

The Status of B2B E-Commerce in the South African Manufacturing Sector: Evolutionary or Revolutionary?¹

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Abstract

While B2B e-commerce represents a major technological innovation and marks a significant development in organisational interconnectivity (i.e., the ability to network both internally and externally), it is premature to categorise e-commerce in the South African manufacturing sector as 'revolutionary'. A technological revolution implies a historic transformation bringing about profound, pervasive change in business processes. The research findings reveal that rather than a 'great event' having occurred, the reality of e-commerce in the South African manufacturing sector appears to be more mundane, i.e. the result of an evolutionary process of IT integration into existing work practices. Therefore, e-commerce cannot claim to have radically changed the way most business is conducted on a day-to-day basis. Moreover, a technology-focused approach to e-commerce tends to deflect attention away from far-reaching systemic changes that need to be made in the South African manufacturing sector.

Introduction

B2B E-Commerce and the New Economy

The 'new economy' remains an ambiguous concept which means different things to different people (Cohen *et al.*, 2000; OECD, 2000a, 2000b; Shapiro and Varian, 1999). We argue that the notion of a 'new economy' is closely tied to the economic transformations which are powered by the development and diffusion of information and communication technologies (ICTs), the rise of knowledge-based productivity and competitiveness, and the increasing dominance of global value chains incorporating global networks of capital, production and trade. The major factors spearheading the new economy are modern microelectronics-based ICTs, deregulation, privatization, and liberalization of trade and investment (Dicken, 1998; Gereffi, 2001). The notion of the new economy is firmly anchored in the new ideological environment that resulted from the collapse of statism, the crisis of welfarism and the contradictions of the developmental state (Held *et al.*, 1999). The new economy originated mainly in the United States, but is spreading rapidly into Europe, Japan, Asia Pacific and in selected developing countries (Schiller, 1999).

The key point that needs to be emphasized is that organizational learning, knowledge management, digital networking and information processing are critical elements for firms operating in the context of a knowledge-based global economy (Tuomi, 1999). According to Castells (2000: 77), the productivity and competitiveness of firms "fundamentally depend on their capacity to generate, process, and apply efficiently knowledge-based information". Electronic commerce and the global networked business model are the archetypical expressions of the new economy (Evans and Wurster, 2000; Hartman *et al.*, 2000). It is important to remember, however, that the growth and development of the new economy has been highly uneven both *within* and *between* countries. The networking logic is based on asymmetrical interdependency, and is exclusionary locking out those individuals, groups, regions, sectors and countries lacking the required knowledge intensive skills and capacities. Moreover, the new economy is not about soft landings and smooth growth, rather it is about a structural shift in the global economy heralding transformation, risk and disruption for developing economies, such as South Africa.

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With the growing impact of ICTs on the global economy, knowledge (and its acquisition) has become the engine of economic progress, and the main determinant of industrial development. And the spread of business-to-business electronic commerce,² which is a product of the economic application of a knowledge-based economy, has become a key factor in the development of a knowledge-based economy. Having said that, there is a dearth of research on B2B e-commerce not only in South Africa, but in the developing world at large.

An incongruity exists between the exhortations of the e-commerce 'optimists' (Cohen *et al.*, 2000; Leebaert, 1998; The Economist, 23/09/2000; US Department of Commerce, 1999; UNCTAD, 2001) about the potential advantages of B2B e-commerce and the actual experiences of developing country producers. As a result, policymakers are having to take positions relating to e-commerce, and they are frequently being guided by overly optimistic and technicist approaches which are based on extrapolations from developed country research, anecdotal evidence or sheer guess work rather than the real experiences of developing country producers. Without an improved evidence base on the actual experiences of South African manufacturing firms, there will continue to be little if any foundation for assessing the validity of the claims (see Section II) made about the uptake and likely geographical distribution of the economic gains (and potential losses) for South African producers as a consequence of the spread of B2B e-commerce.

Scope of the Study

The key issue facing researchers and policymakers is to be able to assess what the baseline state of e-commerce in South Africa's manufacturing sector is in regard to the global demands of the new information economy. This will allow research and policy advice to be based upon real evidence of how trading relationships are being constructed rather than on speculation about the future based largely on experiences within developed countries. Given the time and resource limitations, the study was not aimed at providing a comprehensive and detailed account of all relevant issues. Rather, the objective was to: 1) review pertinent trends, assess their broad implications for policy and draw up an agenda for future action; and 2) form an essential base of information regarding the current state of play of B2B e-commerce in the South African manufacturing sector. The research is qualitative, and is based on 132 firm-level interviews with large South African owned manufacturing firms, and 31 personal interviews with industry experts (the questionnaire is included in Appendix I). The panel of industry experts included representatives from academia, government, trade unions, business associations, IT vendors and private consultancies.

Firms were selected on the basis of interviews with key informants who have a good overview of e-commerce in the selected sectors. In order to extend the range of respondents the snow-balling technique was used. In addition, the author also used the profile of firms that the University of Natal's School of Development Studies has compiled over the last seven years. The firms selected were generally large enterprises (over 100 employees) and were more or less evenly distributed among the three sectors. Recognising that manufacturing is not a homogenous sector, this study focused on three 'typical' manufacturing sub-sectors, viz. automotive components (a technology leader), apparel (a technology follower) and wood furniture (a technology laggard). It seems plausible that when taken together these three sub-sectors may be seen as illustrative of the South African manufacturing sector more broadly. It should be noted from the outset that, because of limited resources available, statistical random criteria for selecting potential participants was not used for this pilot study. However, every effort was made to capture the full range of user experiences within the three sectors examined. The analysis remains tentative, and should be taken only as a first empirical approach to suggest lines of analysis on the evolution of B2B e-commerce in the South African manufacturing sector. The sectoral specificity of organizational impacts have been reported elsewhere (Moodley, 2001a, b; Moodley, 2002a-e; Moodley and Morris, 2001, 2002; Moodley *et al.*, 2001). This paper concentrates on synthesising those findings and observations that can be discussed at more generic levels. The emphasis throughout is upon findings that indicate characteristics and behaviours that appear to be common, or potentially common, across the three industry sub-sectors.

² Hereafter B2B e-commerce.

In the author's considered view, it would be premature at this early stage of B2B e-commerce development to discuss the precise impacts of e-commerce on the South African manufacturing sector, to rigorously define 'best practice' criteria and develop reliable performance metrics. The paper does, however, make recommendations as to how government and industry might best support the successful adoption of B2B e-commerce.

