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Working Party on the Information Economy

BUSINESS-TO-BUSINESS ELECTRONIC COMMERCE: STATUS, ECONOMIC IMPACT AND POLICY IMPLICATIONS

DIGEST

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FOREWORD

This report has been prepared as a background document for the OECD Forum on Electronic Commerce to be held in Paris on 12-13 October 1999.

The OECD Working Party on the Information Economy (WPIE) reviewed an earlier draft of this report and as recommended by the Working Party on the Information Economy, the ICCP Committee has agreed to the declassification of this paper through a written procedure. This final version incorporates comments by Member countries.

The report was prepared by Graham Vickery and Masahiro Katsuno of the OECD Directorate for Science, Technology and Industry and benefited from contributions from other staff of the Directorate.

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Digest

Introduction and summary

This digest summarises work being undertaken on the development, economic impact and policy implications of business-to-business electronic commerce. It is part of the follow-up to the OECD Ministerial Conference on Electronic Commerce (Ottawa 7-9 October 1998), where the OECD Action Plan for Electronic Commerce recommended that the OECD continue to work to deepen understanding of the impact of electronic commerce within and between businesses; and improve the ability to measure the structure and volume of electronic commerce; as well as undertaking work on various other aspects of electronic commerce [SG/EC(98)9/FINAL, see also SG/EC(99)1/FINAL[1]]. A workshop on "Business-to-business E-commerce: Status, economic impact and policy implications" was held in Oslo on 17 June 1999 to bring together business, researchers, and policy makers to review trends and analysis in business-to-business electronic commerce, and contribute to the current report.[2] This digest summarises differences in the development trajectories of business-to-business electronic commerce across countries and selected sectors, reviewing impacts and presenting current and future policy issues. The digest also discusses the transition of business-to-business electronic commerce from already established systems such as proprietary electronic data interchange systems towards open Internet-based systems.

All forecasts predict very rapid growth in electronic commerce. Most forecasts have been constantly surpassed and revised upward.

Electronic commerce is growing rapidly, and estimates from private research organisations suggest that the value of electronic commerce ranged from USD68 billion to USD110 billion in 1999, variations being largely explained by differences in definitions.[3] All forecasts predict very rapid growth, and most forecasts have been constantly surpassed and have been revised upwards to match this growth. Within electronic commerce, the business-to-business segment has attracted increasing attention and is usually estimated to take the most important share of electronic commerce, from around 70 to 85% of the total, and is projected to rise to around USD1.3 trillion by 2003, with some projections twice as large.[4] Furthermore, it is expected to have major impacts on firms, markets, employment and growth, due to the effects on the organisation of business flows and processes, transaction costs, the creation of new business models, and changes in the boundaries of firms across sectors.

Preliminary evidence shows that there are significant variations in business-to-business e-commerce uptake across countries and sectors.

Preliminary evidence shows significant variations in business-to-business e-commerce uptake across countries, with the United States leading. There are also divergences across sectors in terms of the specific type of business-to-business e-commerce models and applications employed. These variations can be attributed to differences in drivers of business-to-business e-commerce. These drivers include the environment in which businesses are operating, access of firms to technological tools (cost, ease of use of technologies, technological infrastructure, availability of other enabling technologies, socio-economic infrastructure), nature of the processes and products of the sector, the competitive market environment, etc. This report focuses mainly on technology development and access of firms to technologies.

The impacts of e-commerce on business and markets will vary across countries and sectors. Country effects will depend on the sectoral composition of the economy and the location of different parts of enterprise value chains and sector supply chains. Impacts will depend on the extent to which firms and industries compete on the basis of design, production, logistics, or marketing. Furthermore, new sector-specific Internet-based business models are developing rapidly in countries which have the appropriate infrastructure (low cost, competitive communications, broad supply and rapid uptake of new technologies, entrepreneurial culture), and these models are spreading quickly across countries which have similar technological and business bases and industry structures. Finally, the advent of business-to-business electronic commerce will have major impacts on market dynamics and the competitive environment, as market power shifts in favour of buyers, re-shaping buyer-supplier relationships; as effects of new business-to-consumer models work back through value chains and supply systems; and through the differential uptake of technologies in different sectors.

Policy implications and issues are identified in the areas of the enabling infrastructure, diffusion and the business environment.

Three types of policy implications and issues are identified: 1) enabling issues which include network infrastructure, and security related to authentication and financial settlement; 2) diffusion issues including technology facilitation and demonstration and small firm issues; and 3) business environment issues including competition, trade, standards and intellectual property rights. Although the pervasiveness of electronic commerce changes, and may lessen, the reach and impact of some national policies, the policy issues outlined above are likely to remain the most pertinent.

Business-to-business e-commerce developments: country and sectoral trajectories

Business-to-business e-commerce trends at a glance

Internet-based business-to-business e-commerce is developing rapidly although it is still a small

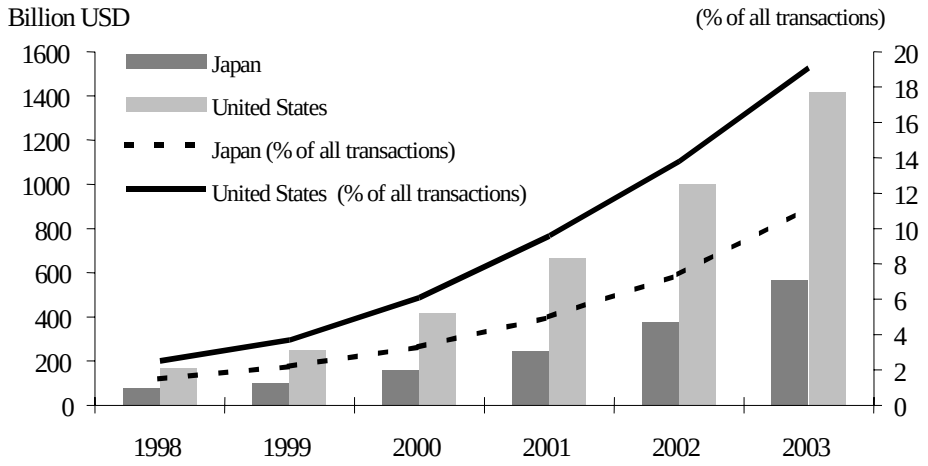
Internet-based business-to-business electronic commerce is developing rapidly although it still represents a small portion of overall business-to-business transactions. Market size is projected to double every two years for the next several years for business-to-business e-commerce transactions,

portion of overall business-to-business transactions.

after having achieved very rapid recent growth (see Fig. 1). However, the measurement of business-to-business e-commerce is fraught with problems. Definitions and methodologies vary widely across available studies, and there is as yet no internationally agreed definition of e-commerce. Some studies include all business activity carried out both over the Internet and over other electronic media, whereas others only include Internet-based transactions which result in the purchase or use of goods or services.[5]

Figure 1. Projected growth of Internet-based business-to-business electronic commerce in the United States and Japan, 1998-2003

(in billion of USD, and as a percentage of all transactions)



1. Wide definition of electronic commerce covering exchange of goods, services, information using TCP/IP technology.
Source: Andersen Consulting, *Report for the MITI* (Japan), p. 41, March 1999.

