The building blocks of an operations strategy for e-business

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Abstract

This paper sets out to explain the vital role of an operations strategy in e-business. Suggests, through various research findings, that a firm can employ a number of operations strategies, and that they each possess certain core building blocks. Further, when properly combined, these strategies can be customised to a particular situation and offer substantial benefits for an organisation in driving e-business best practices. The paper gives definitions and descriptions of operations management, e-business, e-operations and an operations strategy for e-business. The work is also supported by empirical research data in the form of a small case study.

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Introduction

Recent empirical research findings have suggested that organisations employ a number of operations strategies (Lowson, 2001a, 2001b). Further, it has now been generally accepted that these strategies, despite often having similar building blocks, can be given a unique emphasis reflecting their individual situation (Lowson 2002a).

In this paper we set out to offer evidence that operations strategies can be applied to an e-business domain. Further, their adoption can provide an organisation with the ability to improve its value offering, increase quality and customer service levels, and drive continuous improvement initiatives.

The paper is divided into five sections. To begin, we set out to provide a brief but critical review of the nature of e-business, our intention is to begin to bridge the gap between e-hype and true understanding of the Internet as an enabling technology. The second section, considers the role of operations management for an e-business. In section three, we discuss and review the term "e-operations" providing, perhaps for the first time, a definition. The nature of an operations strategy is discussed and applied to the e-business domain in section four. In this part we offer a definition of an operations strategy and outline, in the form of building blocks, its generic components. We also demonstrate how these various elements are fused into a strategic architecture. The paper concludes with a small empirical case study describing the beneficial use of e-business and an operations strategy by a small manufacturer.

The nature of e-business

E-business or e-commerce is the execution of business transactions by electronic means. We differentiate between e-business and e-commerce. Often, the terms are used synonymously; however certain strands of the literature do attempt a distinction. Chaffey (2002) considers e-commerce to be a subset of e-business using the following descriptions:

- *Electronic commerce (e-commerce).* All electronically mediated information exchanges between an organisation and its external stakeholders.

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- *Electronic business (e-business).* All electronically mediated information exchanges, both within an organisation and with external stakeholders supporting the range of business processes.

According to Chaffey then, e-commerce involves external transactions only and is a sub-system of e-business. The latter being both internal and external processes and, presumably, wider than just commercial exchanges (selling and buying). For the purposes of this paper, we will use the term "e-business" in its widest sense.

Whatever the terminology, there are a range of different perspectives applied to e-business. Kalakota and Whinston, (1997) suggest the following:

- *A communication perspective.* The delivery of information, products/services or payment by electronic means.
- *A business process perspective.* The application of technology towards the automation of business transactions and workflows.
- *A service perspective.* Enabling cost cutting at the same time as increasing the speed and quality of service delivery.
- *An online perspective.* The buying and selling of products and information online.

Clearly e-business will often, although not exclusively, be conducted using a Web site. The use of a Web site to conduct e-business can be classified into six general categories:

(1) As a major sales channel for a product or service. Amazon.com for example, with sales exclusively through the Internet.
(2) As a supplemental channel. "Click-and-mortar" firms represent traditional retailers that have extended their market reach by adding a Web site.
(3) Technical support channel. Customers can solve problems regarding the products they have purchased. Many businesses, Cisco for example, boast significantly reduced operating costs through the online provision of answers to frequently asked questions (FAQs), thereby reducing the need for customer service telephone operators.
(4) An embellishment channel for an existing service. Mail services, for instance, can be augmented using a Web site for tracking orders as proved successful by FedEx, or to offer further explanation as in the case of a text book.
(5) A processing channel for orders. A direct connection between the service provider and the customer that cuts out any intermediate stage.
(6) An information channel to convey further details. Technical information about companies, their products or services.

An e-business incorporates one or more of these channels as part of its e-business model. Many authors have attempted to classify and list business models employed. Some are quite exhaustive (see for example Tapscott *et al.*, 1999 and Turban *et al.*, 2002). Others are less ambitious, citing five business models in terms of buyers and sellers:

(1) one seller to many buyers;
(2) many sellers to one content aggregator, then on to many buyers;
(3) one seller to one broker, to many buyers;
(4) many sellers to one buyer; and
(5) many sellers to many buyers (Barnes-Vieyra and Claycomb, 2001).