The promise of b2b e-commerce for the South African manufacturing sector

The inward-orientation of the South African manufacturing sector has been fostered by a history of state protectionism and import-substitution industrialization (ISI) during the apartheid era (Joffe *et al.*, 1995). This inward focus was reinforced by trade isolation, disinvestment and the imposition of economic sanctions during the 1980s and early 1990s. As a result, nationally-based producers were for a long time insulated from the cut and thrust of international competition. Since the transition period (post 1994), however, the South African manufacturing industry landscape has been substantially altered by the twin pressures of globalization and the rapid liberalization of the trade policy regime, and reinforced by a major shift in state policy to open markets, a rapid erosion of both tariff and non-tariff barriers and the implementation of an export-oriented industrial policy (Habib and Padayachee, 2000). The key challenge thus confronting the South African manufacturing sector is not *whether* to participate in global processes, but *how* to do so in ways which provide for sustainable growth. Integrating effectively into the global economy provides the potential for realizing scale economies, tapping larger markets and hence increasing both GDP and employment, accessing technologies, improved product standards for the local market, etc. Global experience suggests that the ability to participate in this high road growth path depends on the ability to adopt and use ICTs, incorporate greater knowledge intensity into manufacturing activities and to move into intangibles (ILO, 2001; Kaplinsky, 2000).

The issue of engaging more openly in global production and trade networks has become central to debates on how formerly inwardly-oriented industrial sectors restructure themselves to maintain competitiveness in a more open, trade-liberalized environment (Moodley, 2002a-e). In South Africa, the critical importance of B2B e-commerce in shaping the performance of domestic enterprises in the global, networked economy has recently come under the policymaking spotlight (DoC, 2000; DTI, 2001; Kaplan, 2000). The use of the Internet to co-ordinate production through domestic and cross-border, inter-firm networks is therefore likely to have a significant impact on the competitiveness of South African firms. The value of B2B e-commerce rests squarely on the ability of the firm to extend processes and integrate with other companies, and on a broader level, to integrate and consolidate supply chains. The question is whether this potential can be translated into reality for South African manufacturing firms.

What is B2B E-Commerce?

There is no standard or uniform definition of B2B e-commerce in the literature. We are, however, cognisant of Anderson's (1998) critique of analysts who narrowly define B2B e-commerce in terms of actual transactions carried out on the Internet. Therefore, for the purposes of this study, B2B e-commerce was broadly defined as *any form of commercial transaction or structured information exchange that takes place between firms within industry value chains via an ICT-based, computer-mediated network*. B2B e-commerce can be divided into two categories: (1) open marketplace-based trade that occurs in public Internet-based environments using the TCP/IP protocol suite³, and (2) direct trade between business partners that occurs through either public Internet-based platforms, proprietary computer networks, or both. The former generally takes place at various World Wide Web-based auctions or exchange sites (information and/or transaction-oriented; open or restricted; horizontal or vertical; independent or industry sponsored; etc.). In contrast, the latter tends to occur either through a firm's Extranet, or website which has an online purchasing function, or an electronic data interchange (EDI) network. These two models are, however, not mutually

³ These marketplaces were originally designed to reduce bid-ask spreads and to bring down transaction costs by matching buyers with suppliers, and enabling suppliers to trade with one another.

exclusive. It may well be that in the future South African manufacturing firms will need to develop 'hybrid' models of B2B e-commerce to handle different aspects of their business. Perhaps this is something to look at in the future especially for South African firms that have yet to go down the B2B e-commerce path and need to develop an investment strategy. There could be savings at the outset if both types need to be developed in parallel.

The understanding of the firm as a monolith was problematised in Coase's (1937) seminal paper, *The Nature of the Firm*. The theory of transaction cost economics that emerged from this work helped to clearly delineate the boundary of the firm as defined by the equilibrium between the advantages of the lower transaction costs of internal production on the one hand, and the lower agency costs and economies of scale and scope of outside procurement on the other (Williamson, 1975). The costs of conducting marketplace transactions, i.e. information seeking, negotiating the terms, and settlement, define to a large extent what a firm will buy, instead of making it (Williamson, 1975). Since these co-ordination costs are lowered in e-commerce, a general agreement exists that an increase in outsourcing is likely to take place (Malone, Benjamin and Yates, 1987).

Drawing on the transaction cost paradigm, Garicano and Kaplan (2000), Humphrey (2002) and Paré (2001) argue that e-commerce has the potential to substantially reduce co-ordination costs and increase efficiency in inter-firm trade.⁴ The efficiency gains that they highlight can be classified into three broad categories: (1) *process improvements* – a substantial reduction in overall transaction costs; (2) *direct information improvements* – minimising information search costs, and a reduction in information asymmetries; and (3) *indirect benefits* – better information processing (e.g., about future demand, about existing and future supply, etc.) as a result of greater transparency and improved connectivity, and more efficient 'make or buy' decisions as a result of a substantial reduction in transaction costs in inter-firm trade. It must be borne in mind, however, that the existence of a network technology infrastructure is not in itself a sufficient condition for the emergence of a durable trade network. That depends on repeated interactions through which parties build reputations for trustworthiness and gain confidence in one another.

Hype or Hope?

While B2B e-commerce forecasts vary, researchers agree that it is growing rapidly and that it constitutes about 90% of total e-commerce transactions (Brookes and Wahhaj, 2000; Lucking-Reiley and Spulber, 2001; Mansell, 2001a, 2001b; Siems, 2000). It is clear that global B2B e-commerce is rapidly increasing in importance, and represents a vast field of opportunity for the South African manufacturing sector. It has been argued that B2B e-commerce facilitates co-ordination and synchronization of workflow between members of the demand and supply chain (OECD, 1999; US Government Working Group on Electronic Commerce, 1999). Historically, a manufacturing firm's ability to collect and manipulate data far exceeded its ability to communicate and interact with partners because of the diversity of systems technology and high costs of private networks. The Internet is a much better channel management platform than proprietary systems such as EDI. Channel partners are largely already connected and start-up costs are low. The ability to search catalogues online, submit orders, modify orders, track shipments, and schedule delivery is a service most manufacturing companies will want to offer their direct customers. The key advantages being tight supply chain integration, customization and better service. A blind spot in the literature is that for those firms that are using EDI, this application is likely to have already influenced how and by whom information within the firm and between firms are managed. Therefore, any shift to Internet-enabled commerce simply cannot assume that changes in the way information is handled will come at zero cost, or indeed, that they necessarily lead to greater transaction efficiencies.

An important caveat is that these benefits are based largely on untested extrapolation from the experiences of highly industrialized countries which are themselves only beginning to be

⁴ In contrast to Garicano and Kaplan (2000), however, both Humphrey (2002) and Paré (2001) suggest that the potential reduction in co-ordination fostered by e-commerce may not be sufficiently large enough to decrease the overall transaction costs incurred by firms seeking to trade in international markets.

examined systematically, as well as on theoretical arguments. In other words, it is uninformed by rigorous empirical research on the actual experiences of developing country producers involved in e-commerce trading relationships. Moreover, the impression created is that all, or the vast majority of, inter-firm commercial transactions will take place through e-commerce portals. Rather companies will continue to use multiple channels for procurement. Companies are likely to reserve their most strategic purchases for off-line negotiation since much of that is locked up in long-term contracts.