Most business-to-business transactions still occur over closed networks, but forecasts suggest dramatic increases in investment in Web-based business-to-business e-commerce software.

Despite the measurement difficulties, a number of general trends can be derived from available data. Business-to-business electronic commerce is growing rapidly; it is developing across both manufacturing and services, and is projected to grow strongly in all major OECD areas. The business-to-business segment is the most important part of total electronic commerce (70-85% of the total, depending on sources and methods used). However, business-to-business Websites represent only about one-fifth of total sites and the majority of these sites are computer-related, with professional services accounting for about one-sixth of business-to-business sites.[6] Most business-to-business transactions still occur over closed networks, of the kind developed for traditional electronic data interchange (EDI). Recent forecasts, though, suggest a dramatic increase in investment expenditures on Internet-based business-to-business e-commerce software, as opposed to constant investment expenditures on software for non-Web EDI, suggesting an important projected shift to Internet-based systems.[7]

Business-to-business e-commerce over the Internet is still dominated by North America. In Europe, the United Kingdom, Germany and France are leading in investing in business-to-business electronic commerce software.

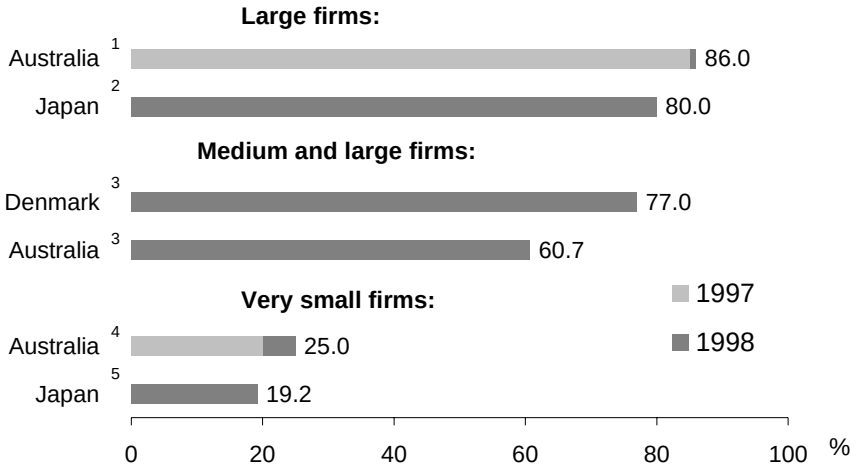
Despite the rapid uptake in every OECD country, all estimates suggest that Internet-based electronic commerce is still dominated by North America in the volume of transactions; furthermore the majority of Websites (86%) appear to have a North American origin.[8] The United States also dominates the business-to-business e-commerce software market (around 63% of the business-to-business e-commerce software market in 1999) and it is forecast to continue to do so.[9] In Europe, the United Kingdom, Germany and France are leading in investing in Internet-based business-to-business electronic commerce software, reflecting national trajectories and sectoral industrial composition.

Beyond differences in the current level of development of Internet-based business-to-business electronic commerce in different countries and sectors, the questions are whether country trajectories are different, and if so, whether they are likely to converge. Recent studies carried out in Japan project that the gap in the level of penetration of Internet-based business-to-business transactions in the United States and in Japan will not be reduced in the near term.[10] These studies suggest that this lag of several years can only be reduced through regulatory reform. Evidence for Europe suggests that countries with relatively more immature Internet-based business-to-business markets are investing more heavily in Internet solutions for business, suggesting possible catch-up in Europe in business-to-business e-commerce investment and use.

Business readiness for e-commerce has increased rapidly across countries, but there are significant country, sector and firm size differences in the potential to use e-commerce.

On the other hand, businesses in Europe and Asia are catching up with North America in business use of the Internet. Adoption of the Internet by business in Europe has increased rapidly and has now reached very high penetration rates, for example in Nordic countries such as Denmark and Finland.[11] In countries as diverse as Australia, Denmark and Japan, Internet penetration among large firms is of the order of 80% or more, but is markedly lower in small firms although small firm access is growing rapidly (see Fig. 2). Across all countries, Internet uptake among firms depends on the sectors in which they are located (with, for example, finance, business services, wholesale distribution and manufacturing leading) as well as the size of firms. Overall trends suggest that business readiness for e-commerce has increased rapidly across countries, but that there are significant country, sector and firm size differences in the potential to use e-commerce due to major differences in the distribution of Internet use.

Figure 2. Internet penetration rate in the business sector in selected countries, most recent year



1. Firms with 200 employees and more.
2. Firms with 300 employees and more.
3. Firms with 20 employees and more.
4. Firms with less than 5 employees.
5. Firms with less than 6 employees.

Sources: National statistical sources: MPT (Japan), Statistics Denmark (Denmark), and ABS (Australia).

The use of technology depends on firm strategies, size and scale, which in turn reflect sector characteristics.

The use of technology depends on firm strategies, firm size and economies of scale and scope, which in turn reflect the sector of activity. To develop, Internet commerce needs a high volume of transactions and a diversity of business transactions and applications. Different technologies (e.g. Internet/Extranet, and EDI) are used for different business functions, and the relative importance of different functions varies across sectors (sectors vary considerably in the relative importance of design, production, logistics and marketing). The Internet, for example, has emerged in every country as a medium for information sharing and marketing, but the importance of marketing varies with sectors. The introduction of low cost Internet applications for procurement will promote the use of the Internet on the buying side, and again impacts will vary across sectors. This mapping between technologies and business functions will vary according to the position of the business in the value chain of the sector.

Business processes and models at a glance

Business-to-business electronic commerce affects existing business processes of firms in their supply and distribution chains, and at the same time creates new business models, including new types of marketplace with new ways to add value.

The electronic medium provides a faster, less error-prone, potentially more cost-effective way to connect firms, rendering already-existing business processes more efficient.

The primary impact of business-to-business electronic commerce on existing business processes is through the ability of firms to develop electronic networks connecting various processes involved in supply, production and distribution chains, and potentially with those outside the chain. The electronic medium provides a faster, less error-prone, potentially more cost-effective way to connect firms, rendering already-existing business processes between those firms more efficient. Business-to-business electronic commerce can also inter-link firms within the supply and distribution chain not previously in direct contact (for example a sales branch of a department store that carries a particular jacket with a designer of the textile used to fabricate that jacket). Impacts can already be observed in collaboration in designing products (shortening the design process, higher level of product customisation, standardisation of parts), and production and logistics (lower inventory cost, faster production, lower supply costs).

