



Impact of information on the value chain of an enterprise in the new economy

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1. Introduction

Increasingly commentators talk about the Information Age. Stewart (1998:21) even goes as far as designating 1991 as Year One – the year that [capital] 'spending for production technology [in the US] was \$107 billion and information technology spending was \$112 billion'. In this new age, 'knowledge and information take on their own reality, which can be detached from the physical movement of goods and services' (Stewart 1998:31). Value chain analysis is based on the assumption that a business's basic purpose is to create value for the users of its products or services (Pearce and Robinson 1997:176). If knowledge – and by implication, information – has indeed become the 'primary ingredient of what we make, do, buy and sell' (Stewart 1998:12), then information must be playing a role in value creation and entering the value chain at various points.

This research looked at the role of information in the value chains of enterprises in the new economy of the Information Age. Furthermore, it looked at information's impact – measured in terms of cost-savings, faster turnaround times, better customer service, or any other factor that contributes to an enterprise's competitive advantage – on the value chain or value-creation process. The methodology employed consisted of a literature review of writings that deal with value chain or supply chain analysis and investigate the role of information in the economics of the last decade of the twentieth century. The literature review included:

- A review of the concepts 'value chain' and 'competitive advantage'
- Some of the issues driving the new economy, including new concepts of value, globalisation, disintermediation, the virtual corporation and information technology
- How information impacts on the value chain by: a) reviewing Rayport and Sviokla's concepts of the 'marketspace' and the 'virtual value chain'; and b) providing specific examples of its impact in terms of procurement, inbound and outbound logistics, operations, marketing and sales, and services
- An example of how information has transformed Fed-Ex's business from parcel delivery into logistics management.

As information increasingly permeates the economy, its role in value creation takes on a new

importance in understanding how the information society does business and places a price on its goods and services.

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2. Value chain

According to Porter and Miller (1985:150), the concept of the value chain 'divides a company's activities into the technologically and economically distinct activities it performs to do business.' These activities create value, which is measured by the amount buyers are willing to pay for the resultant product or service. An enterprise is profitable when the value it creates is greater than the costs of performing the value activities. Each of these activities can add value and act as a source of competitive advantage.

Value chain analysis (Pearce and Robinson 1997:176-181) divides a company's activities into primary and support activities. Primary activities are those that are directly involved in creating the product, getting it to market and supporting it once purchased. Support activities provide the infrastructure that enables the primary activities to take place. These sets of activities all entail associated tasks, costs and assets.

Primary activities:

- Procurement and inbound logistics – purchasing from vendors the materials necessary for production activities; receiving, storing and distributing inputs from suppliers; inspection; and inventory management
- Operations – transforming inputs into final products (production, assembly, packaging, equipment maintenance, facilities, operations, quality control)
- Outbound logistics – ensuring the product reaches its market (warehousing, order processing, packing, shipping and delivery operations)
- Sales and marketing – sales force activities, advertising, market research and planning, and dealer support
- Service – providing assistance to buyers (installation, spare parts delivery, maintenance and repairs, technical assistance, buyer inquiries, and complaints).

Support activities:

- Research, technology, and systems development – product and process R&D, process design improvement, equipment design, software development, telecommunications systems, computer-assisted design and engineering, new database capabilities, and development of computerised support systems
- Human resources management – recruitment, hiring, training and compensation of personnel; labour relations; and development of knowledge-based skills
- General administration – general management, accounting and finance, legal and regulatory affairs, safety and security, management information systems, and other 'overhead' functions.

(In Porter's original model, 'procurement' was listed as a support activity, but Pearce and Robinson group it with inbound logistics as a primary activity.)

The value chain also includes a profit margin, as the markup above the cost of providing value-adding activities is included in the price paid by buyers. The value created over and above the cost generates a return for the firm's effort, also known as profit.

To conduct a value chain analysis, a company's operations need to be divided into specific business processes and grouping them into primary and support activities. Within the broad categories, companies perform a series of discrete activities that vary from business to business. These activities are nevertheless interdependent and connected by linkages, requiring the coordination of activities. For Porter and Miller (1985:150) linkages often create trade-offs and exist 'when the way one activity is performed affects the cost or effectiveness of other activities.' The challenge for managers is 'to disaggregate what actually goes on into numerous distinct, analysable activities rather than settling for a broad, general categorisation' (Pearce and Robinson 1997:179).

Next, the manager attempts to attach costs to each activity and determine how each activity ties up time and assets. Once costs have been determined, activities critical to buyer satisfaction and market success are identified. These activities must be analysed in terms of three considerations. First, how do activities relate to the company's mission, for example, its focus on being a low-cost provider or on differentiation? Second, the nature of value chains and the importance of activities within them vary by industry. For example, the hotel industry's major costs and concerns revolve around operational activities and marketing, while having minimal concern for outbound logistics. Retailers concentrate on procurement and inbound logistics. Third, the relative importance of value activities can vary depending on a company's position in a broader value system.

Every firm exists within an industry. Supplier, distributor and buyer value chains are interdependent and linked at various points. The structure of interdependent value chains is known as a value system (Porter and Miller 1985:150). Supplier value chains create upstream value while the channel and buyer value chains create downstream value.

Analysis of industry structure provides an understanding of the forces that determine competition in an industry and enables understanding of competitors and how they are positioned in the marketplace. Industry structure is defined by four variables (Pearce and Robinson 1997:84-86):

- Concentration, which refers to the extent to which industry sales are dominated by only a few firms. Concentration serves as an effective barrier of entry
- Economies of scale, which refers to the savings achieved through increased volume production leading to a decrease in the average cost of unit produced. Companies enjoying such economies can charge lower prices than competitors and deter entry
- Product differentiation, which is the extent to which customers perceive products and services offered by firms in the industry as different
- Barriers to entry, which are obstacles a firm must overcome to enter an industry. The higher the barriers of entry in an industry the less the competition.

