the transport, handling and storage requirements involved. Recognising that the door-to-door movement of goods with multiple operators and administrations results in information flows that are much more complex than the physical flow of goods (UNCTAD 2003a), it also includes related information flows.

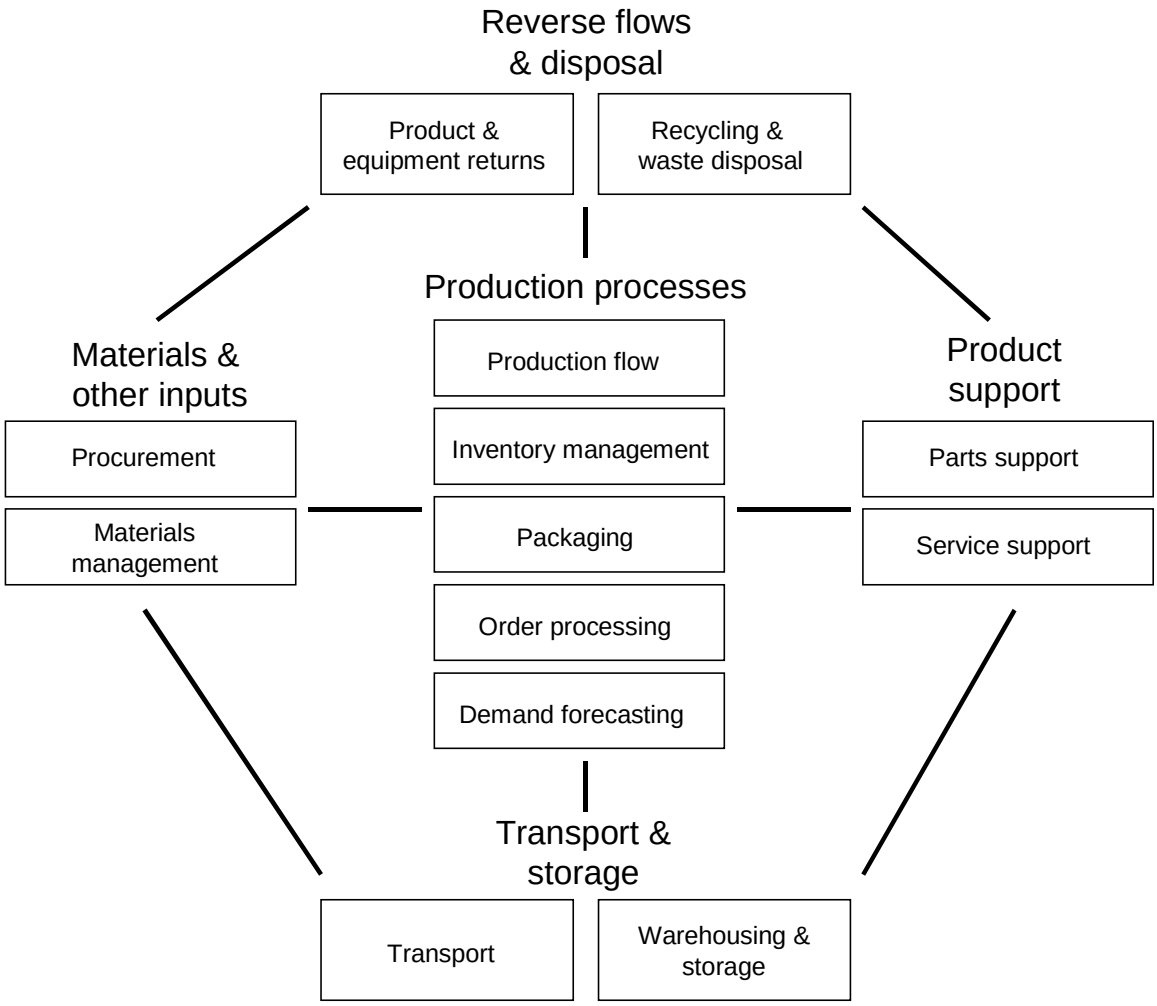
BTRE (2001) provided the following overview of logistics activities – focusing on production processes, materials and other inputs, transport and storage, product support, and reverse flow and disposal – which demonstrates the range of activities involved (Figure 1).

- *Production processes* incorporate production flow management, inventory management, packaging, order processing and demand forecasting.

Production flow management includes production planning and materials handling, which involves movement of raw materials, work in process or finished goods within a plant or warehouse.

Inventory management focuses on economies of scale (through longer production runs), handling seasonal variations in demand and response to changes in demand.

Figure 1. Logistics activities



Source: BTRE (2001), *Logistics in Australia: A Preliminary Analysis*, Working Paper 49, BTRE, Canberra.

Packaging is used to protect products from deterioration, damage, pilferage and tampering, and facilitate the safe containment of dangerous goods during storage, handling and transport. Packaging also provides standard quantities of a product that reflect consumer requirements, contributes to marketing and promotion, and facilitates transport and storage by conforming to the requirements of equipment such as pallets and containers.

Order processing is the system through which a firm receives orders from customers, tracks the filling of the orders and despatches them.

Forecasting incorporates predictions of future demand, affecting production planning, the quantities of inputs ordered from suppliers and decisions about the amount and mix of products to be transported or stored in each market.

- *Procurement and materials management* can have a major impact on competitiveness. Key issues include price, quality, reliability and availability of inputs when required. Procurement involves the purchase of goods and services from outside suppliers, sales and distribution activities. It is generally undertaken by in-house staff, although the use of external operators (*e.g.* brokers) is increasingly common in many industries.

- *Transport* is generally the largest single component of logistics costs, with warehousing and storage the other main activity costs. Major transport activities, and typical arrangements, include: local pick-up and delivery, regional and long-distance transport, with the mode varying in response to factors such as cargo characteristics and destination.

- *Warehousing and storage* play an important part in the production process as well as product distribution.

- *Product support* is a key component of many competitive strategies, with the increased emphasis on service quality in many sectors of the economy. Parts and service support (including installation and maintenance) can be used to enhance the attractiveness and reputation of a firm and its products. These activities are particularly important in situations where any delays or equipment down-time would impose significant costs on the firm's customers.

- *Reverse flows and disposal* are also important activities. Reverse logistics involves the handling, storage and movement of material that flows from the end customer back to the seller or supplier. Appropriate handling of product returns assists a firm to enhance its relations with customers and to identify problems in production processes or product design. Efficient practices in equipment returns (*e.g.* empty containers) facilitate cost savings and adequate availability of equipment. Increasingly, in response to environmental concerns and regulation, there are detailed and extensive requirements for recycling and waste disposal, including an increasing emphasis on producer responsibility and 'product stewardship', which require sophisticated reverse logistics.

With these activities in mind, this report focuses on the use of e-commerce (*i.e.* on line purchasing and sales), e-business solutions relating to the operation and management of the supply chain (*e.g.* procurement and the co-ordination of supplies, demand forecasting, the use of on line catalogues and e-marketplaces, etc.) and digital delivery (*i.e.* the sending or receipt of digital products and services).[1] While the main focus is on these activities in the transport and distribution sectors, their adoption in other sectors that are both users and in-house producers of logistics services is also considered.

Themes for analysis

This study analyses the following questions:

- *What is the current situation in the distribution and logistics sector* – covering such issues as current industry structure and business models, recent market and industry trends, characteristics and dynamics.

- *What are the drivers of the digital delivery of distribution and logistics services* – covering such issues as new service possibilities, customer expectations and demands, market access and expansion, efficiency, cost reduction and regulatory change.

- *What is the potential for e-business and digital delivery in distribution and logistics* and which services are most amenable to digital delivery – covering such issues as ease of remote delivery,

the nature of the service and possible need for complementary face-to-face support and/or physical delivery.

- *To what extent are e-business and digital delivery being adopted in distribution and logistics* – covering such issues as the current level and rate of adoption, and the effects of different distribution channels (*e.g*. broadband access) on current and future use.

- *What are the impacts of the digital delivery on distribution and logistics services* – covering such issues as what established activities are affected and what are the impacts on business models, performance and growth, efficiency and productivity, industry structure and competition among services producers and providers, and on other user and related industries.

- *What are the major impediments to the digital delivery of distribution and logistics services* – covering such issues as access to and cost of the necessary infrastructure, skills and awareness, innovation by suppliers and users, market structures and regulatory barriers.

- *What are the policy issues that arise* from the use of e-commerce, supply chain related e-business solutions and digital delivery in distribution and logistics services – covering such issues as network infrastructure, standards, intellectual property, payments and transactions, privacy, security and trust, trade, investment and taxation, etc., and

- *What policy approaches might be developed to overcome impediments* – covering both existing and new approaches.

KEY CHARACTERISTICS AND RECENT TRENDS

This section analyses industry structures and recent trends in distribution and logistics. It reveals a picture of rapid change, in which ICTs are playing an increasingly important role.

Industry structures

Distribution and logistics services are provided by a range of organisations, with market segments structured according to economies of scale or scope, levels of capital investment, specialisation in particular fields of activity and/or vertical markets, firm competencies and the changing demands and structures of users and user industries. The providers of distribution and logistics services include in-house operations and four major categories of external providers:

- *Contractors and specialists* (*e.g.* warehouse and storage operators, couriers, road transport owner drivers, etc.), with services based on such factors as specialised skills and knowledge, traffic and load aggregation, and specialised assets (*e.g.* warehouses, distribution centres, trucks, cargo aircraft, etc.).

- *Brokers and agents* (*e.g.* customs brokers, freight forwarders, etc.), with services based on such factors as specialist skills and knowledge (*e.g.* of shipping schedules, customs requirements, etc.).

- *Multi-service logistics operators* (sometimes known as 3PLs), with services based on co-ordination of closely related activities in the supply chain (*e.g.* transport and warehousing), and

- *Integrated logistics providers* (sometimes known as 4PLs), with services based on high levels of integration across major parts of the value chain, comprehensive sharing of information with clients and the management of significant parts of the supply chain on a longer-term contractual basis (BTRE 2001).

Transport businesses vary enormously, with specialisation by mode (*e.g.* airlines, shipping lines, railway operators and road transport), by focus of activities (*e.g.* bulk cargo handling versus small package delivery) and by geography (*e.g.* international shipping versus local courier services). Warehousing and storage businesses also vary, specialising by location and focus of activity (*e.g.* refrigerated food stores, etc.). All segments include a range of firm sizes, from one-person operations (*e.g.* local driver delivery) to large multinationals (*e.g.* shipping and airline businesses).

One of the key features of distribution and logistics activities is that they tend to be user driven, responsive to customer needs. They are rarely the drivers or source of major changes. Another feature is that logistics services tend to be structured around long-term relationships, based on client trust and built on historical experience with particular service providers. This is particularly true in the higher value-adding segments, such as full services logistics management, where logistics businesses become vertically integrated into the value chain and, thereby, into the operational structures of client businesses. Consequently, dynamic market entries and exits are relatively rare outside basic services, such as couriers and messengers (Dantuma and Hawkins 2001). Rather, the increasing demand for integrated logistics

services is driving consolidation among distribution and logistics services providers, as businesses seek to encompass the necessary skills and services within their product offerings.

Box 2. Logistics services

Logistics services providers include contractors and specialists, brokers and agents, multi-service logistics operators and integrated logistics providers.

A *contractor or specialist* is an organisation that undertakes a small number of closely related logistics activities, involving narrow interactions with each buyer of its services. Examples of these service providers include: couriers, some major rail operators, suppliers of pooled pallets, airline freight operations and road transport owner-drivers. Contractors and specialists may provide cost savings and/or superior services by applying specialised skills. Aggregation of traffic from multiple users enables them to realise economies of scale and network economies that would not be available to users operating their own services. Differences in working conditions or the cost of capital may also provide cost advantages.

A *broker or agent* provides advice (*e.g.* on customs requirements or freight rates) and arranges various logistics activities. Examples of these service providers include: traditional freight forwarders, custom brokers and warehouse brokers. Brokers and agents have specialised skills (*e.g.* knowledge of shipping schedules and freight rates) but offer a wider range of services than contractors and specialists. For example, freight forwarders co-ordinate activities such as the booking of space, preparation of documentation, customs clearance and the pick-up and delivery of cargoes. They are particularly important for smaller shippers selling into export markets.

A *multi-service logistics operator* (3PL) provides logistics services at several stages of the logistics chain. The services are coordinated with each user's operations. There is significant variation in the mix of activities undertaken by individual operators. Multi-service operators typically focus on closely-related physical activities, such as transport and warehousing. They may provide some co-ordination and enhancement of chain performance using their information systems, but do not manage services across the chain. These operators range from organisations with a variety of loosely-connected activities to operators that provide a limited number of well-coordinated services.

An *integrated logistics provider* (4PL) is an organisation that manages major parts of the logistics chain for firms such as large manufacturers. They have specialist skills and equipment and they integrate various activities to provide 'complete logistics solutions'. Their contributions include supply chain design, capital assets, management, maintenance and information systems. An integrated logistics provider may improve the performance of a supply chain by identifying and contracting appropriate service providers, aggregating traffic, redesigning processes and optimising the logistics chain. Its operations typically incorporate sophisticated information systems that provide such capabilities as vehicle routing, scheduling, track and trace, warehouse management and performance reports.

Source: BTRE (2001), *Logistics in Australia: A Preliminary Analysis*, Working Paper 49, BTRE, Canberra.

Rather than being simply a system of distribution, increasingly logistics is a system in which information and goods are exchanged. This exchange has become accentuated as production systems have evolved from producer oriented 'push systems' based upon mass production, to consumer oriented 'pull systems' based upon flexible customisation. The predominant, but by no means exclusive direction of flow of goods is downstream from producers to consumers; whereas the predominant, but by no means exclusive direction of flow of information is upstream from consumers to producers.

Recent trends

Distribution and logistics have been evolving rapidly, in response to changing industry and consumer requirements. Recent trends include: globalisation, increased competition and a new focus on logistics; falling distribution and logistics costs; increased outsourcing; consolidation of businesses involved in distribution and logistics activities, with integration of activities such as transport and storage into full service logistics solutions; and an increasing integration of distribution and logistics into value chains.

Globalisation, competition and the increasing focus on logistics

Globalisation, deregulation and the reduction of industry protection have brought enhanced competition to almost all sectors of OECD economies. As a result, there has been an increasing focus on costs, including logistics and distribution costs. Logistics and distribution have also been a focus for attempts to improve product transportability, and thereby tradability; improve or maintain product quality through improved packaging and handling, and thereby enable premium pricing; and increase responsiveness to market requirements. Indeed, whereas logistics strategies used to be focused on cost reduction, they are now increasingly seen as a potential source of competitive advantage and revenue enhancement – through the optimisation of performance in such areas as order cycle times, on-time delivery, order fill rates, transit times, order status information, condition of product when delivered and billing accuracy (BTRE 2001).

The reduction of trade barriers, growth of financial markets and improvements in information technology have also contributed to an expansion of international commerce. This expansion has been accompanied by increased requirements for logistics services and a restructuring of services to support increasingly global client businesses. The involvement of more businesses in international trade has also increased the scope and complexity of logistics activities. Movement of products in overseas markets can involve a range of difficulties (*e.g.* maintaining product quality), particularly in countries where logistics services are not well-developed (BTRE 2001). There are also varied regulatory conditions and different customs and quarantine requirements to be dealt with.

As a response to globalisation and increased competition there has been widespread adoption of more efficient production processes among users, which in turn require more sophisticated logistics services. Just-in-time (JIT) manufacturing and the operation of production lines with very low levels of inventory requires smaller, more frequent deliveries of inputs and closer relationships with suppliers. Similarly with efficient consumer response (ECR) and continuous replenishment of inventory and flow through distribution in which retail inventory is managed on a just-in-time basis – also known as vendor managed inventory (VMI) and continuous replenishment planning (CRP). Other changes affecting logistics have included total quality management (TQM), single or dual sourcing policies, transnational sourcing, increased use of contract manufacturing, assembly to order and the shortening of product life-cycles (BTRE 2001). Indeed, shorter product life cycles are an important driver, with products that were previously thought of as ‘durables’ increasingly taking on the characteristics of ‘non-durables’, due to fashion (*e.g.* clothing and footwear) and rapid technological change (*e.g.* computers and other electronic goods). All of these factors are increasing the scope, complexity and importance of distribution and logistics.

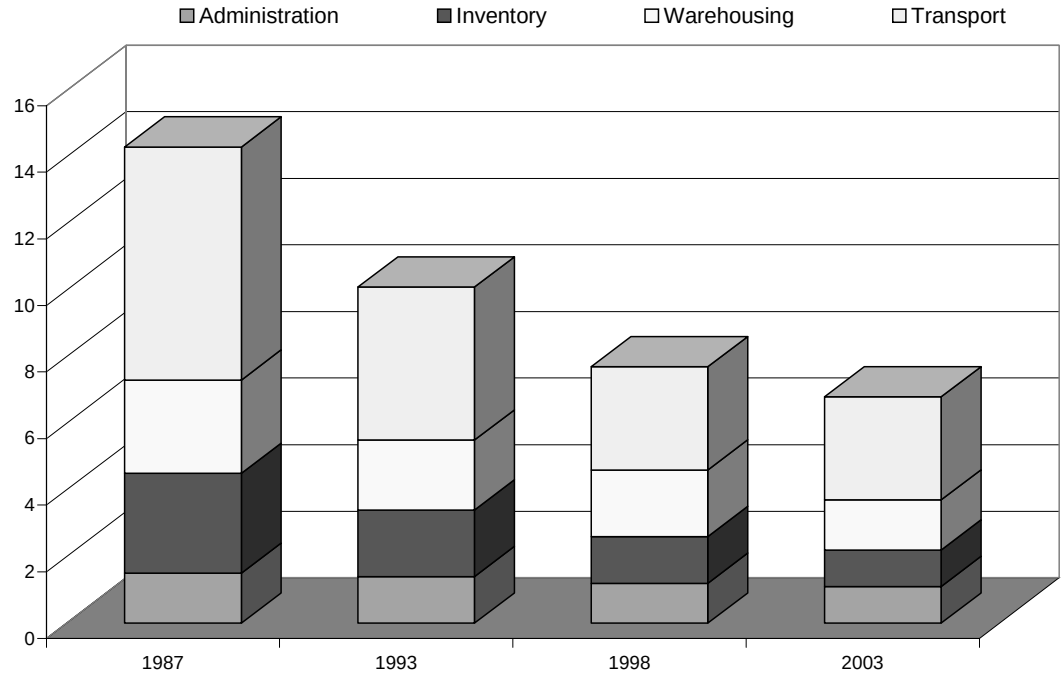
Falling distribution and logistics costs

As noted, the industries and activities involved in distribution and logistics account for a significant share of employment and GDP. Because of differing definitions and timeframes, studies report a range of estimates of the economic significance of logistics activities – anything from 7% to more than 20% of GDP (BTRE 2001). These estimates also reflect country differences in industrial structures, demographics and geography. However, it is clear that transport accounts for the largest share of logistics costs, followed by warehousing and storage, and that logistics costs account for a declining share of total production costs.

BTRE (2001) reported that several studies had shown transport to represent 40% to 45% of logistics costs, with one US study suggesting 46% and a European study suggesting 41%. More recently, JILS (2003) reported that in Japan transport accounted for 61% of distribution costs in 2002, storage for 18.4%, materials handling for 10.2% and packaging and management for 5.2% each. It was also noted that distribution costs had declined from more than 10% of sales in 1975 to less than 7% in 2002 (JILS 2003).

Similarly, the European Logistics Association reported that logistics costs had fallen from 14.3% of revenue in 1987 to an estimated 6.8% in 2003. By 2003, an estimated 46% of European logistics costs were attributable to transport, 22% to warehousing and around 16% each to inventory and administration (Figure 2) (Euro-CASE 2001).

Figure 2. Declining share of distribution and logistics in overall costs, Europe
(per cent)



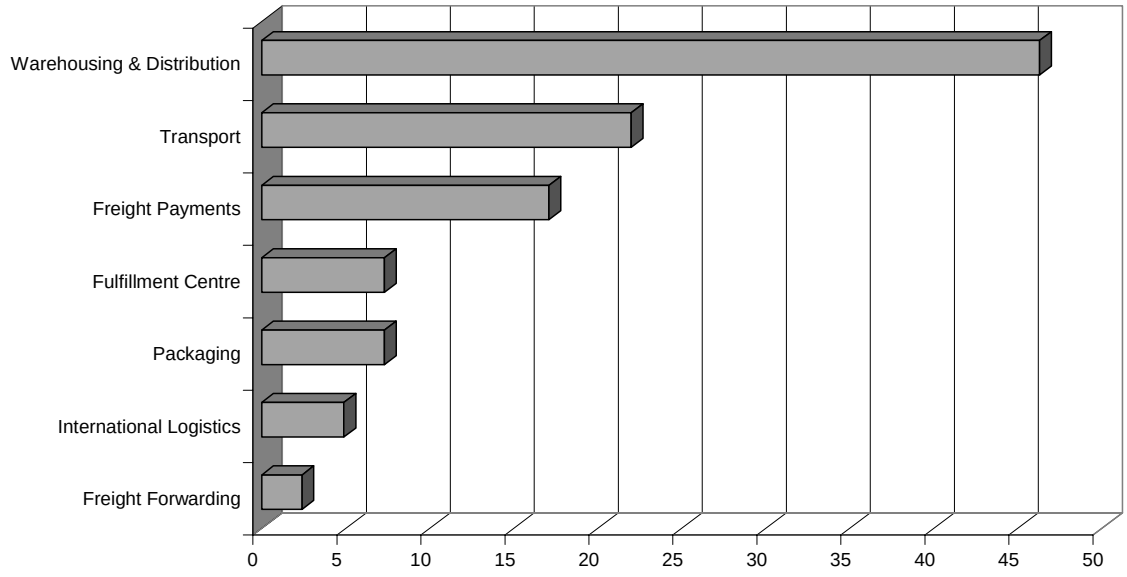
Note: 2003 estimated.

Source: Euro-CASE (2001), *Freight Logistics and Transport Systems in Europe*, European Council of Applied Sciences and Engineering, Paris, p 42.

Outsourcing

One recent development in logistics is increased outsourcing of activities that were previously undertaken in-house. For example, a 1997 study found that more than 69% of *Fortune 500* manufacturers used some form of external logistics service (Bade and Mueller 1999, p79), and in the United States the share of private trucking fleets in the overall truck transport effort has declined while that of for-hire carriers has increased (Costello 2000). In a survey of *Fortune 1000* businesses conducted in 2000, IDC (2000) found that 78% of respondents outsourced some part of their logistics activities – with warehousing, distribution and transport the most frequently outsourced activities (Figure 3). The level of logistics outsourcing varies from country to country. One European study concluded that across 14 countries an average 26% of distribution services were provided by external operators in 1998, with the proportions in individual countries ranging from 12% to 38% (Rushton *et. al*. 2000, pp 58-59).

Figure 3. Logistics activities outsourced, 2000
(percentage of respondents)



Note: N=41.

Source: Ravi, R. (2001), *Key Trends in the Logistics Outsourcing Marketplace,* IDC Bulletin #24119, March 2001.

The potential benefits of outsourcing to external operators include: lower costs, improved service quality, better integration of activities, enabling management to concentrate on their core competencies and the firm's core business, access to global capabilities, capital expenditure savings and working capital reductions (BTCE 2001). Key drivers of logistics outsourcing include operational efficiency and access to logistics and ICT skills and infrastructure (*e.g*. logisticians, specialised software, etc.). As logistics activities become increasingly intertwined with core business activities and strategies, clients are seeking to streamline their outsourcing arrangements, reducing the number of logistics services providers they outsource to and engaging in longer-term contracts in order to more closely monitor performance (Ravi 2001; D'Silva 2004). In turn, this is encouraging consolidation among logistics services providers.

Consolidation and integration

With increasing complexity and diversity of activities, as well as globalisation and the expansion of international markets, comes greater opportunities for, and pressures to realise economies of scale. This is leading to consolidation among distribution and logistics providers. In wholesale distribution in the United States, for example, there was widespread consolidation in the decade to 1995, with the number of wholesale distributors in 14 of the 42 industries (*i.e*. verticals) examined in one study declining by more than 40% (Fein 1997). Similarly, in transport, the freight trucking sector has experienced widespread consolidation, principally through mergers and acquisitions focusing on vertical integration of asset-based and logistics management services (Nagarajan *et al.* 2001, pp343-44).

One aspect of this trend to consolidation is the increasing integration of logistics related services. Logistics services are becoming central to the operation and management of supply chains, and increasingly integrated into them. One consequence of this is that clients are tending to reduce the number of logistics businesses they deal with and enter into longer-term contractual relationships with fewer businesses (as noted above). This, in turn, is driving further consolidation among logistics providers and leading to the emergence of a tiered structure in which major multi- or full-service logistics providers (3PLs and 4PLs) interface with clients, while sub-contracting for some of the activities involved (*e.g*. transport, delivery, warehousing, etc.) to other transport and distribution firms.

The impacts of these trends

Historically, typical distribution functions included shipping and receiving, storage, order picking, breakbulk, freight consolidation and containerisation. Today, many distribution operations are highly automated – already equipped with state-of-the-art material handling equipment and information systems, and moving to adopt new technologies as they emerge (*e.g*. Radio Frequency Identification or RFID).[2] As a result of this and other recent trends, many distribution operations are extending their services to include logistics management, inventory control and tracking, packaging, labelling and bar-coding, procurement, vendor management and customer service functions, such as returns, repair and rework (Lockwood Greene 2002).

Transport is becoming increasingly complex and embedded in economic activity. It is no longer simply a delivery cost, but increasingly a vital element of the supply chain and integral to globalised production and distribution. Traditionally, the transportation of goods was based on freight brokerage, which aimed to minimise the cost of transport by maximising capacity utilisation. With the growth of trade, globalisation of production and international manufacturing, increasing product complexity, supply chain fragmentation and specialisation, both functionally and geographically, and customer demands for flexible customisation and just-in-time delivery, a range of more specialised, value adding activities have emerged.

An overwhelming share of freight shipment relating to distribution is done by road. In the United States, trucking accounts for more than 80% of all freight transportation revenue. The use of just-in-time (JIT) inventory management throughout the supply chain has increased the use of trucks, with a particularly notable increase in scheduled freight (*i.e*. freight that has a definite time of delivery). Another change in the industry is the trend towards shippers reducing the number of carriers they utilise to a core few. This allows better co-ordination of logistics while assuring a high level of service. If a carrier is large enough to take advantage of economies of scale, it can provide a premium service at a reasonable price, based on economies of scope. Many large carriers have started logistics divisions or subsidiaries in response. No longer are they simply transport companies, increasingly they are also logistics and information companies (Costello 2000, p54-4).

Businesses now focus on managing costs throughout the system, from raw material to product delivery and return (*i.e*. on supply chain management). They have moved from a ‘push’ system of production, inventory and sales, to a ‘pull’ system of production based on just-in-time, flexible customisation and build-to-order. Distribution and logistics, which are said to account for up to 20% of some product costs, have become critical supports for supply chain management. To meet this demand a new distribution and logistics services ‘industry’ has emerged, focusing on such activities as taking over responsibility for a client’s warehousing and distribution assets and staff through outsourcing (Portland Development Commission 2002). Ultimately, the aim is to integrate the entire value chain, with multiple businesses contributing to the smooth functioning of the system based on access to network-based systems that provide a ‘glass pipeline’ through which partners can view the entire supply chain flow (Poirier 2003). Consequently, distribution and logistics are becoming increasingly integrated, network-based activities.

Summarising these developments, the key characteristics of distribution and logistics services include: diversity and heterogeneity of activities and services; divergence of scale, as integrated logistics services providers consolidate while many one-person trucking and delivery firms persist; increasing complexity, due to integration and an increasing focus on supply chain management and the globalisation of client businesses; globalisation following the expansion of clients' activities; consolidation of asset-based and knowledge-based activities in the drive to offer one-stop services and realise economies of scale and scope; and an increasingly integrated, networked and information intensive focus. Many of these relate in some way to the adoption of e-commerce, supply chain related e-business solutions and digital delivery, although the extent to which ICTs are a response, a cause or merely a facilitator of changes driven by the forces of competition and other factors is often difficult to determine.

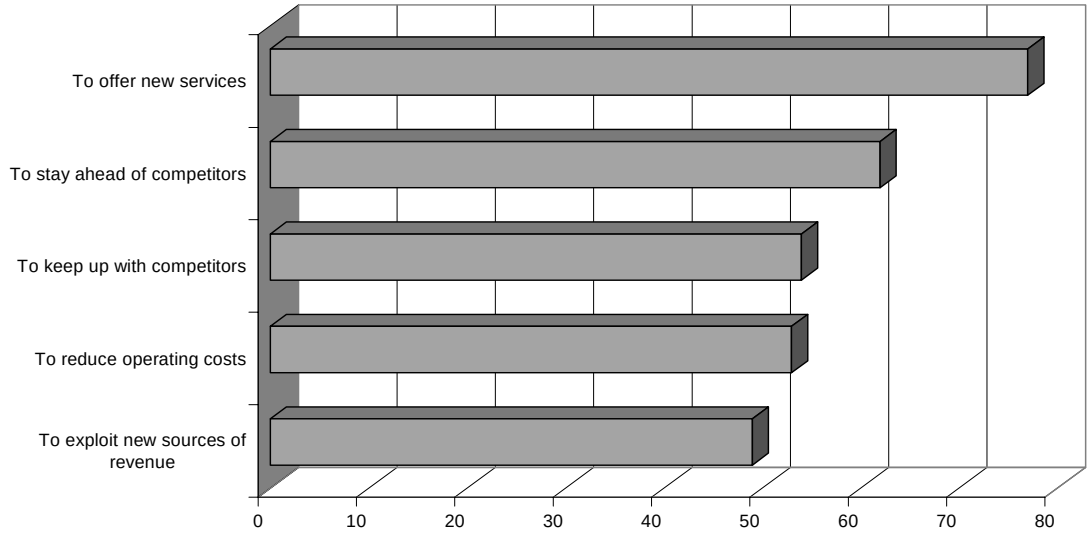
DRIVERS AND POTENTIAL FOR DIGITAL DELIVERY

This section analyses the factors driving organisations to adopt e-commerce, supply chain related e-business solutions and digital delivery in their logistics related activities. It looks at the evidence from experience and then summarises findings in such a way as to identify key drivers. The section concludes by exploring the potential for e-commerce, supply chain related e-business solutions and digital delivery in logistics, both in terms of generic potential and further potential.