In addition, it is claimed that B2B e-commerce reduces the importance of marketing barriers, powerful intermediaries (such as trading organisations in the US or the UK) and of physical distance as barriers to entry into international markets (Morgan Stanley Dean Witter, 2000; Panagariya, 2000; UNCTAD, 2000). It is claimed that buyers in the highly industrialized countries will have much easier access to information about developing country producers, and third world suppliers will find it easier to obtain knowledge of market requirements in developed countries. In this sanguine view, the primary obstacles to realizing the potential of B2B e-commerce rests with physical infrastructure barriers in developing countries, especially inadequate telecom systems. This is most clearly captured and reflected in the 'digital divide' literature which focuses on the limitations and asymmetries of the technological infrastructure and the weak skills and capabilities in developing countries, particularly the least developed countries (Dutta, 1997; UNCTAD, 2000).

The potential benefits of e-commerce for buyers and sellers, based on a general scan of the literature, are summarized in Table I.

Table I: Potential E-Commerce Benefits

Benefits to Sellers	Benefits to Buyers
Expanded access to trading partners and market reach	Expanded access to trading partners and support services
Increased marketing and sales profile	Improved sourcing and procurement process
Enhanced customer contact and service	Enhanced supplier relationships (contact and service)
Reduced cost of sales, technical documentation, and customer service costs	Lower purchasing prices through improved price transparency and comparison
Reduced transaction handling/processing costs	Reduced procurement costs
Reduced working capital and inventory requirements	Reduced operating costs and maverick spending
Competitive advantages through improved efficiencies and process planning	Improved efficiencies and transaction flow, visibility and control

However, there is to-date no reliable evidence of benefits realization and little evidence of quantification of potential benefits in developing country contexts. This notwithstanding, there appears to be e-commerce opportunities throughout the value chain and across the project lifecycle for South African manufacturing firms (Box I). For developing country producers, low-cost, high-speed transaction capabilities and information transfer coupled with relatively low investment and configuration costs, and interactive global market reach are crucial requirements for competing in the global economy. Moreover, the expected reductions in inventory, and process efficiency gains resulting from reduced lead-times, better procurement and production practices, and logistical improvements are also critical success factors.

BOX I: E-Commerce Opportunities for SA Manufacturing Firms

Using e-commerce to:

1. Enhance or replace traditional linkages between supply chain participants (e.g. EDI, e-commerce, e-procurement)
2. Streamline internal processes (e.g. to reduce costs, improve productivity)
3. Co-ordinate internal systems *with* the external electronic environment (e.g. to increase availability of information, potentially reshape market presence, etc.)

Using e-commerce for:

1. Information management (which includes the activities associated with knowledge management, research and development and marketing);
2. Transactions (which encompasses sales and procurement activities);
3. Documentation (which encompasses configuration management, maintenance, repair and overhaul activities); and
4. Collaboration (which encompasses design, engineering, planning activities, etc.).

B2B e-commerce is being widely promoted as a means of enabling developing country producers to become more deeply integrated into the global economy (UNCTAD, 2000). It has been argued that e-commerce provides developing country producers with the ability to expand and extend existing markets, improve their forecasting ability, streamline their procurement operation, and improve data transfer between a firm and its customers and suppliers. With the ever reducing 'time to market' and shorter life cycles of new products, e-commerce provides the means to optimize business processes whereby communication of purchase orders and acknowledgements, data transfer, schedules, etc. is electronic and instant. This suggests that those companies or countries which are most successful in focusing their e-commerce activities on commercial objectives will gain significant competitive advantage in the new economy. Value is derived from more accurate information, greater visibility and transparency in the supply chain and systemic efficiencies. This provides a basis for more open relationships between buyers and sellers from which to conduct trade with proper input cost management, demand forecasting and resultant collaboration.

The promise of greater supply chain transparency is, however, problematic. Assuming a move to the open TCP/IP enabled systems, this does not have to mean that the IT system will likewise be open since the commercial sensitivities surely cannot be expected to disappear. The mixes of applications of IT might create transparency of information in some cases and even greater security than had existed in the past in other cases. Thus one has to be very cautious about claims made by many of the e-commerce gurus about the use of B2B e-commerce in a way that simply 'connects'. Where it is used, the issue is under what terms and conditions?

B2B e-commerce has been widely regarded as a major force likely to raise productivity. However, at least so far, the identifiable effects on productivity appear small and largely confined to the USA (Graham, 2001). How business is done, what skills base exist, and whether there are the resources and an inclination to do things differently are the crucial issues in whether any given application of e-commerce will bring benefits to any particular firm.

Summary of research findings

It would appear that South African manufacturing firms are just starting to explore the possibilities of B2B e-commerce, with some firms already at the experimentation level. In response to the question of whether their company is planning to participate in B2B e-commerce, 33.3% of the respondents said 'yes', 17.4% said 'no', 14.4% were 'not sure', and 34.8% claimed to be 'currently evaluating the potential of e-commerce' for their companies. The overwhelming majority (91.7%) of firms were not able to explicitly articulate specific e-commerce strategies and objectives.

There is a general lack of integration of the back-end systems of the buyers and sellers in their marketplace. A number of South African manufacturers are forecasting with historical data rather than real-time information on shifts in end-market demand. Inventory accumulates because manufacturers are generally not aware of what inventory and manufacturing capacity is available in their own supply chains. Their suppliers in turn cannot see demand two or three levels up the value chain. As a result suppliers are disconnected from the value chain with large buffers of inventory. Firms mentioned the following supply chain problems: high inventory levels; long lead times; poor inter-firm communication; lack of trust and what Sako (1992) calls 'obligational' relationships; limited collaborative forecasting, planning and replenishment processes; little strategic supply chain thinking; and an imbalance between supply and demand. Thus it would appear that companies have much to gain from an appropriate B2B e-commerce strategy geared towards advanced supply chain management and logistics.