New business models and new intermediaries are becoming integral parts of new information-intensive transactions.

The potential to develop and exchange very large amounts of information provides opportunities for new business models to develop and for new intermediaries to enter supply, production and distribution chains to organise and use information. New business models and new intermediaries are becoming necessary parts of new information-intensive transactions. These new intermediaries aggregate the supply of information about certain goods or services (for example steel) from many suppliers and provide the information and a market place for buyers (for example auto-manufacturers and home appliances).

Business-to-business e-commerce drivers: differences across countries and sectors

Different paths in e-commerce development can be explained by factors such as the sectoral composition of the economy, organisational structure of industry, the degree of internationalisation and deregulation of markets and the business environment, and technological factors such as IT diffusion and the availability and cost of infrastructure. This report focuses particularly on the interaction between e-commerce technologies and the way they are used in business-to-business transactions.

The availability of technology is unlikely to explain differences in uptake across countries and sectors.

Business-to-business e-commerce technologies are developing rapidly, and software that enables business-to-business e-commerce is migrating from closed technologies and systems such as EDI to open systems using the TCP/IP protocols, complementing, extending or replacing traditional EDI due to its relative simplicity and lower costs. The emergence of packaged software such as Enterprise Resource Planning (ERP), Supply Chain Management (SCM) and electronic procurement, and its migration from proprietary closed systems to open networks is lowering barriers to the implementation of electronic commerce, by eliminating the burden of development and maintenance of custom software and specialised hardware.

The size of the market for e-commerce software differs across countries (e.g. twice as large in the United States compared to Europe for software that enables Internet business-to-business e-commerce), but major software vendors provide localised versions of software for major markets. Availability and access to technology is thus unlikely to explain differences in uptake across countries and sectors.

Firms have to implement the technologies. A range of factors determine uptake, including infrastructure access and quality of service,

However, the availability of appropriate technologies is only one factor influencing the adoption of business-to-business e-commerce. Firms have to implement them, and there is a range of drivers and impediments to implementation. One potential impediment is access to network infrastructure. The cost of access to network infrastructure by firms differs significantly between liberalised and regulated markets across OECD countries, and this has major impacts on the rate of uptake of Internet-based business-to-business electronic commerce.[12] Further infrastructure access considerations for the migration of proprietary systems towards open systems are quality of service, including reliability and security, which may be different in open environments from closed ones.

previous investments in legacy technologies,

Second, at a more specifically sectoral level, Internet-based business-to-business e-commerce relies on cross-platform/network interoperability. Previous investments in IT infrastructures, and legacy hardware and software which are platform/network specific and proprietary, could be barriers for the implementation of Internet-based e-commerce in sectors such as assembly-intensive ones, which have made large information-exchange investments in the past. Firms which have large sunk costs in an established EDI procurement system for example, may have little incentive to introduce Internet-based systems. However, e-commerce experience acquired through legacy systems can be transferred to an open Internet environment, and Internet-based communication platforms and transaction options can often be added into established EDI systems. Many small firms may be better placed to adopt or upgrade to Internet-based systems because they have more recent standard investments. Limited interoperability of available Internet e-commerce solutions is another possible inhibitor. Different ERP, SCM or electronic procurement systems are cheaper than EDI systems and their interoperability is less of a barrier than between different EDI systems, but the lack of an open standard for interoperability could discourage implementation where interoperability is important.

and the business environment, where competition encourages technology implementation.

Third, the business environment also affects firms' propensity to implement business-to-business e-commerce. In sectors facing global competition, firms of all sizes are more likely to adopt business-to-business e-commerce, just as they have been more likely to adopt other organisational and technological innovations.[13] Inter-firm co-ordination and organisation issues are likely to be of greater importance in the Internet-based business-to-business environment, as firms restructure supply chains and partnerships involving a potentially larger number of geographically and sectorally diversified suppliers and partners. In highly regulated sectors where market entry is controlled, the relationship between firms tends to be more established, the potential value added of business-to-business electronic commerce and greater efficiencies through reorganisation may be small, and hence there may be fewer incentives for adoption.

Finally, content sectors have in part a different set of drivers and paths in e-commerce development. Content such as music and books can be digitised and distributed online. In these sectors, distribution intermediaries and retailers are under pressure as content producers (performers and authors) and new entrants can potentially distribute directly to consumers.[14] The potential for online content delivery means that established firms in content sectors (record labels and publishing companies) are searching for new business models (e.g. becoming new distribution intermediaries) and adopting new strategies (e.g. selling music and CDs online, and consolidating) to retain their links with final consumers.

Impacts on business and the marketplace

This section provides an overview of the impacts on business processes and models and market structure that have been identified in recent studies, giving sector and country specific contexts. The first kind of impacts as firms adopt business-to-business electronic commerce, are efficiency gains, in the form of cost reduction / increased revenues, and faster operation of each business process.

Impacts on existing business processes

Designing products

For existing business processes, in product design there are cost and time savings, and customisation opportunities,

Business-to-business electronic commerce allows for more efficient product development through the collaboration of part makers and assemblers. This could lead to cost-savings (designers do not have to hold physical meetings) as well as savings in time. Because business-to-business e-commerce allows more parties involved in the production process to take part in product design, standardisation of parts becomes easier. Finally, because business-to-business electronic commerce can integrate all players from parts producers to marketing, product customisation is easier and faster.

The extent to which the impact of business-to-business electronic commerce can be felt in the product design process depends on such factors as the nature and information intensity of products, characteristics of the sector such as level of standardisation of products and production process, and the competitive environment which encourages or discourages co-operation among firms. Preliminary evidence indicates that benefits derived from using e-commerce in product design are currently substantial in manufacturing sectors for which studies exist, such as automobiles, aerospace or electronics. Nevertheless, these benefits are becoming increasingly important in service sectors requiring a high degree of customisation such as healthcare.

Procurement and logistics

in procurement there are opportunities for more business partners, faster turnaround, and smaller inventories,

As more e-commerce is conducted over open networks, firms can procure from suppliers that are not necessarily the firms' traditional partners, leading to cost savings and spreading risks of relying on single business partners. Second, it shortens the time to procure supplies, making it possible to cut inventory costs. These impacts are dependent on factors such as the sectoral supply structure, the level of standardisation of the final product, and the actual and potential globalisation of the sector. Impacts are likely to be most significant in manufacturing sectors which have complex and extended supply chains, such as automobiles, electronics and aerospace, flow process industries which have long been automated such as chemicals and paper, and in utilities.

The above impacts also apply more generally to procurement of maintenance, repair and operating supplies (MRO -- low-value, high-volume items that are vital to ongoing business operations and account for a significant portion of expenditures at most companies) where software "supply chain tools" are being developed. Examples include procurement of office supplies and computer equipment, impacting a wide range of sectors including services (healthcare, distribution/retail). Internet-based procurement automation has the potential to dramatically reengineer and improve procure-to-pay processes, and MRO purchases are shifting towards maintenance and repair functions.