Drivers of digital delivery

In an extensive survey of e-commerce activities in 25 countries spanning Europe, the United States, Japan, South Africa and India, Accenture (2001) found that services innovation and enhancement of competitive position were the major drivers of e-commerce adoption – with 77% of those businesses using e-commerce reporting doing so to offer new services to existing customers. Competing and cost savings were also important motivators (Figure 4).[3]

Figure 4. Reasons for pursuing e-commerce in 25 countries, 2001
(percentage of organisations agreeing)

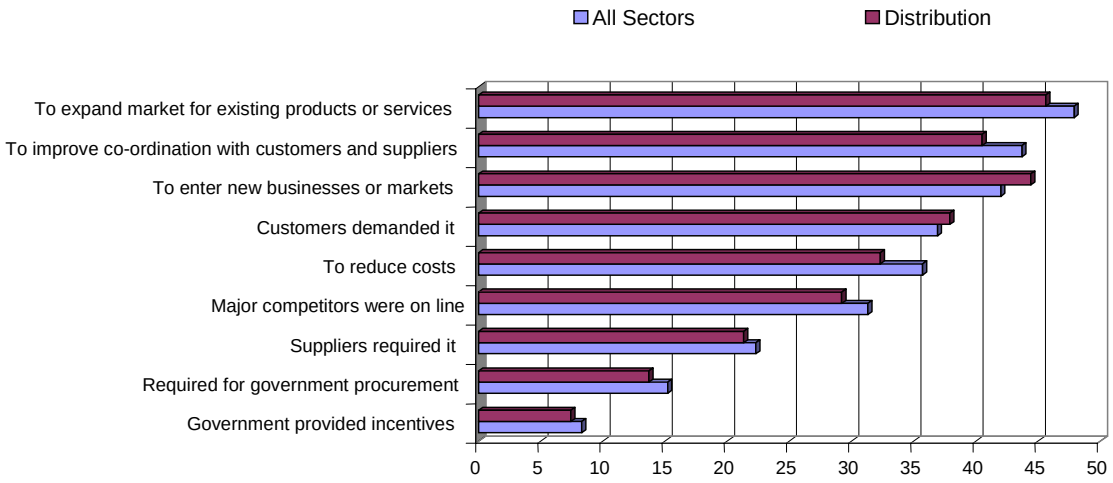


Source: Accenture (2001), *The Unexpected eEurope: The surprising success of European eCommerce*, Accenture.

In a ten country study undertaken during 2002, Kraemer, *et al.* (2002a) found that expanding markets, both new and existing, and improving co-ordination with customers and suppliers were the major reported drivers for the adoption of e-commerce and e-business solutions. Government procurement demands and incentives played a relatively minor role. Reported drivers varied little by industry sector, with wholesale and retail distribution establishments somewhat more responsive to customer demands and interested in

entering new businesses and markets, and correspondingly less driven by cost savings (Figure 5: See also Annex Table A4).[4]

Figure 5. Reasons for adopting e-commerce in 10 countries, 2002
(percentage of establishments saying it was a significant driver)

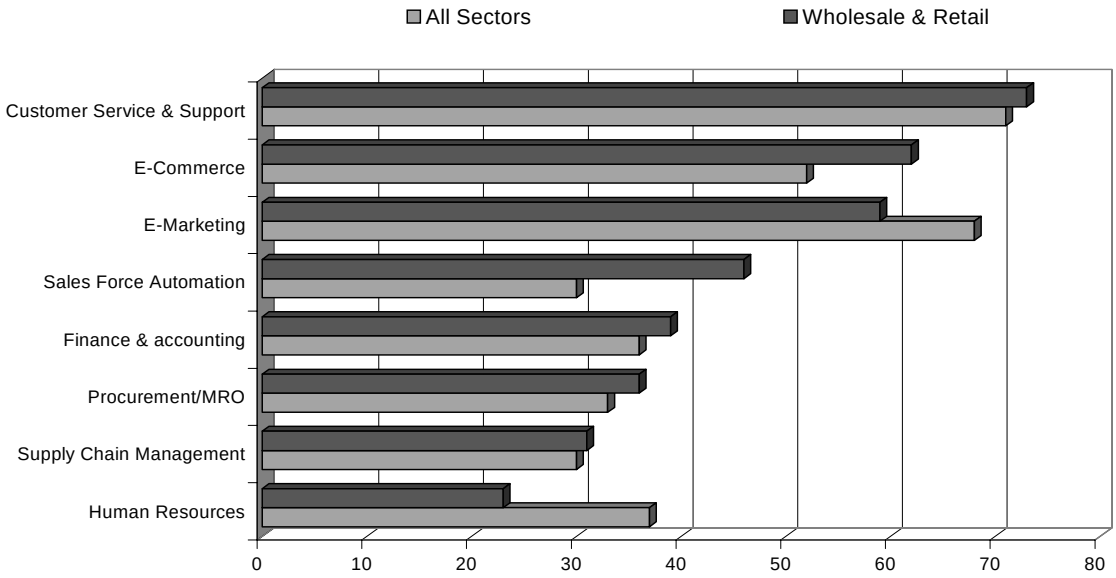


Source: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce: A Mile Wide and an Inch Deep*, CRITO, University of California, Irvine.

In the United States, Varian *et al.* (2002) found that across all industries businesses had adopted customer facing e-business applications first, suggesting that the richness of customer relationships and market reach are major drivers in the adoption of Internet-based business solutions. They found that customer service and support applications were the most commonly adopted, reflecting attempts to get closer to their customers. E-marketing was also widely adopted (Figure 6). The lower adoption levels of back-office solutions, such as finance and accounting, human resources and supply chain management, were thought to reflect priorities with respect to improving relationships with customers. Industry dynamics appeared to determine whether businesses focused on customer attraction or customer retention, with sectors that lend themselves to recurring relations (*e.g.* wholesale and retail trade) tending to focus on building revenue from existing customers, customer support, e-commerce, procurement and supply chain management (Dantuma and Hawkins 2001).

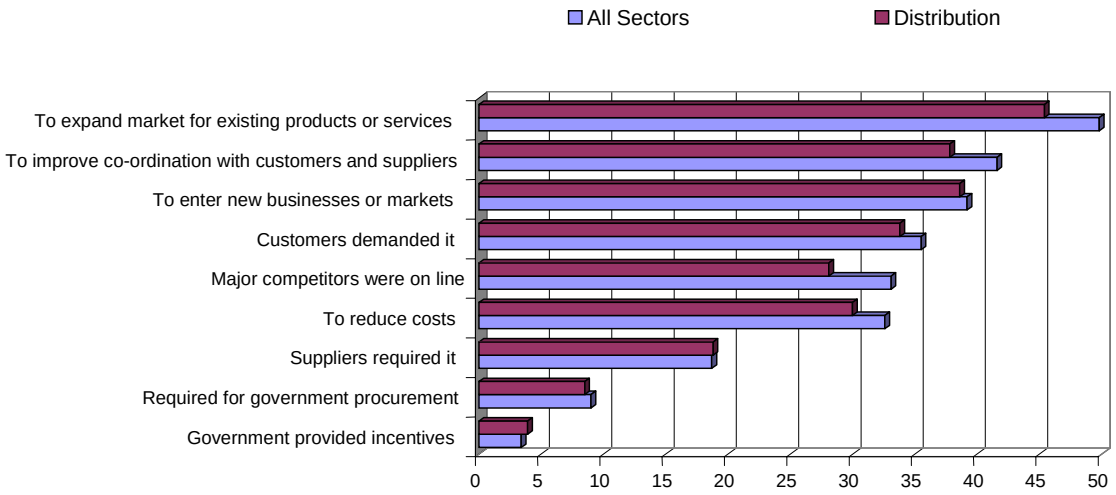
In a survey of US-based establishments undertaken during 2002, Kraemer *et al*. (2002b) found that the most widely cited drivers for the adoption of e-commerce include: expansion of markets for existing products and services (50%), entering new businesses and markets (39%) and improved co-ordination with suppliers and customers (42%). The drivers cited by wholesale and retail distribution establishments were much the same as those across all sectors (Figure 7).

Figure 6. Average Internet business solutions adoption in the United States, 2001
(percentage of businesses adopting)



Source: Derived from Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002, V2.0. pp21-22.

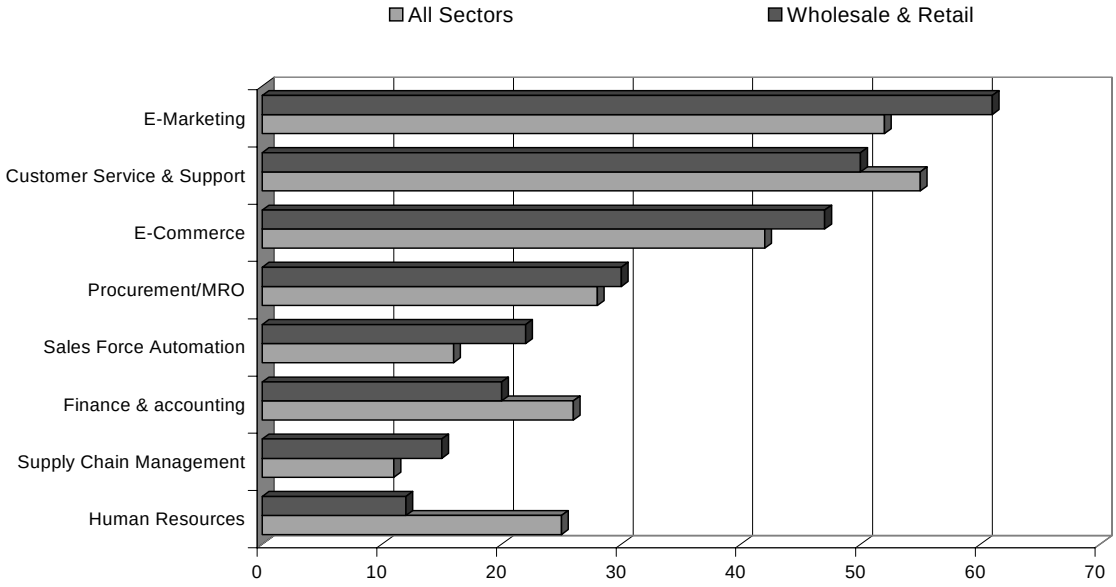
Figure 7. Reasons for adopting e-commerce in the United States, 2002
(percentage of establishments saying it was a significant driver)



Source: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce in the United States: Leader or one of the pack?*, CRITO, University of California, Irvine.

In the United Kingdom, France and Germany, Varian *et al.* (2002) found a similar focus on customer facing applications – with more than half of the businesses using Internet business solutions having deployed e-marketing and customer service and support, compared with 25% or less deploying finance and accounting or human resources solutions (Figure 8). Again industries varied, focusing their efforts to meet industry specific needs. Wholesale and retail businesses reported the highest levels of adoption of e-marketing and e-commerce business solutions, and the second highest adoption of sales force automation and supply chain management; whereas they reported the lowest level of adoption of finance and accounting and human resources solutions of all the sectors studied. This reflects a focus on external and supply chain, rather than internal e-business automation.

Figure 8. Average Internet business solutions adoption in United Kingdom, France & Germany, 2001
(percentage of businesses adopting)

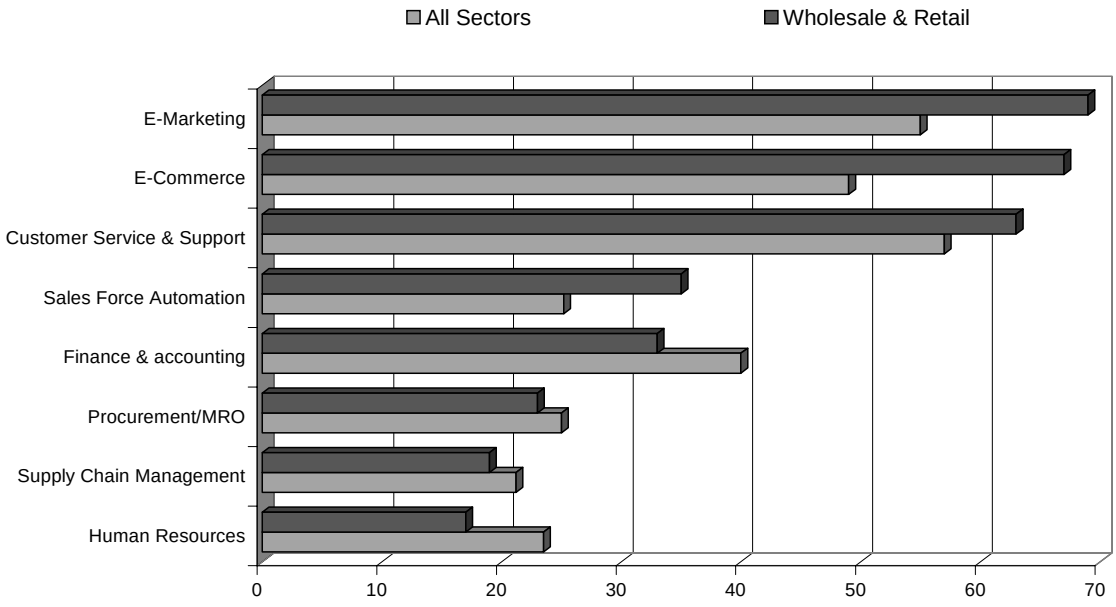


Source: Derived from Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002, V2.0., p38 and p41.

The same pattern was evident in Canada, where the *Net Impact* survey focused on SMEs (CeBI 2002) (Figure 9). Similarly, Strategis (2004b) reported that the main focus of e-commerce among logistics services providers in Canada was collaboration and visibility within the supply chain, enabling buyers, manufacturers and services providers to collaborate on product forecasts and product flow.

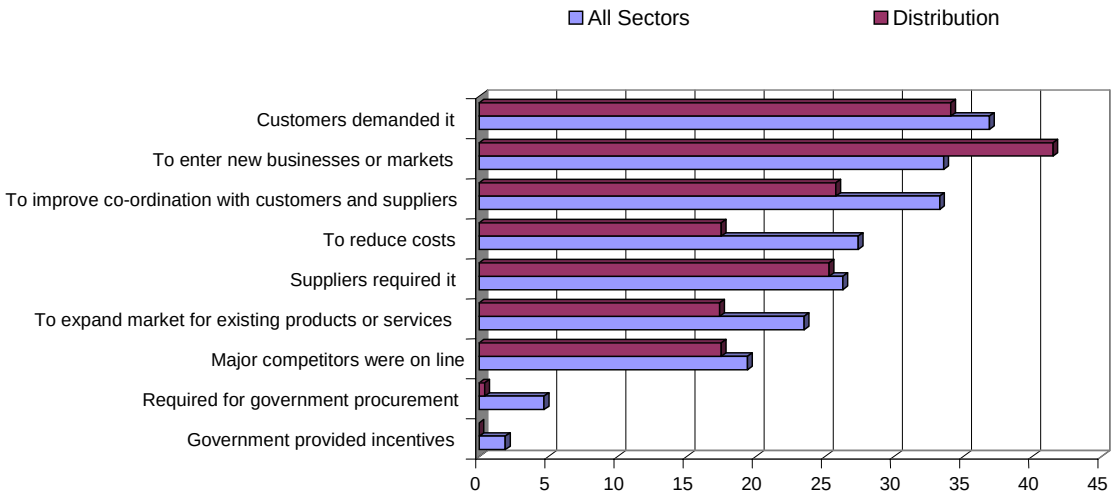
In Japan, the most widely cited drivers for firms adopting e-commerce and e-business solutions in 2002 were: that customers demanded it (37%), to enable them to enter new businesses or markets (34%), and to improve co-ordination with customers or suppliers (33%). Enterprises in wholesale and retail distribution cited the entry into new businesses or markets as a driver more often (42%) than did enterprises in other sectors. All other drivers were cited less by wholesale and retail enterprises – including 'to improve co-ordination with customers or suppliers' and 'to reduce costs' (Figure 10) (Tachiki *et al.* 2004).

Figure 9. Average Internet business solutions adoption in Canada, 2002
(percentage of businesses adopting)



Source: Derived from CeBI (2002), *Net Impact Study Canada: The SME Experience*, CeBI, Industry Canada, p4-5.

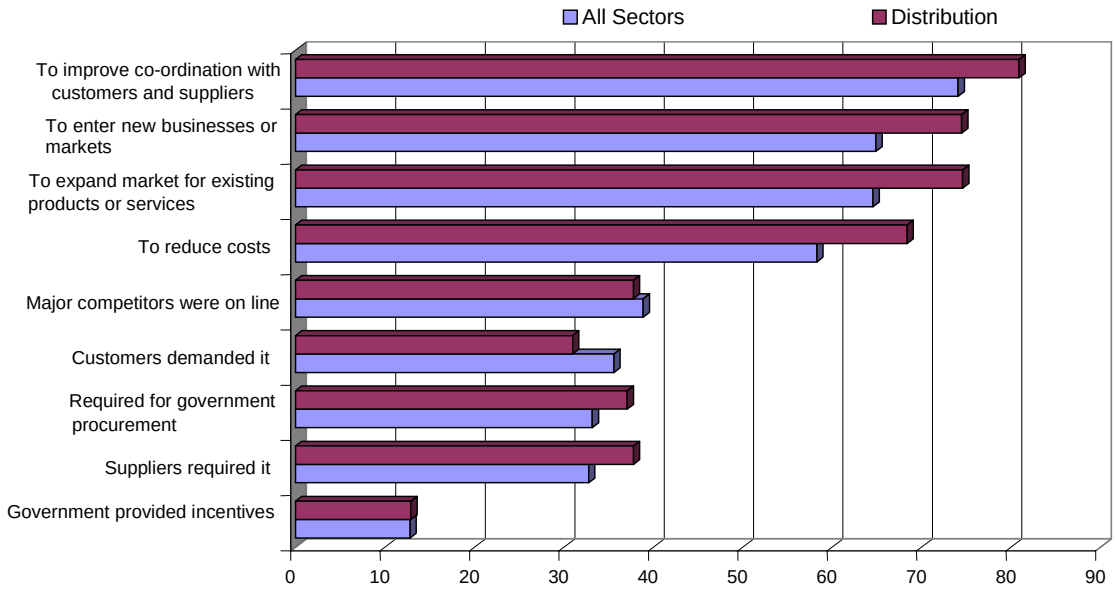
Figure 10. Drivers for e-commerce adoption in Japan, 2002
(percentage of establishments saying it was a significant driver)



Source: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), *Diffusion and the impacts of the Internet and e-commerce in Japan*, CRITO, University of California, Irvine.

In Mexico, there was a customer and supply chain focus. The most widely cited drivers for enterprises adopting e-commerce and e-business solutions in 2002 were: to improve co-ordination with customers or suppliers (74%), to enable them to enter new businesses or markets and to expand the market for existing products and services (65%). Enterprises in wholesale and retail distribution cited all drivers more often than did enterprises in other sectors, except 'customers demanded it' and 'major competitors were already on line' (Figure 11) (Palacios 2003).

Figure 11. Drivers for e-commerce adoption in Mexico, 2002
(percentage of establishments saying it was a significant driver)



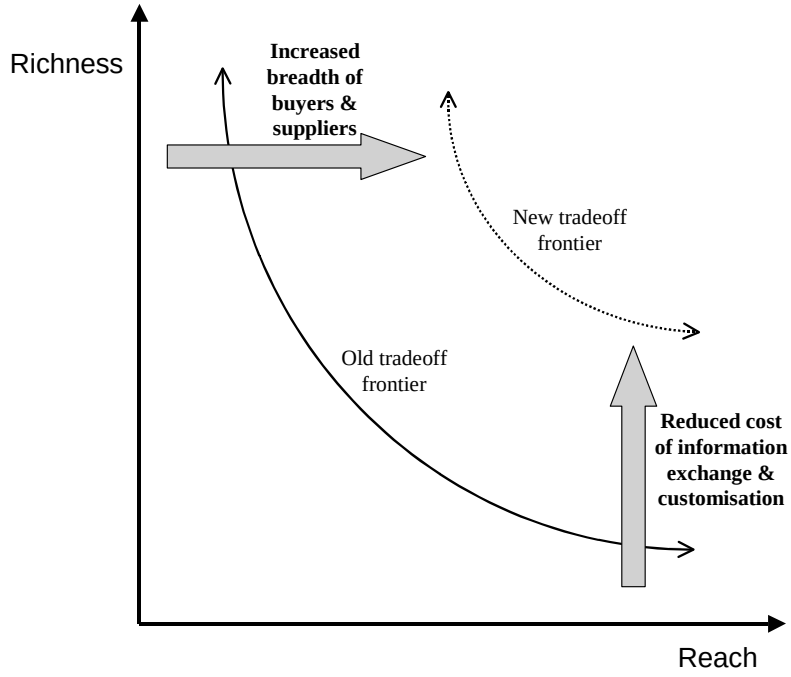
Source: Palacios, J.J. (2003), *Globalization and E-Commerce: Diffusion and Impacts in Mexico*, CRITO, University of California, Irvine.

In Scandinavia, SIKA (2003) reported that the most common reason for businesses having their own Web sites was for marketing. Ninety-four per cent of businesses in Denmark reported using their Web site for marketing, as did 92% in Norway, 87% in Sweden and 73% in Finland. Around one-quarter to one-third of companies in Scandinavia reported using their Web sites for taking orders and customer service, with other non-customer oriented uses significantly lower. And in New Zealand, it has been reported that the main drivers for involvement with e-business were increased efficiency, promotion/marketing, the development of new markets and introduction of new sales channels, and a desire to keep up with or stay ahead of competitors (Clark, *et al.* 2001).

Discussion and analysis

Evans and Wurster (2000) characterised the impact of the Internet as a movement out of the frontier of richness and reach. Richness refers to the depth and quality of information in an interaction, while reach refers to the number of entities that can be reached via Internet. In the past, it was possible to share rich interactions with a limited number of suppliers or customers. A major impact of Internet-based communication and commerce is that it has greatly increased reach *and* increased the number of potentially rich interactions. Organisations can both broaden their supplier or customer base (better reach) *and* make relationships deeper and more effective (greater richness).

Figure 12. Richness and reach



Source: Evans, P. and Wurster, T.S. (2000), *Blown to Bits: How the new economics of information transforms strategy*, Harvard Business School Press, Boston, pp23-38.

The evidence from surveys suggests that the early and primary foci for the adoption of e-commerce, supply chain related e-business solutions and digital delivery are indeed improved customer relationships and enhanced market reach. Cost savings and efficiency improvements have typically been lower in the consideration set of adopters. Industry dynamics determine whether businesses focus on new customer attraction or the retention of existing customers, with sectors that lend themselves to recurring relations (*e.g.* wholesale and retail trade) tending to focus on building revenue from existing customers (Dantuma and Hawkins 2001).

Industries also vary in terms of their focus. The initial focus of user industries tends to be on customer relationships, while that of businesses in distribution and logistics related industries tends to be on automating and sharing information up and down the supply chain (*i.e.* customer support, rather than customer acquisition). Moreover, for all organisations, there is some evidence to suggest that, as adoption and use levels rise, attention shifts towards logistics (*e.g.* customer support and supply chain management). Hence, it is likely that e-commerce in logistics and integrated supply chain related e-business solutions will become an increasing focus for future on line activities – a core element of the second tranche of e-commerce and e-business automation.

Potential for digital delivery

As noted, ICTs are a key enabler and base infrastructure for advanced integrated logistics. ICTs are already intensively used in support of distribution and logistics activities, which increasingly involve multi-organisation processes spanning multiple transport modes, storage, handling and delivery steps. ICTs contribute to the co-ordination and management of the supply chain in three main ways:

- The acquisition, storage and management of source data, through a range of automatic identification, global positioning, tracking and tracing technologies.
- Inter-enterprise co-ordination, through the inter-organisational sharing of documents and data, and
- Support for the collaboration of people working at various points along the supply chain, enabling them to work collaboratively with those data and documents (OECD 1996, p18).

BTRE (2001) noted that: the essence of effective supply chain management is integration – combining the parts (*i.e*. individual logistics activities) into a whole (*i.e*. the chain) that functions seamlessly and provides good performance (*e.g*. transit times). It is particularly important to ensure that the activities within each step along the chain are well co-ordinated. Effective integration requires: adequate infrastructure; good information flows between service providers, between service providers and users of logistics services, and between users; and effective co-ordination mechanisms and dispute resolution procedures (*e.g*. contract management, regular consultation, etc.); and incentives for each service provider to promote the performance of the total chain. According to Forrester Research, more than 70% of all logistics transactions in the United States will be on line by 2005, and the main value added solutions will consist of visualisation tools for logistics tracking coupled with basic and standardised technology, such as the Internet, to connect users (Strategis 2004b). Clearly, then, the major areas of potential and the major areas of impact of ICTs are: data capture, management, access and presentation; EDI and Web-based data and document interchange; and collaborative support systems.

As discussed below, there are obvious areas in which digital delivery of content products that are currently distributed physically may displace some wholesale distribution functions (*e.g*. the substitution of music downloads for CDs or electronic books and print-on-demand for printed books). Generally, however, e-commerce requires fulfilment, and that typically involves physical delivery. Wholesale distributors, transport and logistics businesses increasingly offer logistics services on line, with a significant part of their business being brokerage (*e.g*. matching shippers with carriers, loads with carrier capacity, etc.). Moreover, distribution and logistics services are traded, and an on line presence helps logistics services providers to reach a wider market and offer services to more customers. At the same time, customers can search for and compare the prices and services of more service providers, and greater access to brokerage services is likely to give customers, especially SMEs, access to hitherto unobtainable volume discounts, and thereby lower their logistics costs.

With ICTs underpinning logistics, the economic potential of fully integrated advanced logistics is enormous. There are many stories of significant cost reductions and efficiency gains being realised through an integrated approach to logistics and supply chain management. For example:

- Sainsbury's, in the United Kingdom, is reported to have achieved a 500% return on investment in the first 24 months, and GBP 7 million (USD 10 million) in stock savings per annum after adopting a collaborative logistics planning system in 1998.
- In the United States, Maersk Logistics is reported to have helped reduce one US company's inventory from USD 10.8 million to USD 5.5 million. In the late 1990s, Harley Davidson overhauled its logistics chain and is reported to have produced a USD 40 million reduction in material and reduced development time by 30%, enabling the company to become more responsive to consumer demands.
- In Australia, Smorgon Steel is reported to have improved its customer service levels from 80% to 90%, improved demand forecast accuracy from 70% to 95%, reduced inventory by 5 000 tonnes (producing an AUD 3 million one-off saving) and reduced transport costs by AUD 3 million (USD 1.7 million) per year (Bowdler *et al*. 2002, pp 27-8).

Box 3. Amenability to digital delivery

Important factors influencing the amenability of services to digital delivery include: the significance of the role of information exchange in the service concerned; the level of standardisation; the complexity of the tasks involved; the nature of the knowledge involved; the nature of the 'problem' addressed by the service; and the context of delivery.

The level of *standardisation* of processes is an important determinant of the amenability to digital delivery. Services that can be standardised and delivered in digital form (*e.g.* research reports, statistical updates, images, etc.) and services that can be standardised and ordered via the Internet (*e.g.* courier delivery services, advertising space, airline tickets, etc.) are most amenable to digital delivery. Those that resist standardisation tend to be less amenable.

The *complexity of the tasks* involved is one of the factors retarding standardisation and digital delivery. Morris (2000) pointed out that many have underestimated the complexity of the work environment, and noted two related concepts that shed light on these complexities: articulation and emergence. Articulation is the way in which people arrange and co-ordinate activities to mesh with colleagues. Emergence refers to actions that are often difficult to articulate too far in advance. Complexity makes remote delivery more difficult, although bandwidth increases enable greater richness of interaction and can support remote delivery of more complex services.

The *nature of the knowledge* involved also effects the amenability of services to digital delivery. It is common to make the distinction between codified and tacit knowledge. Codified knowledge is knowledge that can be written down and readily transmitted from one person to another (*e.g.* standard operating procedures, policy manuals, legislation, taxation formulae, etc.). Tacit knowledge tends to resist codification and remain a part of the knowledge and skills of individuals – it is more fluid and interpretive. Knowledge that can be codified is more amenable to digital delivery than tacit knowledge. The transmission of tacit knowledge often requires face-to-face interaction in the negotiation of meaning and in learning. This makes digital delivery more difficult, but high bandwidth networks can enhance the richness of mediated communications and enable the digital delivery of more knowledge intensive services.

The *nature of the problem* involved also effects amenability to digital delivery. Rittel and Webber (1973) noted that there are major differences between different kinds of problems and hence strategies to solve them. A 'tame' problem can be expressed independently of its solution. In engineering, for example, you can specify what needs to be designed independent of any particular design solution. A 'wicked' problem cannot be explained without its solution. In working out a solution you understand the problem more clearly and can redefine it if necessary, which in turn leads to a better solution, and so on. Tame problems are a lot easier to distribute in space and time, because they can be more accurately specified, and worked on independently, drawing on known codified knowledge bases. Wicked problems require much more interaction and negotiation between players in the generation of both problem specifications and alternative solutions and are less likely to be distributed for solution.

The *context of delivery* also affects amenability. In high context work, significant (informal) interaction is needed between co-workers to get the job done, whereas in a low context activity workers can proceed relatively independently. High context work tends to require a high degree of awareness of co-workers and of clients. Clearly, low context work is more amenable to digital delivery than high context work.

Source: Derived from Houghton, J.W. (2003) *Digital Delivery of Business Services*, OECD DSTI/ICCP/IE(2003)2/FINAL. Available http://www.oecd.org/dataoecd/40/5/31818723.pdf.

In areas of particular complexity, such as international trade, the potential impacts can be even greater. UNCTAD (2001, p180) reported that it had been estimated that the global average of the costs of complying with procedures in international trade amounts to 7% to 10% of the overall value of international trade (DTI 2000). Other estimates suggest that potential savings from more efficient information processing of international trade documentation in 1997 would have been of the order of USD 100 billion, or 30% of the total overhead costs of international trade (Crowhurst 2000).

With such potential savings and efficiency gains, one could expect organisations to hasten efforts to develop advanced integrated logistics systems and deploy e-commerce, supply chain related e-business solutions and digital delivery as a matter of priority. However, the networked nature of logistics and inherent complexity present both technical and organisational challenges. Hence, considerable potential remains.

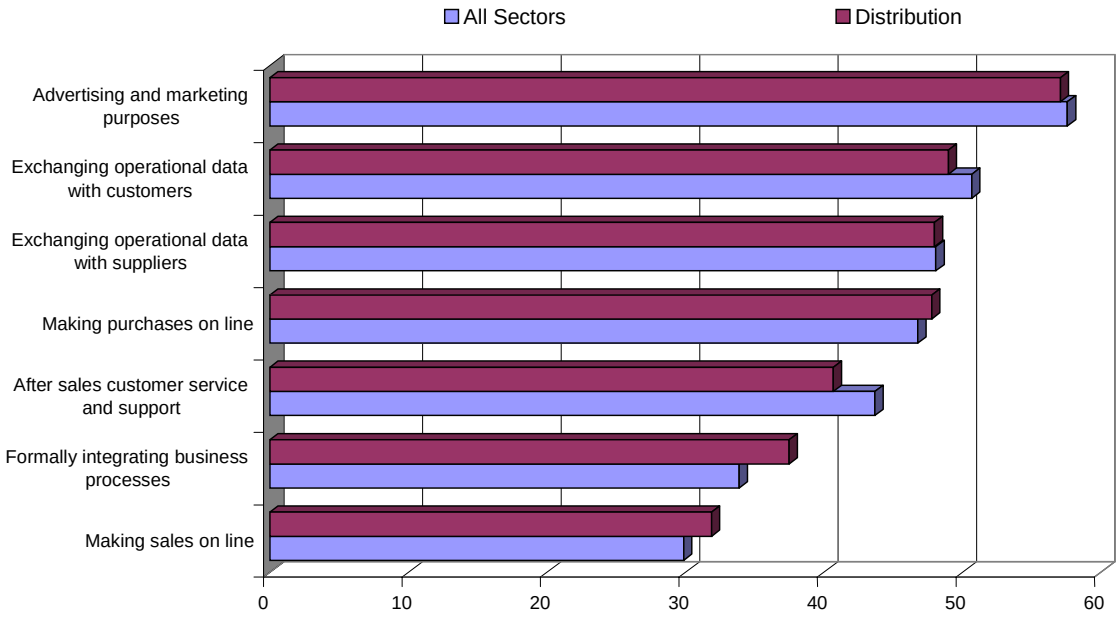
LEVEL OF ADOPTION

This section examines current levels and rates of adoption of e-commerce, supply chain related e-business solutions and digital delivery in distribution and logistics in various countries. It provides an overview of the extent of activities, recent growth and future potential. The primary focus is the distribution and logistics industries, but attention is also paid to users and in-house producers of logistics and related services.