Broadly speaking, the Internet provides a business with a host of faster and more flexible processes that can dramatically ease communication and transactions across geographical boundaries, uncovering opportunities to leverage operations in new and innovative ways. The term "e-business model" simply refers to the approach of the business and the method by which it can sustain itself and generate profitable revenue growth (Trombly, 2000).

At this point a word of caution is necessary. The Internet is an extremely important new technology that has received much attention and fervour through the latter part of the twentieth and the early twenty-first centuries. But, as Porter (2001) points out, it is perhaps time to take stock and develop a clearer view. As he suggests: to move away from the rhetoric about "Internet industries" and "e-business strategies", and a "new economy". To see, according to Porter, the Internet for what it is: "an enabling technology – a powerful set of tools that can be used wisely or unwisely in any industry and as part of almost any strategy". However, according to Porter, technology, and the Internet in particular, does provide better opportunities to establish operational effectiveness than did

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previous generations of information technologies.

The Internet *per se* will rarely provide a competitive advantage. The creation of true economic value (the gap between price and cost to produce) will, at the end of the day, always be the bottom line in terms of survival or failure. Sustainable competitive advantage can only be achieved by operating at lower cost, by commanding a premium price, or doing both. These cost and price advantages can be achieved in two ways. First operational effectiveness (doing the same things as your competitors but doing them better). Second, strategic positioning (doing things differently from competitors in a way that delivers a unique type of value to customers). Best practice in terms of operational effectiveness includes, for example, better technologies, superior inputs, better-trained employees, more effective management structure, and a clearly articulated operations strategy that links business policy to operational activity.

The Internet can affect operational effectiveness. A powerful tool, but, according to Porter: "simply improving operational effectiveness does not provide competitive advantage ... this can only be done by achieving and sustaining higher levels of operational effectiveness than competitors". Best practice tends to be copied quickly! As it becomes harder to sustain operational advantages, strategic positioning becomes all the more important. This goes far beyond the pursuit of best practice (the quest of the operations strategy). Strategic positioning involves the highly integrated configuration of a tailored value chain – the series of primary activities required to produce and deliver a product or service (inbound logistics, operations, outbound logistics, marketing and sales and after-sales services – the first three again being the province of the operations strategy).

Thus we are left, according to this viewpoint, with the proposition that the Internet is ostensibly a powerful new technology to aid operational effectiveness, but in reality just another way of doing business and not a business strategy in itself. It is, however, an operations management resource that can be advantageously exploited at an operations strategy level.

Operations management for e-business

Operations management can be defined with the use of a broad perspective (one that is applicable to e-business) as follows:

> The management of the internal and external systems, resources and technologies that create and deliver the firm's primary products and/or services.

This definition expands the operations management concept beyond just internal production or manufacturing. Here, it will encompass other activities such as purchasing, distribution, product and process design etc. Further, in an e-business operational setting, there will also be external managerial responsibilities at a supply network level, covering the interconnections between external firms.

E-business can revolutionise many elements of operations management due to its effective time, resource and cost reduction. This is mainly achieved through improved communication and dissemination of economically valuable data and information. Improving visibility and integration of supply chains and effectively replacing the need for inventory with real-time information (Van Hoek, 2001). An example of an e-business that has used operations to dominate their market is Amazon.com. Amazon can offer discounts for their books because they need to keep little more than two copies of an average book in their inventory, yet they can still make the product widely available online. A traditional retailer would need several copies of the book to be available in each of its stores across the country; the costs of such inventory can be phenomenal.

Such operational improvements provide opportunities for e-business to further increase economic efficiencies by matching buyers and sellers and facilitating the exchange of information and goods and services – a move closer to the perfect market. In addition, some of the time constraints of trading are reduced (although it should be noted that others do remain, as in e-fulfilment for example).

The evolution of operations management

The e-business domain necessitates fundamental changes for operational management and an operations strategy. First, consider the structure of an e-business supply system. Today's complex and volatile

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supply networks call for businesses to seek greater product and process variation (flexibility) and quality through agility and responsiveness. A rejection of the Fordist principles of mass manufacturing (Piore and Sabel, 1984; Pine *et al.*, 1993), and a move toward individualisation of products and services. However, these advances can only be attained once an entire supply network[1] is fully integrated and data openly shared for visibility at all stages.