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3. **Creating competitive advantage**

For Porter (1979), competition in an industry depends on five forces that ultimately determine the profit potential of that industry:

Threat of entry:

The seriousness of the threat of entry depends on the barriers present and the reaction from existing competitors. There are six barriers to entry:

- Economies of scale, which force the newcomer to enter on a large scale or accept a cost disadvantage
- Product differentiation, which forces entrants to spend heavily to overcome brand identification and customer loyalty
- Capital requirements, which are the need for heavy investment up-front in order to compete
- Cost disadvantages independent of size, where entrenched firms may have unique cost advantages stemming, for example, from proprietary technology, patents or favourable locations
- Access to distribution channels. To secure distribution of products, newcomers must displace existing companies or create their own channels
- Government policy. The need for special licenses or the existence of regulations may discourage entrants.

Powerful suppliers:

Suppliers can exert bargaining power by raising prices or reducing the quality of purchased goods. A supplier group may be powerful due to its domination by a few companies; by virtue of supplying a unique product; not having to contend with substitute products; posing a credible threat of integrating forward into the industry's business; or because the industry is not an important customer of the supplier group.

Powerful buyers:

Customers, too, can force down prices, demand higher quality or services, and play competitors off against one another. A buyer group is powerful when it is concentrated; the product forms a component of its product and represents a significant portion of its cost; the products it purchases are undifferentiated; the products earn low profits; the product is unimportant to the quality of the buyer's product; the product does not save the buyer money; or the buyers pose a credible threat of integrating backward.

Substitute products:

These products limit the potential of an industry by placing a limit on prices that can be charged.

Jockeying for position:

This refers to rivalry between existing competitors and may include tactics such as price and advertising wars, and new product launches.

3.1 Strategies for competitive advantage

Porter and Miller's (1985) generic strategies model outlines how competitive advantage may be sustained or, put differently, how a firm may achieve above industry average profits. They outline three generic strategies: cost leadership, differentiation and focus.

Utilising a cost leadership strategy, a business sets out to be the low-cost leader in its industry. To do this a company must be able to accomplish one or more activities in its value chain in a more cost-effective way than any of its competitors. By reconfiguring the value chain, firms can achieve a cost advantage.

A differentiation strategy 'requires that the business have sustainable advantages that allow it to provide buyers with something uniquely valuable to them' (Pearce and Robinson, 1997:251). The company uniquely positions itself to service specific needs and is rewarded for doing so by being able to charge a premium price.

A focus strategy leads a company to concentrate on serving a narrowly defined market. Focus on a niche market may not be enough to sustain competitive advantage and a company may have to create value chain activities that achieve low cost or differentiation. A cost focus strategy identifies a segment, whose needs can be met best by a specialist, and exploits the cost advantage. A differentiation focus strategy selects a niche that is ignored by competitors and commands a premium price by providing a differentiated service. In all instances the object is to generate above average industry profits.

Porter (1996:64) also stresses that competitive strategy is about 'deliberately choosing a different set of activities to deliver a unique mix of value.' Choosing activities that are different from its competitors, a company can create a unique positioning. For a strategic position to be sustainable, it involves trade-offs, or choices, with other positions and it offers protection against imitators. Competitive advantage is derived from how activities are combined and fit one another. In fact, 'at general management's core is strategy: defining a company's position, making trade-offs, and forging fit among activities' (Porter 1996:77).

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4. New economy

The rise of the Information Age has resulted in fundamental changes in our most cherished notions about society, politics and economics. For Drucker (1993:40-41) the shift that defines what he calls the post-capitalist society is that 'knowledge has become the resource, rather than a resource ... It changes ... the structure of society. It creates new social dynamics. It creates new economic dynamics. It creates new politics.'

4.1 Different view of value

Arthur (1996:104) asserts that 'competition is different in knowledge-based industries because the economics are different.' Marshall's theory of diminishing returns assumes that products

that get ahead in a market eventually run into limitations resulting in rising costs or decreasing profits. Arthur (1996) suggests that the theory may be valid for an industrial or materials processing economy but does not hold in a knowledge-intensive economy. In contrast, the knowledge-based economy operates under conditions of increasing returns. Increasing returns is the tendency for companies or products that are ahead in the market to get further ahead and not to encounter the limitations postulated by Marshall. Increasing returns are characterised by market instability, unpredictability, an ability to lock in the market, the possible dominance of an inferior product and massive profits for the victor. The modern economy consists of two worlds: a bulk-production part creating information-poor products and operating according to the principle of diminishing returns, and a knowledge-based part creating information-rich products and operating under increasing returns.

Another characteristic of operating in the knowledge-based world is that 'players compete not by locking in a product on their own but by building *webs* – loose alliances of companies organised around a mini-ecology' (Arthur 1996:106). Competition is characterised as much by co-operation as by conflict. For example, when Novell launched NetWare, its network operating system, it created incentives for software developers to write applications for its own products rather than those of competitors. Novell recognised that NetWare's success depended on an ecology outside of their control.

Even the laws of value are being up-ended in the new economy. In the industrial economy, value was a function of scarcity and things were devalued when they were made plentiful. In the new economy 'value is derived from plentitude ... Power comes from abundance' (Kelley 1996:4). Owing to shrinking marginal costs, even the objects of the industrial world – clothes, tools, vitamins, etc. – will in future obey the 'law of plentitude'. Note how cellular telephones are given away to lock consumers into a particular network. What increases is 'the value of the network that invents, manufactures, and distributes them' (Kelley 1996:4).