Evidence of adoption and use

Accenture (2001) reported that across 25 countries spanning Europe, the United States, Japan, South Africa and India 46% of businesses reported that they had bought and/or sold on line by 2001. *Of those businesses using e-commerce* in mid 2001 46% were doing so in logistics (Annex Table A5).[5] In a ten country study undertaken during 2002, Kraemer, *et al.* (2002a) found that 74% of the establishments surveyed had a Web site, 44% used EDI and 43% used EFT (Electronic Funds Transfer). The Web site was accessible to suppliers in 21% of cases and to customers in 18%. The levels of adoption in wholesale and retail distribution establishments in the sample were similar, with somewhat more emphasis on EDI and making their Web sites accessible to suppliers, and somewhat less on linking with customers. (Figure 13: See also Annex Table A7).[6]

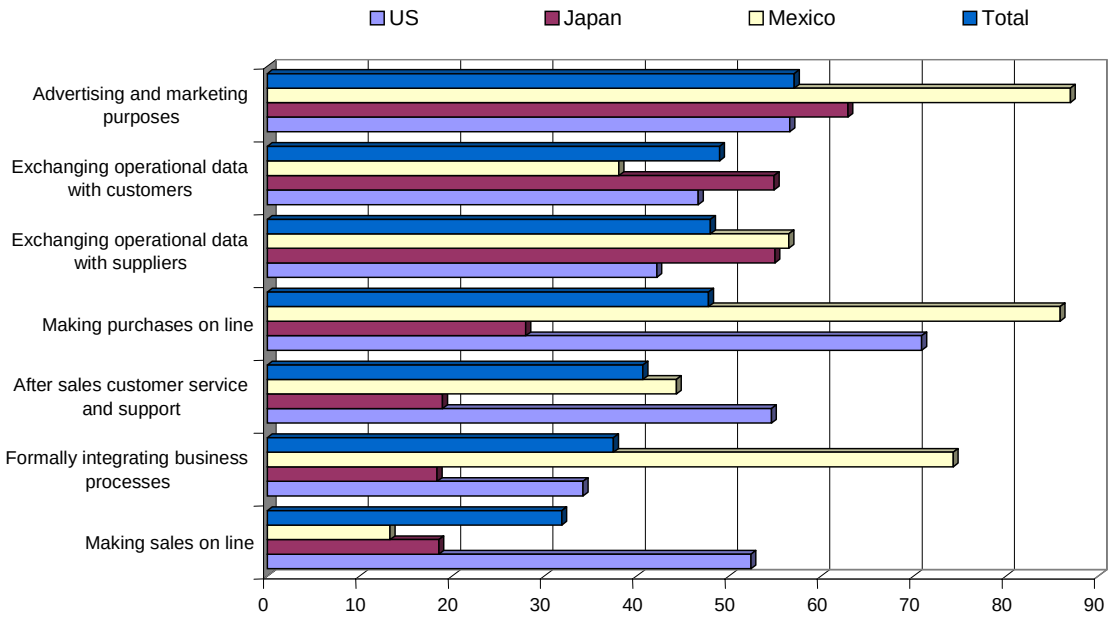
Figure 13. Online activities in 10 countries, 2002
(percentage of establishments surveyed)



Source: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce: A Mile Wide and an Inch Deep*, CRITO, University of California, Irvine.

Across the ten countries, the most widespread on line activities of *wholesale and retail distribution* establishments were: advertising and marketing (57% of establishments surveyed) and exchanging documents and operational data with customers (49%) and suppliers (48%). However, there were marked differences between countries (Kraemer *et al.* 2002a). For example, US-based establishments were more likely to report making on line sales and purchases and providing after sales services and support than was the case across the ten countries, and somewhat less likely to report exchanging data with customers and suppliers and formally integrating business processes. Japanese establishments were less likely to be making on line sales and purchases and formally integrating business processes, but more likely to be exchanging operational data. Mexican establishments reported high levels of on line purchasing, advertising and marketing, and formal integration of business processes, but low levels of on line sales. This positive orientation to e-commerce and e-business solutions may reflect the structure of the Mexican economy and its relationship to major international partners – most especially those based in the United States – and the relative low use of credit cards among consumers in Mexico (Figure 14: See also Annex Table A7).

Figure 14. Online activities of establishments in the distribution sector, 2002
(percentage of establishments surveyed)



Notes: The *Global E-commerce Survey 2002* covered ten countries, including: the United States, Mexico, Brazil, Denmark, France, Germany, Chinese Taipei, Singapore, China and Japan, and involved 2 139 companies. Wholesale and retail included SICs 50-54, 56-57 and 59.

Sources: Derived from Tachiki, D., Hamaya, S. and Yukawa, K. (2004) *Diffusion and the impacts of the Internet and e-commerce in Japan*, CRITO, University of California, Irvine; Palacios, J.J. (2003) *Globalization and E-Commerce: Diffusion and Impacts in Mexico*, CRITO, University of California, Irvine; Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002) *E-commerce: A Mile Wide and an Inch Deep*, CRITO, University of California, Irvine; and Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002) *E-commerce in the United States: Leader or one of the pack?*, CRITO, University of California, Irvine.

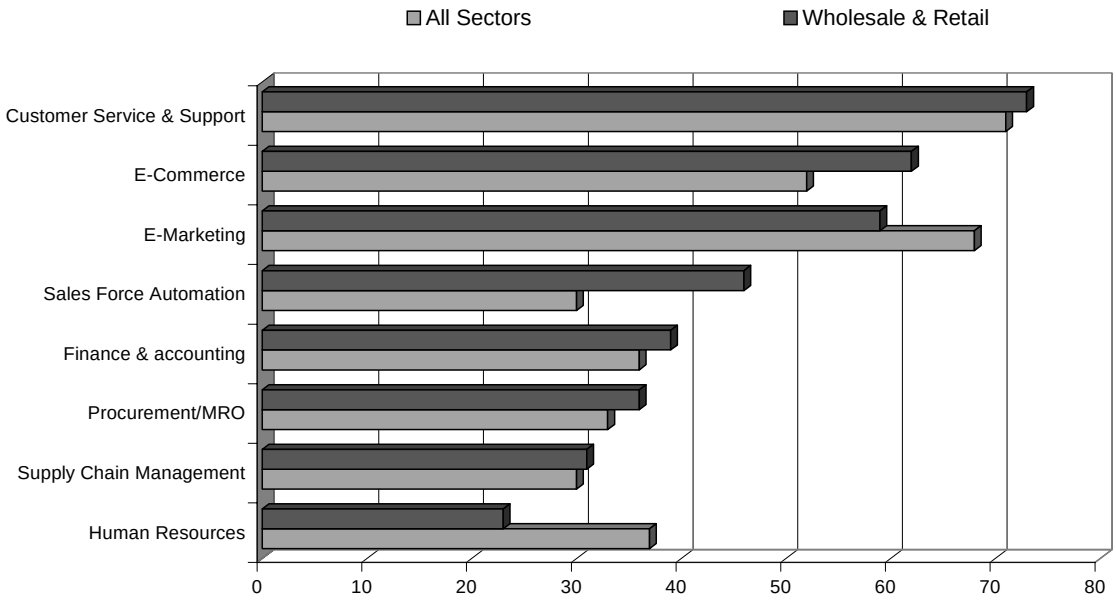
North America

In 2002, e-commerce (including EDI) accounted for 11.7% of US *merchant wholesale* shipments (USD 320 billion), up from 4.6% (USD 109 billion) during 1998 or by 26% per annum. Merchant wholesale e-commerce accounted for 28% of all e-commerce sales by value in the United States during 2002. E-commerce accounted for 12.3% of non-durable goods wholesale sales, and 11% of durable goods wholesale sales. Online sales by merchant wholesalers grew faster than total sales between 2001 and 2002, by 11.7% compared with 1.5%. By contrast, the *transport and warehousing* industries use e-commerce rather less, with e-commerce revenues accounting for just 1.2% of total revenue in 2002 (US Census Bureau 2004).

More than 60% of all on line sales by US merchant wholesalers during 2002 occurred in three sectors: pharmaceuticals (35%, or USD 111 billion), motor vehicles (17%, or USD 53 billion) and professional and commercial equipment (10%, or USD 33 billion). Whereas e-commerce sales accounted for 11.7% of total merchant wholesale sales, they accounted for 48% of pharmaceuticals sales, 25% of motor vehicles sales and 13% of professional and commercial equipment sales. More than half of the total growth in US on line sales between 2001 and 2002 came from pharmaceuticals, which experienced a USD 14 billion increase (US Census Bureau 2004b).

Varian *et al.* (2002, pp20-25) found that the *wholesale and retail* sector showed somewhat higher levels of adoption of Internet-based business solutions in late 2001 than was the case across all sectors. The only on line activities to show lower levels of adoption among wholesalers and retailers were e-marketing and human resources, suggesting a greater emphasis on linkages with suppliers, procurement/MRO and supply chain related applications (Figure 15: See also Annex Table A6).

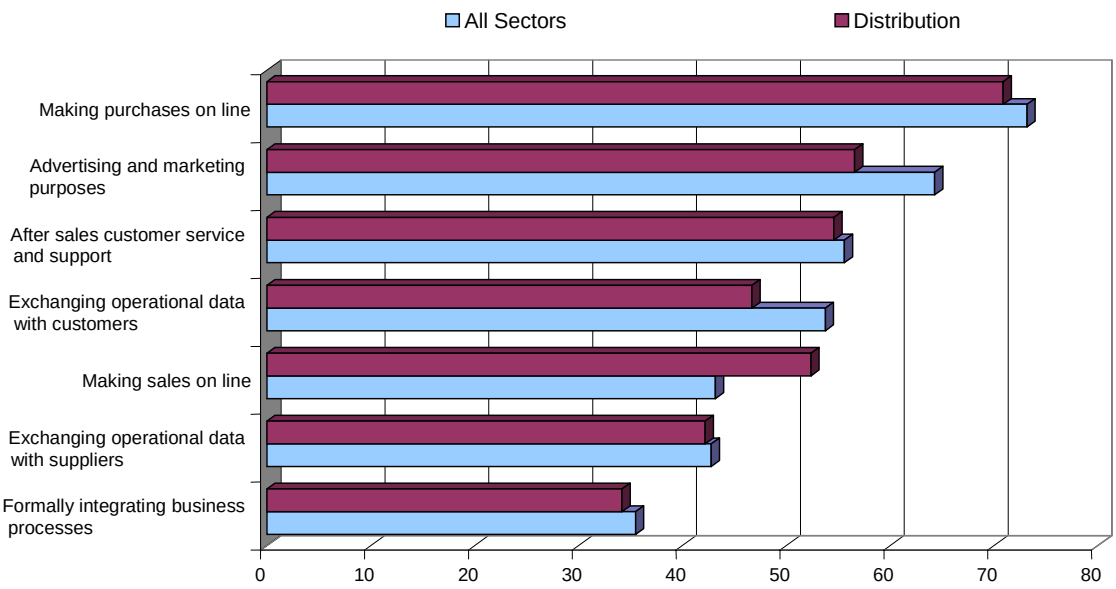
Figure 15. Average adoption of Internet business solutions in the United States, 2001
(percentage of businesses adopting)



Source: Derived from Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002, V2.0., pp 21-22.

In a survey of US establishments undertaken during 2002, Kraemer *et al*. (2002b) found that around 80% had a Web site, 43% used EDI and 63% used EFT. Seventeen per cent had Web sites that were accessible to suppliers and 16% had sites accessible to customers. The main on line activities included: making purchases on line (cited by 73%), advertising and marketing (64%), after sales service and support (56%) and exchanging operational data with customers (54%). Exchanging operational data with suppliers (43%) and formally integrating process (36%) were less widely cited. Activities among establishments in wholesale and retail distribution were similar to those reported across all industries, with somewhat more emphasis on making sales on line, and somewhat less emphasis on advertising and marketing (Figure 16: See also Annex Table A7).

Figure 16. Online activities in the United States, 2002
(percentage of establishments surveyed)



Source: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce in the United States: Leader or one of the pack?*, CRITO, University of California, Irvine.

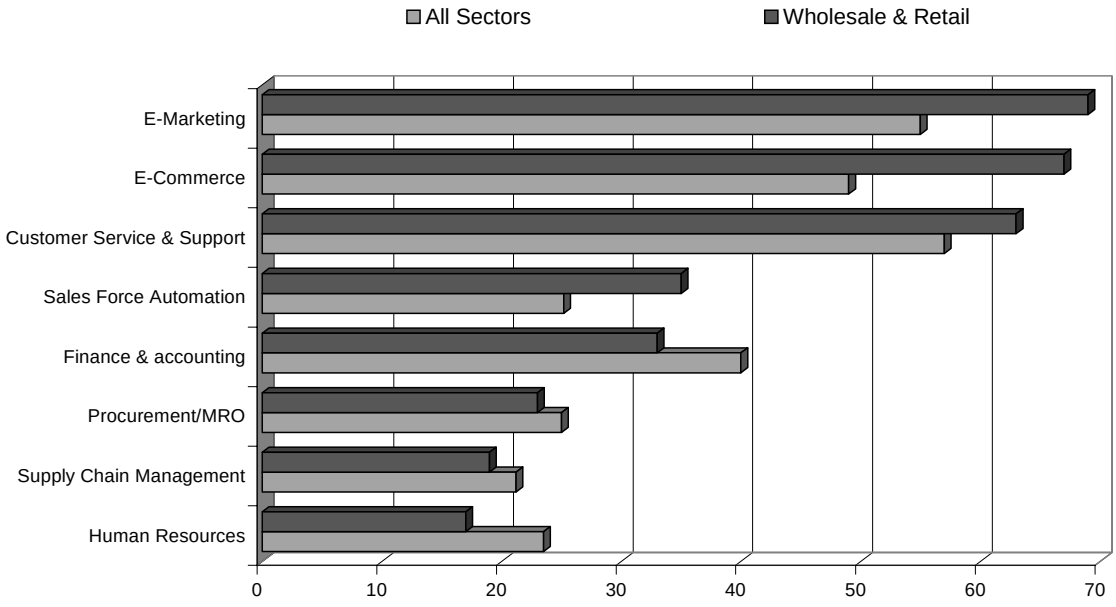
A survey of the US *trucking/logistics* industry in early 2000 found that trucking businesses were adopting Internet to implement e-commerce initiatives and transforming their business organisations in order to do so. They were using the Web to automate exchanges with shippers and consignees, improve communications, acquire new customers and customise services. By early 2000, 75% of businesses reported at least minimal Internet activity, but they were at an early stage of activity – having procured no more than 5% of their shipments via the Internet during 1999 (Nagarajan *et al.* 2001).

In Canada, 7.5% of businesses were using Internet to sell goods or services in 2002, with Internet sales accounting for just 0.6% of total operating revenues. Almost 13% of *wholesale trade* businesses in Canada sold on line, but less than 4% of *transport and warehousing* businesses did so. However, Internet sales accounted for 1.1% of wholesale trade sales and 2.4% of transport and warehousing sales (Strategis 2003a). Interestingly, a high degree of volatility was apparent. Among the businesses that responded to the Statistics Canada surveys in both 2001 and 2002, 43% of those that sold on line in 2001 stopped selling in 2002. In 2002, seven businesses stopped selling over the Internet for every ten that started – suggesting that many adopters were experiencing difficulties and/or finding the experience insufficiently rewarding. Among wholesalers, the level of interactivity and number of digital products and services offered

decreased from previous years, although the number of businesses accepting on line payments increased (Strategis 2003b).

Thirty-two per cent of Canadian *couriers and messengers* had a Web site in 2002, and 13% were selling via the Internet. Most e-commerce activities for the sector consisted of providing on line information. Connectivity was high, with more than 79% of businesses using the Internet and more than 67% of firm Web sites offering interactivity – such as parcel status and customer relationship management capabilities (Strategis 2004c). In *logistics* (*i.e.* service providers in the fields of rail transportation, water transportation, truck transportation and warehousing and storage), Internet-based technologies were found to be changing their activities from a packaging and moving function into an information business. Collaboration and visibility within the whole supply chain were the main focus for logistics providers and their partners – enabling them to collaborate on product forecasts and product flows. In *transport and warehousing*, 15% of businesses had an on line product catalogue in 2002, 12% allowed tracking of order status and 3% tracked inventory (Strategis 2004b). The adoption of supporting e-business solutions in Canada was also somewhat higher, on average, in the *wholesale and retail* sector in 2002 than it was across all sectors. Among wholesalers and retailers, e-marketing, e-commerce, customer services and support, and sales force automation were all more widespread than was reported across all sectors (CeBI 2002) (Figure 17: See also Annex Table A6).

Figure 17. Average adoption of Internet business solutions in Canada, 2002
(percentage of businesses adopting)



Source: Derived from CeBI (2002), *Net Impact Study Canada: The SME Experience*, CeBI, Industry Canada, p 4-5.

Looking in detail at activities through the supply chain from manufacturing to retail in Canada, Strategis (2004d) found that, in 2002:

43% of manufacturing firms, 15% of transport and warehousing firms, 46% of wholesale trade firms and 27% of retail firms were sharing product description catalogues via Internet.

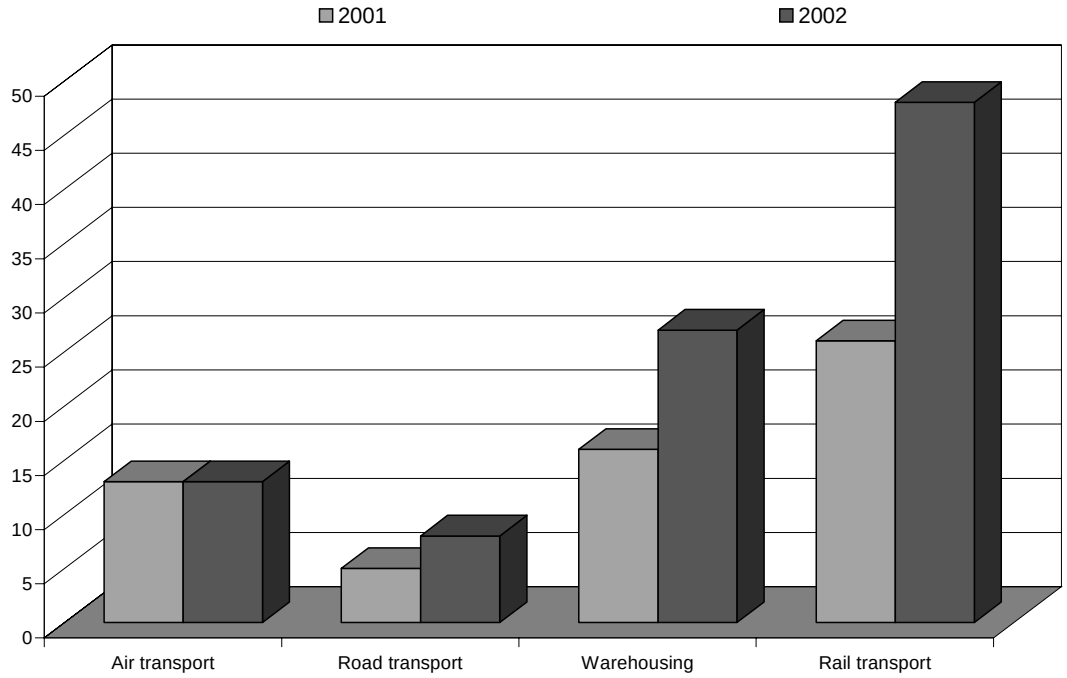
15% of manufacturing firms, 12% of transport and warehousing firms, 21% of wholesale trade firms and 29% of retail firms were sharing order status information.

4% of manufacturing firms, 3% of transport and warehousing firms, 12% of wholesale trade firms and 10% of retail firms were sharing inventory data, and

6% of manufacturing firms, 1% of transport and warehousing firms, 4% of wholesale trade firms and 3% of retail firms were sharing demand projections.

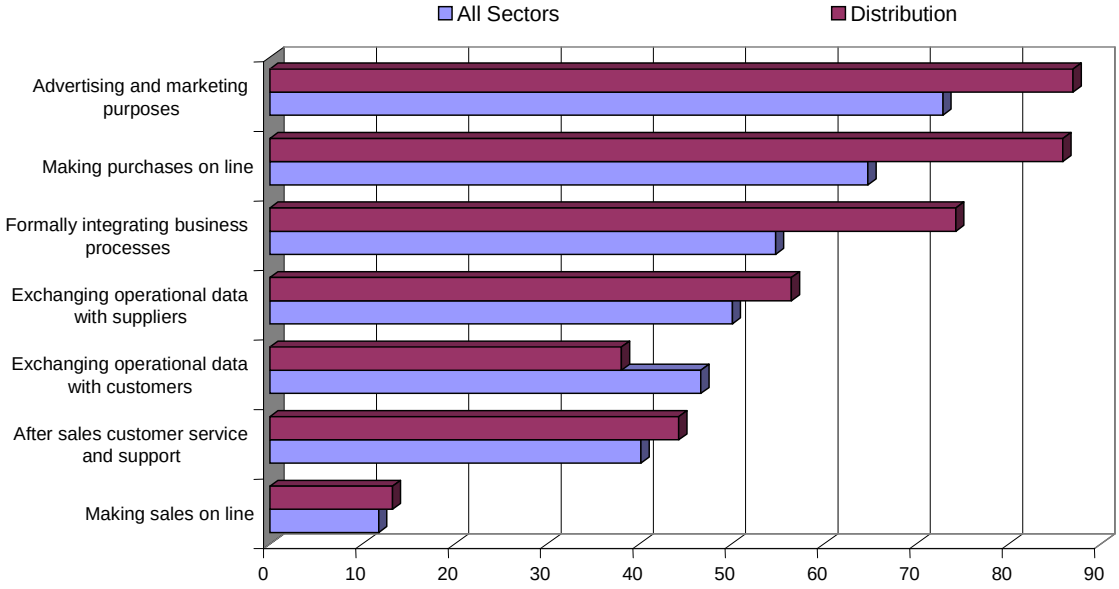
Use of Internet-based EDI among Canadian distribution and logistics businesses increased between 2001 and 2002, with users increasing from 5% to 8% of truck transport businesses, 16% to 27% of warehousing businesses and 26% to 48% of rail transport businesses (Figure 18) (D'Silva 2004).

Figure 18. Use of Internet-based EDI in Canada, 2001 & 2002
(percentage of businesses)



Source: Statistics Canada (2003), *2002 E-commerce Survey*, Statistics Canada.

Figure 19. Online activities in Mexico, 2002
(percentage of establishments surveyed)



Source: Palacios, J.J. (2003), *Globalization and E-Commerce: Diffusion and Impacts in Mexico*, CRITO, University of California, Irvine.

In Mexico, a 2002 survey of establishments in the manufacturing, banking and finance, and wholesale and retail distribution sectors revealed relatively high levels of e-commerce and e-business activity. Sixteen per cent of Mexican enterprises reported that they had an extranet that was accessible to customers and 22.6% one that was accessible by suppliers/partners. Almost 12% of the Mexican enterprises surveyed reported on line sales, 40% offered after sales service and support, almost 65% reported on line purchasing, and around 50% reported exchanging operational data with suppliers and/or customers. In the distribution sector (SICs 50-54, 56-57 and 59), more than 13% reported on line sales, 44% offered after sales service and support, 86% reported on line purchasing, around 56% reported exchanging operational data with suppliers and 38% with customers. Across all sectors, 55% reported formally integrating business processes with suppliers or other business partners, compared with more than 74% in the distribution sector (Figure 19: See also Annex Table A7) (Palacios 2003).

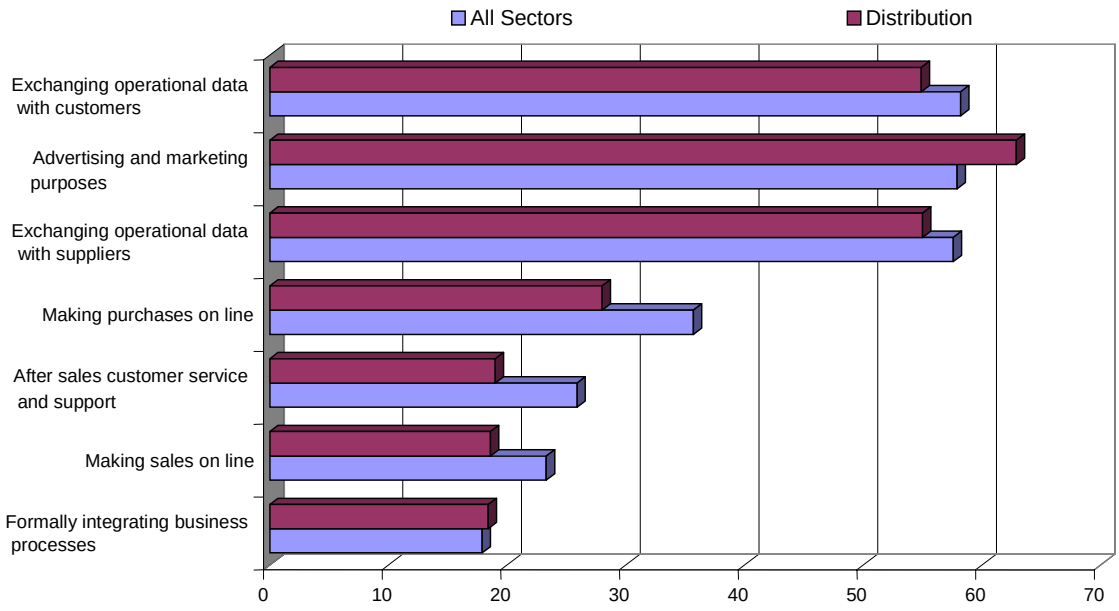
Asia-Pacific

In 2001, a reported 2.14% of sales in the transportation and travel services sector in Japan were by e-commerce (METI 2002). The *Global E-commerce Survey 2002* reported that, in Japan, the level of adoption and use of on line applications appeared to be rather lower than was the case worldwide, and was rather lower in the wholesale and retail sector than was the case across all industries – contrary to findings elsewhere. More than 73% of firms surveyed had a Web site and 64% used EDI, in 26% of firms their Web site was accessible to suppliers and in 22% it was accessible to customers. The major on line activities reported were advertising and marketing and exchanging operational data with suppliers and customers – each reported as a significant activity by between 55% and 60% of firms surveyed. Making sales on line, providing on line customer service and support and formally integrating business processes were all mentioned by around 20%, significantly fewer than was the case worldwide (Figure 20) (Tachiki *et al.* 2004). In early 2003, 78.5% of businesses surveyed in Japan reported that they had already implemented EDI, with the highest rate of adoption among *wholesalers*, and 36% of all businesses surveyed reported

using EDI in *logistics* (*i.e.* for shipping instructions, warehouse control, cargo tracking, etc.) (Seraku 2003).

In Australia, 23% of all businesses had a Web presence in June 2003, 28% had placed orders via the Internet or Web and 13% had received orders on line during the preceding year. Annual Internet income amounted to AUD 24.3 billion, up from AUD 9.4 billion in 2000-01. Businesses in the *wholesale trade* exhibited a higher level of adoption, with 33% having a Web presence in 2003, 36% placing orders via Internet and 29% receiving orders on line. A somewhat lower 20% of business in the *transport and storage* sector had a web presence in 2003, 23% placed orders on line and 12% received orders on line. All reflect significant increases in on line activities over recent years, with the percentage of wholesale trade businesses placing orders on line increasing by 23% per annum from 2000 and the number receiving orders on line increasing by 35% per annum, while the percentage of transport and storage businesses placing orders on line increased by 24% per annum and the number receiving orders on line increased by 4.4% per annum. Of those businesses receiving orders via Internet, 3% reported automated links between their ordering systems and systems for logistics (Australian Bureau of Statistics 2004) (Table 3).

Figure 20. Online activities in Japan, 2002
(percentage of establishments surveyed)



Source: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), *Diffusion and the impacts of the Internet and e-commerce in Japan*, CRITO, University of California, Irvine.

Table 3. Online orders in Australia, 2000-01 to 2002-03
(percentage)

	2000-01	*2001-02*	*2002-03*
Wholesale			
Placed orders	24	33	36
Received orders	16	11	29
Transport & Storage			
Placed orders	15	22	23
Received orders	11	11	12
All Industries			
Placed orders	25	20	28
Received orders	6	9	13

Source: Australian Bureau of Statistics (2004), *Business use of Information Technology 2002-03*, Cat No 8129.0, Canberra.

A survey of Australian SMEs conducted in May 2003, found that at that time:

- 44% of wholesale trade businesses had placed orders via Internet and 47% had paid via Internet, and 45% of transport and storage businesses had placed orders via Internet and 50% had paid via Internet, compared with 46% and 48% for all businesses, respectively, and

- 42% of wholesale trade businesses had taken orders via Internet and 48% had received payments via Internet, and 37% of transport and storage businesses had taken orders via Internet and 34% had received payments via Internet, compared with 33% and 34% for all businesses, respectively (Sensis 2003).

In New Zealand, 95% of businesses surveyed reported that they were using computers in their business activities during 2002. Approximately 64% had Web sites. Online purchases and sales accounted for around 5% of total purchases/sales (Clark, *et al.* 2002). In 2001, it was found that no more than 20% of Web sites were capable of secure transactions and less than 15% were accepting payments on line. The most frequent Web site functions were communication features that enabled information-sharing (*e.g.* with customers and supply chain partners). A list of products or services (*i.e.* a catalogue) was available on almost every Web site and company data was provided on three-quarters. Approximately half of the Web sites featured generic promotions and one third reported having customised promotions. Reflecting the importance of strategic alliances and networks, links to alliance partners were featured on half of the Web sites. However, only 59 companies reported links to an electronic trading hub, which suggested that involvement in electronic marketplaces was limited at that time (Table 4) (Clark, *et al.* 2001).