How close are we to achieving such a situation? Figure 1 shows the evolution of these supply and demand systems. Stage I, depicts the situation for most goods and service sectors at the turn-of-the-last-century. The participants considered themselves as separate and autonomous industries with no influence, reliance or interconnection with each other. Stage II shows the various systems slowly concurring, with stage III illustrating integration of processes through the use of electronic data interchange (EDI).

We argue that many businesses are still operating at the level of stages II and III; particularly small to medium sized firms who are often unable to undertake the cost of technologies and the management of systems integration.

In light of the changing business environment, a fourth more radical and advanced stage is needed for successful competition as an e-business. Figure 2 shows Stage IV, what we term the "cluster of value". This is a future vision. The consumer group is the nucleus of activity, dictating and driving all demand preferences for variety. The entities circling (e-business processes, operations processes, and supplier processes) are all responding by providing value in the exact format required. Consumer groups are constantly changing over time and an e-business will be involved in many different simultaneous "clusters of value" at any given point (thus the need for more than one operations strategy, a point to which we will return). This type of structure and interaction is necessary for an e-business in response to growing demand variety, including the move toward individualisation and the "mass customisation" of services and goods.

We can now begin to examine the distinct implications for e-operations before suggesting and detailing the development of an operations strategy.

E-operations

For operations, the term e-business brings a particular revolution that is fuelled by the Internet and business-to-business commerce. E-operations are quite simply, the application of the Internet and its attendant technologies