Paradoxically, information products tend to get cheaper as they improve in quality. Not only that, many information products are given away for free. Netscape gave away 40 million copies of their Internet browser. Why? Because 'once the product's worth and indispensability is established, the company sells auxiliary services or upgrades' (Kelley 1996:11). Also, what is free today may one day have profitable companies built around it.

4.2 Globalisation

According to Porter (1979), competitive advantage is gained by leveraging the 'Five Forces'. For Downes (1997), three new forces are overwhelming these 'traditional' five. They are the forces of digitalisation, globalisation and deregulation.

One of the main drivers of globalisation is the proliferation of networking technology, itself driven by the convergence of telecommunications and computing. For Cairncross (1997), the break-up of telephone monopolies, new delivery systems for television such as cable and satellite, the meteoric rise of the Internet and the increasing convergence of these three technologies are driving the process of 'shrinking the world'.

Deregulation of industries and the increasing acceptance of free market economics by governments have also hastened globalisation. In developed countries, government interference in the airline, communications, utilities and banking industries has dramatically decreased. The acceptance of open, international competition can be seen in the advent of GATT and NAFTA, the growth of common markets such as the European Union and the collapse of highly regulated economies such as those of the Soviet Union and Eastern Europe (Downes 1997:2).

For Sachs (1998:3-4), globalisation has gripped nearly every major economy in the world. 'Both trade and financial systems are opening up as never before in modern history ... [and] the powerful economic, political and technological forces that are prompting the increasing integration of the world economy are continuing unabated.' Open markets, convertible currencies and international agreements supporting market-based trade are the order of the day.

Another trend is the rise of homogeneous markets, or the tendency for consumption and spending habits to be increasingly similar around the world. This will lead to the proliferation of

global brands as the global reach of companies increases. Paradoxically, there will also be scope for greater diversity, as millions of tiny companies find that they can cater to local tastes or niche markets more precisely than before (Cairncross 1997:143).

According to Crainer (1996:221), organising a company's activities on a global basis has several advantages. R&D can be more efficiently performed through mutual cooperation and help to simplify an organisation's product range. Global purchasing allows companies to react speedily to changes in the market for raw materials and move more quickly to meet customer needs. Organising production on a global basis can bring economies of scale and cost reductions. Global marketing can help companies make more cost-effective use of global media; help eliminate duplication and enable the sharing of knowledge and experience across borders. Distribution systems will ensure a wide range of products is more readily available anywhere in the world. In fact, globalisation has repercussions for the firm's entire value chain.

4.3 Disintermediation and reintermediation

Middlemen – those that operate between buyers and sellers – brokers, agents, dealers and distributors are being side-lined as technology fuels the shift to direct connections between buyers and sellers (Batz 1996:1). EDI, shared databases, telephone and television retailing have all diminished the distance between vendor and customer, but it is the World-Wide Web (WWW), especially, that is threatening intermediaries with extinction. The process of getting rid of the middleman from the equation is known as disintermediation. Stockbrokers, travel agents, real estate agents and car dealers are particularly vulnerable.

While power currently rests with business, increasingly it could tip in favour of consumers (Hagel and Rayport, 1997:53). Consumers are better informed than ever and seek more control over their transactions. There are four main reasons for this shift of power on the Web (Hof 1999:EB17):

1. Competitive alternatives are just a mouse click away
2. Through new intermediaries such as CompareNet, comparison shopping is easy
3. Consumers and corporate buyers from all over the world can band together, pool their purchasing power and get volume discounts
4. Global reach eliminates the geographic protections of local businesses.

For Garven (1998:3), 'the process of disintermediation more often than not ends up creating opportunities for new and different forms of intermediation'. The process of entering the distribution chain in a new form as an intermediary between buyer and seller is known as reintermediation. Individuals that migrate further up the digital chain and carve out niches for themselves are in a position to exploit new relationships.

It is of critical importance that intermediaries reinvent themselves to perform a different mix of services that will allow them to extract value. Buyers will still make use of intermediaries because 'information overload' may discourage consumers from doing the sourcing themselves. In fact, 'an intermediary's value-added may no longer be principally in the physical distribution of goods, but in the collection, collation, interpretation, and dissemination of vast amounts of information' (Quelch and Klein 1996:66).

The new economy also sees the rise of infomediaries who act as brokers of customer information, which is marketed to businesses on behalf of consumers. The infomediaries will aggregate time-starved consumers and negotiate on their behalf with vendors. In this environment, where ownership of information has shifted to the consumer and is no longer freely handed over to marketers, infomediaries perform the role of 'connecting information supply with information demand ... building a new kind of information supply chain' (Hagel and Rayport 1997:60).

4.4 Virtual corporation

For Hopland (cited in Financial Technologies Group (FTG) (1) 1997), the term virtual corporation describes 'an enterprise that can marshal more resources than it currently has on its own, using collaborations both inside and outside its boundaries'. For Nagel (cited in FTG (1) 1997) it means 'using technology to execute a wide array of temporary alliances with others in order to grasp specific market opportunities.' For Preston (1996:3), the virtual corporation is defined firstly by 'the development of relationships with a broad range of potential partners,

each with a particular competency that complements one's own'; and secondly, by 'the mobility and responsiveness of the telecommunications infrastructure to transcend the obstacles of space.' This new, emerging, organisational form points to a fundamental shift occurring within corporations and affects internal, supplier and customer relationships.

The virtual corporation affects changes in the internal dynamics of a company in four major areas (FTG (1), 1997):

- Decentralisation of operational controls to increase market response
- Global corporations move into remote locations to accommodate employee preferences and to escape high prices for office space in the cities
- Use of links between small business units and sales people in the field. These include wireless computing, groupware, fax, voice-mail and video conferencing
- Redefining the workplace. As Grulke (1997:7) puts it: 'Work is no longer where you go. Work is what you do'.