Table 4. Web site features, New Zealand 2001
(percentage of respondents)

Web site Features	*Percentage*
Lists products/services	94.3
Provides company data	75.6
Provides generic promotions	54.9
Links to alliance partners	49.3
Receives customer orders	39.6
Provides after-sales support	33.7
Provides customised promotions	33.4
Provides secure transactions	23.1
Receives payments on line	15.3
Maintains account records	13.0
Tracks delivery services	12.3
Links to e-trading hub	8.9
Sends bills on line	7.8

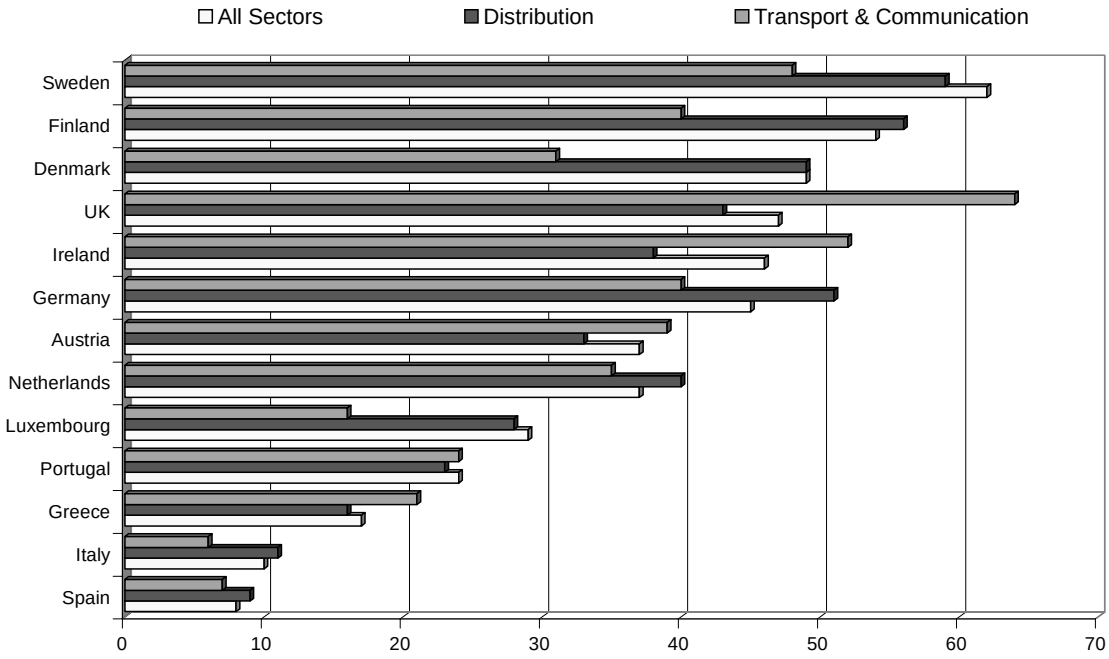
Source: Clark, D., Bowden, F., Corner, P., Gibb, J., Kearins, K. and Pavlovich, K. (2001), *Adoption and implementation of e-business in New Zealand*, University of Waikato, Hamilton, p9.

In Korea, total e-commerce transactions amounted to USD 148 billion in 2002 (UNCTAD 2003b). Following the same patterns observable elsewhere, some USD 3.2 billion or 14% of total sales in the wholesale and retail sector were by e-commerce during 2001, although e-commerce accounted for just 1% of sales in the transport sector (MoCIE 2003).

Europe

During 2001, 24% of enterprises in EU15 countries made purchases via the Internet and 3% made purchases via other EDI networks. Somewhat fewer had sold on line, 10% via Internet and 2% via other networks. There were significant differences between countries. Enterprises were engaging in purchasing via Internet in Sweden (59%), Finland (52%) and Denmark (46%) more than was the case in, for example, Portugal (16%), Italy (7%) or Spain (7%) (Eurostat 2003). Approximately 30% of European enterprises with an Internet connection used it at least once to *make purchases* during 2001. The importance of this channel for purchasing appeared to depend on the sector concerned, ranging from 22% of Internet connected enterprises in manufacturing to 41% in business services – with 34% in *distribution* and 27% in *transport and communication*. There were also significant differences between countries in terms of on line purchasing, with 9% of Internet connected enterprises in the *distribution* sector in Spain having purchased via the Internet, compared with 43% in the United Kingdom, 49% in Denmark, 51% in Germany, 56% in Finland and 59% in Sweden. Similarly, 6% of Internet-connected enterprises in the *transport and communication* sector in Italy had purchased via the Internet and 7% had in Spain, compared with 64% in the United Kingdom, 52% in Ireland and 48% in Sweden (Figures 21 et 22: See also Table 5) (Eurostat 2003).

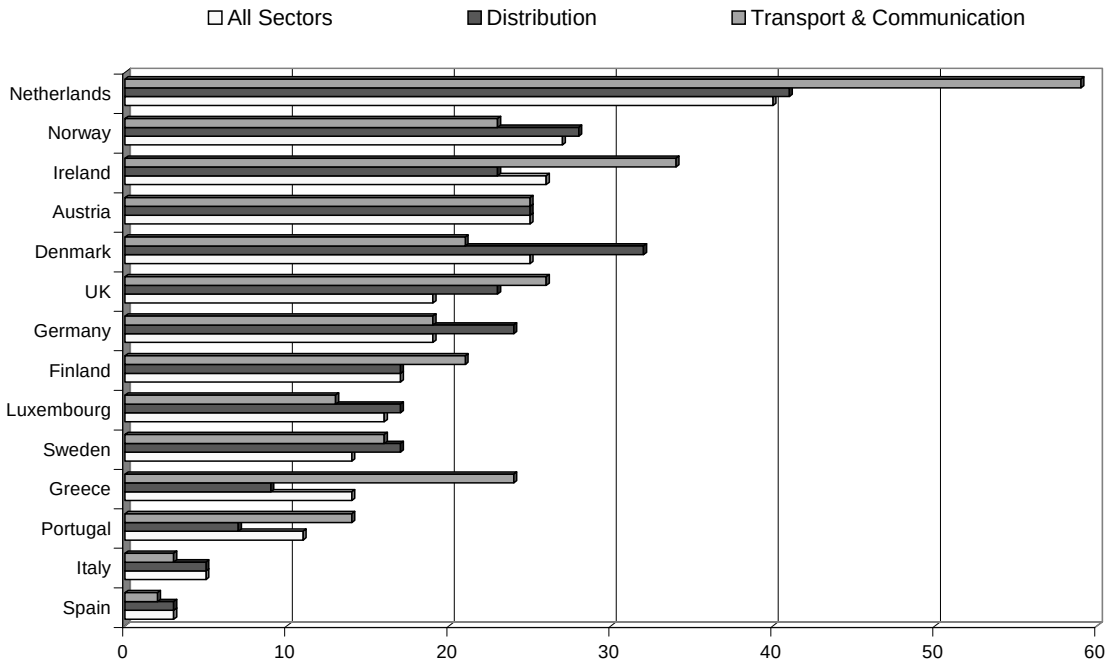
Figure 21. Online activities of enterprises in Europe: purchasing, 2001
(percentage of enterprises using Internet)



Source: Derived from Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.

The proportion of Internet-connected enterprises having made on line *sales* during 2001 was considerably less than had made on line purchases. Across all sectors the average was 13% of Internet-connected enterprises, with 16% in *distribution* and 13% in *transport and communication* having made on line sales. Again there were notable difference between countries, with 41% of *distribution* sector enterprises having sold via Internet in the Netherlands, 32% in Denmark, 28% in Norway and 25% in Austria, compared with 3% in Spain, 5% in Italy and 7% in Portugal. Just 2% of *transport and communication* enterprises in Spain reported making on line sales during 2001, compared with 59% in the Netherlands. Intensity of use also varied, with Internet sales accounting for 25% or more of total sales across all sectors for 13% of enterprises in Sweden, 11% in Netherlands and 8% in Austria, compared with 1% in Germany and 2% in Spain (Figures 21 et 22: See also Table 5) (Eurostat 2003).

Figure 22. Online activities of enterprises in Europe: sales, 2001
(percentage of enterprises using Internet)



Source: Derived from Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.

In 2001, 67% of *distribution* enterprises across the EU15 had a Web site, as did 59% of enterprises in *transport and communication* – compared with 68% across all sectors. Sixty-five per cent of enterprises across all sectors used the Internet for banking or financial services during 2001, 45% to monitor markets and 36% to receive digital products. Among enterprises in the *distribution* sector, the proportions were 65%, 41% and 35%, respectively. Among enterprises in the *transport and communication* sector, the proportions were 69%, 44% and 27%, respectively. There were also marked differences between countries, with 45% of distribution enterprises in the United Kingdom using Internet during 2001, compared with 96% in Denmark and 95% in Sweden and Finland. Similarly, just 13% of enterprises using Internet in Greece had received digital products on line, compared with 61% in Sweden, 59% in Finland and 57% in Norway (Table 6) (Eurostat 2003).

Table 5. Online activities of enterprises in Europe, 2001
(percentage of enterprises using Internet also using e-purchasing and e-sales)

	Online purchasing			*Online sales*		
	All Sectors	*Distribution*	*Transport & Communication*	*All Sectors*	*Distribution*	*Transport & Communication*
Belgium	..	..	..	..	..	..
Denmark	49	49	31	25	32	21
Germany	45	51	40	19	24	19
Greece	17	16	21	14	9	24
Spain	8	9	7	3	3	2
France	..	..	..	..	..	..
Ireland	46	38	52	26	23	34
Italy	10	11	6	5	5	3
Luxembourg	29	28	16	16	17	13
Netherlands	37	40	35	40	41	59
Austria	37	33	39	25	25	25
Portugal	24	23	24	11	7	14
Finland	54	56	40	17	17	21
Sweden	62	59	48	14	17	16
UK	47	43	64	19	23	26
Norway	..	..	..	27	28	23
EU15	*30*	*34*	*27*	*13*	*16*	*13*

Source: Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.

Table 6. Internet uses by sector in Europe, 2001
(percentage of enterprises using Internet)

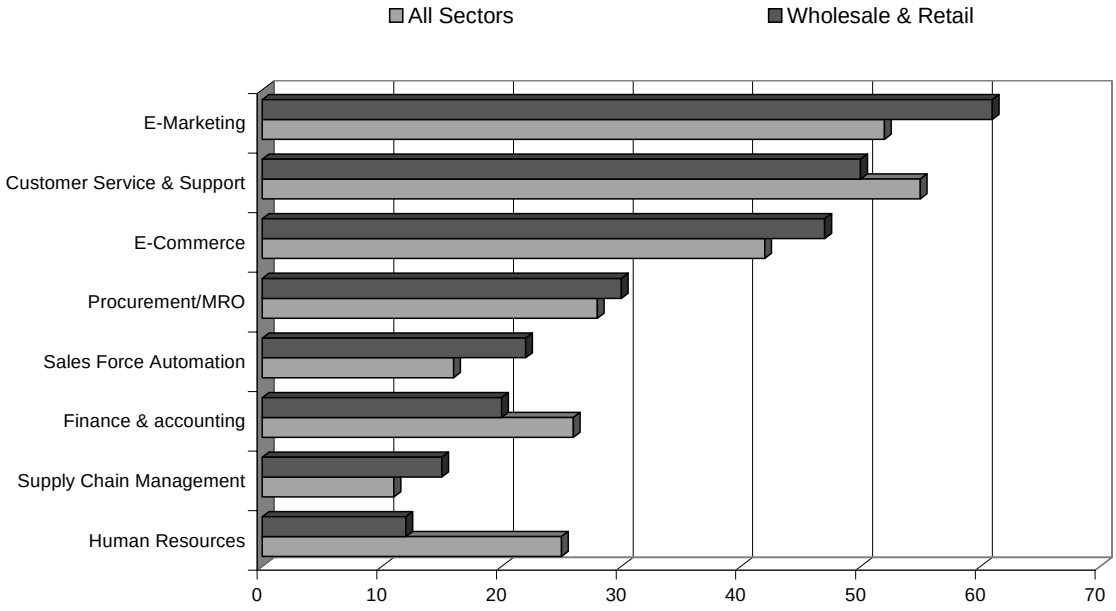
	All Sectors	*Distrib'*	*Monitor Markets*	*All Sectors*	*Distrib'*	*Receive Digital Products*	*All Sectors*	*Distrib'*	*Obtain after sales services*
			Transport & Comms			*Transport & Comms*			*Transport & Comms*
Belgium	..	..	..	..	..	..	..	..	..
Denmark	44	46	27	45	43	27	..	..	..
Germany	41	29	47	42	43	27	50	48	53
Greece	77	78	83	15	13	16	15	15	14
Spain	53	54	46	21	18	18	23	25	23
France	..	..	..	..	..	..	..	..	..
Ireland	40	39	41	30	23	22	22	19	23
Italy	38	37	31	33	34	26	15	21	23
Luxembourg	54	58	50	62	58	57	30	38	21
Netherlands	63	58	54	27	27	22	30	31	25
Austria	66	72	71	26	21	25	16	19	11
Portugal	43	41	52	18	15	17	14	14	12
Finland	61	58	51	60	59	52	36	35	30
Sweden	53	50	36	65	61	50	70	64	60
UK	..	..	..	..	..	..	..	..	..
Norway	52	49	47	58	57	49	..	..	..
EU15	*45*	*41*	*44*	*36*	*35*	*27*	*..*	*..*	*..*

Source: Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.

In Sweden, 56% of businesses with ten or more employees bought goods or services via the Internet during 2002, and 9% had sold goods and services via Internet. In the transport sector, a lower share (39%) had purchased via Internet and 7% had sold via Internet (SIKA 2004). Among the Eastern European 'acceding countries', an average 73% of enterprises had Internet access in June 2003 and 39% had a Web site.[7] However, just 9% had received orders on line and 4% had received payments on line at that time. Among OECD member countries included in the survey, 18% of enterprises in the Czech Republic had received orders on line and 32% purchased on line during 2002, compared with 6% and 7% in Hungary, 14% and 13% in Poland, and 11% and 18% in Slovakia, respectively (European Commission 2004).

In the United Kingdom, France and Germany, Varian *et al.* (2002) found a high level of adoption of supporting e-business applications among *wholesale and retail* organisations. Wholesale and retail businesses reported the highest levels adoption of e-marketing and e-commerce business solutions, and the second highest adoption of sales force automation and supply chain management; whereas they report the lowest level of adoption of finance and accounting and human resources solutions of all the sectors studied (Figure 23: See also Annex Table A6).

Figure 23. Average adoption of Internet business solutions in the United Kingdom, France & Germany, 2001
(percentage of organisations adopting)



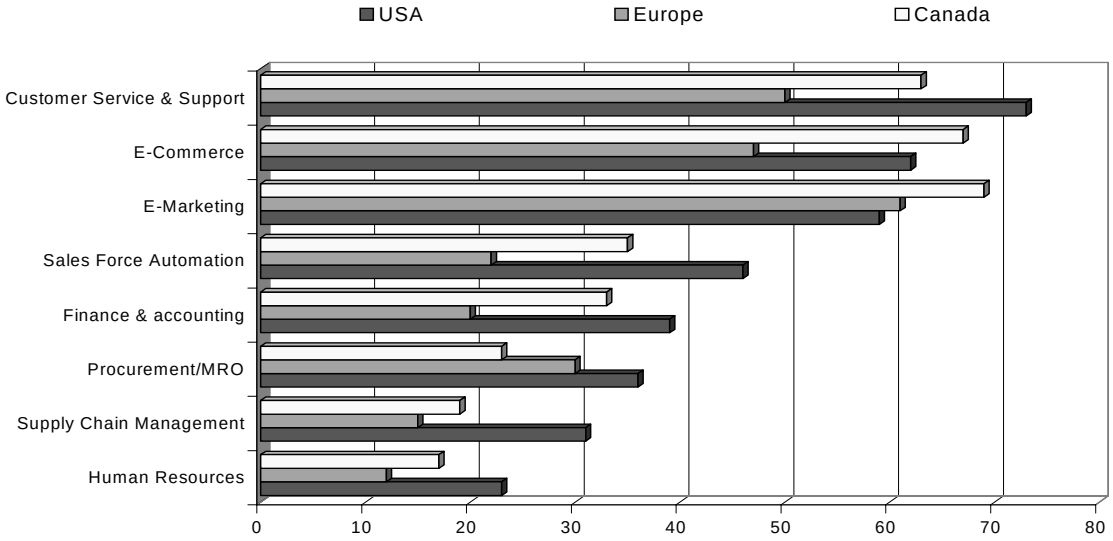
Source: Derived from Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002, V2.0., p38 and p41.

More recently, E-business Watch (2003) reported on e-commerce activities within the EU5 countries (*i.e*. Germany, France, Italy, Spain and the United Kingdom). They suggested that: 76% of enterprises surveyed had Internet access in early 2003, of which 36% had a Web site, 9.5% were selling on line, 31% were procuring on line. Almost 12% collaborated with partners in the design of products, 3.3% participated in e-market places, 2.3% collaborated in supply chain management and 22% shared documents on line in support of collaborative activities (*e.g*. logistics and supply chain management). Unfortunately, there are no more recent data by sector.

Supporting Internet business solutions

In the United States, Internet business solutions supporting supply chain management and digital delivery were reported to have been implemented by 70% of wholesale and retail trade businesses (SIC 50-59) by the end of 2001. The most common applications were customer facing (*e.g*. customer services and support 73%, e-commerce 62% and e-marketing 59%). Thirty-one per cent of US wholesale and retail trade businesses surveyed had adopted Internet business solutions in supply chain management and 36% in procurement, compared with 18% and 20%, respectively, across all sectors. In the United Kingdom, France and Germany, a significantly lower 44% of businesses in the wholesale and retail sector had adopted Internet business solutions by the end of 2001. Again, customer-facing applications were more common, although levels of adoption were somewhat lower than in the United States – with the exception of e-marketing which had been adopted by 61% of European wholesale and retail businesses, compared with 59% in the United States (Varian, *et al.* 2002). In Canada, a similar survey of SMEs undertaken during 2002 found that there too customer-facing applications were the most widely adopted (Figure 24: See also Table 7) (CeBI 2002).

Figure 24. Adoption of Internet business solutions in wholesale & retail, 2001
(percentage of organisations surveyed)



Sources: Derived from Varian, H., Litan, R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study;* and CeBI (2002) *Net Impact Study Canada: The SME Experience*, CeBI.

International comparison of the *Net Impact Studies* shows that more than 30% of the US-based businesses surveyed were using Internet-based business solutions in relation to supply chain management by 2002, compared with just over 20% of Canadian businesses and less than 15% of European businesses (McClean, *et al*. 2003). By sector, just over 60% of retail, wholesale and distribution business surveyed in the United States and Canada had adopted Internet business solution, compared with around 20% of wholesale and distribution businesses in Europe. Notably, and as noted above, organisations in the distribution sector focused somewhat more attention on supply chain related and logistics solutions (*e.g*. supply chain management, procurement/MRO, e-commerce and customer support) than was the case across all sectors.

Table 7. Average adoption of Internet business solutions, 2001
(percentage of organisations)

	Europe		*US*		*Canada*	
	All Sectors	*Wholesale & Retail*	*All Sectors*	*Wholesale & Retail*	*All Sectors*	*Wholesale & Retail*
Human Resources	25	12	37	23	24	17
Supply Chain Management	11	15	30	31	21	19
Finance & accounting	26	20	36	39	40	33
Sales Force Automation	16	22	30	46	25	35
Procurement/MRO	28	30	33	36	25	23
E-Commerce	42	47	52	62	49	67
Customer Service & Support	55	50	71	73	57	63
E-Marketing	52	61	68	59	55	69

Sources: Varian, H., Litan, R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study;* and CeBI (2002) *Net Impact Study Canada: The SME Experience*, CeBI.

Discussion and analysis

Generally, customer facing activities are the priority for organisations going on line, and procurement, supply chain management and logistics-related activities follow. However, as might be expected, organisations in the distribution and logistics-related industries appear to focus somewhat more attention on supply chain related and logistics solutions than is the case across all sectors.

In the United States, there is widespread use of e-commerce, but for most adopters it still accounts for a relatively limited share of sales and purchases by value – although there are exceptions. E-commerce activities in the wholesale distribution sector are extensive, with particular focus on a few key vertical sectors – with more than 60% of all on line sales by US merchant wholesalers during 2002 occurring in three sectors: pharmaceuticals, motor vehicles and professional and commercial equipment. Transport businesses tend to be lower/slower adopters of e-commerce than are those in wholesale distribution. Nevertheless, trucking/logistics businesses were found to be using the Web to automate exchanges with shippers and consignees, improve communications, acquire new customers and customise services.

Similarly in Canada, wholesalers were found to be above the all industry average for on line sales, but transport and warehousing businesses were lower. However, there is evidence that the focus of connectivity in logistics-related industries is to share information, rather than sales and purchasing *per se*, making surveys of on line sales/purchasing difficult to interpret comparatively. Collaboration and visibility within the whole supply chain were the main focus for logistics providers and their partners – enabling buyers, manufacturers and service providers to collaborate on product forecasts and product flow. That transport and delivery-related businesses now appear to be catching up with other sectors, may reflect network issues (*e.g.* that there are only now sufficient users and supply chain partners on line) and/or infrastructure issues (*e.g.* that there is increasing availability of the necessary software).

In Europe too, wholesale distribution businesses were more active in on line sales than was the case across all industries. Marked country difference in levels of adoption and on line activity appear to reflect network issues, with lower levels of activity primarily reflecting the sense that there is a lack of supply chain partners on line. Elsewhere, a similar situation is evident, with wholesalers higher users of e-commerce, supply chain related e-business solutions and digital delivery than the all-industry average and transport carriers typically lower users. Again, while starting later, they are now catching up – with supply chain and logistics-related activities now growing rapidly.

IMPACTS OF DIGITAL DELIVERY

There is no doubt that distribution and logistics are evolving rapidly and that ICTs, e-commerce, the adoption of e-business solutions in supply chain activities and digital delivery are an important part of the story. However, it is difficult to separate the specific effects of e-commerce and digital delivery from those of a range of other technological and structural changes (Dantuma and Hawkins 2001). This section looks at evidence from a range of surveys of the impacts and then attempts to draw some tentative conclusions. Discussion focuses on more qualitative assessments of impacts.

Evidence of impacts

In an extensive survey of e-commerce activities in 25 countries spanning Europe, the United States, Japan, South Africa and India, Accenture (2001) found that:

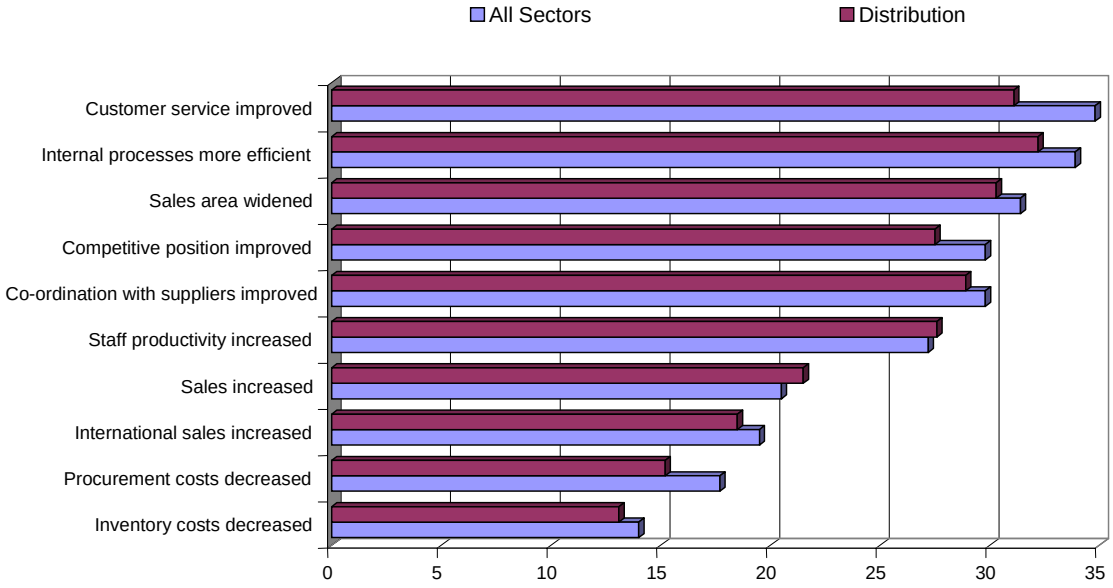
- 73% of respondents surveyed thought e-commerce was increasing the benefits of being an established company, and just 9% thought it was decreasing the benefits of being established.
- 72% thought e-commerce was increasing the rewards to successful companies, and just 5% thought it was reducing rewards to the successful.
- 65% thought e-commerce was increasing the benefits of being a large company, and 15% thought it was reducing the benefits of scale.
- 62% thought it would enable them to bring products and services to market more quickly, and 20% thought it would not.
- 60% thought e-commerce would provide a lower cost channel for transactions with customers, and 20% thought it would not.
- 54% thought e-commerce was increasing market concentration, and 19% thought it was reducing concentration.
- 54% thought it would enable them to develop stronger relationships with buyers and suppliers, and 19% thought it would not.
- 50% thought e-commerce was reducing barriers to market entry, and 33% thought it was raising barriers to entry, and
- 46% thought e-commerce would enable them to get a better understanding of their clients' needs, and 25% thought it would not.

On all of these indicators there were some significant variations between countries.

Looking at a range of industry sectors, Varian *et al.* (2002) found that those organisations in the United States, United Kingdom, France and Germany that had deployed Internet business solutions realised cumulative cost savings of USD 163.5 billion between 1998 and 2002. It was suggested that Internet business solutions had yielded cumulative cost savings of USD 155.2 billion (0.6%) to US-based organisations and helped to increase revenues by approximately USD 444 billion (1.9%). Similarly, the adoption of Internet business solutions in the United Kingdom, France and Germany had resulted in cumulative cost savings of EUR 9 billion (0.1%) (USD 8.5 billion) and helped to enhance revenues by EUR 86.4 billion (0.9%) (USD 81.5 billion). The differences between reported US and European impacts were thought to reflect different patterns and levels of adoption and different business environments.[8]

In a ten country study undertaken during 2002, Kraemer, *et al.* (2002a) found that the most widely cited impacts of the adoption of e-commerce and e-business solutions were: improved customer services (35%), more efficient internal processes (34%), wider sales area (31%), improved competitive position and improved co-ordination with suppliers (30%). There were few major difference between the impacts felt by wholesale and retail distribution establishments (SICs 50-54, 56-57 and 59) and those felt across all industries (Figure 25: See also Annex Table A10). In general, the impacts were to do with expansion of activities and internal efficiency gains, rather than reduced costs.[9]

Figure 25. Impacts of e-commerce in ten countries, 2002
(percentage of establishments surveyed)



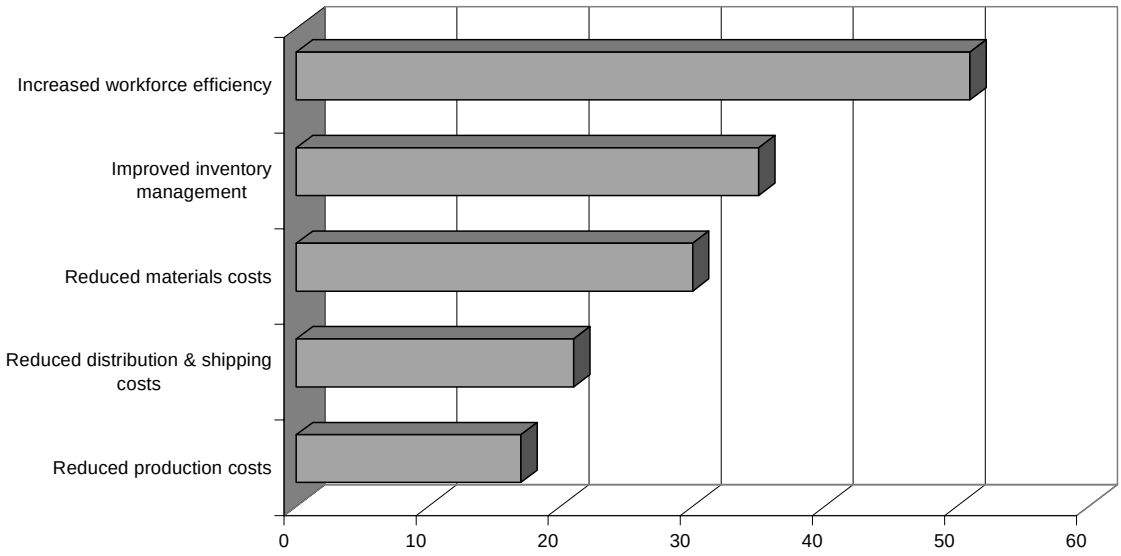
Source: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce: A Mile Wide and an Inch Deep*, CRITO, University of California, Irvine.

North America

In the United States, reported impacts of Internet business solutions included: increased customer attraction, cited by 57% of businesses; increased customer satisfaction (54%); increased customer retention (37%); increased customer loyalty (32%); increased frequency of sales to existing customers (25%); increased volume of sales to existing customers (17%); and increased value of sales to existing customers (7%). Fifty-one per cent reported increased workforce efficiency, 35% reported improved inventory

management, 30% reported reduced materials costs, 21% reported reduced distribution and shipping costs and 17% reported reduced production costs (Figure 26). Within the *wholesale and retail* sector (SICs 50-59), a somewhat lower than average 65% reported attracting new customers, 32% reported more frequent interactions, 17% reported selling more expensive items and 15% reported increased sales volume (Varian *et al.* 2002). Internet business solutions have clearly contributed to a reduction in inventory management and distribution costs.

Figure 26. Impacts of Internet business solutions in the United States, 2001
(percentage of organisations surveyed)

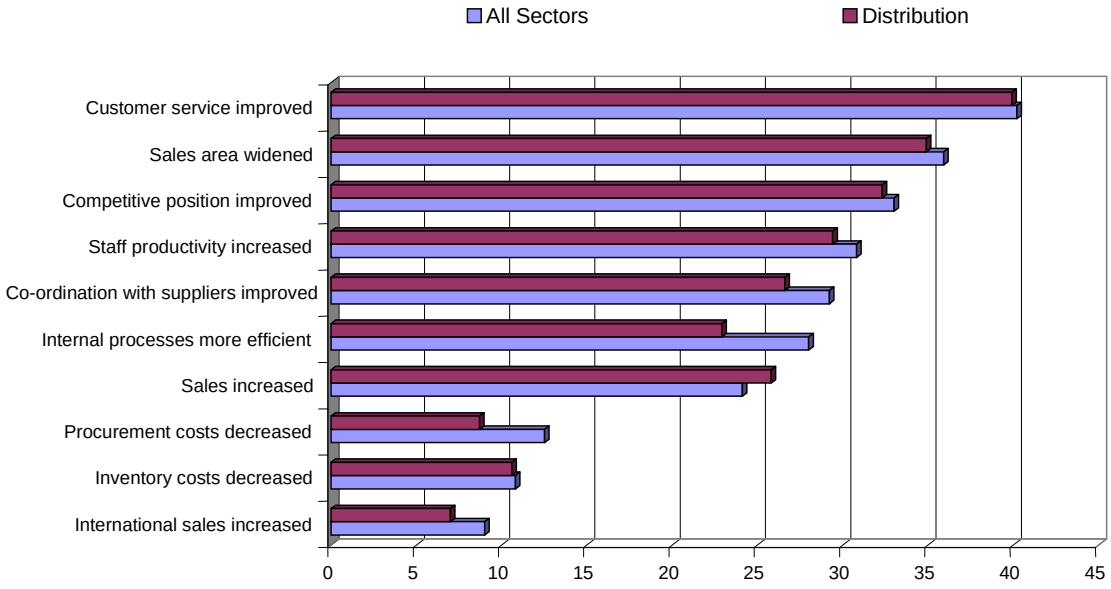


Source: Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002, V2.0, p26.