There may be particular procurement and logistics implications for SMEs. The implementation of e-commerce in procurement and logistics can be very beneficial as it allows SMEs to form buying and selling groups to achieve bulk discounts and purchasing economies and to reach new national and international markets.

Sales and marketing

and better integration of marketing with product design.

Sales and marketing are at the interface between business processes and end consumers. Market information facilitates product development (by transmitting for example consumer tastes to product designers) as well as production (by relaying the actual demand gauged at the sales and marketing levels). In the retail sector, the use of a range of point-of-sale technologies, including fidelity cards, track consumer spending patterns, which can be linked to production.

Evolving technologies and business models

E-commerce enormously increases information generated by business processes.

Business-to-business electronic commerce has positive impacts on business processes by making them faster, more cost-efficient, and making it possible for more parties to participate in transactions. At the same time, relationships among business partners can go beyond those defined by existing linear business processes, to connect businesses which are not adjacent in traditional supply chains, or those not on the same supply chain. Overall, much more information is generated about various aspects of business-to-business transactions that needs to be processed by transaction participants. The more complex, newly established business relationships can constitute a new business-to-business market, where information becomes the core of the transactions, exploited by new intermediaries.

New intermediaries are developing to deal with this information.

There are different types of intermediaries. Distinctions can be made between information intermediaries, which mediate information pertaining to goods or business services, and functional intermediaries which take charge of a particular function necessary for the operation of business-to-business e-commerce such as sales, electronic payment or authentication - functional intermediaries.

Information intermediaries often reflect existing market power.

An information intermediary can be supplier or buyer led. This depends a great deal on pre-existing market structure, with the intermediary likely to be created from the side with more market power. Where the supply can be used by many different sectors (such as steel[15] used in automobiles, aerospace, household appliances etc.), supplier intermediaries are likely. In the reverse situation where the buyer already has more power relative to suppliers, the intermediary is likely to be more buyer-centric (such as in the relationship between auto-manufacturers and auto-parts makers). This contrasts with business-to-consumer electronic commerce where the shift of power towards consumers is one of its most important characteristics.

Functional intermediaries are more likely to act as neutral enablers.

Functional intermediaries providing functions that are necessary to carry out business-to-business transactions, such as sales, payment and authentication, are less likely to be either supplier- or buyer-led. Instead, these intermediaries are likely to play a more neutral role, acting as enablers of business-to-business e-commerce.

The principal driver of both types of intermediary business model is related to the amount of information processing that business processes can save by involving the intermediary. Since the amount of information increases rapidly with the number of players involved, information intermediaries are more likely in vertically segmented markets, such as the supply of many different kinds of speciality steel. On the other hand, functional intermediary services such as payment or authentication are likely to be provided by existing financial services and information technology services providers, as they already handle large amounts of related information.

Business-to-business portals often provide both information and functional intermediary services.

Integrators and aggregators are a particular type of intermediary which can play both information and functional roles. Integrators/aggregators often take the form of a portal, a comprehensive Web entry point, directory and navigation service, providing specialised services to users. Business-to-business examples include one-stop shops for businesses to conduct online procurement for non-production supplies (office supplies, travel tickets etc.); they are also common in sectors that have vertically segmented markets and where products are commodities.

Impacts on market dynamics and the competitive environment

Buyer-supplier relationships

Demand-driven models of electronic commerce appear to be restructuring business-to-business relations.

The general model of electronic commerce development suggests that the Internet provides more information, more choice and greater discretion to consumers, dramatically lowering the cost of information and often reducing information asymmetries between suppliers and customers. How does this work in business-to-business electronic commerce relationships? The shift towards demand-driven models is clear in industries such as distribution and publishing, where consumers are the final buyers, or business-to-business sectors such as computer software and hardware or office supplies. Another way of looking at the issues is to assess whether the final link in the business-to-business chain is increasing market power. In sectors such as distribution, automobiles, publishing and content, and financial services,[16] there is some evidence that the shift has been in favour of final business-to-business links, as markets become more concentrated. This can be seen in the automobile industry, where consolidation is leading to a more concentrated global market with fewer, larger, automobile firms, at the same time as competition via production or imports is increasing in individual national or regional markets. The same phenomenon appears to be true in sectors such as distribution. Market information from distributors is increasingly driving production efficiencies along supply chains, and this is reinforced by globalisation (the ability to use more international suppliers) and lower transaction costs linked with ICT and Internet use.

In sectors such as distribution and publishing, distributors at the end of supply chains are increasing or maintaining their market power.

In sectors with established routine supply chains such as distribution and publishing, two kinds of effects of the expanded use of business-to-business electronic commerce could be expected. Aggregation of demand at the final stage of the supply chain could favour customers (i.e. the final-stage distributors in the supply-chain), whereas diversification via lower cost Internet-based strategies could favour suppliers to these distributors. For example, in France in the distribution sector it appears that customer pull of

final distributors is being exerted through increased efficiency along the supply chain as new technologies replace older ones (fax and paper replaced by Internet). This is adding to pressures on suppliers, although it is not the crucial element changing the relative power between suppliers and distributors. At the same time, some SME suppliers are improving their visibility to more distributors, and diversifying their supply strategies. In publishing (content) the industry has traditionally been supplier-led. Publishing houses provide products to distributors who in turn supply booksellers. In principle, publishers could supply direct to booksellers and customers by electronic means or by mastering logistics with the intensive use of ICT. However, in France distributors have moved more rapidly to use new technologies, including the Internet, to improve their logistics, and in some cases to diversify their outlets (to supermarkets, etc.).

The impacts of more efficient supply-chain relations will also change the competitive structure of up-stream commodity markets (e.g. foodstuffs, other commodities) due to greater consumer buying power. At the same time, commodities suppliers are moving onto the Internet (e.g. for metals sales) to widen markets and make them more transparent.

Established suppliers and distributors adopting e-commerce processes are likely to maintain and possibly reinforce established positions.

First-mover advantages for new entrants may not be large, for example in established sectors such as distribution or supply chains such as in the automobile sector. Reputation and trust appear to be of key importance. Small new suppliers may have some advantages if they can leverage their position to grow rapidly. But because the technology is relatively standardised, larger known suppliers should be able to emulate smaller ones and lead to likely shakeout of small new entrants. In terms of the impacts of first-mover advantages in business-to-consumer retailing, the business model for selling and distributing via the Internet is still in flux. Larger incumbents are likely to be relatively successful in imitating new models once they are more clearly established. There may however be relatively large first-mover advantages for large incumbents, e.g. in distribution and publishing (content) industries.