Changes in supplier relationships are bringing separate firms together 'to form closer, longer duration linkages for strategic purposes' (FTG (2) 1997). Outsourcing is of particular relevance in this context. Outsourcing is 'a process by which a company hires another company to perform a task that is currently handled internally' (Wons 1998:1). Vertically integrated companies control all aspects of their business, but the trend is for companies to outsource business processes that are not considered part of the core business. This allows companies to concentrate on their core competencies instead of dispersing energies by trying to do it all themselves. Changes in customer relationships are also becoming more complex and the dividing line between the corporation and its customers is becoming blurred.

New technologies and globalisation allow products and services to be produced anywhere in the world and transported across corporate and geographical lines (Quinn *et al.* 1997:194). This makes it possible to: a) disaggregate the organisation; b) outsource many activities at which the firm is not outstandingly competent; and c) concentrate on those activities where the company can achieve best-in-world capabilities. Further, each company is in competition with the best-in-the world providers of each activity in its value chain. Successful companies target a few activities in its value chain most critical to the firm's success, its core competencies, while outsourcing the rest.

Core-competency-with-outsourcing strategies make special sense in rapidly changing marketplaces and technological situations. They decrease risks, shorten cycle times, lower investments, flatten and produce lean organisations, and make their sponsors more responsive to customer needs. They leverage intellect and innovation to the maximum extent through software coordination with customers, partners and vendors.

For Malone and Laubacher (1998:146), the growing proliferation of virtual organisations, outsourcing, telecommuting, freelance and temporary workers, ad-hoc project teams, 'intrapreneurs' and independent business units all 'point to the devolution of large, permanent corporations into flexible, temporary networks of individuals'. What they call the emergence of the 'e-lance economy' consists of electronically linked freelancers who form temporary networks for a particular assignment and then disband once the job is done. A good example of a temporary company is provided by the movie business, where diverse specialists come together to produce a film before moving on to the next project. Again the main driver of this change is technology, because once 'information can be shared instantly and inexpensively among many people in many locations, the value of centralised decision making and expensive bureaucracies decreases (Malone and Laubacher 1998:147).

4.5 Information technology (IT)

Porter and Millar (1985:149) make the point that information technology is more than just computers and 'must be conceived broadly to encompass the information that businesses create and use as well as a wide spectrum of increasingly convergent and linked technologies that process the information'. This includes computers, data recognition equipment, communications technologies, factory automation and related hardware, software and services. Today, information technology also encompasses Internet-based applications.

Collaborative computing tools – from shared databases to e-mail to desktop video

conferencing – are helping companies 'leverage off-site expertise, minimise downtime, improve communications and increase customer confidence and loyalty' (Avistar Systems Corporation 1997:1). The pressures of competitive advantage to bring higher products to market faster at a lower cost 'have prompted a new reliance on cross-functional teams that can quickly make key decisions based on the most timely and complete data' (Avistar Systems Corporation 1997:2). These tools bring together dispersed personnel from different departments within the organisation and often scattered across the globe.

Upton and McAfee (1996) list three principal technologies employed to create the virtual factory: electronic data interchange (EDI), groupware and wide-area networks (WANs). EDI is used to exchange data such as buying orders, transfer electronic funds, or delivery information to customers. Groupware applications help coordinate work by making available a common stock of information, allow users to collaborate from remote locations by tracking work flows and provide a platform for communication with e-mail, bulletin boards and on-screen video. WANs provide dedicated high-speed links with universal access to all data on connected local-area networks. They are exclusive, expensive and are rarely extended to other partners. They have also been largely superseded by the open, non-proprietary TCP/IP protocols of the Internet.

Kalakota and Whinston (cited in Riggins, 1998) claim that the convergence of four previously separate uses of information technology have created e-commerce. These IT uses include:

- Electronic messaging – fax and e-mail
- Sharing a digital library for collaborative work
- EDI
- Electronic publishing to promote marketing, advertising, sales and customer support.

Riggins (1998) outlines three classes of electronic commerce applications: customer-to-business, business-to-business and intra-organisational. IT applications utilising Internet technology can make information available to users both inside and outside the network's firewall. WWW sites can be used to allow free access by the general public to company information. Intranets are used to provide information to employees within the firewall. According to Benjamin *et al.* (cited in Riggins 1998), Internet applications can be used to both support existing relationships (enhancing applications) and establish new relationships (facilitating applications). Internal relationship-enhancing applications include e-mail to promote efficiency within the enterprise, as well as applications that promote decentralised virtual work teams, such as groupware and video conferencing systems. External relationship-enhancing applications include EDI and WWW sites used for marketing purposes.

The Internet is classified as a customer-to-business e-commerce application, while intranets are intra-organisational. Extranets bridge the two by providing a business-to-business application. An extranet is defined as 'a collaborative network that uses Internet technology to link businesses with their suppliers, customers, or other businesses that share common goals ... [it] can be viewed as part of a company's intranet that is made accessible to other companies or that is a collaboration with other companies' (Riggins 1998:4). Extranets can be further classified as intranets or supranets. In an intranet, external trading partners are allowed controlled access to the company's intranet. On the other hand, a supranet is an interorganisational network that is sponsored and controlled by a consortium, providing seamless communication services between members.

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5. Impact of information on the value chain

Every value chain has two dimensions: a set of physical activities and a flow of information. For Porter and Millar (1985:152) 'every value activity has both a physical and information-processing component'. Rayport and Sviokla (1995:75) insist that managers must not only pay attention to how value is created in both the physical and virtual world, but must also be aware that the 'processes for creating value are not the same in the two worlds'. Evans and Wurster (1997:72) suggest that every business is an information business because, besides physical activities, the value chain includes 'all the information that flows within a company and its

suppliers, its distributors, and its existing or potential customers'. Furthermore, all the company's relationships (supplier, customer and employee), brand identity and process coordination are dependent on various forms of information. In short, information is at the heart of contemporary business processes.