In a study undertaken during 2002, Kraemer, *et al.* (2002b) found that the most widely cited impacts of the adoption of e-commerce and e-business solutions by establishments in the United States were: improved customer services (40%), wider sales area (36%) and improved competitive position (33%). There were few difference between the impacts felt by wholesale and retail distribution establishments (SICs 50-54, 56-57 and 59) and those felt across all industries (Figure 27: See also Annex Table A10). The main impacts were to do with expansion of activities and internal efficiency gains, rather than reduced costs.[10]

In a survey of US *trucking/logistics* businesses, Nagarajan *et al.* (2001, p351) found that those businesses using the Internet in early 2000 reported that it had a substantial impact on exploitation opportunities, building on existing services (*i.e.* increased reach). The most commonly cited benefits included: improved internal process quality (56%) and process time (43%); improved external relationships with shippers (52%), consignees (45%) and third parties (49%); improved service speed (42%), timeliness (32%) and dependability (34%); reduced costs (33%); improved dedicated services (32%); and improved analysis of customers (33%). Reflecting increased reach, 58% reported adding new customers, 38% reported adding new services and 34% reported adding new markets. A 2000 survey of shippers (*i.e.* of the users of transport services) found that those who used Web-based workflow automation services achieved between 20% and 30% reductions in their transport management costs (D'Silva 2004).

Figure 27. Impacts of e-commerce in the United States, 2002
(percentage of establishments surveyed)

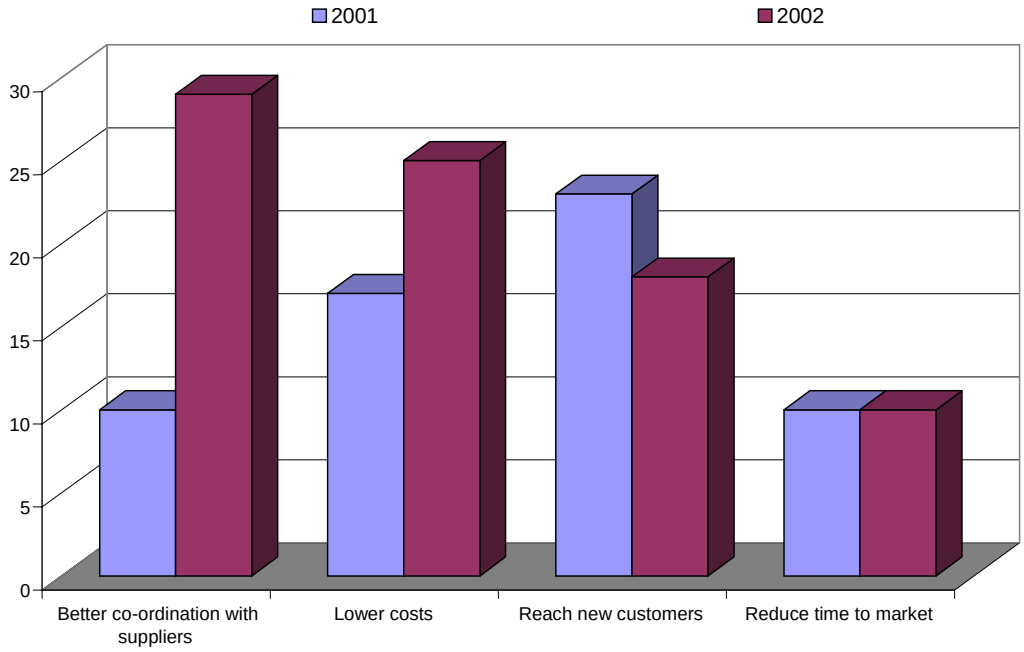


Source: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce in the United States: Leader or one of the pack?*, CRITO, University of California, Irvine.

In Canada, CeBI (2002) found that those businesses adopting Internet business solutions realised substantial financial benefits. On average, revenues increased 7.2%, costs of goods sold decreased 9.8% and the cost of sales decreased 7.7%. It was also reported that Internet-based customer development and marketing had the biggest impacts. These impacts varied between sectors, with SMEs in financial services reporting a 12.7% revenue increase compared with a 4.4% increase for those in retailing, wholesaling and distribution. The main reasons for revenue increases in wholesale and retail trades included: attracting new customers (cited by 75%); increased frequency of sales to existing customers (33%); existing customers buying in greater volume (30%); existing customers buying more expensive items (17%); and ability to raise prices (16%).

According to Statistics Canada's 2002 e-commerce survey, the main benefits cited by *logistics service providers* were: better co-ordination with suppliers (29%) and lower costs (25%). Reaching new customers was of lesser importance in the 2002 survey than it had been in 2000 – cited by 18% of respondents (Strategis 2004b). For those in the *wholesale trade*, the principal benefit lay in attracting new customers (43%). Other important benefits included: better co-ordination with suppliers (31%), lower costs (22%) and reduced time to market (17%) (Strategis 2003b). Over time, Canadian businesses are realising greater supply chain co-ordination benefits, with 29% of transport and warehousing businesses citing better co-ordination with suppliers in 2002, compared with 10% in 2001 (Figure 28) (D'Silva 2004).

Figure 28. Benefits of e-commerce and e-business applications, Canada 2002
(percentage of enterprises)



Source: Statistics Canada (2003), *2002 E-commerce Survey*, Statistics Canada.

Canadian SMEs reported relatively modest average revenue increases from the implementation of Internet business solutions (7.2%) compared with businesses in the United States (9%) and Europe (10%), similar impacts in terms of decreases in sales, general and administration expenses, and higher decreases in cost of goods sold (Table 8). Within the *retail and wholesale distribution* sector, Canadian SMEs experienced lower revenue increases than in the United States and Europe, and expected future gains lagged those of US-based businesses (CeBI 2003, pp19-23).

Table 8. Impacts of Internet business solutions on revenues and costs
(percentage of organisations)

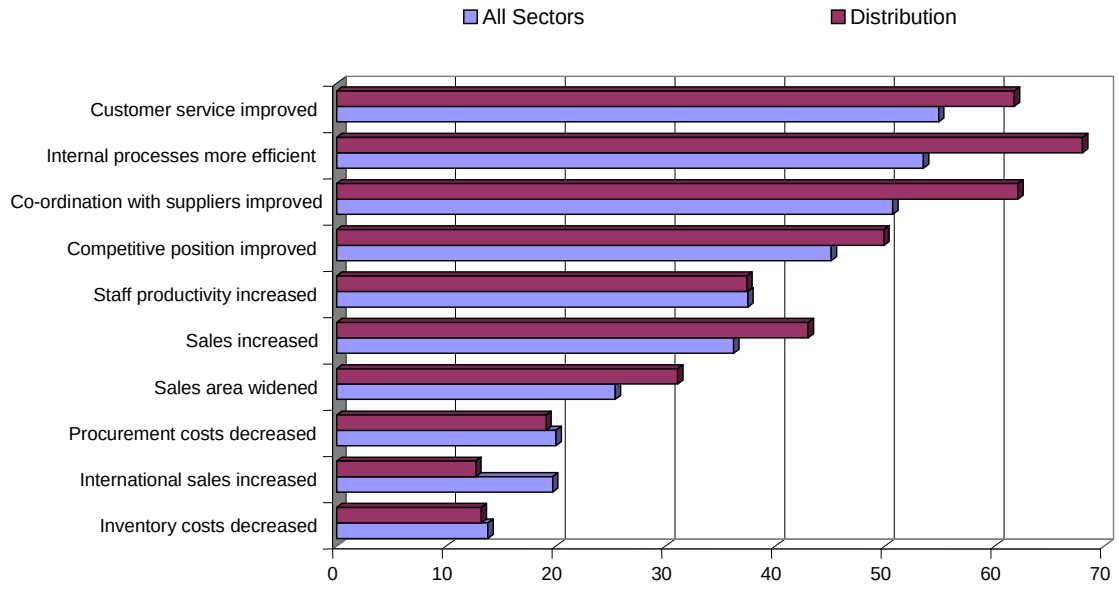
	United States	*Europe*	*Canada*
Revenue increase %	9.0	10.0	7.2
Cost of goods sold decrease %	6.9	1.3	9.8
Sales, general & administrative cost decrease %	7.8	3.6	7.7

Note: Europe refers to France, Germany and the United Kingdom.

Source: Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002, V2.0.

In Mexico, Palacios (2003) found that the most widely cited impacts of the adoption of e-commerce and e-business solutions were: improved customer service (55%), more efficient internal processes (54%) and improved co-ordination with suppliers (51%). *Wholesale and retail distribution* establishments (SICs 50-54, 56-57 and 59) reported greater impacts from these factors than did establishments across all sectors (Figure 29). In Mexico, the main impacts were to do with co-ordination of activities and internal efficiency gains, rather than reduced costs.[11]

Figure 29. Impacts of e-commerce in Mexico, 2002
(percentage of establishments surveyed)

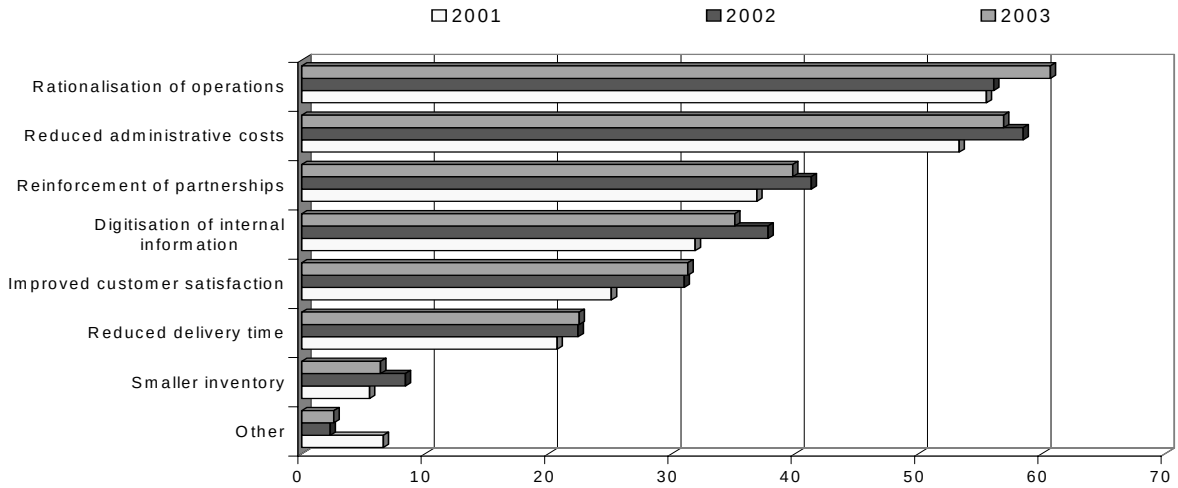


Source: Palacios, J.J. (2003), *Globalization and E-Commerce: Diffusion and Impacts in Mexico*, CRITO, University of California, Irvine.

Asia-Pacific

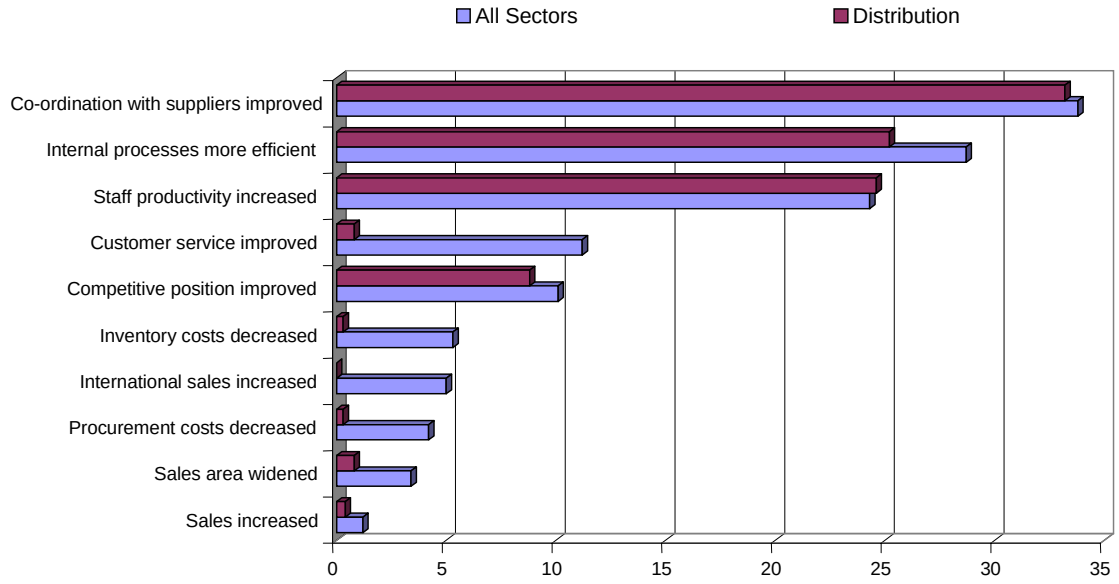
In Japan, the benefits resulting from EDI that have been most widely cited include: improvement in rationalisation (61%), reduction in administrative costs (57%) and reinforcement of partnerships with important customers (40%) (Figure 30) (Seraku 2003). Tachiki *et al.* (2004) reported that the impacts in Japan were rather different from those reported by the same survey in the United States and Mexico (above). Improved co-ordination of operations with suppliers and internal improvements in efficiency and productivity were widely cited, while other impacts were less cited (Figure 31).

Figure 30. Advantages of EDI in Japan, 2001 to 2003
(percentage of firms)



Source: Seraku, T. (2003), 'Summary Report of the 7th EDI Survey, *ECOM Journal* 6.

Figure 31. Impacts of e-commerce in Japan, 2002
(percentage of establishments surveyed)



Source: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), *Diffusion and the impacts of the Internet and e-commerce in Japan*, CRITO, University of California, Irvine.

In a study of SMEs in Australia, NOIE (2001) found that: 62% viewed e-commerce primarily as an opportunity to improve the efficiency of their business operations. For the remaining 38% the primary opportunity was potentially higher sales to new and existing markets. On average, 55% of the gross benefit of e-commerce came from efficiency savings and the remaining 45% from additional revenue. Businesses that made smaller investments in e-commerce saw a higher proportion of their return come from additional revenue, while those making a larger investment reaped the most benefit from business efficiencies. Efficiency savings generally came from leveraging electronic communications, using the Web site as a marketing tool and using the Internet to conduct financial transactions on line. The key non-financial benefits were improved customer service and improved relationships with other businesses (*e.g.* supply chain partners), highlighting the importance of Internet-based business solutions for supply chain relationships and supply chain management.

During 2002-03, Australian businesses receiving orders via the Internet reported the following benefits: faster business processes (53%), improved quality of customer service (51%), keeping pace with competitors (36%), increased sales (33%), lower transaction costs (28%) and increased number of customers (28%) (Australian Bureau of Statistics 2004). Sixty-eight per cent of Australian SMEs surveyed in 2003 said that e-commerce had met their expectations, and 56% suggested that they had already recovered their investment. Just 6% did not expect to recover their investment within five years (Sensis 2003, p32).

In New Zealand, businesses reported that the most important impacts of e-business were: enhancing the company image, improving information exchange with customers, faster response to customers, improving competitive position, creating new business opportunities, providing access to new customers, improving customer services, increasing efficiency of business processes, removing geographical barriers

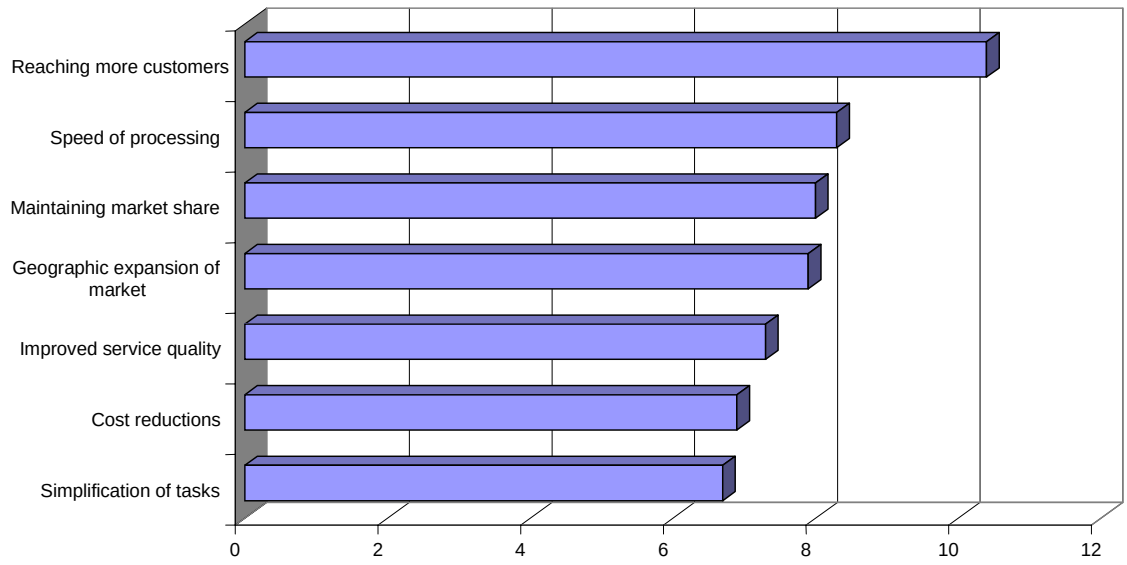
and building customer relationships (Clark, *et al.* 2001). Five of these focus on improving customer relationships (*i.e.* richness) and three relate to expanding business opportunities (*i.e.* reach).

Europe

In the United Kingdom, France and Germany, customer service and support was the Internet business solution reported to have had the most significant impact on reducing costs – cited by 45% of businesses. E-commerce (cited by 37% of businesses), customer development and Internet-based marketing (14%) and finance and accounting (13%) were the other applications contributing most to cost savings. Customer facing applications were found to have contributed most to increasing the revenue of businesses in the United Kingdom, France and Germany – with 18% citing customer service and support as the major contributor, 17% citing e-commerce, 16% citing customer development and Internet-based marketing and 10% citing sales force automation (Varian *et al.* 2002).

Eurostat reported that the main benefit of *on line sales* cited by enterprises in Europe was increased reach and access to new customers (cited by 10.4%). Other benefits cited included: speed of processing (8.3%), avoidance of loss of market share to others using e-commerce (8%), geographic expansion of market (7.9%), improvement in service quality (7.3%) and cost reductions (6.9%). The most widely cited benefits of *on line purchasing* included: speed of processing (14.3%), simplification of tasks (12.5%), cost savings (10.6%) and access to more suppliers (6.9%) (Figure 32) (Deiss 2002).

Figure 32. Benefits of on line sales in Europe, 2001
(percentage of enterprises)



Source: Deiss, R. (2002), *E-commerce in Europe*, Cat KS-NP-02-012-EN-N, Eurostat, Brussels.

Focusing on *logistics* in the Netherlands, Dantuma and Hawkins (2001) suggested that most of the effects of e-commerce lie in process innovation. Few of the businesses they interviewed could quantify the effects and none claimed that e-commerce had increased revenues through increasing their customer base. The positive impacts were in process efficiency and customer care, through better internal and external communication, increased transparency in business processes, increased transparency in the logistics

processes for the client, and more flexibility in logistics processes. Where logistics businesses were active in product innovation, it was mainly in conjunction with specific interfaces and systems that were made available to customers as a part of the overall logistics service (*e.g.* ordering, tracking and tracing). Relational innovations were relatively minor, with long-term relationships characterising the industry. Nevertheless, there was evidence of some logistics businesses exploiting the capabilities of client-oriented tools to increase customer loyalty.

Discussion and analysis

E-commerce, supply chain related e-business solutions and digital delivery impact distribution and logistics in a variety of ways. While sometimes difficult to distinguish at the margins, these impacts are of three main types. They include:

- The impacts of the use of e-commerce and digital delivery throughout the economy on logistics activities, in terms of the changing role of distribution and delivery related activities.
- The impacts of the use of e-commerce and supply chain management by the customers of distribution and logistics services on logistics activities and logistics services providers, and
- The impacts of the use of e-commerce, supply chain related e-business solutions and digital delivery by logistics services businesses on their activities and services, and thereby on their customers.

Impacts of e-commerce and digital delivery (fulfilment)

Use of the Internet by consumers to buy and sell (*i.e.* B2C e-commerce) is changing the role of distributors. There is some disintermediation, with the distribution channel fragmenting to become a one-step link between the on line retailer and the customer. B2C e-commerce demands on distribution and logistics include: delivery of more and smaller consignments; delivery in specific time slots, both in terms of narrower and more specific delivery time windows (*e.g.* between 6 pm and 8 pm) and in terms of time shifting (*e.g.* from daytime to evening delivery); delivery to residential areas, rather than to central shopping and business districts; worldwide delivery capabilities; reverse logistics (*i.e.* handling returns as well as deliveries); and an increasing role for delivery as the point of customer contact and customer care.

To date *wholesale distributors* appear to have benefited from the growth of B2C e-commerce. Fein (2000) noted a number of reasons. First, Internet retail has been most popular in areas where wholesale distribution was already relatively concentrated and consolidated (*e.g.* books, CDs, videos, pharmaceuticals, etc.). Second, Internet retailers have tended to use existing distributors to handle fulfilment (*e.g.* Ingram Books for Amazon, Valley Media for CDNow, McKesson for PlanetRX, etc.). Hence, to-date, on line retailing has led to growth among the larger consolidated distributors, due to an expansion of outsourced fulfilment.

Nevertheless, there are potential threats in B2C e-commerce for wholesale distributors. As the scale of on line retail builds, some of the larger players may move their distribution and fulfilment activities in-house – to control costs, differentiate on service and expand their business activities. Wholesale distributors may also face disintermediation through competition in fulfilment from small package and overnight delivers who simply ship – although this assumes that the Internet businesses handle the pick and pack activities themselves or operate them through other logistics services providers. Most importantly, however, wholesale distributors are vulnerable to digital delivery of the products they are currently distributing physically, eliminating the need for physical distribution (*e.g.* on line music sales replacing CDs, e-books and print-on-demand replacing books, etc.) (Fein 2000).

B2C e-commerce is also affecting the *transport* industry, particularly trucking, with increased demand for small deliveries to residential locations in narrower time slots. The winners to date have been the package and parcel carriers (*e.g.* UPS, FedEx, etc.) and the 'less-than-truckload' carriers. Other winners might be transport businesses that can exploit economies of scope in terms of warehousing and distribution, thereby offering integrated fulfilment services (Costello 2000). There are also potential economies of scale, with a demand to match the worldwide reach of the Internet with worldwide fulfilment capabilities.

Both distributors and deliverers are affected by an increased demand for reverse logistics, with returns an inevitable feature of mediated commerce, be it e-commerce or traditional mail order. In effect, the Web site and delivery driver become the only points of customer contact and customer care. Consequently, many businesses are seeking to ensure that delivery is more than simple delivery, becoming the critical point of customer care at which service is provided and customer feedback captured.

The emergence of on line sales has also led to the development of e-commerce fulfilment centres, which perform distribution-related functions for goods purchased via the Internet. They assemble and repackage materials, consolidate orders and shipments, and physically deliver goods to customers. For manufacturers, e-commerce fulfilment centres enhance inventory control and just-in-time manufacturing, thereby helping to control costs and opening up new business models (*e.g.* Dell's build-to-order business model). For retailers, e-commerce fulfilment centres provide a cost-effective means for individual shipping to customers who make purchases on line, thereby underpinning the viability of on line sales and 'e-tail' business models (Lockwood Greene 2002).

There are a number of implications. B2C can eliminate various steps in the traditional retail chain. Where the on line retailer is a new entrant (*e.g.* Amazon), B2C e-commerce often bypasses retail to become an 'e-tail' front end to a warehouse operation, with the core focus behind the Web site being pick, pack and delivery. Where the on line retailer is an established 'bricks and mortar' retailer expanding to on line sales, however, warehouse activities can be bypassed, with the pick and pack activities undertaken in existing stores, possibly overnight or during relatively quiet periods for walk-in shopping. Consequently, the impacts of B2C e-commerce on warehousing and storage can vary significantly, and may depend, in part, upon the relative longer-term viability of various on line retailer business models.

Delivery, however, is central to on line retail fulfilment. While digital delivery may replace physical delivery for some content goods, it will not be possible to eliminate delivery entirely. Indeed, to date, B2C e-commerce has tended to generate more delivery business. Nevertheless, B2C e-commerce brings with it new delivery demands and calls for new transport and delivery business models. These include:

- The combination and integration of fulfilment activities (*e.g.* pick and pack, delivery, returns, etc.) into fulfilment services.

- A re-orientation from bulk to small package delivery, with consequent redesign of distribution facilities (*e.g.* moving away from large storage facilities towards smaller distribution and transhipment centres near major roads, airports and/or residential areas).

- A shift from daytime delivery to business districts to evening and weekend delivery to residential areas (with a range of new traffic routing, vehicle suitability issues and driver demands).

- More varied delivery patterns, related to product shelf-life, product customisation, production and retailing strategies, etc..

- A re-orientation from simple delivery to customer service (*e.g*. carrying, handling returns, etc.), and

- The formation of closer relationships between logistics services providers and their clients, and the tendency for clients to use fewer service providers (Euro-CASE 2001).

Impacts of use by customers (supply chain)

The impacts of B2B e-commerce and supply chain related e-business solutions are more significant for wholesale distribution and transport, because B2B (*i.e*. intermediate) services form the major part of their business activities. As noted, the adoption of e-commerce, supply chain related e-business solutions and digital delivery are a part (part cause and part consequence) of underlying changes in the management of the supply chain. The adoption of production practices, such as just-in-time, efficient consumer response and vendor-managed inventory, and the development of new business models, such as flexible customisation and build-to-order, are bringing a new focus on distribution and logistics activities. Typically, they involve more information intensive and time critical management of procurement and inventory.

This: "…reorganization of interfirm relations… is more than a story of price compression; it should be viewed instead as a story of strategic sourcing. …Internet-based software is being implemented not only to lower costs, decrease inventories, and shorten elapsed times, but also to render the intricacies of the value chain and its documentation more visible. In other words, the Internet has become a tool for thinking about, and reconfiguring, the organisation and operation of the value chain." (Cohen *et al.* 2001, p243). To compete in e-commerce the complete business model, including marketing, merchandising, product selection, pricing, vendor relations, technical management and fulfilment, must be re-evaluated (Hultkrantz and Lumsden 2000, p5).

Responses among both wholesale distribution and transport businesses vary. Some are becoming 'one-stop' logistics services suppliers, some are becoming more specialised sub-contractors to full-services suppliers and others are becoming more specialised niche services suppliers. Responses depend upon a range of factors, including the businesses' own capabilities, their ability and inclination to consolidate activities and the forces operating in particular supply chains – with changes sometimes imposed from above (*e.g*. efficient customer responses in grocery supply imposed by lead retailers) and sometimes the result of organic development among channel partners (*e.g*. customers outsourcing the procurement function to distributors and using networked business systems to reduce inventory and cut costs). The wholesale distributor's role in an integrated supply relationship varies widely, ranging from simple warehouse storeroom management at the low end, to becoming the outsourced procurement department for a customer. In the latter role, the integrator is hired to transform an entire procurement process by managing procurement at individual sites, including inventory, delivery and the transaction process, while providing the information technology infrastructure to optimise the purchasing process across multiple locations (Fein 2000, p41-6).

One-stop *logistics services providers* are emerging from a process of consolidation in both the wholesale distribution and transport industries. That consolidation is often vertical in nature, with businesses seeking to bring together capabilities and services in combinations previously unavailable. As logistics services have become more integrated into the value chain, logistics providers tend to enter longer-term arrangements with customers (be they manufacturers or retailers). Increasingly, these have taken the form of multi-year outsourcing contracts governed by service level agreements (Hassall 2001). As a result, the business orientation is increasingly to service, rather than simply price. Like B2C e-commerce and fulfilment, production practices and business models in client industries (*e.g*. just-in-time, efficient consumer response, vendor managed inventory, flexible customisation and build-to-order) are

demanding smaller, more frequent and time sensitive delivery, as well as much greater track and traceability in the system (*i.e*. the so called glass pipeline).

For *sub-contractors and niche specialists*, there are similar demands for more information about their activities and consignments, integration of information and information systems into supply chain management systems, and responses to the range of changed demands (*e.g*. smaller, more frequent, time sensitive consignments). Warehousing and storage is seeing a shift from large scale storage facilities focusing on the exploitation of economies of scale in storage and handling, to more distributed distribution centres focusing on handling rather than storage, with more cross-docking and more information intensive and information-based pick and pack, track and trace, and load optimisation activities. For freight transport businesses, similarly, there is a marked shift to smaller, more frequent and time sensitive deliveries, more information about and tracking of consignments, and more emphasis on service reliability.

Impacts of use by distribution and logistics service providers (own use)

While the distinctions are sometimes difficult to draw, it is clear that the impacts of the use of e-commerce and supply chain related e-business solutions by customers are different from the impacts of the distributors' *own use* of e-commerce, supply chain related Internet-based business solutions and digital delivery in their services. Again there are both opportunities and threats. In relation to trucking, Costello (2000, p 54-5) noted that:

> *Some carriers are starting their own Web pages to take advantage of the surge in Web sales. Carriers move more than just freight; they also move data. On the Web pages of several large carriers, especially in the LTL [less-than-truckload] segment, shippers can get rates, schedule pickups, trace shipments, pull invoices, and make payments on-line.*

In relation to wholesale distribution, Fein (2000, p 41-6) noted that:

> *Many wholesaler-distributors are seeking to build their own e-commerce hubs aimed at corporate purchasers. These Web sites are essentially on-line storefronts for an established company. For instance, Grainger.com allows W.W. Grainger customers to access their standard accounts and price discounts and the company catalog on-line. It is thought that these sites will allow individual distributors to reach much larger, potentially global marketplaces that were previously unavailable because of advertising and servicing costs. Niche market distributors and distributors with specialized processing skills may be able to expand a previously limited customer base significantly. Larger wholesaler-distributors may be able to channel significant portions of their overall customer base through an in-house Web site, lowering the costs of customer ordering and gaining greater control in the customer relationship.*

There are also threats. The increase in reach facilitated by Internet-based commerce and increased information about products and services available and their prices could, in theory, lead to a situation where small package deliverers and the re-internalisation of some activities by manufacturers could eliminate wholesale distribution in some industries (Fein 2000, p 41-5).

Information brokers, such as traditional freight brokers and freight forwarders, are also threatened by the emergence of specialist on line brokers. The Internet allows greater opportunities for load matching (*i.e*. matching shipments to available transport) and access to volume discounts. A number of specialist on line freight brokers and marketplaces have emerged to allow customers requiring delivery services and transport operators who can supply them to exchange information about their needs and capacities, thus bypassing traditional freight forwarders. These players may be existing freight forwarders or related

industry players, or they may be new entrants, building on the capacity of new load matching software (Nagarajan *et al.* 2001).