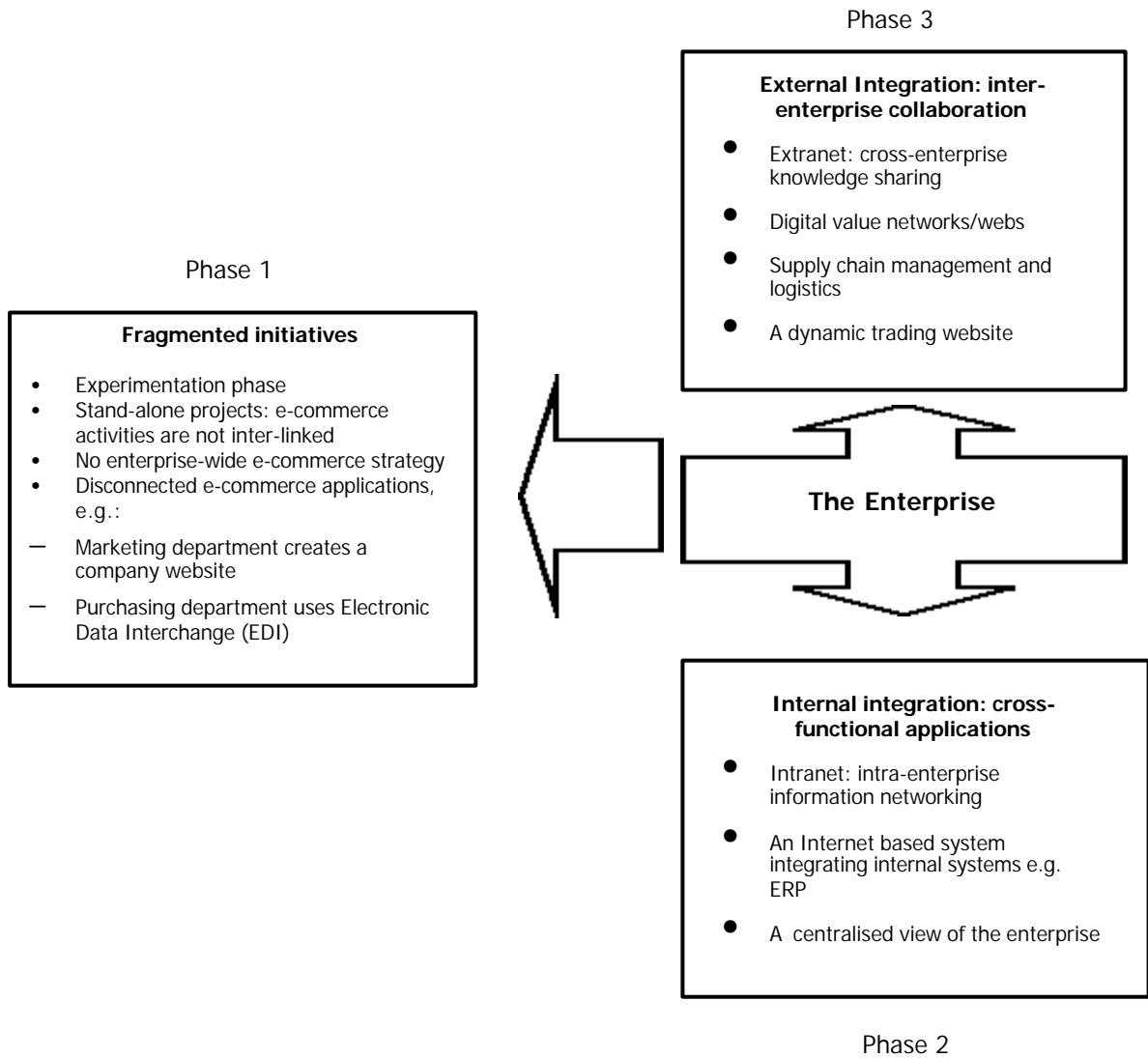
Most B2B e-commerce still occurs on proprietary platforms, such as EDI, which pre-date web applications. Where traditional EDI links have been established, they are typically being under-exploited. Companies are using EDI to perform only a limited range of information flow and document delivery functions (e.g. placing orders, checking material availability, providing test certification) and less than 10% of companies surveyed are using EDI for any form of sales transaction (e.g. sending invoices, conducting price negotiations). Internet platforms are being used mainly to supplement existing private networking technologies such as EDI, process management systems (such as CAD and ERP) and proprietary database systems, mainly through the use of websites and e-mail to provide general information and communication services.

Table II: Corporate Internet Use (N=132)

Corporate Internet Use	Current (%)	Planned (%)
E-mail with customers	100%	-
E-mail with suppliers	100%	-
Basic website	34.1%	31.8%
Intranet	37.9%	28%
Technical data exchange	31.8%	35.6%
Dedicated network EDI	30.3%	5.3%
Interactive website	18.9%	25%
Web-based customer service	18.9%	37.1%
Website payment systems	15.2%	22%
Extranet – supply chain management	3.8%	5.3%
Internet EDI	14.4%	22%
Inventory/stock management	20.5%	37.9%
Supply chain logistics	20.5%	25%
B2B trade exchanges	16.7%	24.2%

Source: Interview data

Figure I: The E-Commerce Cycle



All of the firms have multiple access points to the Internet, and are using the Internet for a wide variety of purposes (Table II). Corporate Internet use, however, tends to be focused largely on general e-mail correspondence/exchange of information and marketing/customer lead generation. There was limited use of the Internet for technical information transfer (data, drawings and designs), receiving electronic payment, receiving orders, electronic payment, ordering goods and services, and supply chain management and logistics (Table II). The majority of firms in the industry are unable to support e-commerce ventures as yet, because they do not have the integrated customer and supplier ICT interfaces in place.

Figure I provides a highly stylised structural overview of an evolutionary e-commerce cycle model. Phase I is largely experimental and exploratory, with firms adopting basic e-commerce tools such as email and/or a website. Inter-firm electronic information flows, where it exists, are still mainly centred on more traditional private networking technologies like EDI via direct lines or VAN applications. Phase II marks a shift to integration, with firms exploring the intra-organisational potential of e-commerce, to link different aspects of their business, from production to sales. The objective being to streamline internal processes (to reduce costs, or improve business process productivity). Phase III sees 'transforming' firms deploying e-commerce for inter-organisational networking, and aligning its benefits to strategic planning. E-commerce is used here to enhance traditional linkages between value chain participants, to build new business partnerships and to restructure existing business models. Currently, most of the firms' prime focus is still largely on a functional orientation (Phase 1 in Figure I), i.e. they do not form part of an enterprise-wide e-commerce or business strategy, or on operational efficiency across the enterprise (Phase 2) where the focus is on using technology to improve efficiency and support existing business processes. Only a minority of firms are using e-commerce to increase the organization's effectiveness outside the enterprise by linking across the Internet with suppliers and customers to create virtual supply chains (Phase 3).