Products have always had both a physical and information component (Porter and Miller 1985:154). Until recently, the physical component has always been more important and the real source of value. Increasingly, products with a higher information component can command a premium in the market. These are innovative products with hefty research and development costs and a large advertising budget (Symonds 1999:49). Both R&D and advertising are information-intensive activities. Davis and Botkin (1994:166) predict that 'businesses that are based on providing information to customers will do better than those that are not, and businesses that know how to convert information into knowledge will be the most successful'.

Rayport and Sviokla (1994) distinguish between the marketplace and the marketspace. In many cases the physical world of the marketplace is being replaced with information-based services of the marketspace. The three basic elements of the 'value proposition', or how value is created and perceived – content, context and infrastructure – are aggregated in the traditional marketplace. Consumers receive the three as a single package and perceive them as part of one unit. Content (the product or service offered) is the 'what' of the equation; context (the brand) is the 'how' of the offering; and the infrastructure is composed of the channels of supply, production and distribution that enable the transaction to take place.

But in the marketspace 'content, context, and infrastructure can be disaggregated... Information technology adds or alters content, changes the context of the interaction, and enables the delivery of varied content and a variety of contexts over different infrastructures' (Rayport and Sviokla 1994:145). In the marketspace the interface between seller and buyer changes and the three elements of the value proposition can be combined in new ways to lower costs, build new relationships and add value. For example, in the marketplace, *Time* is a weekly magazine competing with *Newsweek*. In the marketspace, *Time* is a daily news provider competing online with CNN, traditionally a television network in the industrial economy model (Gulke 1997:2).

For Rayport and Sviokla (1995), successful companies exploit and co-ordinate both their physical and virtual value chains. Value added information processes occur in three stages:

1. Information enhances the visibility of physical operations. IT systems collect information about the value chain enabling managers to plan, implement and evaluate better and faster. These systems provide information about suppliers, customers and competitors and 'gives managers the ability to visualise nearly every element of the company's value chain as part of an integrated whole' (Rayport and Sviokla 1995:78).
2. Once firms have the IT infrastructure and have mastered monitoring the value-adding process, they can begin creating mirroring capability by implementing a virtual value chain that parallels and improves on the physical one. For example, a manufacturer may decide to move product development into the marketspace by utilising virtual work teams enabled by video conferencing and computer-aided design (CAD) technologies. The result is usually greater speed and flexibility coupled with lower costs. As Rayport and Sviokla (1995:80) express it, 'on the VVC [virtual value chain] companies may find dramatic low-cost approaches to delivering extraordinarily high-value results to customers'.
3. Once companies have a presence in the marketspace and are creating value they must move to extracting value. Today this is usually accomplished by establishing relationships with customers in the virtual world of the Internet and the WWW. Companies must move to maximise customer relationships and leverage opportunities to deliver value in both the physical and virtual market.

Each stage of the virtual value chain mirrors that of the physical chain – procurement and inbound logistics; operations; outbound logistics; and marketing, sales and services – and presents opportunities for extractions from the information flow. Each extraction presents opportunities for new products and services. While the physical value chain consists of a linear sequence of activities, with set input and output points, the virtual value chain is non-linear and includes a range of possible inputs and outputs, and a variety of access and distribution channels. To exploit these opportunities requires processes that constitute information's five value-adding steps: gathering, organising, selecting, packaging and distributing information in a form that delivers benefits to customers. In essence, 'these value-adding steps, in conjunction

with the virtual value chain, make up a value matrix that allows companies to identify customers' desires more effectively and fulfill them more efficiently' (Rayport and Sviokla 1995:80-81).

The shift from marketplace to marketspace means the old guiding principles of the industrial economy no longer apply (Rayport and Sviokla 1995:84-85):

- Digital assets unlike physical ones are not depleted in their consumption. This makes it impossible for companies pricing according to the consumption of physical assets to compete with information age rivals who successfully exploit their virtual value chain.
- The virtual value chain redefines economies of scale, allowing small companies to compete in markets dominated by large companies. The marketspace makes low unit costs possible.
- A single set of digital assets can be used to provide value across different and disparate markets to achieve economies of scope.
- Transaction costs are lower along the virtual value chain than along the physical one. Plummeting computing costs make it possible to capture and process increasing amounts of information.
- Change from a supply-side orientation to a demand-side orientation. Companies must learn to sense demand rather than just concentrate on producing and selling.

Porter and Millar (1985:155) note that information technology, and by extension information, change the rules of competition in three ways. First, IT changes industry structure. Second, increasingly IT and information can be used to leverage competitive advantage. Third, the information revolution is giving rise to entirely new businesses.

As we have already seen, industry profitability is determined by the industry structure embodied in five competitive forces – the power of buyers, the power of suppliers, the threat of new entrants, the threat of substitute products and the rivalry among existing competitors. IT can affect each of these five forces and, in turn, the attractiveness of the industry. Some ways in which IT alters industry structure include the following:

- It affects linkages between companies and their suppliers, channels and buyers, especially the bargaining relationships between suppliers and buyers
- Large-scale production is no longer necessary for automation, resulting in falling barriers of entry in many industries. Smart manufacturing systems means automation is no longer inflexible and more customised options are available
- Large IT investments in systems and software have also raised the barrier to entry in some industries
- Increased flexibility and falling costs of product design has led to mass customisation and opportunities to serve niche markets.

5.1 Procurement

Only the impact of information on primary activities within the value chain are discussed in more detail here. Of course, information has an impact on secondary activities, too.