There are a number of examples. TransPlace (www.transplace.com) is an example of existing industry players providing a new Internet platform to improve the efficiency of freight transport through load matching and a range of other services to shippers and carriers. This is an example of broker (*i.e.* freight forwarder) substitution, with shippers matching requests with transport providers directly. FreightQuote (www.freightquote.com) is an example of a new intermediary seeking to aggregate the demand of smaller shippers, thereby enabling access to volume discounts on their shipping. In such a scenario the new intermediary is an on line broker, combining the industry skills of traditional freight forwarders with new on line business and information systems skills (Nagarajan *et al.* 2001). Other examples of logistics related players and marketplaces, include: ShipXact (www.shipxact.com), FreightMatrix (www.freightmatrix.com), Nistevo (www.nistevo.com), e-trucker (www.etrucker.net), Shipping-world (www.shipping-worldwide.com), Integres (www.integres.com), ezfreightrates (www.ezfreightrates.com), etc. One recent report suggested that, in Europe, the 'Quick Quotes' service of on line freight specialist FreightTraders (www.freight-traders.com) revealed significant price quote difference – with prices quoted for a single movement by curtain-sided trailer from Italy to the United Kingdom ranging from GBP 680 to GDP 1 420 (*e.logistics* 2002). This demonstrates the potential of such marketplaces and business service models to facilitate logistics cost savings and efficiency gains.

Nagarajan *et al.* (2001) noted that there were major changes taking place within the trucking industry as a result of changes in the information environment due to the Internet, including: the emergence of 'virtual trucking', consolidation and the emergence of one-stop transportation services, and the exploration of new business possibilities.

- Virtual trucking businesses own no assets, acting instead as system integrators for asset-based businesses. The Internet creates the link between shippers, virtual trucking businesses and carriers, with the business based around information and optimisation software (*e.g.* www.FreightPro.com).

- One-stop transportation services are emerging from consolidation of the various elements, with most consolidation in the industry involving vertical integration of transport and related and complementary services (*e.g.* carriers, freight forwarders, logistics businesses, etc.), and

- New business opportunities are arising in various market niches, such as e-commerce fulfilment, in which the delivery driver becomes a key point of customer contact and customer care (*e.g.* HomeDirect's furniture delivery service).

Increasingly, the provision of sophisticated distribution and logistics services requires a range of information systems, such as vehicle routing and scheduling, track and trace, warehouse management, performance reporting and payment processing, as well as their integration into e-business solutions, e-commerce and digital delivery mechanisms (BTRE 2001). While it is difficult to separate the impacts of e-commerce, the use of supply chain related e-business solutions and digital delivery from those of a range of other forces operating within distribution and logistics, it is clear that be it as drivers or enablers they are fundamental to the re-structuring of supply chain related and logistics activities.

IMPEDIMENTS

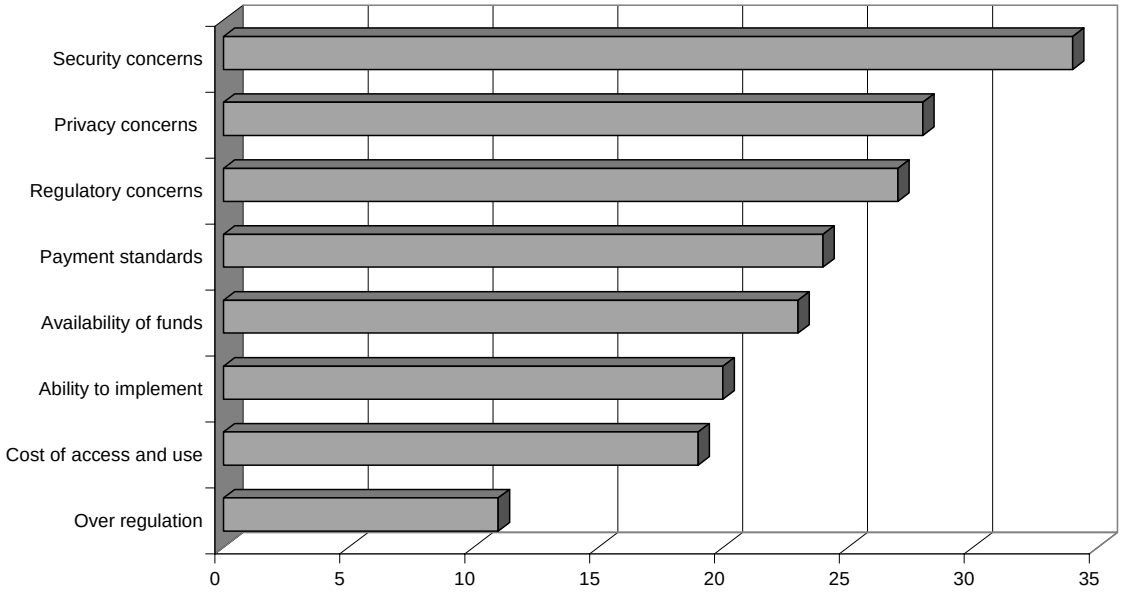
Organisations face a range of impediments to the adoption of e-commerce, supply chain related e-business solutions and digital delivery in their distribution and logistics activities. Generally, suitability of the particular products or services, concerns over security and privacy, internal and external skills availability, infrastructure and implementation costs, and regulatory barriers are among the most widely cited. Because of the networked nature of supply chain management and logistics activities and services, there are additional difficulties with co-ordination, integration, harmonisation and standardisation. This section examines the evidence from recent surveys, then summarises the situation facing both distribution and logistics businesses and their users.

Evidence from experience

In an extensive survey of e-commerce activities in 25 countries spanning Europe, the United States, Japan, South Africa and India, Accenture (2001) found that: 74% of businesses surveyed cited security concerns as a barrier to further development of e-commerce; 67% cited the lack of a transparent regulatory framework; 66% cited concerns over privacy; 59% cited lack of payments standards; 59% cited a lack of ability to successfully implement new technology; 57% cited lack of capital to fund implementation projects; 50% cited costs of communications access and usage; and 42% cited over-regulation. There were significant variations from country-to-country (Figure 33 shows the proportion of businesses citing barriers as 'significant').

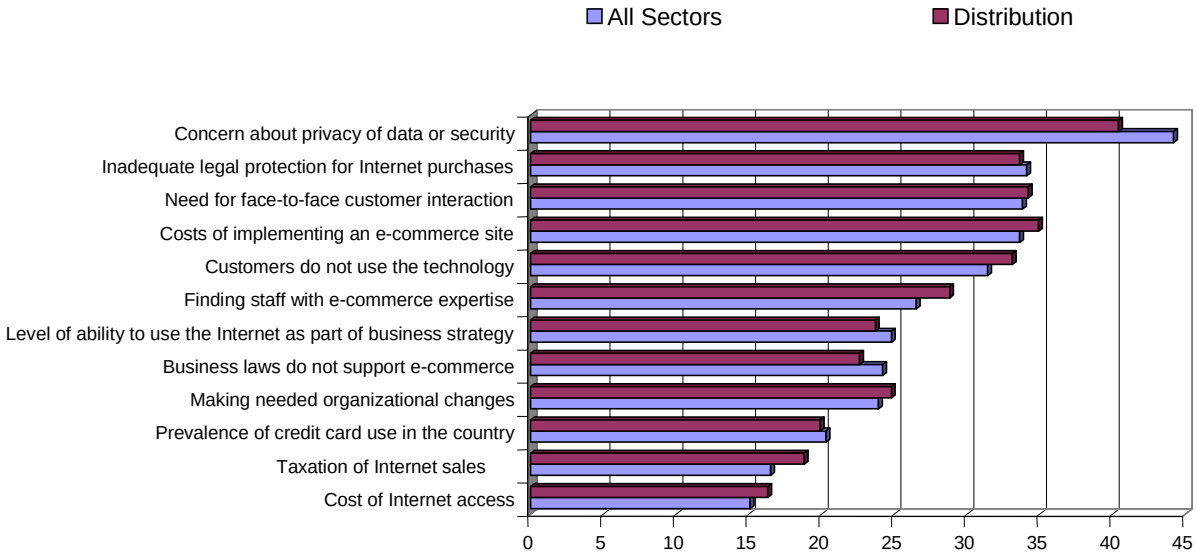
Similarly, in a ten country study undertaken during 2002, Kraemer, *et al.* (2002a) found that the most widely cited barriers to the adoption of e-commerce and e-business solutions were: concerns about privacy and data security (44%), inadequate legal protection for purchasers and the unsuitability of their products and services (34%). Implementation costs, lack of customers on line and inability to find skilled staff were also widely cited barriers. There were few major difference between the barriers facing wholesale and retail distribution establishments (SICs 50-54, 56-57 and 59) and those faced across all industries (Figure 34: See also Annex Table A11). To some extent, these findings reflect the timing and coverage of these surveys, being undertaken in 2001 and 2002, and the inclusion of a number of developing countries.

Figure 33. Barriers to the use of e-commerce in 25 countries, 2001
(percentage of businesses saying it was a significant barrier)



Source: Derived from Accenture (2001), *The Unexpected eEurope: The surprising success of European eCommerce*, Accenture. Annex Tables.

Figure 34. Barriers to the use of e-commerce in ten countries, 2002
(percentage of establishments saying it was a significant barrier)

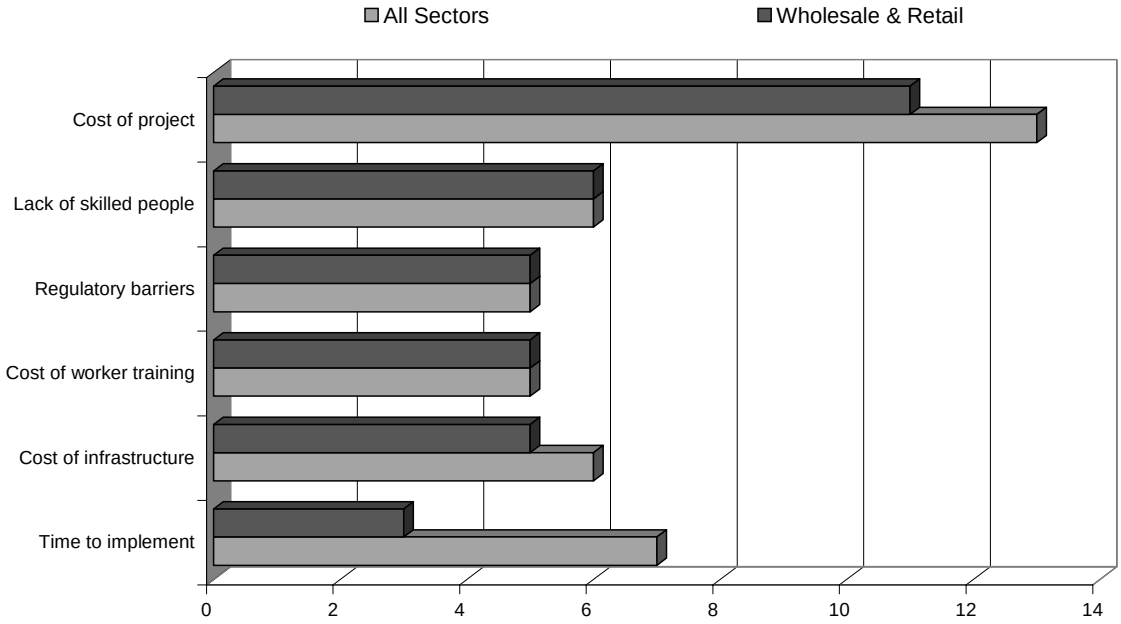


Sources: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce: A Mile Wide and an Inch Deep*, CRITO, University of California, Irvine.

North America

In the United States, Varian *et al.* (2002) found that the major barriers to the further implementation of Internet business solutions were: the cost of projects and infrastructure, cited by 13% and 6% of organisations, respectively; time to implementation (7%); the difficulty of obtaining skills (6%); worker training internally (5%); and regulatory barriers (5%). Organisations in different industries had somewhat different perspectives on the most important barriers, with cost and time to implementation less significant barriers for those in wholesale and retail (Figure 35).

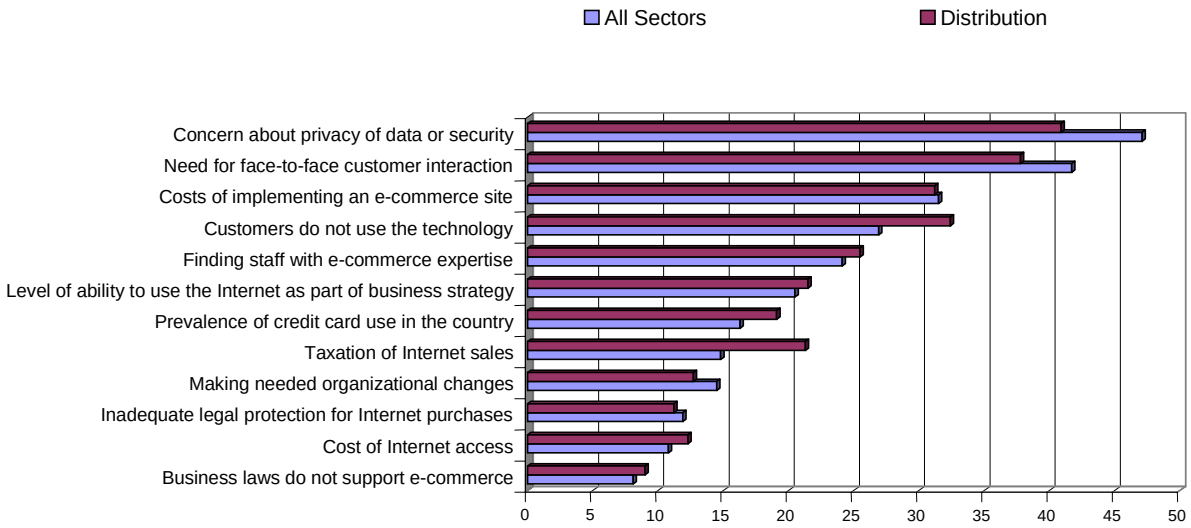
Figure 35. Barriers to adoption of Internet business solutions in the United States, 2001
(percentage of organisations surveyed)



Source: Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002, V2.0, pp31-32.

Kraemer, *et al.* (2002b) found that the most widely cited barriers to the adoption of e-commerce and e-business solutions by establishments in the United States in 2002 were: concerns about privacy and data security (47%), unsuitability of products and services (42%), implementation costs (32%) and lack of customers on line (27%). Legal issues and infrastructure costs were less widely cited by US-based establishments in the study than was the case across the ten country sample (Figure 36: See also Annex Table A11). There were few difference between the barriers facing wholesale and retail distribution establishments (SICs 50-54, 56-57 and 59) and those faced across all industries.

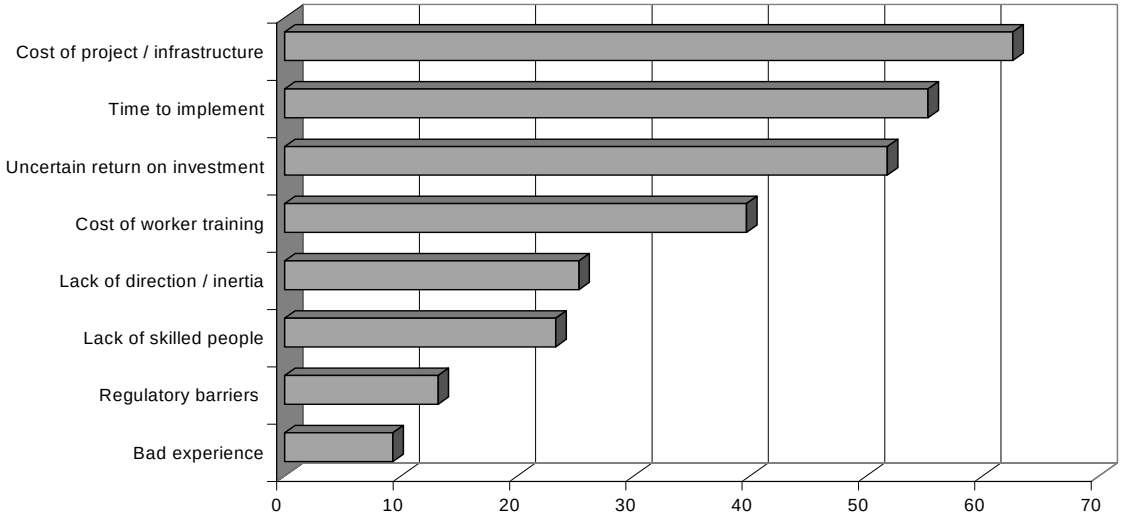
Figure 36. Barriers to the use of e-commerce in the United States, 2002
(percentage of establishments saying it was a significant barrier)



Sources: Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), *E-commerce in the United States: Leader or one of the pack?*, CRITO, University of California, Irvine.

In Canada, the most commonly cited barriers to the adoption of Internet business solutions among SMEs that were adopters were: cost of projects and new infrastructure, cited by 63% of respondents; time to implement projects (55%); uncertain return on investment (52%), worker training (40%); lack of management direction and organisational inertia (25%); access to skills (23%) and regulatory barriers (13%) (Figure 37) (CeBI 2002). In the Canadian study, there was no sector specific report of perceived barriers. More recent evidence suggests that in logistics in Canada, data integrity and the cost of achieving data integrity and standards for radio frequency identification (RFID) are important barriers to the further implementation and integration of radio frequency identification in the supply chain. It is difficult for firms to justify the significant investments required to 'clean up' supply chain and logistics related data and to implement RFID-based systems when the return on investment time horizon is six months to a year, and/or when the costs faced by SMEs are equivalent to those faced by larger businesses.

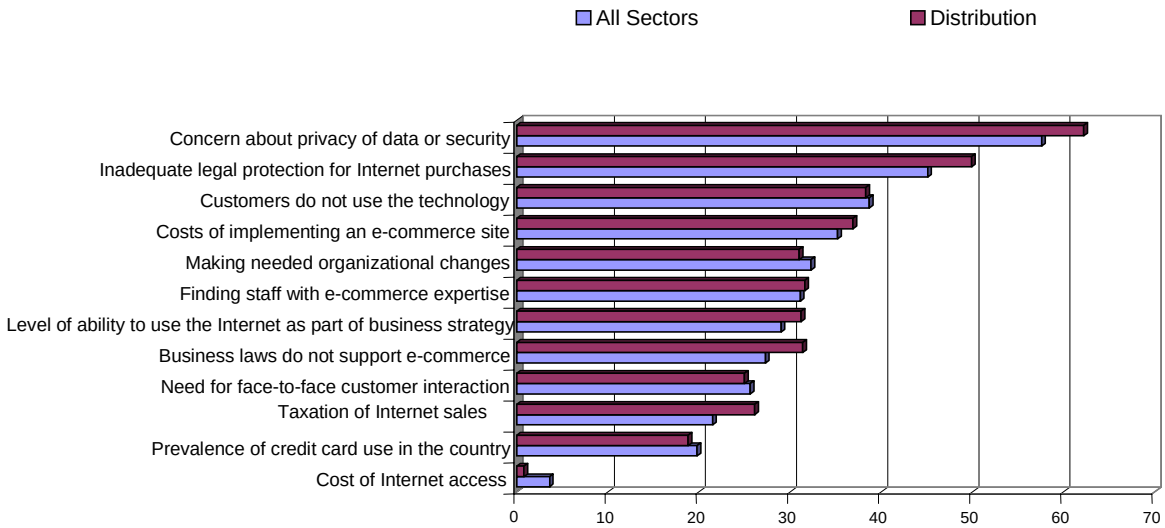
Figure 37. Barriers to the adoption of Internet business solutions cited by Canadian SMEs, 2002
(percentage of adopters)



Source: CeBI (2002), *Net Impact Study Canada: The SME Experience*, CeBI, Industry Canada.

In Mexico, the barriers to adoption of e-commerce and e-business solutions reported in a 2002 survey reflected the level of development, with concern about privacy of data or security (58%), inadequate legal protection for Internet purchases (45%), low use of the technology among customers (39%) and costs of implementing an e-commerce site (35%) the most widely cited barriers. Again, there were few major difference between the barriers facing wholesale and retail distribution establishments (SICs 50-54, 56-57 and 59) and those faced across all industries (Figure 38: See also Annex Table A11) (Palacios 2003).

Figure 38. Barriers to the use of e-commerce in Mexico, 2002
(percentage of establishments saying it was a significant barrier)



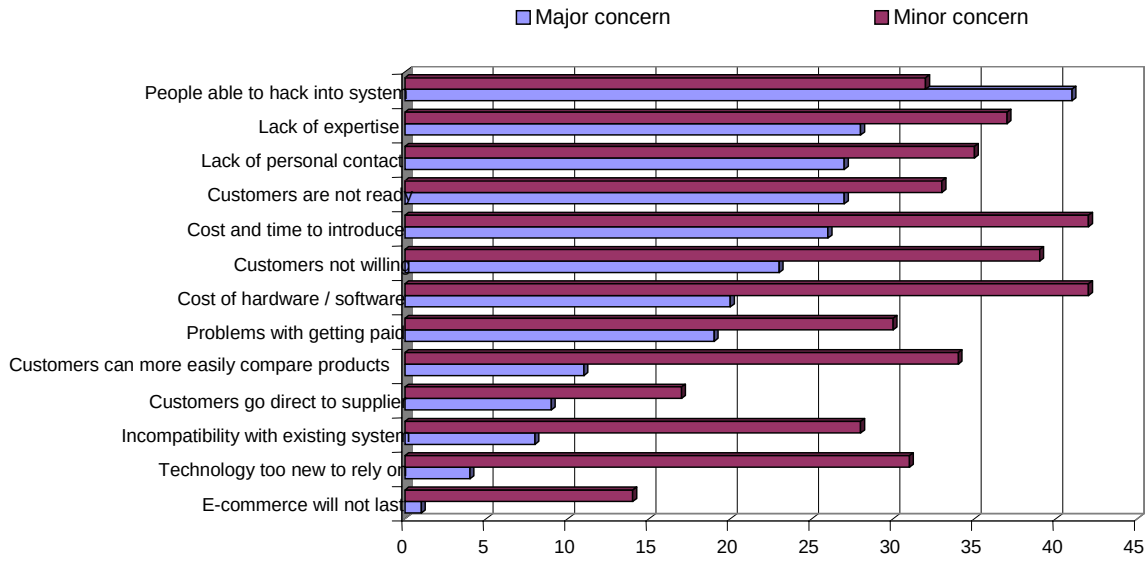
Sources: Palacios, J.J. (2003), *Globalization and E-Commerce: Diffusion and Impacts in Mexico*, CRITO, University of California, Irvine.

Asia-Pacific

In Australia, NOIE (2001) noted that one-third of small business owners found it difficult to find information about the different business applications of e-commerce. Many found the Internet itself to be the most useful e-commerce research resource. The next hurdle was finding the right person or company to construct their Web site, and in a number of cases businesses were dissatisfied with the work of their first Web developer and needed to use a second developer to get the right result. For businesses selling high volume/low value products or services over the Internet an important success factor was found to be keeping their Web site up-to-date and dynamic to encourage customers to return, but these companies found maintaining and updating Web sites costly and time-consuming. Those businesses that used e-commerce to export faced a number of additional challenges, including finding the right logistics solution for delivering products and selecting an ordering system that was both easy for customers to use and secure. A key inhibitor of e-commerce growth at that time, which prevented some small businesses from gaining the full benefit of e-commerce, was the lack of widespread use of on line business channels.

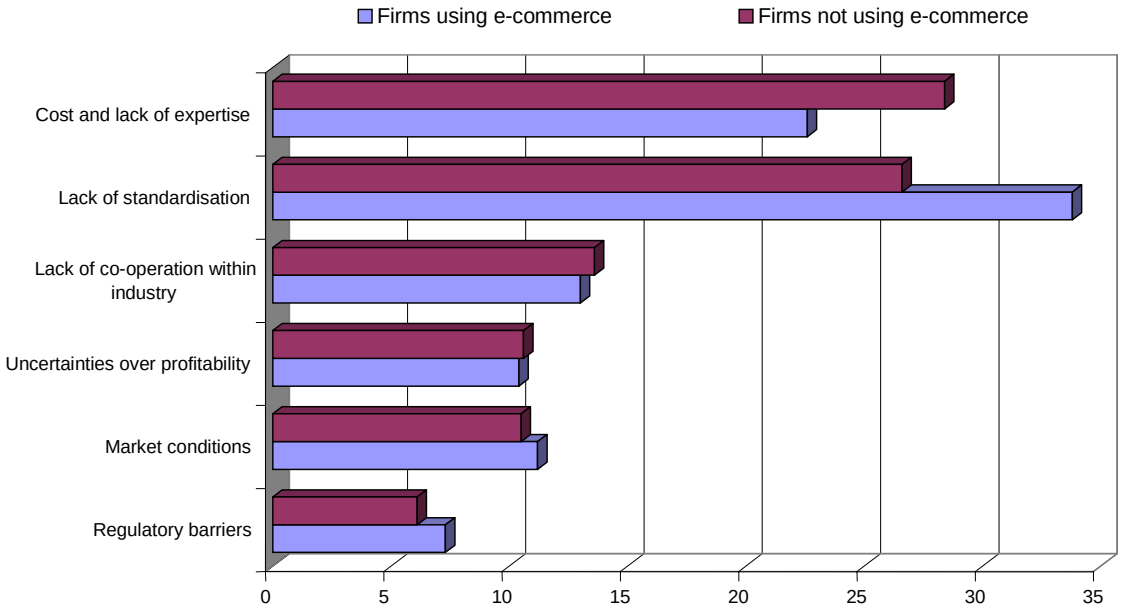
A survey of Australian SMEs conducted in May 2003 found that, unprompted, the perceived unsuitability of the business (30%) and need for personal contact (20%) were the main reasons cited for not being able to use e-commerce. The lack of use of e-commerce by customers was the only other barrier regularly cited (11%). When given a list to chose from, the major barriers cited related to security, lack of expertise and skills, costs and lack of demand from customers (Figure 39 and Annex Table A12) (Sensis 2003, p35). Similarly, the Australian Bureau of Statistics (2004) reported that the major barriers to receiving orders via Internet for Australian businesses during 2003 were: that the goods or services were not suitable (63%), a preference for the retention of their current business model (39%), lack of customer demand (24%), costs of development and maintenance too high (14%), skills availability (13%) and security concerns (8%).

Figure 39. Barriers to SMEs engaging in e-commerce in Australia, 2003
(percentage of responding SMEs)



Source: Sensis (2003), 2003 *Yellow Pages Business Index E-Business Report*, Telstra Corporation, Melbourne, July 2003.

Figure 40. Barriers to growth of e-commerce in Korea, 2002
(percentage of businesses)

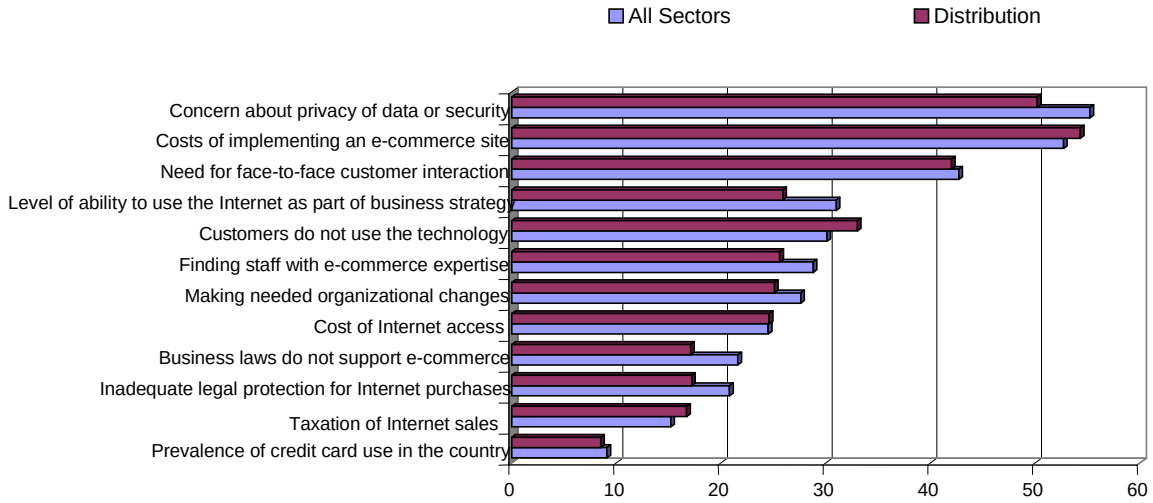


Source: MoCIE (2003), *E-Commerce in Korea*, Ministry of Commerce, Industry and Energy.

In New Zealand, the major barriers cited included: low customer use of e-commerce, the cost of computing and network technology, and limited knowledge of the technologies (Clark, *et al*. 2001, p17). In Korea, the most important barriers to the adoption of e-commerce have included: lack of standardisation, cost and lack of expertise, and lack of co-operation within the industry (MoCI 2003). Lack of expertise is a greater barrier to those businesses not using e-commerce than to those already doing so, suggesting the value of learning and experience; and the lack of standardisation is a greater barrier to those using e-commerce than anticipated by those not using e-commerce (Figure 40 and Annex Table A13).

In Japan, similarly, concern about privacy of data or security (55%), costs of implementing an e-commerce site (53%) and unsuitability of product or services (43%) were the most widely cited barriers. Again, there were few major difference between the barriers facing wholesale and retail distribution establishments (SICs 50-54, 56-57 and 59) and those faced across all industries (Figure 41: See also Annex Table A11) (Tachiki 2004).

Figure 41. Barriers to the use of e-commerce in Japan, 2002
(percentage of establishments saying it was a significant barrier)



Sources: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), *Diffusion and the impacts of the Internet and e-commerce in Japan*, CRITO, University of California, Irvine.

Europe

E-business watch (2002, pp26-28) reported two surveys of European businesses conducted in 2001 that suggested that the main barriers to selling on line were:

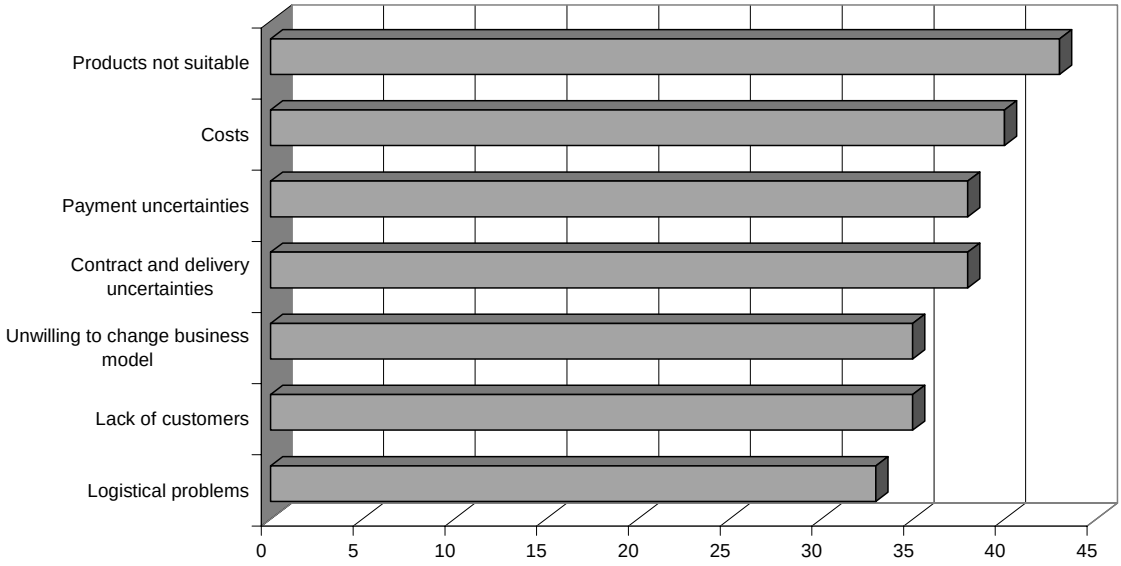
- *Goods and services were unsuitable for on line sales* – 25% of respondents to a Eurostat survey and 38% of respondents to an Empirica survey cited suitability as very important, and more than 50% said that it was either important or very important.