Impact of vertical market integrators

New intermediaries are likely to reorganise supply chains,

The impacts of new integrators will mainly be seen in the re-structuring of business-to-consumer markets, rather than in business-to-business processes and relations. However there will be impacts as the new integrators re-organise the goods and services supply chains feeding into them. For example in the publishing industry, new intermediaries are being established and re-intermediation is occurring as Internet-selling of books requires new kinds of intermediate distributors to deliver products to consumers or book-sellers in more limited or one-off quantities.

but when products and services can be delivered online, content ownership rights are important.

Barriers to entry are lowered by the adoption of lower-cost, open-standard and more ubiquitous Internet-based technology. This applies particularly when the product or service can be delivered online (e.g. content products in publishing, music industries). However authors rights, intellectual property rights and established ownership of these rights means that the market structure, growth and operations of new intermediaries and new

ways of delivering products will be heavily influenced by the ownership of content and by copyright and intellectual property right regimes.

New Internet-based services are becoming integral parts of supply chains.

New services are becoming integral parts of supply chains. For example new intermediaries provide services essential for the operation of supply chains such as new Internet-centred value-added services which are integral parts of supply-chain relations (maintaining sites, operating Internet-based systems, providing Internet content). Although such services were part of EDI-based supply chains, they may now come from different service providers and may become new essential intermediaries in the supply chain. New kinds of specialised portals (for example for SMEs) are a further example of the provision by new intermediaries of Internet services (site hosting, promotion, etc) and other information and business services at low cost, competing for example with established institutions and industry associations. These are likely to increase the relative market power of SMEs and increase competitiveness of markets. It is too soon to tell whether market structure in the provision of portals is becoming increasingly concentrated due to first-mover advantages.

Commodity technology and the competitive playing field

E-commerce technology is increasing efficiency along supply chains, but competition is mainly among firms in the same part of the supply chain, on the basis of established business models and strategies.

Technology is diffusing rapidly, and technology-based competition is more prominent in the same part of the supply chain, for businesses to capture first-mover advantages and to improve efficiencies. For example, distribution is being restructured in part by competition in standard products with standard distribution models, and business-to-business electronic commerce is accelerating the diversity of products, and diminishing stock and overhead costs by making supply-chains more efficient. This contrasts with new specialist Internet-based business models. These are developing in the supply of non-perishable items (computers, electronics, clothing), and increasingly in digital content products which can be delivered online (starting with software, and, increasingly, music, books, video) and other service products which can be researched, chosen and delivered electronically (travel, financial services). These are business-to-consumer applications based on standard technology, but experimentation with, and widespread adoption of, new business models in these areas will probably have larger impacts on market structure and competitive dynamics.

But in areas such as supply of business equipment, adoption of e-commerce is likely to be an important competitive factor.

On the other hand in some areas of business-to-business relations, standard electronic commerce methods are aiding distribution efficiency. New distributors are gaining market share in areas such as the supply of business equipment (computers, office supplies) where businesses traditionally purchased final consumption items from catalogues or by similar means. Internet-based business-to-business electronic commerce is enhancing such transactional forms, rather than supplanting them, with some evidence that competition is increasingly on service quality and variety.

Diffusers/consulting firms facilitate diffusion of new technologies. What is less clear is the kind of business models which will be successful (witness the rapid consolidation via mergers and acquisitions of Internet-based and other firms, and the lack of profits from most Internet ventures). New Internet-based business models are being trialled by start-ups and new

ventures, which can experiment with new models much more readily than established firms. Established firms with established business models are often waiting to see what kinds of models are likely to succeed, or further developing their own successful ones.

Policy implications and policy issues

Policy implications and issues surrounding business-to-business electronic commerce centre on: 1) enabling issues which include network infrastructure, and security related to authentication and financial settlement; 2) diffusion issues including technology facilitation, demonstration and small firm issues; and 3) business environment issues including competition, trade, standards and intellectual property rights.

Enabling issues

Enablers need to be affordable, standardised, inter-operable, and of adequate quality and quantity to support firms conducting business-to-business electronic commerce.

Three types of enablers of business-to-business electronic commerce can be envisaged: network infrastructure, security issues related to authentication/certification and financial security. These enablers need to be affordable, standardised to some extent, or at the least inter-operable, and be of adequate quality and quantity to support the requirements of firms conducting business-to-business electronic commerce. Firms involved in business-to-business electronic commerce as users or providers of business-to-business electronic commerce services are best placed to develop and implement these enablers. The role of policy would then be to create an environment that facilitates the development of enablers and encourages their interoperability.

A predictable operating environment for business-to-business e-commerce.

At the same time, there needs to be clear sets of rules that govern the usage of the enablers, making the business operating environment predictable. This is especially true in case enablers fail to deliver the expected services, raising liability issues. The liability issue is analogous to that for consumer protection for business-to-consumer electronic commerce. Existing commercial laws may not be adequate to cover liability issues raised by business-to-business electronic commerce. In areas where they are not sufficient, they could be complemented by industry self-regulation or through additional government rule making.

Network infrastructure

Competition among infrastructure providers is crucial.

Two types of access to infrastructure need to be examined: backbone infrastructure at various scales (inter-continental, international, and other long-distance) and "local loop" connections or "tails". Because much business-to-business network traffic relies on leased lines provided by telecommunication carriers ("private" lines), capacity and pricing of leased lines by different providers in different geographical locations are crucial. A recent OECD study identifies competition among infrastructure providers as the most important factor influencing the availability and pricing of leased line network infrastructure for business-to-business electronic commerce and ways to procure these services.[17]

Competition is beginning to emerge and is likely to increase in long distance and transborder infrastructures, but legal monopolies in some countries and the market power of former monopolies in recently liberalised markets lead to insufficient availability of infrastructure capacity and higher prices. For short distance "local loop" connections, lack of competition means that alternative infrastructures will take longer to develop, keeping prices high and constituting a barrier to electronic commerce. Competition can be increased by regulators encouraging efficient interconnection between pan-regional networks and national/local networks. The development of alternatives to leased line networks provided by telecommunication operators, such as xDSL, connection via cable television infrastructures and satellites, ISDN lines and more efficient dial-up connections could play an important role, especially since small businesses tend to rely on these network connections for local access.

What if the network fails…?

As the proportion of business processes conducted by business-to-business electronic commerce increases, the reliability of the network infrastructure and service providers using the network (ISPs, cable television companies etc.) becomes increasingly crucial. Recent events have signalled the impact of network failures on business processes. This liability issue connected with access to infrastructure for business-to-business electronic commerce can be resolved in principle by the market, for example, through contractual arrangements, or by the ability to easily switch providers of infrastructure services. This however may not apply to smaller users of infrastructure who may obtain their infrastructure services through entities that sub-lease network capacity, suggesting that there are continuing issues regarding the appropriate regulatory environment to handle network failures.

Transaction security - authentication and certification

Authentication issues differ from those in business-to-consumer electronic commerce.