According to Kalakota (1997), the 'supply chain is essentially a business process that links manufacturers, retailers, customers and suppliers in the form of a "chain", to develop and deliver products as one "virtual" organisation of pooled skills and resources'. Furthermore, 'interdependencies in the supply-chain create an extended enterprise far beyond the manufacturing facility'. The WWW and Intranets can be used to manage the supply-chain.

For a company, procurement is a complex, multi-step process (US Department of Commerce 1997). These steps include:

- Finding a capable supplier that meets volume, quality, price and delivery requirements
- Once a supplier has been selected, information is transmitted to ensure the product is built to exact specifications
- Once the product sample is approved, the buyer transmits a purchase order (PO) for a specific quantity of goods
- The buyer, in turn, receives notification from the supplier that the PO has been received and confirmation that the order can be met
- When the product shifts from the supplier, the buyer receives notification and an invoice

- The buyer's accounting department matches the invoice with the PO and pays the invoice.

Any change to the order further complicates the process. Before the use of information technology this process had to be accomplished by telephone, post office mail or by fax.

In the 1970s and 1980s, organisations began sending and receiving purchase orders, invoices and shipping notifications electronically via EDI over private communication networks called value-added networks (VANs). The cost of these networks often made them unaffordable for smaller businesses. The Internet – including intranets and extranets – has made electronic procurement available even to the smallest companies.

According to the US Department of Commerce report on electronic commerce (1997), some of the benefits of online procurement include:

- Lower procurement costs by consolidating purchases and developing relationships with key suppliers
- The ability to cast a wider net for lower-cost suppliers
- Faster response times
- Reduced labour, printing and mailing costs
- More time available to staff to negotiate better prices and forge relationships.

The use of the Internet for procurement purposes brings further benefits:

- Lower transmission costs relative to EDI and VANs
- Wider scope of doing business electronically with new suppliers, especially small and medium-sized businesses
- For small companies, the Internet opens up new sales opportunities.

The gains experienced by the General Electric lighting division's move from a manual purchasing system to one using Internet protocols are instructive. The division's labour costs for procurement have decreased by 30%. Sixty per cent of the procurement staff has been redeployed. Material costs have fallen by up to 20% as the ability to reach a wider range of suppliers has generated more competition and driven down prices.

According to Evan and Wurster (1997:82), companies will have to find new ways of extending customer loyalty as the shift from proprietary EDI systems to the Internet reduces switching costs. With almost costless switching, companies will no longer be locked into supplier relationships. For example, the Automotive Network eXchange (ANX) is an extranet linking together US car manufacturers with thousands of automotive suppliers. The system will save costs, reduce errors and increase response and, by lowering 'switching costs and creating greater symmetry of information, ANX will intensify competition at every level of the supply chain' (Evans and Wurster 1997:82).

5.2 Inbound and outbound logistics

For Stewart (1998:24), 'one of information's most powerful advantages is its ability to wipe out inventory'. The more inventory a company holds the higher its operating costs, and the lower its profits (US Department of Commerce 1997). The objective is to keep inventories small but more targeted on customer needs. In attempts to manage their inventories better, manufacturers and retailers have turned to strategies embodied in just-in-time (JIT) and quick-response (QR) inventory management systems respectively (Curl 1997:1). JIT and QR are designed around four major elements: a) zero inventory; b) short lead times; c) small frequent orders; and d) high quality. In this sense, information about the inventory replaces the need for physical inventory itself.

QR is driven by the customer's purchase (Curl 1997:2). The point of sale purchase – through the use of scanning technology and associated barcoding technology – triggers the ordering process through a planned, coordinated response of the major players within the supply chain. Orders are then processed electronically, over an extranet for example. Automated order processing has greatly improved outbound logistics, greatly improving customer service. And automated warehousing simplifies the previously laborious tasks of storing and retrieving goods. The load is scanned into a computer system and then sent direct to stores. The result

is time saving, improved processing and cost benefits.

Information is central to the flow of goods and parallels the flow of physical products. It must also be remembered that one company's inbound logistics is dependent on another's outbound logistics. Integrating information is vital to the proper functioning of the supply chain, ensuring customer orders, inventory levels, purchase orders and other information flows automatically from one business function to the next. As Kalakota (1997:7) puts it, 'in this new business model, competition is no longer simply viewed as company versus company, but as supply-chain versus supply-chain'.

Improved management of inbound and outbound logistics through the application of information technology adds value at this point in the value chain by reducing inventory-related interest, handling and storage costs (US Department of Commerce 1997:5). Utilising existing manufacturing capacity more efficiently reduces the need to make further investments in plants and equipment to meet increased volume requirements.

5.3 Operations

'Operations management is about developing and managing value-added processes, and supporting these through various tools, techniques and methods' (Voss cited in Twigg 1998:3). Operations are a transformation process where resources (inputs) are converted into services and goods (outputs). Resources may be raw materials, information, or even customers.

One of the greatest benefits of using information technology in a company's operations is the dramatic impact on cycle time reduction (US Department of Commerce 1997:7). Cycle time is the total time it takes to produce the goods a company sells. EDI enables partners to share product specifications and drawings over VANs, speeding product design and development. The Internet further facilitates collaboration across work teams and geography. For example, through the use of computer-aided design (CAD), computer-aided manufacturing (CAM) and computer-aided engineering (CAE), and sharing information electronically, teams in the American car industry have reduced the time it takes to develop and build a new vehicle from four to six years down to about 30 months.