- *Lack of confidence and trust* – 29% of respondents to an Empirica survey said that lack of confidence and trust was very important, 20% of respondents to a Eurostat survey were concerned with uncertainty over payments, and 17% were concerned with uncertainties in contract, delivery and guarantees; and

- *Cost* – 18% of respondents to a Eurostat survey were concerned with costs, as were 16% of respondents to the Empirica survey.

According to Deiss (2002), widely cited barriers to European businesses *selling* on line in 2002 included: unsuitability of products (cited by 43%), maintenance and development costs (40%), uncertainty of payment (38%) and contract and delivery uncertainties (38%) (Figure 42). Barriers to *purchasing* on line included: contract and delivery uncertainties (41%), unsuitability of products (38%), uncertainty about payments (35%) and fulfilment concerns (30%).

Figure 42. Barriers to on line sales in Europe, 2001
(percentage of enterprises)

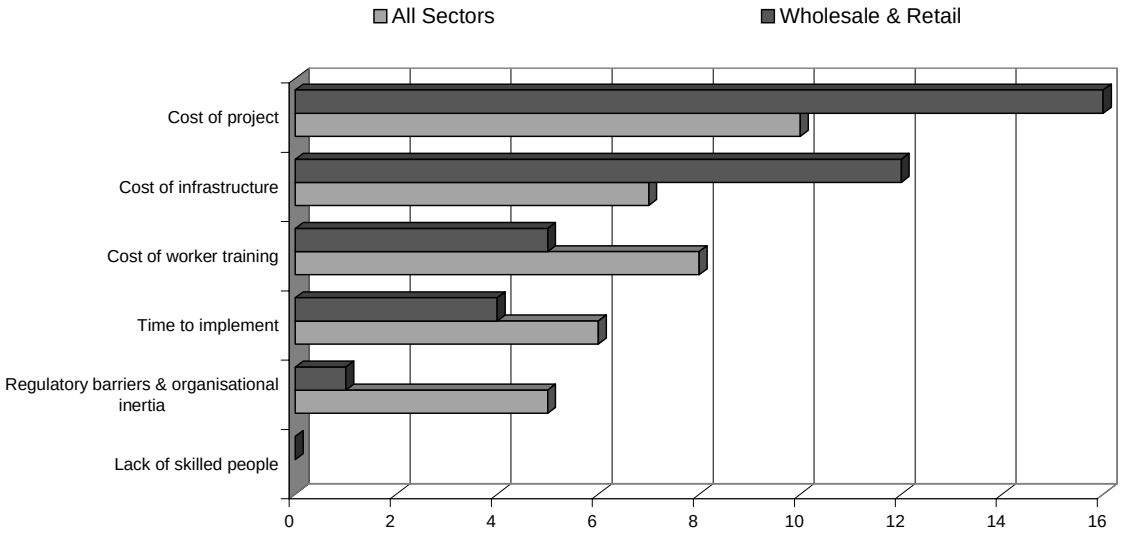


Source: Deiss, R. (2002), *E-commerce in Europe*, Cat KS-NP-02-012-EN-N, Eurostat, Brussels.

There were significant differences between countries. Generally, more enterprises that were not already selling on line cited barriers to e-commerce than enterprises that were already selling on line. Those not selling on line tended to see the unsuitability of products and lack of customer demand or customers not being ready as the main barriers. Once selling on line, security concerns, logistics and fulfilment loom larger as barriers to expansion. In those countries with relatively lower levels of adoption of on line sales, a higher percentage of enterprises cited barriers, and the barriers most cited tended to relate to customers not being ready. Elsewhere, unsuitability of products (*e.g.* Denmark and Norway) and/or security concerns loom larger (*e.g.* Denmark, Luxembourg, Austria, Sweden) (Annex Tables A14 and A15) (Eurostat 2003, p. 32).

Varian *et al.* (2002) reported that organisations in the United Kingdom, France and Germany identified a similar set of barriers to those noted in the United States. Reflecting different levels of readiness, however, organisations in Europe did not identify regulatory issues as a major barrier, but did see worker training and organisational inertia as more important issues. The time to implement projects was also more widely cited as a barrier in Europe. Again there were difference between sectors, with a higher rate of citation of barriers among those in wholesale and retail, much greater concern about the cost of infrastructure and projects, and less concern about training and skills (Figure 43). Dantuma and Hawkins (2001) noted that in 2001 most logistics businesses in the Netherlands found difficulties establishing electronic relationships with customers and developing new electronic marketplaces.

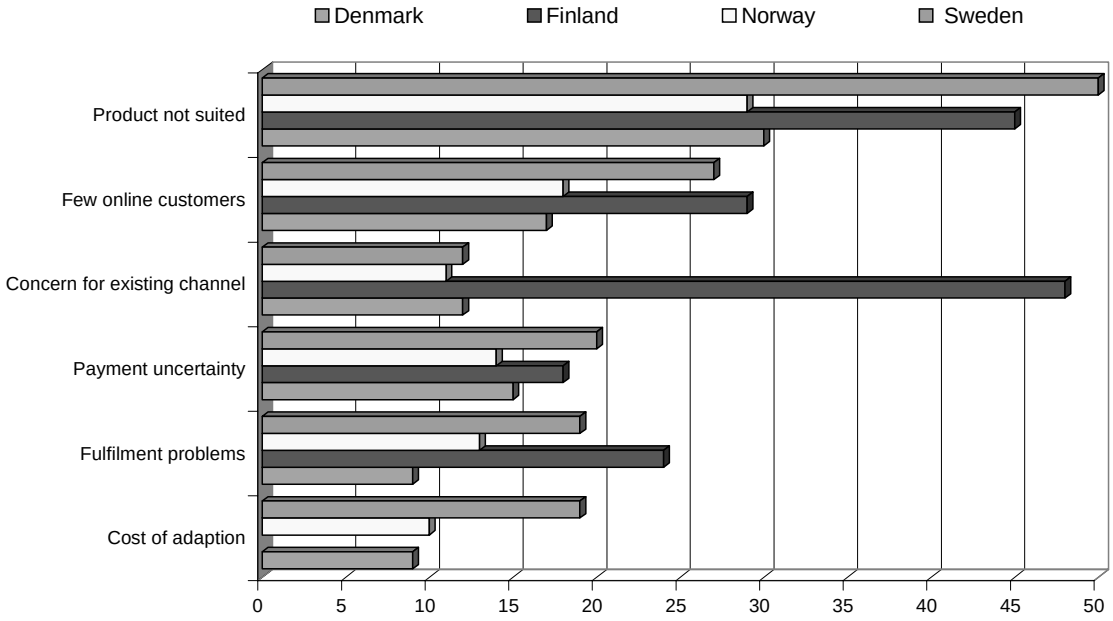
Figure 43. Barriers to adoption of Internet business solutions in Europe, 2001
(percentage of organisations)



Source: Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study*, January 2002.

In Scandinavia, SIKA (2003) found that among businesses that did not use Internet in 2000 the major barrier cited was security concerns – cited by 38% of non-using businesses in Finland, 30% in Sweden and 26% in both Norway and Denmark. The second most commonly cited barrier was the cost of developing and maintaining Internet-based systems – nominated by 28% of non-using businesses in Sweden, 20% in Finland, 14% in Denmark and 13% in Norway. The most significant obstacle to e-commerce (*i.e.* sales via Internet) reported by businesses was that their product was not suited to on line sales – cited by 50% of businesses in Sweden, 45% in Finland, 30% in Denmark and 29% in Norway. Lack of an on line customer base was cited as a barrier by 29% of businesses in Finland, 27% in Sweden, 18% in Norway and 17% in Denmark. Other commonly cited factors included: uncertainty regarding payments, costs of adoption and concerns for existing sales channels (Figure 44). Again there is a clear pattern, despite national differences.

Figure 44. Barriers to Internet sales in Scandinavia, 2000
(percentage of businesses)



Source: SIKA (2003), *Facts About Information and Communications Technology in Sweden 2003*, SIKA Institute, Sweden. Available www.sika-institute.se accessed October 2003.

Barriers are magnified when shipments are international. Globalisation has brought distribution and logistics businesses additional challenges, which are still being worked through. A key characteristic of the Internet is its reach – allowing even the smallest businesses access to a potentially global market. However, what is sold must be delivered, making fulfilment crucial to the success of e-commerce. Hence, the emergence of e-commerce has rendered international distribution and logistics difficulties more visible and more immediate.

In a survey conducted by Forrester Research in 2001, 46% of the interviewees with company Web sites said that they turned away international orders because they did not have processes in place to fill them. Obstacles included: an inability to handle direct international orders, language and cultural barriers that hinder basic communications, and uncertain and varying stages of Internet adoption and infrastructure. Another Forrester study found that 85% of the businesses surveyed could not fill international on line orders because of the complexities of shipping across borders. Of the 15% that did handle global orders, most shipped only to a few countries in Europe and Asia where they could fill orders out of local warehouses. Three-quarters of the businesses that did not ship globally stated that the main reason was their system's inability to register international addresses accurately or their inability to price total delivery costs accurately (Bayles 2002).

Discussion and analysis

Organisations face a range of impediments to the adoption of e-commerce, supply chain related e-business solutions and digital delivery in their distribution and logistics activities. Generally, suitability of the particular products or services, concerns over security and privacy, internal and external skills availability, infrastructure and implementation costs, and regulatory concerns are among the most widely cited impediments. Because of the inter-organisational, networked nature of supply chain management and

logistics activities, there are additional difficulties with co-ordination, integration, harmonisation and standardisation.

Generic impediments, felt by all industry sectors, include: suitability of products or services for on line transactions, internal and external skills availability, infrastructure and implementation costs, concerns over security and privacy, and regulatory barriers. Suitability, costs and skills are truly generic. Of somewhat greater concern for both user organisations engaging in supply chain related activities and distribution and logistics businesses are such things as security and privacy of shared information, messaging and payments standards and regulatory difficulties. These issues are magnified in logistics and related supply chain management activities because of their networked nature, and they are doubly magnified when those activities cross international borders because of both network extension and added complexity.

The evidence suggests that there is value in experience, with lack of expertise a greater barrier to those businesses not on line than it is for those already on line. However, experience also brings new problems, with lack of standardisation a greater barrier to those on line than anticipated by those not on line. Differences between countries and industries also appear to be related to learning and experience. Generally, more enterprises that are not already selling on line cite barriers to e-commerce than those that are already selling on line. Those not selling on line tend to see the unsuitability of products and lack of customer demand or customers not being ready as the main barriers. Once selling on line, security concerns, logistics and fulfilment issues loom larger. In those countries with relatively lower levels of adoption of on line sales, a higher percentage of enterprises cite barriers, and the barriers most cited tend to relate to customers not being ready.

Because of the networked nature of supply chain management, there are additional difficulties with co-ordination, integration, harmonisation and standardisation when organisations move to Internet-based supply chain integration and management. Having users, both upstream and downstream, that are already connected and experienced, and with whom it is possible to integrate systems, is crucial for the successful application of e-commerce, supply chain related e-business solutions and digital delivery of services. Co-operation within industry verticals and along supply chains is essential, and issues relating to privacy, security and compatibility loom larger. Harmonisation and standardisation of systems is vital. One critical problem is data integrity, with the present level of accuracy of data in the system often insufficient to support supply chain integration and the implementation of increasingly data intensive systems (*e.g.* RFID).

EMERGING ISSUES AND NEW CHALLENGES

This section analyses the challenges of implementing radio frequency identification systems as one example of the challenges facing distribution and logistics. It then turns to a broader treatment of emerging issues and policy challenges.

RFIDs: the challenges facing logistics in microcosm

Radio frequency identification devices (RFIDs) are currently the leading-edge of product tracking. With the ultimate aim, perhaps dream, of reversing the supply chain so that actual rather than forecast demand drives production and shipment, technologies contributing to transparency and immediacy of information and product flows are keenly sought.

RFID technologies involve: tags that emit short-range radiofrequency signals; readers that pick up the signals and may be networked to databases; databases that hold customer account, stock control or other information; and software that integrates information supplied by the tag to the reader with information held in one or more databases. There are two types of RFID tags: active and passive. An active tag uses its own power source to contact the reader, which enables transmission of a signal over a greater distance than that of a passive tags but involves greater tag cost, size and weight. Passive tags derive their power from the RFID reader, have a shorter range than active tags and are affected by barriers, such as metal shipping containers or concrete walls. However, they can be smaller, more resilient and substantially cheaper (Carlson Analytics 2004, OECD 2004).

RFID technologies have been around in various guises for some years. They are, for example, used on Australian toll roads, in Swiss ski passes and US airport baggage handling. At the heart of supply chain related RFID is the electronic product code (EPC), which differs from the universal product code (UPC) used for barcoding in that it allows individual items to have a unique identifier, rather than a product class identifier. The EPC also differs from the UPC in that it identifies non-consumer products, such as cases and pallets (Shutzberg 2004).

The potential of RFID technologies to reduce costs and increase internal and supply chain efficiency is considerable (Table 9). Potential benefits include: reduced supply chain labour costs as a result of greater efficiency in handling and tracking; reduced inventory holdings as a result of supply chain transparency and streamlining; improved product availability and consequent higher sales; and easier product life-cycle management (*e.g*. product stewardship) and product recall (Radko and Schumacher 2004).

RFID adoption is being driven by major customer demands and falling RFID equipment costs. Late in 2003, Wal-Mart announced a mandate requiring its top 100 suppliers to put RFID tags on all cases and pallets they ship to Wal-Mart's first distribution centre by January 2005. Since that time, other retailers (*e.g*. Target, Albertsons, Best Buy, Tesco and the German Metro Group), as well as the US Department of Defence, have also announced RFID mandates and Wal-Mart has extended its mandate to the next 200 suppliers, who must tag by January 2006. While mandates of this sort are the major driver, a few companies are pursuing RFID for internal operating efficiency gains, while others are attempting to differentiate themselves from their competitors by incorporating RFID as part of their product and service offerings (Shutzberg 2004).

Table 9. Potential RFID benefits for supply chain partners

Manufacturers	Logistics Providers	Retailers
Shorter shipment loading times	More efficient order selection	Better store planning, programming and merchandising with real-time data
Greater shipment accuracy	Better order fill rates	Improved point-of-sale productivity and accuracy at checkout
Better consumer sales data from retailers	Less inventory shrinkage	More accurate returns
Reduced counterfeiting/diversion	Fewer administrative and other human errors	Improved reverse logistics
Improved support for vendor-µmanaged inventory	Lower labour requirements	Greater inventory accuracy and velocity
Easier product safety recalls	Less vendor fraud	Optimised store in-stock levels
More accurate demand planning	More accurate inventory	Reduced internal and external shrinkage
Shorter order lead times	Less time and lower cost for managing inventory	Lower labour requirements
Less need for safety stock	Higher routing efficiency	Automated receiving, vendor payments and shipments to store
Better use of labour	Better security for distributing medical products	Better use of reusable assets (*e.g*. pallets)
Higher sales	Automated receiving, vendor payments and shipments	Lower detention/demurrage charges
Less time and lower cost of cycle counting, receiving, picking and shipping	Increased capacity through more efficient operations	Better grey-market containment
Fewer charge-backs for inaccurate deliveries	Fewer penalties for execution errors	Better ways to measure the execution and effectiveness of display programs

Source: Shutzberg, L. (2004), *Radio Frequency Identification (RFID) in the Consumer Goods Supply Chain: Mandated Compliance or Remarkable Innovation?* Industry White paper, Rock-Tenn, Norcross GA. p51.

As trials extend and adoption takes off demand for RFID equipment is increasing and economies of scale in production can be realised, reducing the cost of tags and equipment. Ultimately, tags costing no more than a few cents will become available, enabling potentially cost effective tagging of even relatively low value products – although the costs of implementation and operation will remain significant. McGann (2005) suggested that the worldwide RFID tag market might grow from around USD 300 million in 2004 to USD 2.8 billion by 2009.

In consumer goods and retail the majority of applications involve RFID tagging of cases and pallets, with relatively few applications extending to individual item tagging for a number of reasons. First, there is demand for individual identification at the pallet and case levels that has not been met before. Second, there is an existing system (*i.e*. barcoding) for the identification and tracking of product classes that is reasonably effective for wholesalers and retailers. Third, individual item tagging is more difficult to implement, not only because of the amount of data involved, but also because of consumer concerns over privacy (*e.g*. traceability of items purchased, credit card matching, etc.).

The level of uncertainty, speed of development of technologies and systems, multiplicity of evolving standards, complexity and costs involved in RFID implementations are significant barriers. With RFID mandates by leading customers driving adoption, and complexity, cost and risk making it difficult for firms to make a strong business case for internal adoption, the most common response to date has been minimalist compliance (*i.e.* 'slap and ship') in which manufacturers and/or shippers simply attach complying RFIDs to pallets and cases without capturing or using the related data. To date, relatively few RFID implementations are fully integrated with internal information systems and even fewer have integrated with supply chain partners.

Many challenges remain, with standards, data integrity, integration and consumer resistance (*e.g.* privacy concerns) among the most important. At present, there are multiple standards (*e.g.* EPCglobal, ISO, EAN, UCC, etc.) and multiple formats (*e.g.* 64-bit, 96-bit, etc.) for the product codes and different international allocations for the frequency ranges that can be used.[12] Different frequency allocations make the integration of RFIDs into international supply chains all the more difficult (Shutzberg 2004). There are also issues of multi-use frequency allocations leading to problems of interference from other devices and consequent data corruption.

One of the greatest challenges faced by firms adopting RFIDs is data quality and integrity. RFIDs generate far more data than barcode-based systems, require the clean up of multiple reading and mis-reading, and a higher level of accuracy of data. Radko and Schumacher (2004) suggested that: "delivering the benefits promised by RFID... will only be possible if trading networks also address the issue of inaccurate data." Current supply chain management and logistics applications are often ill-equipped to handle high volumes of repetitive data, making essential the development of, and integration into middleware applications designed to manage the data flow.

Integration is required both internally and externally. Internally, firms must integrate RFIDs with their existing systems and link them to product, shipment, invoice and other data. Externally, firms need to integrate RFIDs into the global registry systems, to enable the handling and synchronisation of product data, *and* integrate their internal systems into those of their supply chain partners. Putting RFIDs on pallets and cases is only one step in the process of getting business data to flow alongside the physical supply chain (Radko and Schumacher 2004), and it is by no means the most difficult.

One important barrier to item tagging is consumer concern over privacy. It has been reported that trials of item-level tagging by such firms as Benetton, Tesco and Gillette have been suspended following pressure from consumer privacy groups over how EPC data on individual items might be used (Radko and Schumacher 2004). Privacy concerns are less important when implementing RFID tagging at the pallet or case level, since the tags are only used and read within the factory, warehouse or in transit. At the consumer item level, however, concerns are real. Marks & Spencer, Metro and Wal-Mart are among those now developing privacy policies that inform users how data from RFID tags will be used and/or commit to removing or de-activating tags before the items leave the store (Radko and Schumacher 2004). The challenges of standardisation, harmonisation, integration and management involved in RFID implementations make them a microcosm of the broader challenges facing logistics.

Policy challenges

Government involvement at the generic level focuses on: strengthening the framework conditions underpinning the use of e-commerce, supply chain related e-business solutions and digital delivery; enhancing diffusion of e-commerce best practice; and ensuring that the business and regulatory environments enable their positive impacts to diffuse widely. At a sectoral level, governments are becoming increasingly aware of the importance of distribution and logistics, for a range of economic, environmental and social reasons. Government involvement in logistics often attempts to address market

failures, such as information asymmetries, the public good nature of some transport and distribution infrastructure, and negative externalities (*e.g.* pollution and congestion). Governments around the world are also becoming increasingly aware of the economic importance of logistics, with an efficient system a key element of the competitive strength of firms, regional and national economies. Governments are also increasingly realising how regulatory frameworks can affect the operation and efficiency of local and international freight logistics systems, with regulation in seemingly distant areas (*e.g.* town planning, parking regulation, traffic congestion and pollution control) having a direct and immediate impact on distribution and logistics (Allen Consulting Group 2001). At the same time, governments and semi-government agencies are often intricately involved, through the ownership and operation of infrastructure (*e.g.* roads, ports, etc.) and as major in-house producers and users of logistics services (*e.g.* defence procurement). Consequently, there are many points at which government policy and logistics activities intersect. In this section, attention focuses upon those which directly relate to the further development of e-commerce, supply chain related e-business solutions and digital delivery in distribution and logistics.[13]

A supportive competitive environment

While governments seek ways to encourage the adoption of e-commerce and e-business solutions, it has often become evident that competition is a key driver of innovation. Consequently, the competitive conditions within the local transport, distribution and logistics industries are crucial.

Industry structure and competition

Developing, monitoring and maintaining a supportive regulatory environment for e-commerce and digital delivery is already a priority for many OECD governments. Competition policy is vital. Policy makers need to be aware of, and responsive to the potential effects of e-commerce and digital delivery on competition *and* of competition on the adoption and use of e-commerce and digital delivery. One key challenge will be to appropriately define 'markets' in what are rapidly evolving, dynamic and converging activities.

Both distribution and transport have experienced significant rationalisation, restructuring and consolidation in recent years. In some vertical markets (*e.g.* pharmaceutical wholesaling) there may be no more than a few players. However, it is important to take account of the entire logistics system when considering competition issues. Whether it is in the privatisation of formerly government held assets and establishing their regulatory environments (*e.g.* rail networks, ports, etc.), considering issues of competition regulation in respect to mergers and acquisitions in the distribution or transport sectors, or in a range of other areas that may be significant users and/or in-house producers of logistics services, it is becoming increasingly important to consider the entire logistics chain and to look at competition both within and between supply chains – recognising that competition is increasingly between entire supply chains, rather than between firms.

Information, advice and support clearly raise awareness and help businesses assess their e-commerce and e-business options, but rarely do they drive. Dantuma and Hawkins (2001, p45) concluded that:

> *"Heretofore, most national government (and EU) policies for e-commerce have tended to focus on defining best practice paradigms, and on technology development and/or adoption programmes. Our findings tend to show that the market can generate solutions like these fairly efficiently. Of concern to economic policy-makers is ensuring that the adoption of any of these solutions does not create inequities that bias the market and restrict the supply of viable solutions."*

This suggests a policy focus on competition issues, standards and interoperability, in order to encourage the greatest possible competition, avoid the development of technical barriers to entry and ensure that customers' supplier swapping costs are minimised.

E-commerce and e-business solutions in distribution and logistics are enabling the emergence of a number of knowledge or intangible asset-based business models, and increasingly opening local markets to international competition in the very services upon which these business models are built. The emergence of lead or 'one-stop' logistics services providers (3PLs and 4PLs) is one way in which information systems, supply chain management and specialist ICT skills are changing the underlying structure of the industry, of businesses and of inter-organisational relations along supply chains. These businesses tend to both move up *and* dominate the value chain, using their superior information skills to manage logistics throughout an entire supply chain. This has a number of consequences and policy implications.

First, these firms can become dominant in the provision of logistics within particular supply chains. This may lead to smaller businesses, operating primarily as sub-contractors, being squeezed (in terms of margins and profitability) and to potentially negative consequences for local investment and employment (*e.g.* sub-optimal investment in local delivery fleets, etc.). This may lead, in turn, to potentially negative externalities (*e.g.* increased urban air pollution). Lead logistics firms may also pursue business strategies that have negative consequences for their sub-contractors, such as the adoption of different proprietary supply chain management related information systems, which they might do to lock-in their major clients, or complex and expensive solutions (*e.g.* RFID currently). In such circumstances, they may impose unnecessary compliance costs on their sub-contractors (*e.g.* forcing small delivery businesses to install and maintain a number of different proprietary systems in parallel or to install complex and expensive systems in order to win local business). Lead logistics firms also tend to become integrated into their clients' businesses. This may involve them providing their logistics services worldwide. This may, in turn, make them more 'footloose' as investors, more able and more likely to move major centres and activities to lower cost locations and/or larger consumer markets. As they command a significant and growing share of the value of logistics services activities, this may make an increasing share of the value 'footloose', with all the local and regional development implications that that implies.

There are other business models, such as *on line brokers and e-marketplaces*, which may also have a significant impact on competition. Online shipping brokers and marketplaces, which can be located anywhere, may increase the efficiency of logistics for shippers, but do so at the cost of squeezing local businesses by, for example, putting downward pressure on prices. Alternatively, if controlled by existing industry players, they may seek to build parallel proprietary systems and control certain routes, areas or market verticals, thereby making the overall logistics system less competitive.

Moreover, e-commerce, e-business solutions in supply chain management and the emergence of on line brokers and marketplaces may enable larger firms to better manage their logistics needs internally and, possibly, re-internalise the higher value-adding elements of their logistics activities. Whereas outsourcing has been a trend to-date, further use of ICTs in logistics may reverse that trend. In so far as outsourcing, specialisation and scale in market-based distribution and logistics contribute to increased efficiency, (re)insourcing may have the opposite effect and/or change the industry's competitive dynamics.

Industry and activity regulation

There are many cases in which regulation in what might at first sight seem unrelated areas can impact upon distribution and logistics activities. These include, for example:

- Transport – load size, vehicle size, driver hours and conditions, etc.

- Congestion – access to urban areas, routing limitations, traffic management, aircraft landing slots, etc.

- Pollution – engine emissions and their relation to fuel costs, routing limitations and geographic exclusion zones for hazardous goods, treatment of accidents and spills, etc.

- Urban and land-use planning – location of distribution centres and related transport access corridors, etc., and

- Product stewardship and producer responsibility – for the disposal of potentially damaging goods (*e.g.* disposal of cellular mobile phone batteries and other product stewardship requirements in electronics) and its implications for reverse logistics, etc.

While these things are outside the scope of this paper, even this brief list demonstrates the complexity of linkages and the difficulty of the task facing governments and regulatory agencies. In all these areas, the implications of changed logistics demands, capabilities and patterns created and/or enabled by the use of e-commerce, supply chain related e-business solutions and digital delivery should be considered. Equally, conversely, their impacts as potential enablers or barriers to the adoption and development of integrated advanced logistics should be taken into account.

More directly, governments might seek to liberalise trade in e-commerce enabling and complementary logistics related services (*e.g.* distribution, express delivery, etc.) (Wunsch-Vincent 2004, p77). Initiatives in this area may help overcome some of the difficulties of integration, help diffuse best practice in logistics and supply chain management, and help support the globalisation and expansion of client businesses, while at the same time increasing pressure for international harmonisation and standardisation of regulatory and trade processes.

Strengthening the framework

Bandwidth availability and competitive communications costs are among the foundations for digital delivery. Much progress has been made in OECD countries in respect to liberalisation of communications and the introduction of competition. Nevertheless, there is scope for further improvement in this rapidly evolving environment. Governments cannot afford to allow slow reform in one sector to adversely effect the development of globally competitive firms in others. Every effort must be made to ensure that communications and converging media regulation encourage the provision of low cost broadband services. Such issues are not unique to distribution and logistics, but they are magnified by its dependence upon inter-organisational communication and collaboration and by the enormous quantity of data generated by track and trace systems (*e.g.* RFID).

Governments can play an important role in the development of both formal and informal messaging standards, which are essential for successful e-commerce and digital delivery, and in the promulgation of best practice guidelines. Governments can do much to support and enable standardisation in these areas. In the particular case of distribution and logistics there are special difficulties and opportunities – difficulties in the form of demands to conform to a multiplicity of vertical industry standards, and opportunities in the form of the potential for logistics services to be a vehicle for the diffusion of standards across industries.

Quality certification and accreditation of service providers is also an important foundation. Governments can work with industry and professional organisations to further improve quality standards and encourage quality accreditation, and to encourage continuous professional development through a

variety of training and education activities. Where governments are a purchaser of logistics services they can further support quality certification and accreditation by being a demanding customer.

Compatibility, interoperability, harmonisation and standardisation

Distribution and logistics are inherently network-based activities. When a single company sees an opportunity to improve its operations, management can assess the options and act accordingly. But when the improvement requires actions by multiple and diverse parties in different locations, involved in different primary industries and/or in different sectors (*i.e*. public and private), assessing options and taking action is more difficult (OECD 1996, p114). There is a need for multi-organisation collaboration in development and implementation and there are a range of network compatibility, interoperability, harmonisation and standardisation issues. Governments can do much to promote the sharing of knowledge among relevant parties, and encourage work towards the harmonisation of national regulation and protocols for information exchange, the development of standards for open Internet-based systems, efficient customs procedures and consistent liability regulations.

As noted, many of the bigger industry players invested in EDI some time ago. This can be a major factor in encouraging SMEs to follow suit and invest in e-commerce and supply chain related e-business solutions. However, this lead can also have some negative consequences, such as potential lock-in to proprietary legacy systems and the imposition of multiple incompatible proprietary systems on smaller players in the logistics chain. The key is to ensure that all players along the logistics chain can have a voice in the development and implementation of systems, rather than following a piecemeal approach to adoption that suits some along the chain but may not suit others, and may impose costs for the system as a whole. Governments can assist in various ways. Together with industry associations and other stakeholders, they might encourage and support studies, industry fora and related activities that seek to bring all the parties together to discuss and develop solutions that suit all parties. Technically, governments might also seek to encourage interoperability of systems by informing and supporting the development of non-proprietary systems and/or the development of middleware that bridges existing proprietary systems.

Many countries have initiatives in the area of Intelligent Transport Systems (ITS), which relate closely to logistics activities in many ways. There needs to be a base level of compatibility between and co-ordination of logistics related and ITS initiatives in order to realise the benefits of both. Again governments might help industry associations and other stakeholders to create the fora and the environment in which co-operation and co-ordination are possible.

One of the keys to compatibility and interoperability is the use of standards in relation to the documents and forms exchanged, product codes, tagging and reading devices. In co-operation with industry, governments can foster the development of appropriate standards. Incompatibility and the lack of standards and shared or interoperable systems is a particular problem when the exchanges are international, and governments can do much in national and international fora to promote the development of standards and encourage compatibility of international trade documentation and supply chain management systems. There is also potential for innovation in government procedures to reduce the time and cost of international transactions (*e.g*. the documentation required for international trade, inspection procedures, environmental and health requirements, etc.). Greater harmonisation of requirements in the regulation of international transactions could make a substantial contribution to direct time and cost reductions *and* to the ease with which compatible and interoperable logistics systems can be developed and implemented. There is also considerable potential for governments to support the development and harmonisation of standards in areas relating to particular logistics technologies, such as radio frequencies allocations for RFID.

UNCTAD (2001) concluded that: "To achieve more efficient e-logistics and e-fulfilment, it is desirable to have a trading environment in which there is sufficient information about goods as regards their description, origins and destinations. Sellers and buyers should be able to monitor and track goods at every point along the way from the supplier to consumer. All stakeholders should be able to check on the Internet the availability and status of orders. All this can be achieved if trade information is simplified, automated and fully harmonised in all countries and when all restrictive government export/import regulations and practices have been eliminated. It also requires sophisticated supply chain management systems for compiling and enabling global end-to-end monitoring of trade information." To accomplish these broad objectives, UNCTAD recommended that governments, the international community and the private sector co-operate in promoting measures to:

- Take advantage of the great potential provided by Internet technology in order to capture, transfer and monitor trade information over global networks of supply chains in an open fashion.