Table III: Stages of E-Commerce Development (N=132)

Stage 1	E-mail - global communication and general data exchange	100%
Stage 2	A <i>basic website</i> which serves as a shop window to the world, and gives the firm a global presence. The website has been designed for advertising and marketing rather than for selling or to be interactive	34.1%
Stage 3	An <i>interactive website</i> , which enables two way communications with customers, suppliers and key partners through e-mail, search engines, registration for newsletters, interactive tools for product selection, order placing, downloadable information, etc.	18.9%
Stage 4	A <i>trading website</i> which enables transactions over the Internet with suppliers or customers	15.2%
Stage 5	Business processes are increasingly driven by Internet technology. Through secure Intranets and Extranets, remote workers, customers and suppliers can access the business at selected points	8.3%
Stage 6	Highly integrated infrastructures linking customers, suppliers and other key partners. Processes and logistics are largely automated using Internet technology, creating a seamless chain of communication and management	–

Source: Interview data

A significant 68.2% of firms have a website (Table III). The vast majority of these websites are 'static', communicating information about their companies but offering no interactive capability other than possibly an e-mail link. In the South African manufacturing sector e-commerce is so far largely limited to improving communications with value chain partners, particularly customers. Currently, very few firms are using the Internet as a fully interactive e-commerce platform, and for managing inter-firm relationships in the supply and demand chain. Internet use tends to be confined to the provision of product information and general communication within and between firms. South African manufacturing firms are at present exploring only a fraction of the potential of e-commerce. The majority of the large

manufacturing firms have spent the last five years or so integrating their internal computing systems, and many are now in the midst of consolidating and restructuring their front-office applications. The next phase of automation would be greater integration between transaction activities and general business process management. This will be followed by synchronizing inter-enterprise business processes across a global, web-based network.

There are two main reasons for South African manufacturers' sluggishness to adopt e-commerce systems: (1) their inability to develop an apposite e-commerce model which is tightly integrated into their respective value chains; and (2) the large, unanticipated barriers impeding their progress to a functional e-commerce system. The major barriers to the diffusion and adoption of e-commerce can be summarized as follows:

- Uncertainty about the scope and scale of e-commerce, and the returns from e-commerce investments;
- Technical barriers: lack of industry-wide standards, especially for data formats, system security, transmission speeds and infrastructure reliability;
- Managers are inherently conservative about large IT investments. Moreover, after the disappointing results of enterprise resource planning (ERP) and computer integrated manufacturing (CIM), managers are very cautious about elevating e-commerce to core business strategy levels;
- Entrenched organizational cultures – e-commerce, as a systemic innovation, challenges traditional ways of thinking about business, as well as of doing business. The culture is typically insular and reactive and, as a result, e-commerce developments are seen often as a threat rather than an opportunity to be seized to improve competitiveness and profitability;
- Migration from EDI and VANS to Internet-based systems are often inhibited by pressures to extract maximum value from sunk investment in a previous generation of IT systems;
- The lack of a critical mass of e-commerce enabled firms, thus impeding sector-wide activity;
- Fear that e-commerce in the form of co-ordinated or pooled procurement systems may lead to 'commoditization' of products resulting in downward price pressure;
- The absence of robust assessment methodologies, and the fact that the e-commerce environment is very dynamic makes it difficult for companies to carry out a systematic cost-benefit analysis;
- The current Internet bandwidth is inadequate for large data downloads, i.e. datasheets, CAD data photo images, etc.
- Security concerns fuelled by media coverage of 'Internet fraud' and 'virus software'. This stems largely from a poor understanding of new Internet technologies, which fuels concerns such as loss of transaction security, loss of reliability and loss of accountability. These security issues then discourage the firm's pursuit of e-commerce initiatives;
- Firms typically lack awareness and understanding of the potential impact that e-commerce could have on their operations;
- Many companies remain skeptical about the potential for new e-commerce opportunities to enhance linkages within the supply chain as a result of negative experiences or perceptions of traditional EDI linkages;
- The slow pace of planned liberalization of the telecommunications sector;
- Unexpectedly high implementation costs. Apart from technology investment costs, HR costs (new employees with IT skills, training of existing staff, etc.) need to be factored in as well. Having said that, it must be borne in mind that the operating costs of Internet-based e-commerce systems are much lower than proprietary networks such as EDI ;
- High cost of broadband connectivity. Large South African firms pay on average \$22,222 per month for a dedicated 1.5Mbps leased line. In the US the same capacity costs \$1,795. At the lower end, in South Africa a 128Kbps line costs \$1,222 per month, compared to \$842.1 in Britain and in the US a firm can get six times the capacity for just \$768; and
- Inadequate e-commerce infrastructures, skills and capabilities.

Though there is much discussion, neither customers nor suppliers in the South African manufacturing sector are applying real pressure to adopt e-commerce. However, there are pressures from international customers (i.e. US and Western Europe). South African

manufacturing companies are confused about how best to adopt e-commerce and reluctant to invest in initiatives that might not be supported by their customers. As a result, few independent web enabled e-commerce initiatives are underway. Integration is currently very limited, whether it be with internal ERP systems in place or with external value chain partners.

Many companies see e-commerce as an evolutionary process and expect to become more strategic over the next few years, by developing interactive websites, website-based customer service, supply chain Extranets and giving customers/suppliers access to their Intranet. The vast majority of companies are adopting a 'wait and see' approach until there is more clarity on the e-commerce strategy of major players in their respective value chains and the response of customers to the new wave of electronic services. Table II gives some indication of firms' plans for future e-commerce development. It seems as if the firms are more likely to stress knowledge sharing in the short-term, transaction capability development in the medium-term and integrating the extended enterprise in the long-term.

Policy recommendations

Government

There is wide acceptance of the case for government involvement in the development of technology and in technology change in developing countries, given the many and obvious reasons for market failure (Stoneman and Vickers, 1998). However, Geroski (1990) warns that there is a tendency for the public sector to end up financing second-best projects, especially those seen to be of national prestige. Moreover, the state may not have the resources and capabilities to 'go it alone'. Recently, in development studies, there has been a distinctive shift in the literature towards a multi-stakeholder, pluralist system rather than a purely state or market driven conception of the technology development and diffusion process (Mansell and Wehn, 1998; Talero and Gaudette, 1995). To this end, joint public-private sector partnerships are the key to maximize the opportunities of individual firms to benefit from the business potential offered by the Internet.

Based on the preceding discussion, it would be prudent for policy-makers to adopt a cautious approach to assessing claims about the potential of Internet-based e-commerce to facilitate South African manufacturers' access to international markets. Simple, undifferentiated policy prescriptions are unlikely to succeed. The impact of e-commerce is likely to vary from market to market and from firm to firm. Therefore, "a one-size fits all" approach is inappropriate. Government needs to understand that e-commerce is a complex concept, with many different facets, with each posing its own challenges. Policy-making is further complicated by the fact that e-commerce is a 'moving target' which is constantly evolving and changing.

The potential benefits of e-commerce are more likely to come to fruition if policy-makers adopt a broader approach to e-commerce. Specifically, one that draws more actively on a deeper and more balanced understanding of this concept, its implications, and the relationship between e-commerce and development. This means that policy-makers will need to move beyond the standard model of e-commerce which is fixated on online commercial transactions and transaction-oriented trading exchanges. Greater consideration will need to be given to: creating and enhancing ICT links between South African manufacturing firms and geographically dispersed firms in global value chains; Internet-based communication and information exchange such as collaborative product design, joint problem solving and quick response to customer requirements; and streamlining tasks such as production planning, inventory control and scheduling that lie closer to the heart of supply chain management.