Until recently collaborative computing systems could deliver information in three formats: a) free text, that is, online interactive chat and e-mail; b) audio, that is, real-time telephone and forwarded voice mail; and c) documents, namely, faxes and online document and image sharing systems. The emergence of real-time video conferencing has been especially useful to manufacturing organisations in the move towards virtual workgroups. Avistar Systems Corporation (1998:6-8) notes some of the advantages of using collaborative technologies:

- Facilitates concurrent engineering by creating virtual meetings, enabling vast improvements in time-to-market and in quality owing to easy access to a wide array of information
- Increased flexibility in all product processes – from product design to material procurement to manufacturing to distribution to marketing – to meet a constantly changing market
- Enhanced lifecycle management. Close contact with vendors throughout the supply chain, and with customers, results in substantial cost savings in the course of a project
- Comprehensive quality assurance (QA). QA managers can confer with multiple colleagues and managers quickly and easily, monitoring changes to reduce product development time and improve quality
- Joint design and remote repair – save on travel expenses by helping distant partners to diagnose problems and suggest solutions; conduct repairs and maintenance using desktop video systems
- Allows personnel to engage in continuous learning by viewing real-time video clips of new processes and techniques, integrated with text and graphics, from their desks.

5.4 Marketing and sales

As a company's number of accounts increases so does the size of the sales force. Web trading, on the other hand, can add new customers with little or no extra cost (US Department of Commerce 1997:11). In this instance, computer servers replace physical shops and sales people. A commercial Web site is established for two primary reasons: a) to impart product

information to the marketer's target audience; and b) to effect transactions of its products and services (Quelch and Klein 1996). Increasingly, more and more Web sites follow a mixture of the two business models.

A Web site can serve as the electronic equivalent of a corporate brochure or company catalogue, but a successful site has to provide more than brochureware. According to Schwartz (1997:52), a good Web site should:

- Provide a valuable, interactive, service to customers
- Get highly interested customers to spend time learning about a product
- Collect psychographic information from users
- Take orders and sell product/service online.

Most advertising is based on a mass media model that pushes information to the audience to build brands. The Web, however, is an interactive medium where the user pulls information, thus shifting control back to the audience. Traditional advertising thrusts its message onto a consumer who has no choice. Tomorrow's advertising agencies must learn how to forge relationships between marketers and consumers, because 'the Web makes the marketing process a much more collaborative one' (Schwartz 1997:70).

Dell Computer's direct model is a good example of technology can help to speed up delivery and cut costs. Dell's model is based on eliminating middlemen and selling PCs directly to customers. About 20% (or \$10 million worth) of Dell's business is done online. Dell expects that eventually half its business will be through the Internet. This is a big money saver because Dell doesn't have to hire so many order-entry people (Brown 1999: 32).

The Internet operates 24 hours a day, seven days a week, 365 days a year. With its global reach, it can access markets across the world. In fact, any company that establishes a site on the Internet automatically becomes a multinational company (Quelch and Klein 1996:62). The Web breeds infinite choice and can lead to confusion. This in turn leads to new branding opportunities 'for third parties that neither produce a product nor deliver a primary service' (Evans and Wurster 1997:81). Search engines such as AltaVista and browsers like Netscape's Navigator are good examples of these 'navigator' or 'agent' brands. It also fits in with Porter and Millar's view (1985:155) that 'the information revolution is spawning completely new businesses'.

5.5 Service

The efficient application of information is also generating value in the service link of the supply chain. Efficient and effective customer service leads to cost savings and increased customer loyalty as consumers are more predisposed to a brand if their experience is positive.

In 1994, Toys 'R' Us had 100 stores and four customer support staff handling about ten calls per day. By the end of 1997, the retailer had expanded to over 900 stores and estimated that it would need 200 people to provide adequate support. Instead it manages with 36 analysts averaging over 50 calls per day. By implementing knowledge-based problem resolution technology, such as expert systems, and leveraging the intellectual capital of existing staff, Toys 'R' Us was able to run an efficient help desk. What is more, 'every customer interaction teaches someone in the company more about the customer, the market, the company's image and the product' (Dorfman 1998:2).

Davis and Botkin (1994:169) provide examples of how information allows businesses to act instantly, thereby maximising value. Both Xerox and Otis build 'smart' machinery that provide preventative maintenance by communicating information timeously. Otis lifts send a call to technicians to warn of an impending malfunction, thereby saving money and preventing customer frustration. Some of Xerox's larger machines have a built-in modem and telephone that automatically calls for field service. Information is also used to customise offerings. As Pine *et al.* (1993:118) explain: 'capability to codesign and even coproduce products with customers provide mass customisers with the ability to capture new knowledge'. How information about customers can lead to new products and services is exemplified by USAA, traditionally an insurance company. Capitalising on aggregated information about customer losses due to theft or accident, USAA became a buyer for its customers and transformed itself into one of the biggest direct markets in the US (Rayport and Sviokla 1995:81).

The Web has also promoted better customer service through interactive offerings. A good example of this is how FedEx and UPS allow users to track their parcels online, thereby cutting costs by reducing the number of telephone operators. As Schwartz (1997:119) puts it, 'more and more resources will be invested into making self-service on the Web efficient ... [as] a growing number of companies are coming to realise that self-service provides for the highest level of customer comfort'. Besides order tracking information, the Web also allows enterprises to include software downloads and technical support information online. By enabling product ordering through their Web site, Cisco Systems reports productivity increases of customer service of between 200 and 300% and customer service cost savings of up to \$125 (US Department of Commerce 1997). In this way, intangible information has a capacity for translating into tangible results.

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6. Case study: information's impact on the shipping industry

The theory of the experience curve states that the cost of using a new technology decreases as the enterprise gains more experience with the technology (McNurlin 1997). Primožic *et al.* (cited in McNurlin 1997) present a new view that consists of a series of connected curves rather than one continuous learning curve. Each curve represents different technologies. Moving to a new curve requires heavy investment and the decision often has to be made between competing technologies, none of which is yet a clear winner. Enterprises that correctly identify a new market and the technology to exploit it can shift to a new experience curve and open up a new industry segment. Primožic *et al.* provide the example of the shipping industry.