Business-to-business electronic commerce transactions are likely to occur between parties that know each other and are linked contractually, in contrast to most business-to-consumer transactions. For transactions between firms that have no established relationship, it is likely that those transactions occur through intermediaries such as vertical business-to-business portals, and authentication can be established indirectly. Hence, the level of authentication required for business-to-business transactions is likely to differ from business-to-consumer transactions.

Interoperability of different systems is crucial.

Interoperability is the most important technical issue for electronic authentication. While this applies equally to both business-to-business and business-to-consumer transactions, the complexity required for authentication for business-to-business transactions (such as the need to authenticate the authority to conduct certain transactions, in addition to authentication of identity) makes interoperability more important. Firms offering authentication/certification services range from financial services, IT services, to quasi-governmental bodies including postal authorities. It is not clear what direction the development of business-to-business authentication will take in terms of interoperability. Left to the market, the most likely outcome is the rise of a *de facto* standard. Another possibility is for a basic standard protocol to emerge either from within industry, or through co-operation with public authorities. New technological developments, such as XML, might encourage this type of outcome.

Liability issues require continuing attention.

Once there are workable solutions for business-to-business authentication, there needs to be a clear and predictable environment about who bears responsibility in case the system is used for fraudulent purposes or in case of system failure. There currently are very few rules that govern the level of liability that should be borne by the parties to transactions and the providers of certification/authentication services, and this issue will require continuing attention.[18]

Settlement security - electronic financial payments

Payment for business-to-business e-commerce is very much about authentication and certification.

Payment settlement in the business-to-business marketplace relies very much on the banking sector, either in electronic forms or in physical checks or billing, in contrast to business-to-consumer electronic commerce where payment using credit cards seems to be becoming a *de facto* standard. Payment settlements for business-to-business transactions are in general of larger value, taking place in a recurrent fashion, and requiring a more structured operation. Most importantly, anonymity is not an issue in business-to-business transactions, unlike for some business-to-consumer transactions. Business-to-business transacting parties need to be certain of the identity and the authority of each other to initiate/receive payments. Payment settlement is hence very much interconnected with the issue of authentication and certification, and in some cases payment systems incorporate mechanisms to address these issues.

EDI and Financial EDI (FEDI) have played some role in providing electronic means to settle business-to-business transactions. Recently new technologies such as electronic checks and electronic bill presentment and payment (EBPP) have emerged as potential tools for settling business-to-business payments. However, usage of available electronic means is still minor.[19] Business-to-business payment settlement is carried out either in physical form (paper bills and paper checks) or through the intermediary of banks (direct credit/debits), although part of the transaction could be done electronically through e-banking. The fact that the payment settlement process, a crucial part of the business-to-business electronic commerce, is not entirely conducted electronically as part of other business-to-business electronic commerce processes, could dampen the positive impacts of business-to-business electronic commerce.

Interoperability of payment systems and liability also require attention.

Part of the reason for the low uptake of business-to-business electronic payment settlement might be due to the fact that business-to-business transactions require some kind of authentication mechanisms to be part of payment methods. Hence all the issues that are pertinent to authentication also apply to business-to-business electronic payment settlement. There is an additional issue of payment standards and interoperability. For example, EBPP, is envisaged to be a promising payment tool for business-to-business transactions but is suffering from the lack of a standard, due to diverging interests of various players, which make different emerging models incompatible with each other. Finally, the liability of the provider of payment settlement services for both payment and authentication functions, and the regulation of providers, both require attention and the appropriate regulatory framework.

Diffusion issues

Public policy has a continuing role in facilitating diffusion of information and demonstration of new technologies.

The business sector will continue to develop the technological and organisational innovations that facilitate business-to-business electronic commerce. However, because e-commerce technologies and related business opportunities are developing rapidly, questions remain as to whether businesses across different countries and size classes have the capacity to continually adapt their strategies to benefit from these opportunities. One potential public policy role is to foster diffusion of information and technology demonstration to business sectors that may find it hard to keep up with rapid change. This has been an ongoing preoccupation of government business policy. Initiatives to facilitate uptake of business-to-business electronic commerce are usually extensions of previous government efforts to facilitate information flows and encourage demonstration and adoption of new technologies.

Facilitation and demonstration

The rationale for government intervention comes from market failures in the supply of and demand for appropriate information regarding new technology applications and complementary organisation and skills required to implement these new solutions, and asymmetries between supply and demand for information.

Most OECD countries have initiatives to facilitate the uptake of business-to-business electronic commerce, through information exchange, skill development, and low-cost advisory services.

There is a wide range of initiatives undertaken by governments to facilitate business-to-business electronic commerce, usually as part of wider government support for information and extension activities. Examples include: in Australia, launching of the Australian Electronic Business Network to assist electronic commerce training, and specific initiatives such as funding the development of guidelines for standard messaging and labelling to improve transport logistics (National Office for Information Economy NOIE); in Canada projects to develop e-commerce business skills and to diffuse information on benefits and requirements for e-commerce success (E-commerce strategy); in France, inter-enterprise electronic commerce has been extensively studied by the "*Mission commerce électronique*", to identify courses of action and mobilise participants; furthermore a mechanism has been adopted to encourage more widespread use of the Internet by SMEs (*Rapport Lorentz, Ministère de l'Économie, des Finances et de l'Industrie*); Ireland has adopted a comprehensive strategy for e-commerce, including efforts to encourage the growth of new intermediaries, increase awareness and to encourage use along enterprise value chains (Forfás); in Italy a set of interventions for electronic commerce has been introduced including tax and financial incentives, local technical assistance and training tools, online public administration and procurement and establishment of the permanent Advisory Board for Electronic Commerce (Ministry of Industry); in Japan, support for test-beds and demonstration projects have been organised, mainly with large firms, to improve corporate certification, security management, payment and related technical infrastructures for open EDI, and to develop common business process platforms (Ecom); in the United Kingdom, initiatives such as the Information Society Initiative, TradeUK and Local Support centres are designed to improve skills, enhance access and increase advice and information flows (Competitiveness White Paper); in the United States, the National Institute of Standards and Technology supports electronic commerce applications through its Manufacturing Extension Partnership network, to improve manufacturing operations and processes, and through Advanced Technology Program research on inter-operable infrastructures; and the European Commission has earmarked new business services, sectoral networks, public procurement, and raising awareness as requiring attention for businesses to take advantage of electronic commerce (Communication).

Small firms

Many of these initiatives are aimed at small firms.

One particular area where demonstration and facilitation is important is for small firms (SMEs). As with the diffusion of all technologies and organisational innovations, SMEs tend to lag larger organisations. On the other hand, studies suggest that small enterprises that are early Internet adopters have larger turnover per employee, grow faster, provide higher salaries and have superior performance in general. In light of the apparent benefits of early and more widespread adoption, most governments have made particular efforts to increase uptake of Internet and e-commerce technologies and organisation in SMEs. Most of the above examples have either a particular focus on SMEs or there are separate policies focused on increasing the access of SMEs to information, advice, training and other skills to facilitate more widespread adoption of ICT and, in particular, e-commerce abilities.