Reliable, high-speed Internet connections are essential for these tasks. In addition, Government will need to commit significant resources to training employees to exploit the new Internet-based technologies and systems. According to Lundvall (1992), in the new growth regime *knowledge, information and learning* are crucial for economic growth and competitiveness, and policies relating to ICTs are especially important. Therefore, Government needs to take a leading role in the technology policy sphere, partly since its room to manoeuvre in the macroeconomic and labour market policy arenas are being curtailed. In this sense, industrial policy focuses on 'empowering firms' rather than 'picking winners'.

Government intervention is justified in areas where it is foreseen that market forces will not be sufficient to ensure effective and more widely spread implementation of e-commerce in South Africa. State policy should, therefore, focus on: governance and leadership; establishing the ground rules for B2B e-commerce; knowledge building (information systems and human resources development); infrastructure and connectivity; and trust.⁵ Government should also explore the possibility of creating a time-limited tax incentive to raise e-commerce awareness and adoption by manufacturing companies. This incentive would be for investments in e-commerce technologies and could be in the form of accelerated depreciation.

The State should also take a leading role in: providing advice on matters like technology choice; identifying and disseminating information on best practice; providing a critical assessment of the available e-commerce technologies and approaches; developing meaningful industry benchmarks; setting in motion programmes aimed at raising appreciation of the strategic impact of e-commerce; and investing in training and skills development. A policy priority is to liberalise the highly regulated and concentrated South African telecommunication market and promote competition in order to stimulate new investment, increase demand for communications access and services through falling prices, and promote greater efficiency and innovation in the provision of infrastructure and services. Policy initiatives to lower network infrastructure costs and Internet access charges for manufacturing firms are important. This is likely to provide a stimulus to the growth of e-commerce among South African firms. In the OECD (1999, 2000a, 2000b) countries, for example, the availability of affordable access to high-speed telecommunication infrastructure is closely linked with firm migration to e-commerce.

The government's recent decision to license one additional full service network operator and one international-only operator introduces competition into the fixed line voice market for the first time.. The key issue is whether this competition is likely to be sufficient to bring about improved efficiency in the market and lower prices for consumers. With proper regulatory oversight, it is possible to have vigorous competition among two firms. It is, however, of critical importance that the regulator, ICASA, has the resources and technical capacity to monitor and act decisively against any potentially anti-competitive actions by Telkom.

Policy-makers should be especially wary of not slipping into an overly technocratic approach that ignores the priorities and needs of the firms in question, and broader industrial development goals. The biggest e-commerce challenges facing the South African manufacturing sector is not technical, since the technology is already available for information exchange, trade and financial transactions. Therefore, focusing primarily on the production or acquisition of e-commerce technologies is counterproductive. The challenge rather is for Government to exercise a strategic vision and leadership. Government must focus on what manufacturing firms need, and on decisions about how e-commerce is to be incorporated into economic activities, at both the intra- and inter-firm levels. Ultimately, the policy-makers must have a vision of the most important e-commerce applications for the South African manufacturing sector, and how such priorities are to be realised.

Public-Private Partnerships

The magnitude of the e-commerce challenge is such that there is a need for various public-private and multi-partnerships, alliances and consortia. There is an urgent need for the forging of partnerships to: (1) assist firms to access capital for their e-commerce ventures; (2) allay basic fears about the sharing of information; (3) establish a standard format for conveying information and transaction standards; (4) encourage firms to form networks in order to share knowledge, reduce the average costs of their input transactions, and increase their relative market power in e-commerce transactions; and (5) develop ICT capacities and skills through education and training, and counter skill shortages which are greatest in three

⁵ Trust implies confidence that electronically-based purchases, funds transfers, and business deals will be as valid as traditional activities; that personal information and finances will be secure; and that the world of online information and communication will be at least as accountable for the quality, reliability, and legality of products and services as in the physical world of paper-based documentation. Security and cryptography issues tie in with both privacy protection and certification, as well as with the technical options for creating and validating digital signatures.

areas, viz. managers capable of completing complex technology projects, local content creators aware of the network's potential, and software and hardware engineers.

Public-private partnerships should influence Telkom (and the second telecommunications service provider) to improve bandwidth and speed of transmission, and to implement simpler and cheaper models for access e.g. local call charging by ISP's. A rapid diffusion of B2B e-commerce is not possible without telecom infrastructure, access, declining prices, etc. and telecom liberalization can play a role in attracting investment (OECD, 2000a, 2000b). However, what matters is the 'how' of the specific liberalization process and the types of regulatory arrangements that are put in place. Western Europe spent over a decade working out that regulators needed to intervene in strategic areas, and the UK's reluctance to do so, has resulted in it becoming Europe's laggard in terms of higher capacity networks, despite early liberalization.

Business associations together with government should actively raise awareness of B2B e-commerce by widely disseminating information on international e-commerce trends, new opportunities and best practices, and provide information on e-commerce service providers, competitive benchmarking, finance, legal, technical, and import/export figures. Assistance should also concentrate on matters relating to technology choice, identification of best practice and the construction of viable business plans in an e-commerce context. Government and industry should also take a lead in encouraging the development and/or harmonization of standards; organizing good practice workshops and training seminars; financing benchmarking activity; validating and documenting best practice in the industry as it emerges; and providing advice on selecting and implementing appropriate technology platforms, installation of Intranets to improve internal communications and Extranets to improve communication with partners. Targeted assistance should also be provided to companies intent on developing e-commerce strategies to exploit European Union and other markets that are becoming more open to competition.

A government-industry initiative is also needed to bring together companies operating at different positions in the value chain and project lifecycle and break down the barriers that are currently inhibiting the realization of industry wide e-commerce benefits. To take no action would be to miss the opportunity for South Africa to secure an international advantage through e-commerce in the manufacturing sector, and risk increasing domination by more thoroughly e-enabled competitors, particularly from the highly industrialized countries of the North. Such policy support should be targeted at two levels:

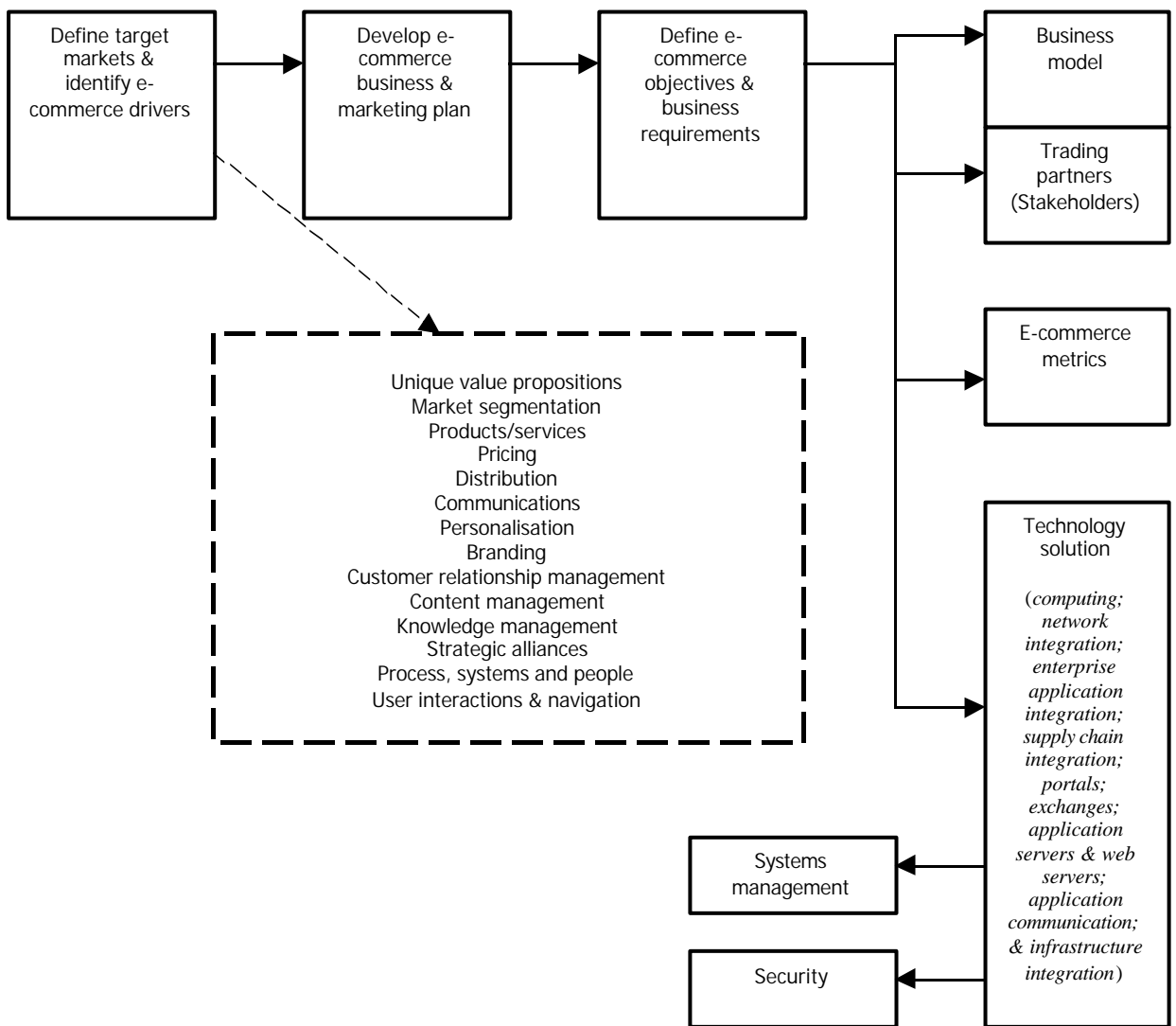
- *Intra-firm applications*: to reduce costs and improve business process productivity, and
- *Inter-firm applications*: improve supply chain management, i.e. to enhance and streamline linkages between firms in the value chain, restructure supply chains, enable strategic partnerships with trading partners and integrate small and medium enterprises within supply chains.

The policy challenge is to provide evidence on the potential of e-commerce for including or excluding South African manufacturing firms from global trade, and formulate policies to enable more effective access to e-commerce for South African firms. A priority is the funding of research to provide evidence of the benefits of e-commerce solutions for small, medium and large companies in the South African manufacturing sector through a series of focused analyses identifying and quantifying the benefits of specific major e-commerce options. Security is another important issue, but one which can be addressed, albeit at a cost. There is a host of security measures, both software and hardware, a company can take, the most common being anti-virus software, firewalls, separate hosting of the website and SSL encryption for transaction sites. Reliability can be ensured by back-up servers, although it also depends a great deal on the system architecture. The different aspects of security are crucial for the creation and establishment of trust within the group of users in a value chain.

Management at the Firm-Level

Figure II illustrates a systemic approach which policymakers could adopt as a guide to developing and upgrading South African manufacturing firms' e-commerce capabilities. We advocate an incremental approach guided by appropriate technology rather than one-off large-scale, expensive transformations such as Enterprise Resource Planning (ERP) which is fraught with risk and a large number of failures. The e-commerce model (Figure II) questions the appropriateness of e-commerce for the particular firm and its circumstances. In other words, the model forces the firm to think strategically about the ultimate suitability of e-commerce for its business operations. This approach requires a systematic understanding of the forces at play in determining the appropriateness of e-commerce to the firm, the fundamental characteristics of the organization, as well as the underlying principles that determine success and failure.

Figure II: E-Commerce Strategy



Before making decisions about e-commerce systems, and choosing the necessary hardware and software, managers should carefully determine the format for communication, information flows and transactions favoured by the lead firms in their value chain, and then use e-commerce to support those relationships. Also, the firm should conduct a cost-benefit and business risk analysis, and determine and budget the costs involved. Finally, the firms need to factor in the organizational and management changes that are needed to optimize the use of e-commerce technologies (Zwass, 2001).

The e-commerce system should be implemented in stages where return on investment is achievable within a 6 to 12 month period. The stages are as follows:

1. Develop a knowledge sharing platform with a mix of automated features and web enabled personal interaction;
2. Reduce the cost-to-serve by moving inquiries to the website;
3. Focus on developing transaction capabilities, both via own trading sites or Extranets to improve customer loyalty and via third party service providers to reduce costs;
4. Integrate the website/Extranet with internal back end systems to ensure efficient knowledge management; and
5. Integrate with other value chain partners

This ensures that the risk is minimized and gains are maximized, since the implementation team will be able to gauge when any future ICT investments are likely to lead to diminishing returns. Managers should also take care not to employ B2B e-commerce in ways that disrupt existing, successful relationships. Ultimately, South African firms should pursue B2B initiatives that are aligned with the e-commerce systems of the lead firms in their respective value chains.

Evolving from an enterprise focus (Phase II) to an inter-enterprise architecture (Phase III), i.e. linking the various elements of the extended enterprise together will take time but could amount to a major productivity enhancement (Figure I). Collaboration outweighs commerce here. Any move to strengthen capacity to implement various forms of e-commerce needs to keep supply chain management as the core, including at the policy level. Our experience is that e-commerce strategies seem very quickly to detach themselves from the business in the minds of designers/implementers. This is nothing new and the whole history of information systems design and implementation is characterized by this phenomenon. But that history serves as a reminder of the important 'politics' of embedding IT systems within and between organizations. This goes beyond awareness and skills to the need to work out how to counter the 'technology push' mentality of the IT vendors and business consultancies. Supporting intermediaries in business associations who can negotiate between e-commerce system suppliers and firms is important.