- Enhance and improve the harmonisation of the classification of commodity tariffs and facilitate the identification of individual consignments.

- Automate trade processing, particularly customs declaration systems in order to develop customs-to-customs information exchange.

- Harmonise and simplify trade facilitation regulations and procedures, and encourage greater harmonisation of customs procedures.

- Encourage greater transparency in trade processing activities and take measures to reduce corruption and other forms of malpractice in customs administration.

- Promote greater integration of software applications for logistics functions, and

- Provide technical co-operation programmes for developing countries, promoting services that support e-logistics (UNCTAD 2001).

This wide ranging agenda serves to demonstrate the range of issues involved and the scope of co-operative initiatives that governments could encourage.

Information and transaction issues

There is a range of privacy, security and authentication issues fundamental to the digital delivery of services. The networked, inter-organisational nature of distribution and logistics creates an additional burden. In order to provide logistics services businesses must be able to track suppliers and customers, record and analyse information. This raises a number of privacy concerns, relating to the use of that information elsewhere in the logistics chain. It requires the development and adoption of systems that allow accessibility and promote collaboration, while at the same time ensuring data security, integrity and commercial and personal privacy. It also requires both national and international dispute resolution systems. Clear national privacy legislation, applicable to organisations of all sizes and in all sectors across the economy (*i.e*. in both the private and public sectors) is an essential foundation. Providing information and support to logistics services providers and users on its appropriate implementation and operation is also an important contribution that governments could make.

Concerns relating to security of payments, authentication and the potential for fraud are widespread. While many of the issues depend upon appropriate technological developments and implementations, there are also significant regulatory, awareness and education issues. Online payments are a crucial part of

e-commerce, but work remains to be done to enable secure payments and enhance the ability of service providers to accept and process international payments – especially when those payments involve developing countries. Governments can enhance the level of confidence by addressing and publicising regulation and standards relating to privacy, security and authentication nationally, and those relating to cross border disputes and issues of jurisdiction internationally.

Information, skills and access

Moving to advanced integrated logistics and digital delivery is not costless for either service providers or clients. Online activities must be integrated into businesses, and inter-organisational collaboration established. Often the learning curve is steep and organisational restructuring and retraining costs are considerable (Buckley and Montes 2002, p18). The small scale of many transport and delivery services providers affects their capacity to implement digital delivery and e-business solutions (*e.g.* they lack vision, strategic leadership, skills, capital, etc.) and the affordability of doing so (*e.g.* the solutions available in the marketplace tend to be designed for, and scaled to larger organisations). Governments might consider ways to publicise existing commercially available solutions, especially those appropriate for smaller businesses (*e.g.* by reviews, competitions and awards). There may also be potential to encourage the development of new, less expensive solutions on the supply-side and foster consortial development and/or purchasing of such solutions on the demand-side (*e.g.* by working through industry and professional associations on consortial licensing and access to requisite software and systems).

Governments are significant suppliers and consumers of logistics services, both directly and indirectly. Governments can serve as a role model, by buying and selling services on line and supporting initiatives that aim to raise the awareness of other organisations of the potential advantages of digital delivery alternatives. Either directly, or working through industry and professional associations, governments can also assist in the promulgation of realistic, vendor-independent information, tailored to the needs of local businesses.

One particularly important area is that of skills. Moving to digital delivery requires new specialist skills (*e.g.* logistics, supply chain management, ICT and organisational change management skills), internal retraining and reskilling in support of the business transformation. Historically, such industries as road and rail freight transport have been seen as relatively low skill, male dominated activities. Integrated logistics requires a 'cultural' transformation in some areas, which can only be driven through education, up-skilling and re-skilling. Governments play a major role in the provision of education and can influence the emphasis given to specific areas through information provision and target setting. Governments can also promote lifelong learning through direction setting, funding and other incentives.

In all these areas governments can play a significant facilitating role, contributing to unlocking the full potential of integrated advanced logistics supported by e-commerce, supply chain related e-business solutions and digital delivery. Because of the generic, enabling role of distribution and logistics, by doing so governments will also contribute to the efficiency and competitiveness of their economies *and* the diffusion of best practice through and across supply chains.

NOTES

[1] This report deals with e-commerce (*i.e*. on line sales/purchases), supply chain related e-business activities/solutions, and digital delivery. It is often difficult to separate the transaction from the service. This is particularly so when the services is information (*e.g*. shipment tracking, shipment pricing, load optimisation, etc.) and the transaction (*i.e*. sale/payment) is the culmination of on line access to it. Logistics involves the two-way flows of goods and information, such that the part of the service that is capable of digital delivery is information – the delivery of physical goods must remain physical. Hence, the focus is on e-commerce (*i.e*. the exchange of money and information), supply chain related e-business solutions (*i.e*. the integration of the supply chain related information into business processes) and, where possible, digital delivery (*e.g*. of brokerage services).

[2] Industry leaders, such as Wal-Mart in the United States, and the US Department of Defence have mandated the use of RFID by suppliers, and it is likely that others will follow (See section on RFIDs).

[3] The 25 countries were: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Ireland, Italy, Japan, Netherlands, Norway, Poland, Portugal, Russia, Slovak Republic, South Africa, Spain, Sweden, Switzerland, United Kingdom, United States. See Accenture (2001) *The Unexpected eEurope: The surprising success of European eCommerce*, Accenture. Available www.accenture.com/eEurope2001 accessed January 2003. The survey was conducted during June and July 2001.

[4] The *Global E-commerce Survey 2002* covered 10 countries: the United States, Mexico, Brazil, Denmark, France, Germany, Chinese Taipei, Singapore, China and Japan, and involved 2 139 companies. Sector coverage included manufacturing, wholesale and retail, and banking and finance. Wholesale and retail distribution included SICs 50-54, 56-57 and 59. See http://www.crito.uci.edu/2/prGEC3.asp accessed May 2004.

[5] It should be noted that this Accenture survey reported relatively high levels of e-commerce usage compared to other surveys conducted at that time.

[6] The *Global E-commerce Survey 2002* (See note 4).

[7] The countries included in the survey were: Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovenia, Slovakia and Turkey.

[8] The estimated impact on the US economy is from organisations that have implemented IBS and have reported cost savings and/or revenue increases, while the estimated impact on the combined economies of the United Kingdom, France and Germany is from organisations that have implemented IBS and have reported revenue increases or cost decreases. Cost savings and revenue increases are cumulative from the earliest year of implementation through 2001 and are based on estimates reported by companies participating in study. See Varian, H., Litan R.E., Elder, A. and Shutter, J. (2002) *The Net Impact Study*, January 2002, V2.0, p5 and pp36-37. Available www.netimpactstudy.com accessed January 2003.

[9] The *Global E-commerce Survey 2002* (See note 4)

[10] The *Global E-commerce Survey 2002* (See note 4)

[11] The *Global E-commerce Survey 2002* (See note 4)

[12] National and international RFID data standards evolving today include: ISO/IEC 18000 Part 6 — Air interface for item management at UHF; ISO/IEC 15961 & 15962 — Information interface for object-

oriented use of RFID in item management; ANSI INCITS 256:2001 — American RFID standard for item management; EAN.UCC G TAG — Application standard for use of RFID in the macro supply chain; ANSI MH10.8.4 — Application standard for RFID on reusable containers; ISO/IEC 18000 Part 4, Mode 1 (2450 MHz); ISO 18185 Electronic Seal Tags; Automotive Industry Action Group (AIAG) B-11 Time and Wheel Identification; etc (Shutzberg 2004).

[13] In order to maintain a focus on e-commerce, supply chain related e-business and digital delivery issues, those relating to the physical infrastructure for transport, storage and distribution (*e.g.* roads, ports, etc.) are not covered.

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ANNEX TABLES

Table A1. Employment in wholesale, retail, transport and storage, 1990-2002
(Thousands)

	Wholesale & Retail				*Transport & Storage*			
	1990	*1995*	*2000*	*2002*	*1990*	*1995*	*2000*	*2002*
Australia	1 335	1 462	..	..	..	..	..	..
Austria	482	507	541	542	165	181	189	189
Belgium	..	400	430	446	..	..	..	..
Canada	..	..	2 419	2 587	..	..	524	521
Czech Republic	..	564	498	..	..	249	233	..
Denmark	347	351	393	401	117	119	120	117
Finland	296	218	257	266	111	92	103	104
France	2 652	2 638	2 949	3 084	856	863	991	1 041
Germany	..	4 954	5 291	5 249	..	1 412	1 458	1 464
Greece	..	183	209	205	..	134	131	128
Hungary	..	314	401	427	..	..	..	..
Iceland	..	..	..	..	..	..	..	..
Ireland	..	..	..	..	..	..	..	..
Italy	1 566	1 668	1 936	2 084	..	564	658	665
Japan	..	..	..	..	2 889	3 127	..	..
Korea	..	1 641	1 694	..	..	..	..	..
Luxembourg	26	29	33	35	..	..	..	..
Mexico	3 136	3 496	4 162	..	1 332	1 407	1 814	..
Netherlands	914	1 011	1 211	1 241	254	272	304	314
New Zealand	210	227	257	268	..	..	..	..
Norway	277	275	304	..	124	127	140	..
Poland	..	1 079	1 325	1 344	..	..	..	..
Portugal	..	508	..	..	..	..	..	..
Slovak Republic	..	180	..	..	..	..	..	..
Spain	1 322	1 392	1 757	1 796	431	441	508	..
Sweden	..	..	..	..	..	..	..	..
Switzerland	..	..	..	..	..	..	..	..
Turkey	..	..	..	..	..	..	..	..
United Kingdom	3 995	4 042	4 386	..	978	918	1 018	..
United States	27 932	29 850	32 900	..	3 555	3 956	4 589	..

Source: OECD STAN database.

Table A2. Production in wholesale, retail, transport and storage, 1990-2002
(USD millions, current prices)

	Wholesale & Retail				*Transport & Storage*			
	1990	*1995*	*2000*	*2002*	*1990*	*1995*	*2000*	*2002*
Australia	..	..	..	..	..	..	..	..
Austria	32 931	46 428	38 603	41 161	13 735	19 554	17 835	20 236
Belgium	..	63 129	67 536	73 511	..	..	..	..
Canada	92 433	92 722	123 766	..	37 953	39 161	50 413	..
Czech Republic	7 631	12 205	12 946	..	1 897	7 040	5 693	..
Denmark	25 971	35 662	29 548	33 386	15 291	21 629	24 632	26 010
Finland	21 779	19 340	19 146	21 338	14 523	14 529	13 109	14 399
France	179 943	216 871	182 243	197 499	83 959	106 566	105 666	113 621
Germany	..	392 971	302 598	313 552	..	173 987	147 420	150 508
Greece	..	23 484	21 270	24 549	..	7 139	8 790	9 705
Hungary	..	9 557	9 696	13 748	..	4 654	4 323	..
Iceland	..	..	..	..	..	..	..	..
Ireland	..	..	..	..	..	..	..	..
Italy	220 934	232 685	225 306	243 459	..	122 666	112 864	..
Japan	..	..	..	..	243 515	432 343	..	..
Korea	41 503	72 800	68 511	..	22 313	45 123	49 280	..
Luxembourg	2 110	3 083	3 386	3 664	..	..	..	..
Mexico	56 393	53 741	112 196	..	29 331	33 565	74 868	..
Netherlands	59 962	82 727	76 043	84 049	26 107	37 613	34 796	37 522
New Zealand	13 937	18 512	..	..	4 425	6 507	..	..
Norway	20 199	25 225	24 225	28 917	20 847	24 631	26 289	31 114
Poland	..	39 205	54 828	67 209	..	12 736	15 592	..
Portugal	17 940	24 441	..	..	5 784	7 296	..	..
Slovak Republic	..	5 217	..	..	..	3 003	..	..
Spain	..	95 455	..	..	..	51 664	..	..
Sweden	..	37 336	34 250	..	32 757	28 856	29 809	..
Switzerland	50 585	62 129	46 979	54 901	..	..	19 170	20 382
Turkey	..	..	..	..	..	..	..	..
United Kingdom	180 291	221 209	312 332	..	..	116 015	154 029	..
United States	1 478 292	1 950 993	2 539 219	..	361 109	453 798	619 005	..

Source: OECD STAN database.

Table A3. Value add in wholesale, retail, transport and storage, 1990-2002
(USD millions, current prices)

	Wholesale & Retail				*Transport & Storage*			
	1990	*1995*	*2000*	*2002*	*1990*	*1995*	*2000*	*2002*
Australia	33 437	39 859	38 474	..	16 686	19 696	18 737	..
Austria	21 142	28 485	22 955	23 664	7 872	10 760	8 798	9 661
Belgium	23 544	30 780	24 181	26 054	..	..	..	..
Canada	64 251	59 785	73 847	..	22 742	23 840	27 352	..
Czech Republic	3 139	5 574	6 796	..	535	2 850	1 832	..
Denmark	15 109	21 097	16 945	18 225	6 617	8 967	8 213	8 547
Finland	13 609	11 560	10 537	11 834	8 316	8 576	7 706	8 348
France	123 826	151 782	120 487	129 501	47 118	56 283	50 095	54 967
Germany	..	246 226	183 112	197 327	..	75 174	62 244	64 916
Greece	..	14 735	13 072	14 737	..	4 362	5 775	6 613
Hungary	..	4 432	4 346	6 707	..	2 432	1 954	..
Iceland	..	..	..	..	..	..	..	..
Ireland	..	..	..	..	..	..	..	..
Italy	144 548	142 890	130 813	142 542	55 423	56 831	50 777	53 862
Japan	..	..	..	..	153 482	281 258	220 981	187 091
Korea	27 765	48 369	42 620	..	11 793	22 602	20 453	..
Luxembourg	1 445	2 027	2 009	2 165	..	..	..	..
Mexico	48 369	42 242	86 628	..	18 968	21 780	50 093	..
Netherlands	38 014	50 906	45 333	49 828	13 621	19 090	16 244	17 568
New Zealand	6 178	8 291	..	..	2 071	3 011	..	..
Norway	12 017	13 994	13 456	16 399	8 959	10 339	9 913	12 721
Poland	..	22 203	29 117	35 100	..	..	..	..
Portugal	10 678	14 450	..	..	2 777	3 589	..	..
Slovak Republic	..	2 259	2 706	..	..	1 460	..	..
Spain	56 561	64 327	59 471	67 055	26 428	31 007	29 402	..
Sweden	23 847	24 842	22 731	22 921	13 660	12 657	12 191	..
Switzerland	33 990	41 060	31 149	35 839	..	..	8 587	9 105
Turkey	..	..	..	..	..	..	..	..
United Kingdom	101 021	117 740	156 744	174 299	47 759	52 145	64 851	66 499
United States	951 873	1 233 250	1 706 718	..	177 404	233 379	313 662	..

Source: OECD STAN database.

Table A4. Drivers of adoption of e-commerce, 2002
(percentage of establishments surveyed)

	US		*Japan*		*Mexico*		*Total*	
	Distrib'	*All Sectors*	*Distrib'*	*All Sectors*	*Distrib'*	*All Sectors*	*Distrib'*	*All Sectors*
Customers demanded it	33.8	35.5	34.1	36.9	31	35.6	37.9	36.9
Government provided incentives	3.9	3.4	0.0	1.9	12.9	12.8	7.4	8.3
Major competitors were on line	28.1	33.1	17.5	19.4	37.8	38.9	29.2	31.3
Required for government procurement	8.5	9.0	0.4	4.7	37.1	33.2	13.7	15.2
Suppliers required it	18.8	18.7	25.3	26.3	37.8	32.8	21.3	22.3
To enter new businesses or markets	38.6	39.2	41.5	33.6	74.5	64.9	44.4	42.0
To expand market for existing products or services	45.4	49.8	17.4	23.5	74.6	64.6	45.6	47.9
To improve co-ordination with customers and suppliers	37.8	41.6	25.8	33.3	80.9	74.1	40.5	43.7
To reduce costs	30.0	32.6	17.5	27.4	68.4	58.3	32.3	35.7

Notes: The *Global E-commerce Survey 2002* covered 10 countries: the United States, Mexico, Brazil, Denmark, France, Germany, Chinese Taipei, Singapore, China and Japan, and involved 2 139 companies. Wholesale and retail included SICs 50-54, 56-57 and 59.

Sources: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), Diffusion and the impacts of the Internet and e-commerce in Japan, CRITO, University of California, Irvine; Palacios, J.J. (2003), Globalization and E-Commerce: Diffusion and Impacts in Mexico, CRITO, University of California, Irvine; Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce: A Mile Wide and an Inch Deep, CRITO, University of California, Irvine; and Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce in the United States: Leader or one of the pack?, CRITO, University of California, Irvine.

Table A5. E-commerce activities (including logistics), mid 2001
(percentage of businesses and percentage of businesses using e-commerce)

	Buy or Sell on line	*E-commerce is significant part of operations*	*Sales & Marketing*	*Purchasing*	*Logistics*	*Human Resources*
	% of firms	*% of firms*	*% using e-commerce*	*% using e-commerce*	*% using e-commerce*	*% using e-commerce*
Austria	66	13	88	66	41	63
Belgium	33	20	70	47	43	60
Czech Republic	60	67	93	60	43	57
Denmark	73	40	93	73	40	33
Finland	44	25	75	72	56	47
France	70	7	67	67	57	57
Germany	31	31	74	49	34	34
Greece	32	26	81	58	39	42
Hungary	47	17	47	30	27	17
India	44	60	79	45	60	56
Ireland	61	13	81	58	45	48
Italy	40	20	87	43	33	50
Japan	23	18	60	32	33	72
Netherlands	50	19	97	44	38	38
Norway	53	37	90	80	70	50
Poland	23	47	93	53	40	40
Portugal	27	60	83	23	47	43
Russia	47	37	77	60	60	67
Slovak Republic	43	43	73	60	40	53
South Africa	33	67	93	50	50	53
Spain	40	17	93	37	30	27
Sweden	77	33	77	67	30	37
Switzerland	40	17	80	70	67	67
United Kingdom	53	37	93	70	63	67
United States	62	23	70	73	53	57
Europe	*48*	*29*	*82*	*56*	*44*	*46*
Total	*46*	*32*	*79*	*55*	*46*	*51*

Source: Accenture (2001), *The Unexpected eEurope: The surprising success of European eCommerce*, Accenture. Compiled from Appendix Tables.

Table A6. Average adoption of Internet business solutions, 2001
(percentage of organisations surveyed)

	Europe		*US*		*Canada*	
	All Sectors	*Wholesale & Retail*	*All Sectors*	*Wholesale & Retail*	*All Sectors*	*Wholesale & Retail*
Human Resources	25	12	37	23	24	17
Supply Chain Management	11	15	30	31	21	19
Finance & accounting	26	20	36	39	40	33
Sales Force Automation	16	22	30	46	25	35
Procurement/MRO	28	30	33	36	25	23
E-Commerce	42	47	52	62	49	67
Customer Service & Support	55	50	71	73	57	63
E-Marketing	52	61	68	59	55	69

Sources: Varian, H., Litan, R.E., Elder, A. and Shutter, J. (2002), *The Net Impact Study;* and CeBI (2002), *Net Impact Study Canada: The SME Experience*, CeBI.

Table A7. Levels of adoption and use by technology and activity, 2002
(percentage of establishments surveyed)

	US		*Japan*		*Mexico*		*Total*	
	Distribution	*All Sectors*	*Distribution*	*All Sectors*	*Distribution*	*All Sectors*	*Distribution*	*All Sectors*
Web site	76.1	79.8	67.9	73.4	75.1	79.0	69.9	74.1
Accessible by suppliers	15.9	16.9	32.7	26.4	24.8	22.6	21.8	20.9
Accessible by customers	13.6	15.6	24.4	21.5	12.6	16.2	17.0	17.8
EDI	37.6	42.5	64.0	63.8	62.5	58.4	45.2	44.3
EFT	60.3	62.7	0.8	7.6	74.0	70.6	42.1	43.4
Advertising and marketing purposes	56.6	64.3	62.9	57.9	87.0	72.9	57.1	57.6
After sales customer service and support	54.6	55.6	19.0	25.9	44.3	40.2	40.7	43.7
Exchanging operational data with customers	46.7	53.8	54.9	58.2	38.1	46.7	49.0	50.7
Exchanging operational data with suppliers	42.2	42.8	55.0	57.6	56.5	50.1	48.0	48.1
Formally integrating business processes	34.2	35.5	18.4	17.9	74.3	54.8	37.5	33.9
Making purchases on line	70.9	73.2	28.0	35.7	85.9	64.8	47.8	46.8
Making sales on line	52.4	43.2	18.6	23.3	13.3	11.8	31.9	29.9

Notes: The *Global E-commerce Survey 2002* covered 10 countries: the United States, Mexico, Brazil, Denmark, France, Germany, Chinese Taipei, Singapore, China and Japan, and involved 2 139 companies. Wholesale and retail included SICs 50-54, 56-57 and 59.

Sources: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), Diffusion and the impacts of the Internet and e-commerce in Japan, CRITO, University of California, Irvine; Palacios, J.J. (2003), Globalization and E-Commerce: Diffusion and Impacts in Mexico, CRITO, University of California, Irvine; Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce: A Mile Wide and an Inch Deep, CRITO, University of California, Irvine; and Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce in the United States: Leader or one of the pack?, CRITO, University of California, Irvine.

Table A8. Online activities of enterprises in Europe, 2001
(percentage of enterprises using Internet also using e-purchasing and e-sales)

	Online purchasing			*Online sales*		
	All Sectors	*Distribution*	*Transport & Communication*	*All Sectors*	*Distribution*	*Transport & Communication*
Belgium	..	..	..	..	..	..
Denmark	49	49	31	25	32	21
Germany	45	51	40	19	24	19
Greece	17	16	21	14	9	24
Spain	8	9	7	3	3	2
France	..	..	..	..	..	..
Ireland	46	38	52	26	23	34
Italy	10	11	6	5	5	3
Luxembourg	29	28	16	16	17	13
Netherlands	37	40	35	40	41	59
Austria	37	33	39	25	25	25
Portugal	24	23	24	11	7	14
Finland	54	56	40	17	17	21
Sweden	62	59	48	14	17	16
UK	47	43	64	19	23	26
Norway	..	..	..	27	28	23
EU15	30	34	27	13	16	13

Source: Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.

Table A9. Internet uses by sector in Europe, 2001
(percentage of enterprises using Internet)

	Monitor Markets			*Receive Digital Products*			*Obtain after sales services*		
	All Sectors	*Distrib'*	*Transport & Comms*	*All Sectors*	*Distrib'*	*Transport & Comms*	*All Sectors*	*Distrib'*	*Transport & Comms*
Belgium	..	..	..	..	..	..	..	..	..
Denmark	44	46	27	45	43	27	..	..	..
Germany	41	29	47	42	43	27	50	48	53
Greece	77	78	83	15	13	16	15	15	14
Spain	53	54	46	21	18	18	23	25	23
France	..	..	..	..	..	..	..	..	..
Ireland	40	39	41	30	23	22	22	19	23
Italy	38	37	31	33	34	26	15	21	23
Luxembourg	54	58	50	62	58	57	30	38	21
Netherlands	63	58	54	27	27	22	30	31	25
Austria	66	72	71	26	21	25	16	19	11
Portugal	43	41	52	18	15	17	14	14	12
Finland	61	58	51	60	59	52	36	35	30
Sweden	53	50	36	65	61	50	70	64	60
UK	..	..	..	..	..	..	..	..	..
Norway	52	49	47	58	57	49	..	..	..
EU15	45	41	44	36	35	27	..	..	..

Source: Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.

Table A10. Impacts of adoption and use of e-commerce, 2002
(percentage of establishments surveyed)

	US		*Japan*		*Mexico*		*Total*	
	Distrib'	*All Sectors*	*Distrib'*	*All Sectors*	*Distrib'*	*All Sectors*	*Distrib''*	*All Sectors*
Internal processes more efficient	22.9	28.0	25.2	28.7	68.0	53.5	32.2	33.9
Staff productivity increased	29.4	30.8	24.6	24.3	37.4	37.5	27.6	27.2
Sales increased	25.8	24.1	0.4	1.2	43.0	36.2	21.5	20.5
Sales area widened	34.9	35.9	0.8	3.4	31.1	25.4	30.3	31.4
Customer service improved	39.9	40.2	0.8	11.2	61.8	54.9	31.1	34.8
International sales increased	7.0	9.0	0.0	5.0	12.7	19.7	18.5	19.5
Procurement costs decreased	8.7	12.5	0.3	4.2	19.1	20.0	15.2	17.7
Inventory costs decreased	10.6	10.8	0.3	5.3	13.2	13.8	13.1	14.0
Co-ordination with suppliers improved	26.6	29.2	33.2	33.8	62.1	50.7	28.9	29.8
Competitive position improved	32.3	33.0	8.8	10.1	49.9	45.1	27.5	29.8

Notes: The *Global E-commerce Survey 2002* covered 10 countries: the United States, Mexico, Brazil, Denmark, France, Germany, Chinese Taipei, Singapore, China and Japan, and involved 2 139 companies. Wholesale and retail included SICs 50-54, 56-57 and 59.

Sources: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), Diffusion and the impacts of the Internet and e-commerce in Japan, CRITO, University of California, Irvine; Palacios, J.J. (2003), Globalization and E-Commerce: Diffusion and Impacts in Mexico, CRITO, University of California, Irvine; Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce: A Mile Wide and an Inch Deep, CRITO, University of California, Irvine; and Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce in the United States: Leader or one of the pack?, CRITO, University of California, Irvine.

Table A11. Barriers to adoption of e-commerce, 2002
(percentage of establishments surveyed)

	US		*Japan*		*Mexico*		*Total*	
	Distrib'	*All Sectors*	*Distrib'*	*All Sectors*	*Distrib*	*All Sectors*	*Distrib'*	*All Sectors*
Need for face-to-face customer interaction	37.8	41.7	42.0	42.7	25.0	25.6	34.2	33.8
Concern about privacy of data or security	40.9	47.1	50.2	55.2	62.2	57.6	40.4	44.2
Customers do not use the technology	32.4	26.9	33.0	30.1	38.3	38.7	33.1	31.4
Finding staff with e-commerce expertise	25.5	24.1	25.6	28.8	31.6	31.1	28.8	26.5
Prevalence of credit card use in the country	19.1	16.3	8.5	9.1	18.8	19.8	19.9	20.3
Costs of implementing an e-commerce site	31.2	31.5	54.3	52.7	36.9	35.2	34.9	33.6
Making needed organizational changes	12.7	14.5	25.1	27.6	31.0	32.3	24.8	23.9
Level of ability to use the Internet as part of business strategy	21.5	20.5	25.9	31.0	31.2	29.0	23.7	24.8
Cost of Internet access	12.3	10.8	24.6	24.5	0.8	3.6	16.3	15.1
Business laws do not support e-commerce	9.0	8.1	17.1	21.6	31.4	27.3	22.6	24.2
Taxation of Internet sales	21.3	14.8	16.7	15.2	26.1	21.5	18.8	16.5
Inadequate legal protection for Internet purchases	11.2	11.9	17.2	20.8	49.9	45.1	33.6	34.1

Notes: The *Global E-commerce Survey 2002* covered 10 countries: the United States, Mexico, Brazil, Denmark, France, Germany, Chinese Taipei, Singapore, China and Japan, and involved 2 139 companies. Wholesale and retail included SICs 50-54, 56-57 and 59.

Sources: Tachiki, D., Hamaya, S. and Yukawa, K. (2004), Diffusion and the impacts of the Internet and e-commerce in Japan, CRITO, University of California, Irvine; Palacios, J.J. (2003), Globalization and E-Commerce: Diffusion and Impacts in Mexico, CRITO, University of California, Irvine; Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce: A Mile Wide and an Inch Deep, CRITO, University of California, Irvine; and Kraemer, K.L., Dedrick, J. and Dunkle, D. (2002), E-commerce in the United States: Leader or one of the pack?, CRITO, University of California, Irvine.

Table A12. Barriers to engaging in e-commerce in Australia, 2003
(percentage)

	Major concern	*Minor concern*
People able to hack into system	41	32
Lack of expertise	28	37
Customers are not ready	27	33
Lack of personal contact	27	35
Cost and time to introduce	26	42
Customers not willing	23	39
Cost of hardware / software	20	42
Problems with getting paid	19	30
Customers can more easily compare product	11	34
Customers go direct to supplier	9	17
Incompatibility with existing system	8	28
Technology too new to rely on	4	31
E-commerce will not last	1	14

Source: Sensis (2003), 2003 *Yellow Pages Business Index E-Business Report*, Telstra Corporation, Melbourne, July 2003.

Table A13. Barriers to growth of e-commerce in Korea, 2002
(percentage of firms)

	Firms using e-commerce	*Firms not using e-commerce*
Lack of standardisation	33.8	26.6
Cost and lack of expertise	22.6	28.4
Lack of co-operation within industry	13.0	13.6
Market conditions	11.2	10.5
Uncertainties over profitability	10.4	10.6
Regulatory barriers	7.3	6.1

Source: MoCIE (2003), *E-Commerce in Korea*, Ministry of Commerce, Industry and Energy. Available http://www.moc*ie*.go.kr/eng/policies/ecommerce/ecommerce1.asp accessed May 2004.

Table A14. Barriers for enterprises not already selling on line in Europe, 2002
(percentage of businesses not already selling on line)

	Products not suitable	*Customers not ready*	*Security concerns*	*Uncertain legal framework*	*Logistical problems*
Belgium	..	..	..	..	..
Denmark	67	53	43	45	27
Germany	..	..	..	..	..
Greece	34	47	43	41	24
Spain	79	66	58	55	46
France	..	..	..	..	..
Ireland	51	45	37	34	32
Italy	60	60	59	55	43
Luxembourg	13	13	14	13	10
Netherlands	..	..	..	..	..
Austria	55	48	60	57	36
Portugal	32	31	29	30	25
Finland	63	55	38	40	41
Sweden	72	61	24	45	32
UK	..	..	..	..	..
Norway	50	41	37	39	28

Source: Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.

Table A15. Barriers for enterprises selling on line in Europe, 2002
(per cent of businesses already selling on line)

	Products not suitable	*Customers not ready*	*Security Concerns*	*Uncertain legal framework*	*Logistical problems*
Belgium	..	..	..	..	..
Denmark	14	11	14	14	9
Germany	..	..	..	..	..
Greece	44	81	73	75	43
Spain	70	92	87	83	61
France	..	..	..	..	..
Ireland	42	58	56	46	39
Italy	55	84	80	74	49
Luxembourg	52	59	63	61	50
Netherlands	..	..	..	..	..
Austria	63	58	72	66	43
Portugal	67	74	64	54	61
Finland	61	74	53	50	46
Sweden	43	52	52	43	26
UK	..	..	..	..	..
Norway	54	40	46	44	28

Source: Eurostat (2003), *E-commerce and the Internet in European Businesses*, Cat KS-54-03-889-EN-N, Eurostat, Brussels.