Network effects and first-mover advantages by large established enterprises need to be balanced against opportunities for new entrants.

Other SME-related issues include whether network effects and first-mover advantages in business-to-business e-commerce will increase the dominance of larger and more advanced players, leading to fewer suppliers along supply chains, and greater concentration in value chains in fewer enterprises. Such concerns have to be balanced against opportunities for new entrants to transform some areas of electronic business. This can occur through exploiting the potential for new business models (e.g. new portal strategies, the creation of new intermediaries and aggregators), re-organisation of supply chains to capture efficiency gains, or participation in more geographically diverse supply systems.

Business environment issues

Competition

New business processes and business models, and the nature of IT influence the competitive environment.

Business-to-business electronic commerce involves competition issues related to 1) changing market structures due to changes in the business processes and business models; and 2) the changing nature of competition in the information technology sector, on which business-to-business electronic commerce relies. While the first set of issues involves firms conducting business-to-business electronic commerce, the second mainly involves enablers. The two types of competition issues intermingle, as the traditional enablers of business-to-business electronic commerce are also increasingly involved in business-to-business transactions.

The emergence of new players in the market in the form of new intermediaries has a very large role in reshaping the competitive environment of individual sectors. Their emergence is caused primarily by the surge in the amount of information that needs to be processed between groups of players that are adjacent in the supply chain. Furthermore, the ability of established firms to organise and use their information flows (e.g. through early and successful use of Internet-based strategies to better position themselves in the business-to-business supply chain) will also have a major impact on the competitive environment.

Competition could change to a scenario where competition is between firms in different sectors.

The information technology sector itself poses a unique set of competition issues, in that there is a great potential for firms which have captured a significant part of the market in one key area to use market power to influence other markets. The antitrust case involving Microsoft concerns the alleged anti-competitive behaviour of the firm in the IT sector, but as IT firms start providing business-to business electronic commerce services and infrastructure as intermediaries, the same competition issues could apply to electronic commerce. In this kind of environment, the notion of competition could change dramatically from one in which firms in the same sector compete against each other to a scenario in which competition occurs between firms in different sectors.

Market consolidation and network effects, versus new competition exploiting the potential of the Internet.

A further consideration for competition is the market consolidation taking place among e-commerce providers and users. Recent examples include the decision of IBM and Cisco to join forces to provide business solutions using Cisco networking equipment, further consolidating the position of Cisco as by far the dominant supplier of Internet routers and switchers, the consolidation of browser software suppliers (the AOL acquisition of Netscape), increasing merger and acquisitions of ISPs, portals and most Internet-related businesses, and consolidations in various sectors using the Internet to increase supply chain efficiency. There are also counter-trends of potential enhancement of competition, via for example, the use of network computers and "software on tap" Internet services to provide commonly used office and business software applications (Sun Microsystems) to confront the incumbency advantages of Microsoft and Intel in PCs. Furthermore, the general lowering of barriers to entry due to the open systems nature of the Internet may foster greater competition from new firms with new business models.

Trade issues

Distribution of digitised content and free/bundled goods and services are important trade-related issues for business-to-business e-commerce.

The adoption of electronic commerce and Internet-based strategies reduces barriers to international transactions, shifts the boundaries of firms and restructures the organisation of supply chains. Two different sets of issues are raised related to business-to-business electronic commerce. The first relates to online delivery of content-rich products (computer software, audio and video products, books, information and advisory services), most of which can be business-to-business as well as business-to-consumer. Such products can be readily delivered and downloaded electronically and provide challenges to traditional trade policy because their origin and destination cannot be so readily tracked as with conventional goods. Furthermore, the adoption of business models which provide many online-delivered products free, and which charge for bundles of services or products, blurs traditional notions of pricing and valuing products for trade purposes, and makes the establishment of clear audit trails more difficult.

Changes in supply chains and increasing inter- and intra-firm trade.

The second relates to the transformation of business-to-business supply chains. Despite the continuing trend towards globalisation of industries, many supply chains remain very local, due to economies associated with externalities and agglomeration effects. Business-to-business electronic commerce may encourage a broader geographical range of suppliers and customers, increasing inter and intra-firm transactions, expanding trade, and possibly raising new trade issues as trade moves from batches of similar products delivered occasionally, to more varied products delivered continuously.

Trade liberalisation and deregulation can have impacts on business-to-business e-commerce.

Many countries have adopted policies to liberalise their communications infrastructure or directly encourage electronic commerce, both of which have implications for trade. Telecommunications liberalisation and reform, coupled with the resulting expansion of services and reductions in telecommunications tariffs, have had major impacts on Internet use and e-commerce, with attendant growth in trade of goods and services. Lowering of taxes and tariffs on ICT equipment (e.g. through the WTO Information Technology Agreement to eliminate tariffs on selected IT products) has also had a positive impact in facilitating e-commerce growth. Trade facilitation initiatives such as those designed to encourage small firms to use the Internet to provide information about themselves and seek trade opportunities will contribute to expansion of business-to-business e-commerce and international trade. On the other hand, tariff and non-tariff barriers may impact the growth of business-to-business electronic commerce and the efficiencies which can be reaped from reorganisation of supply chains and adoption of new business models which expand the geographical scope of supply.[20]

Standards and intellectual property rights

There is increasing need for interoperability of standards, and diffusion of information on standards.

Standards for electronic commerce have been developed through market mechanisms (often following initial development in public institutions such as the development at CERN of the HTTP, URL and HTML standards). Standards are being continuously developed and applied: in infrastructure to support information transport and networking; to support business applications such as product identification; and for enabling software and systems to facilitate electronic commerce applications.[21] In all of these areas there is need for increasingly higher levels of interoperability of standards. New more flexible solutions to the relative inflexibility and cost of proprietary, closed EDI systems are being developed, for example with XML (extensible mark-up language). Similarly, proprietary systems for enterprise resource planning are migrating to TCP/IP systems to provide more accessible ways for firms to co-ordinate business functions. In many areas there is potential for policy involvement at national and international level (for example in UN-CEFACT), to ensure interconnection and interoperability. There may also be considerable room for policy involvement to ensure that information about new standards is diffused effectively, for example to small firms, which may help to reduce lock-out effects from the introduction of new standards by established players along supply chains.

The impact of the open source movement and free distribution of software cannot be neglected.