Federal Express – now FedEx, part of the FDX Corporation – was launched in 1973. Its rival, United Parcel Service (UPS), had been around since 1907. The trucking industry initially shipped two types of truckloads of goods: full truckloads and less-than-truckloads. When UPS based its entire business on less-than-truckloads shipping, this saw the beginning of a new industry segment, package delivery. As a result UPS became much larger than the tracking companies because it served a market with more customers. The technology that facilitated this shift to a new experience curve was efficient package sorting at distribution centres to maximise use of the trucks.

However, UPS did not guarantee a delivery time or track packages. Federal Express saw the gap in the market and started another new industry segment: overnight delivery. Information technology was central to this jump to a new experience curve. Recently, a third industry segment has emerged: advanced logistics. Utilising their distribution networks and inventory facilities, overnight delivery services now handle inventory for large corporate clients.

Information is at the heart of what FedEx does. Couriers are equipped with portable barcode scanners that connect the physical network of aeroplanes and vans with the virtual network of information. This close connection between the 'datasphere and the physical world is what enables FedEx to accomplish its daily miracle of collecting, sorting and delivering millions of packages ...' (Lappin 1996:2). The movement of bytes is as important as the movement of bits.

FedEx's operational backbone is a proprietary online network called COSMOS IIB that tracks the status of every package handled by the company, processing 45 million transactions each day. A device scans the barcode on the package and every time the package changes hands the barcode is scanned, updating the package's location. This information is constantly fed into the COSMOS system. This computer network 'allows the company to fine-tune its shipping system by amassing reams of information about who is sending what, where, and to whom' (Lappin 1996:5). For FedEx, the data about each shipment are just as important as the shipment itself.

FedEx's flair for information management has led to the establishment of a subsidiary, FedEx Logistics. For example, this spin-off handles all aspects of fashion retailer Laura Ashley's order fulfilment and distribution operations, including warehouses, inventory management, packing and shipping. The other shipping companies such as UPS and Airborne Express had to follow suit. As James P. Kelly (1997:3), CEO of UPS, puts it: 'The leader in information management will be the leader in international package distribution ... period.'

As its rivals matched the technology that once gave FedEx its competitive edge, the company had been forced to compete on price rather than service. Some observers (Blackmon 1998) are starting to ask whether FedEx is 'morphing from a transportation company into an information company'. FedEx is looking at the high valuations of Internet companies and comparing them to their own struggling numbers. In fact, FedEx may soon traffic solely in information while outsourcing its routes. Already it has made subcontracting agreements with other airlines and trucking companies (Blackmon 1998:2). As James Barksdale, CEO of Netscape Communications and FedEx's former Chief Operating Officer, explains: 'Moving an item from point A to point B is no longer a big deal. Having the information about that item, and where it is, and the best way to use it ...that is the value' (cited in Blackmon 1998:1).

While the rise of e-commerce is driving FDX's growth, FDX is driving e-commerce. The FedEx site – www.fedex.com – rolled out in November 1994 was one of the first interactive Web sites that went beyond brochureware. The site soon averaged 12 000 visitors a day doing their own package tracking and saving FedEx \$2 million a year (McNurlin 1997:2). Also, 'by keeping close tabs on how customers use its Web site, FedEx has diligently collected and analysed heaps of customer feedback and usage data to understand how Internet users conduct transactions on the Web' (Lappin 1996:6). That feedback informed the introduction of a function that allows customers to order a FedEx shipment on the Web. More importantly, it 'completes the transformation of any Internet-connected computer into a seamless extension of the Cosmos network' (Lappin 1996:6).

FedEx also tested an e-commerce software package called BusinessLink. The company has a vision of the future consisting of 'cyberspace superstores, operated by managers who need only worry about marketing, customer service, and counting the cash as it rolls in' (Lappin 1996:7). FedEx would take care of invoicing, inventory management, order fulfilment and shipping. Known as 'virtual warehousing', this practice involves moving products directly from manufacturer to consumer. Dell's direct model is based on logistics providers such as FDX, which allows the computer supplier to get by with an absolute minimum JIT inventory of PC parts (Palmer 1998). E-commerce has provided a boost to the shipping business. In the marketplace, the FedExes and UPSs of the world become the only physical connection between seller and buyer. Information will never entirely replace physical goods. What has changed is that increasingly companies rely on 'information about those goods so they can better manage their businesses' (Kelly 1997:3).

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7. Conclusion

The concepts of the value chain and competitive advantage are well established in the literature. Competitive advantage is achieved by performing activities in the value chain in such a way that they deliver extra value to customers. Information, enabled and enhanced by information technology, plays an important role in creating value and achieving competitive advantage. The new economy of the Information Age is based on new economic principles and new concepts of value. Among these is the theory of increasing returns and the economics of plenty. Globalisation, disintermediation and reintermediation, and the virtual corporation are all features of the new economy. One of the main drivers in all these changes is information technology, including EDI, groupware, collaborative computing, and Internet-based technologies. Information impacts on all levels of the value chain, from procurement to service, resulting in cost-savings, lower cycle times and improved customer service, among other advantages. The information-based marketplace is replacing the marketplace, while the virtual value chain mirrors the physical one and presents new opportunities to extract value. Information's impact on the value chain of a company and an industry is illustrated by the changes experienced by FedEx in its shift from parcel delivery to logistics management. In terms of the Information Age these are early days. Further research is needed to understand how information affects business processes and presents new opportunities to create value, re-invent value chains and alter industry structures.

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