Conclusion

The current extent of B2B e-commerce in the South African manufacturing industry is limited. The volume of transactions carried out electronically represents only a small percentage of the total transaction volume in these sectors. There does not appear to be any evidence to indicate any linear relationship between basic sector characteristics and the level of sophistication of e-commerce use. Although one might expect the automotive sector to lead by example, it is itself still exploring the potential of e-commerce adoption in many areas of its own value chain. The paper has argued that policy decisions will have a major impact on the kind of environment in which e-commerce will develop and should therefore be crafted with due recognition of its fragile and evolving nature.

It is difficult to make meaningful international comparisons with other developing countries given the paucity of rigorous empirical research in this field. Therefore, it is difficult to say whether the South African manufacturing sector is lagging behind their counterparts in the developing world vis-à-vis e-commerce development. Currently, research tends to focus on quite sophisticated e-commerce activity, and is concentrated in the highly industrialized countries of the North. There is little doubt that there is an increasing need for co-ordinated

information flows and knowledge management in the South African manufacturing sector. There is enormous scope for extending the use of e-commerce in the South African manufacturing sector, particularly in using the Internet as a channel for the communication and exchange of structured business information, and for improving the flow of scheduling information along the supply chain to help reduce inventories and improve production planning efficiencies at each stage. In the South African manufacturing sector there is an acute need to share information and co-ordinate decisions and activities. B2B e-commerce provides the platform to create a flexible, transparent channel responsive to market conditions, where each firm is a value-added node in the value chain contributing content, knowledge and specialized services.

Making B2B e-commerce work will take time, and will prove to be more difficult than many analysts previously thought. The infrastructure required for B2B e-commerce is complex: many systems and business processes have to be restructured, and the associated technology-integration issues could take years to perfect. Only a few companies have begun to address the IT, process and people issues associated with adopting web enabled e-commerce. We advise that a cautious and selective approach be adopted. The question for most South African manufacturing firms is not just whether to engage in e-commerce, but on which business terms, and in which technical configurations.

The small scale and volumes of the South African market perhaps made the viability of fully-fledged electronic business information systems questionable. However, the current pressures of globalization and trade liberalization, and the challenge to direct overseas market expansion underscores the importance of e-commerce for the manufacturing sector. Even those firms that have not yet become involved in B2B e-commerce are increasingly faced with the need to integrate ICTs in their operations. If South Africa does not face the B2B e-commerce challenge systematically at the level of its overall economic and industrial strategy it could lag behind in industrial development.

In the developing world, there is a great need to shift the debate on e-commerce from theoretical concerns to what firms are actually doing. This paper clearly shows that when one penetrates the veil of hype that surrounds e-commerce, the results are sobering. In spite of all the talk of e-commerce changing the established rules of the game in developing economies, it would appear that e-commerce is only starting to filter into the South African manufacturing sector, and its transformative potential is yet to be realized. It is not that B2B e-commerce is of marginal importance in the South African manufacturing sector, but rather that it is not yet significant, but could become so. B2B e-commerce development in South Africa, and in much of the developing world, is likely to be evolutionary rather than revolutionary. The bottom line is that despite the sanguine claims of the e-commerce 'optimists', there are many barriers to be overcome before we can even begin to speak of e-commerce as 'revolutionary', i.e. transforming business processes in a fundamental way.

E-commerce development in the South African manufacturing sector is likely to be a cumulative, incremental and path-dependent process, which takes the form of the steady accumulation of tacit capability (which is acquired through a collective learning process within the firm), rather than a sequence of discrete acts of technology building (David, 2001; Rosenberg, 1976). E-commerce is likely to occur as an evolutionary development of previous technologies (telex, fax, EDI, etc.) in established relationships between purchasers and suppliers. South Africa will need to take great care to avoid overly optimistic and technicist approaches to e-commerce which do not take into account the real world of global trade and production networks and the situation of South African manufacturing within it. Moreover, a technology-focused approach to e-commerce tends to deflect attention away from far-reaching systemic changes that need to be made in South African manufacturing firms. An important lesson from business history is that innovation and the use of new systemic technologies is a highly unpredictable and uncertain process (Archibugi and Michie, 1997; Archibugi, Howells and Michie, 1999). E-commerce is unlikely to be any different.

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Appendix I: B2B E-Commerce Questionnaire

1. What IT/e-commerce technology investments has your company made so far?
2. How would you describe the IT set-up and capabilities of your organisation?
 - 2.1 How 'technically able' (IT/E-commerce) are you as an organisation?
 - 2.2 How effectively is IT used in the 'day-to-day' life of the company by general and technical staff alike?
3. How does your company currently make use of electronic communication (E-mail, Internet, Intranet, Extranet)?
 - 3.1 How integral are these to your everyday working life?
4. Generally, how do computers affect your relationships with clients and suppliers?
 - 5.1 What are the main ways in which they affect these relationships?
 - 5.2 Do they help or hinder your relationships?
5. In order to gain an understanding of exactly what B2B e-commerce means to you, please can you give a description of what you understand by the term 'B2B e-commerce'.
6. What are the positive characteristics of B2B e-commerce, i.e. the main benefits of B2B e-commerce? (Please list as many as possible)
 - 6.1 How significant are they?
7. What are the negative characteristics of B2B e-commerce, i.e. the main drawbacks? (Please list as many as possible)
 - 7.1 How significant are they?
8. What are the main triggers/incentives to increasing the use of B2B e-commerce within your organisation?
9. What are the main barriers to increasing the use of B2B e-commerce within your organisation?
10. How is your organisation planning for the future in terms of utilising 'B2B e-commerce' tools?
11. What are the main internal incentives or benefits that you can see from effective use of B2B e-commerce? (i.e. in day to day operations, administration, internal communication etc.)
12. What are the main external incentives? (i.e. in relationships with customers and suppliers, when conducting research or marketing, etc.)
13. Thinking about B2B e-commerce in comparison with more 'traditional' methods of communication, what are the major obstacles presented for your business in the transition to B2B e-commerce?
14. How will the relationship between clients, customers and suppliers develop or be affected by the growth of B2B e-commerce?
 - 14.1 What role does security play in this relationship?
15. What are the financial implications of B2B e-commerce to your company, and the wider business environment?

16. How likely are you or your company to use the Internet to buy or sell goods and services online?

16.1 Why or why not?

17. In your opinion, what are the main advantages and disadvantages of conducting business transactions online?

18. Thinking about your company's website, what kind of information and services does it provide?

18.1 Who would you say it is primarily aimed at?

18.2 If your company does not have a website, please feel free to answer with how you feel they would represent themselves on the web

19. What do you see as the primary function and role of your company's website and how does this fit in with your e-commerce activities generally?