Standardisation requirements are also evolving with the advent of the open source movement. One of the major advantages of Linux (a free, UNIX-like operating system, developed originally for home PCs, but which now runs on a variety of platforms) is that nearly all development software for Linux is free and source code for nearly any Linux programme is freely available. This speeds application development and maintenance, but it also means that the software is rapidly evolving, posing new challenges regarding the approach to standards and to ways that firms can develop proprietary rights in an essentially free and open software environment. Although this is not necessarily linked with business-to-business electronic commerce, the impacts of such developments and the potential shift towards making software free (or nearly free), and available on the Internet has major implications for improving transparency and decreasing the proprietary and exclusionary impacts of privately-developed standards.

Effective intellectual property protection is a continuing issue in the new e-commerce environment.

In the area of products that are online delivered content, there are particular challenges to ensure that copyright is adequately protected. For example, content creators demand stronger IPR protection, whereas the content distributor in the new Internet medium (for example network operators) may benefit from lesser regulation. Furthermore, with rapid and worldwide distribution of electronic information, there are issues surrounding the posting of copyright material on public Web sites, protection of technical designs and other copy-rightable material, and how to enforce copyright protection.[22]

Further work

This digest summarises work to date on the economic impact and policy implications of business-to-business electronic commerce. Further work is being undertaken to prepare a more complete review of these impacts and implications, to be presented to the Working Party on the Information Economy at its November 1999 meeting. Furthermore, because of the relative lack of information and studies on the development, impacts and policy implications of business-to-business electronic commerce, further internationally comparable case studies and surveys need to be undertaken to deepen understanding of differences across countries, sectors and size of firms, its impacts on efficiency, productivity and employment, the additive versus substitution effects of new and evolving business models, and of its impacts on the organisation of the economy.

NOTES

[1] The Proceedings of the Ottawa Ministerial Conference, SG/EC(99)1/FINAL summarise this work into a seven-point near-term programme of work relating to electronic commerce including: Point 4: Initiate work on defining and measuring electronic commerce; Point 5: Extend the analytical work at the OECD examining the economic and social impacts of electronic commerce, and applications in government, particularly education. For an overview of previous work see: OECD, "The Economic and Social Impacts of Electronic Commerce: Preliminary Findings and Research Agenda " Ottawa Ministerial Conference on Electronic Commerce (October 1998).

[2] Workshop papers and proceedings available at: http://www.oecd.org/dsti/sti/it/ec/act/oslo_workshop.htm. See also OECD Workshop "Defining and measuring E-commerce", 21 April 1999, reported in DSTI/ICCP/IIS(99)4/FINAL.

[3] Benchmark group August 1999, and IDC 1999.

[4] IDC, 1999, Forrester Research 1998.

[5] For progress with definition of e-commerce see the companion paper on "Defining and measuring electronic commerce: A status report" [DSTI/ICCP/IIS(99)4/FINAL]. A set of definitions will probably be required comprising a broader definition (sometimes termed "e-business" -- any business process conducted over a computer-mediated network, including the exchange of information at any stage in the supply chain) and narrow definitions dealing with transactions (sometimes termed "e-transactions" -- a transaction completed over a computer-mediated network that involves sale or the transfer of rights to use goods or services). Furthermore, if the impact of e-commerce is the focus of measurement, then the role of infrastructure to carry out e-commerce activities may need to be included in the definition. Even when the issue of the definition and methodology for collection of information on electronic commerce is resolved, the volume of Internet-based business-to-business electronic commerce could be very small in some countries. A survey of e-commerce in Europe reveals that sales and purchases are not a significant share of overall transactions for 74% of European organisations which conducted sales and 89% of those which conducted purchases on Internet-based networks (PFA Research, 1999). On the other hand Intel is transacting USD1 billion per month from orders placed on the Web and expects that by the end of 1999 close to 50% of its business to be carried out over the Web.

[6] "Real Numbers Behind 'Net Profits 1999'", *ActivMEDIA Research*, 1999.

[7] The Internet-based business-to-business market and Web-EDI market are forecast to grow at annual compound growth rates of 69% and 40% over the period 1997-2003 (*Datamonitor*, 1999).

[8] *ActivMEDIA Research*, 1999.

[9] *Datamonitor* 1999.

[10] The level of Internet-based e-commerce penetration in the United States in 2002 is forecast to be roughly twice that in Japan, regardless of the segment (business-to-business, business-to-consumer) or the sector (manufacturing and non manufacturing) (McKinsey/ECOM, 1999). The Andersen Consulting study for MITI (1999) using a broad definition of business-to-business transactions occurring over networks using

TCP/IP protocols, shows the US use of e-commerce transactions to be double that of Japan throughout the period 1999-2003.

[11] See also, for example, U.S. Department of Commerce (1999), *The Emerging Digital Economy II*, Washington, Chapter 1.

[12] OECD, "Building Infrastructure Capacity for Electronic Commerce - Leased Line Development and Pricing", DSTI/ICCP/TISP(99)4/FINAL, Paris.

[13] OECD (1998), *The OECD Jobs Strategy. Technology, productivity and job creation*, Chapter 11, "High performance workplaces and intangible investment", Paris.

[14] The distribution, automobile, publishing and financial services sectors are given as illustrative examples of changes taking place. See e.g. section on Buyer-supplier relationships.

[15] http://www.esteel.com.

[16] These sectors have been chosen as illustrative examples of many of the changes associated with business-to-business electronic commerce transactions. The sectors can be classified by two criteria: whether their products can be digitised or not, and whether their processes are routine or complex. This gives the following typology: distribution - non-digital products, routine processes; automobiles - non-digital, complex; publishing (content) - digital, routine; financial services - digital, complex. These sectors are likely to have relatively intensive use of Internet-based business-to-business electronic commerce in the near future (see e.g. Forrester (1998) "Resizing online business trade" and similar consultant reports).

[17] OECD, "Building Infrastructure Capacity for Electronic Commerce - Leased Line Development and Pricing", DSTI/ICCP/TISP(99)4/FINAL, Paris.

[18.] EU: Proposal for a European Parliament and Council Directive on a common framework for electronic signatures, Article 6 (http://europa.eu.int/eur-lex/en/com/dat/1998/en_598PC0297.html). In Japan, ECOM formulated a guideline document (http://www.ecom.or.jp/ecom_today/no.6/wg03.html).

[19.] Barouski, William A. and Cynthia J. Pijarowski, "Technological Innovations in Banking: Business-to-Business Electronic Commerce", paper prepared for the OECD Oslo Workshop on Business-to-business E-commerce, 17 June 1999. This study shows that Financial EDI carries some 30 million payment messages per year in the United States, where EDI is relatively well developed, compared to 25 billion business-to-business payments made by checks.

[20] See also TD/TC/WP(99)38/REV1, "Initial survey of unilateral liberalisation and facilitation measures", October 1999.

[21.] Electronic Commerce Task Force, Industry Canada (1999), "Standards for a global digital marketplace".

[22.] Forfás (1999), *Report on e-commerce - The policy requirements*, Dublin.