Figure 1 Supply system evolution

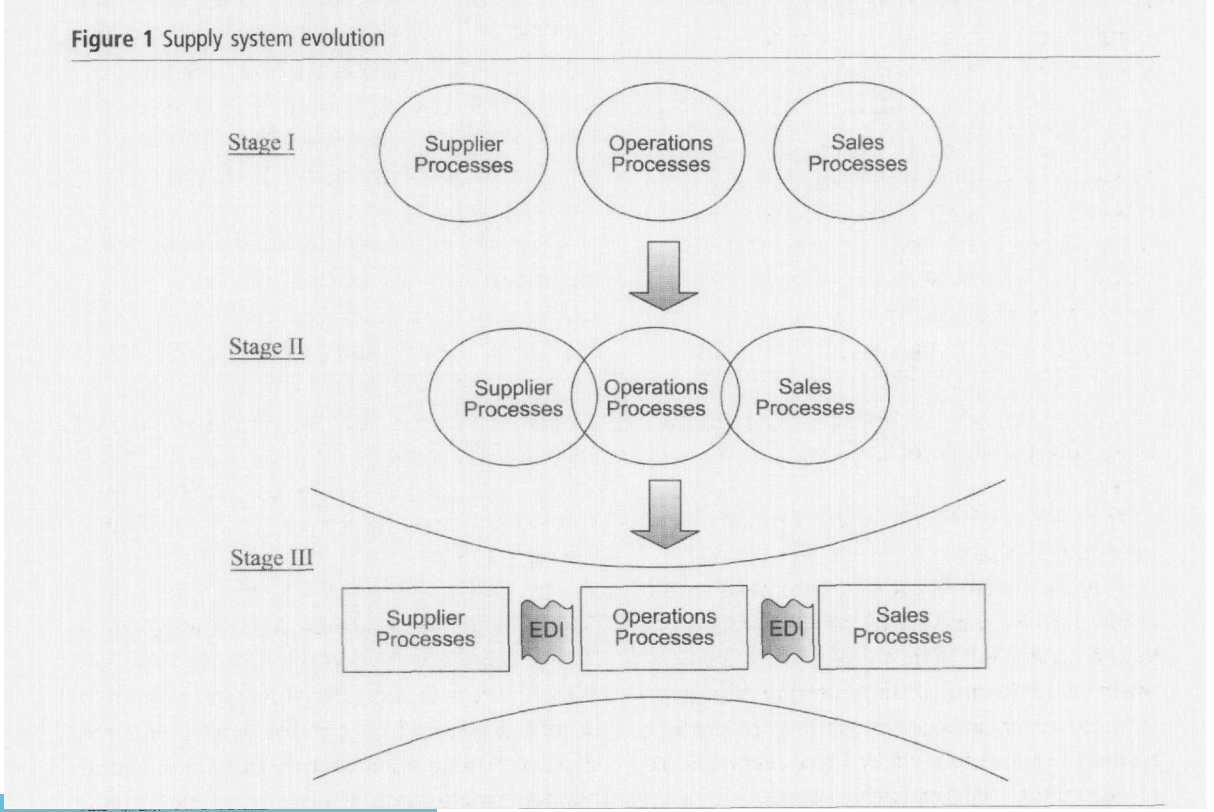

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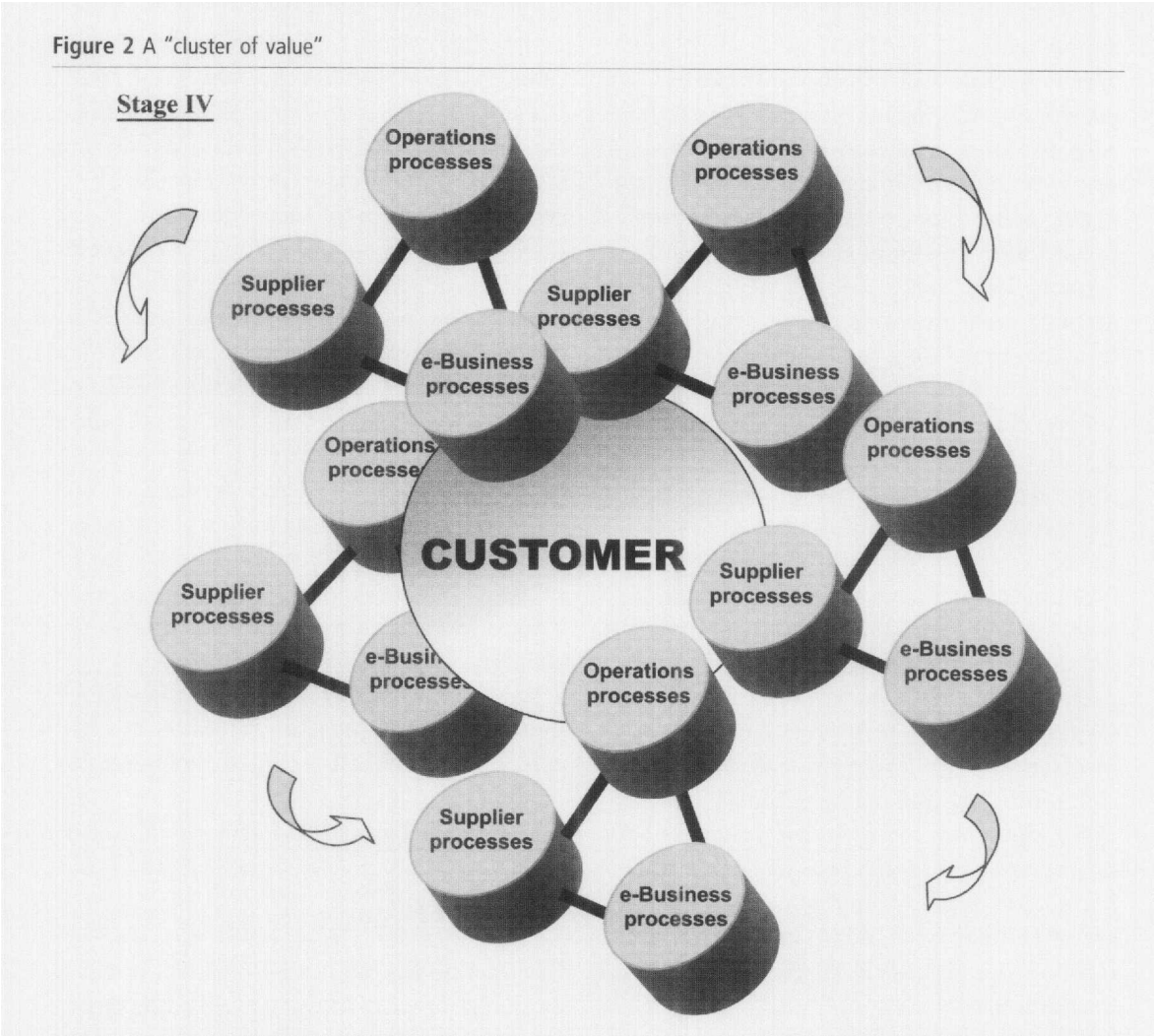
Figure 2 A "cluster of value"



to the field of operations management. Cohen and Agrawal (2001) describe the ideal scenario in which:

> . . . information, material flow, product attributes and decision making realize the full potential of e-commerce technologies. Information flows in this ideal world will be accurate, rich and instantaneous. Information, moreover, will be based on all supply [network] transactions . . . and will be visible throughout the [network]. The Internet will reduce search and price discoveries to a minimum.
>
> Goods will flow directly between supplier and end customers, controlled by just-in-time shipment. In this environment the cost of changing suppliers will be zero. Products will be more customized.

But, as the authors ask, "how realistic is this picture of the future?" Certainly the technologies and profit incentives exist for firms to build such networks. Innovative supply system structures now offer expanded access to e-sources of supply that can use Web-based exchanges and hubs, interactive trading mechanisms, and advanced optimisation and matching algorithms to link customers with suppliers for individual transactions. In terms of an operations strategy, as we saw in Figure 2, these developments require flexibility and responsiveness and will often necessitate the need for more than one strategy that is customised by a particular customer or product group.

This paper can now offer an analytical definition of e-operations as being:

> Electronically mediated data/information exchanges, and the information communication technology systems that support them, to facilitate the operation, enhancement, re-engineering and integration of the range of business processes, both within an organisation and externally (up and down-stream)[2].

Here, we propose the e-operations task includes: data and information exchanges using electronic media to provide operations, improvement, innovation and integration as well as efficacy of business processes. In other words, a good starting point being the three general dimensions of performance: efficiency (doing the thing right), effectiveness (doing

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the right thing) and efficacy (producing the right result).

Having reviewed the role of operations management, we can now turn to the question of an operations strategy for e-business.

The nature of an operations strategy for an e-business domain

As with the subject of operational management, we can supply a broad definition of an operations strategy that is conducive to an e-business domain:

> . . . major decisions about, and strategic management of, medium- to long-term operational expertise. Including: core competencies, capabilities and processes; technologies; resources; and key tactical activities necessary in any supply network, to create and deliver products or services and the value demanded by a customer. The strategic role also involves the blending of these various elements and precepts into one or more unique, organisational-specific, strategic architectures.

In this definition we see the strategic role is one of fusing certain building blocks (both internal and external) into a unique operations strategy. Each strategy will be different due to the manner and emphases of this blending activity.

This definition has a number of important implications for e-business:

- it encompasses the earlier definitions of operations management and e-operations;
- it embraces the situation whereby the operational activities are seen as the firm's distinctive competence;
- it provides support for the implementation of the business strategy. The operations strategy links long-term strategic decisions (corporate strategy) to short-term, tactical, day-to-day operational management decisions;
- it is a definition that can equally apply to all organisations producing products or services no matter what the mix (tangible or intangible) as well as any e-business capabilities; and
- it places clear emphasis upon the strategic importance of unique activities as being the foundation of competitive advantage.

Ingredients of an operations strategy

The operations strategy then, is composed of a pattern of decisions. Medium- to long-term decisions are made regarding certain generic factors. Earlier empirical research (Lowson, 2002b) has identified the components of an operations strategy as being selected[3] and blended to represent both the resource-based and market-driven views of policy making. In the case of the former, we can view companies as a collection of resources, rather than holding purely market positions. The market-driven view of strategy formulation meanwhile, argues that it is not just the industry that is important, but where the organisation wants to compete and the nature of the competition.

The building blocks of the operations strategy will display particular emphases and linkages that reflect the exigency of any specific situation – both internal and external. At a generic level, they can be conceptualised as:

- core competencies, capabilities and processes;
- resources;
- technologies; and
- certain key tactical activities.

These are the "building blocks" of the operations strategy and we will return to them in a moment for an e-business setting.

Operations strategy – the e-business context

To understand the organisational context of e-operations and an operations strategy, it is useful to view the infrastructure of the modern organisation as consisting of four conceptual levels:

(1) *Business model.* Where a general, long-term business strategy is defined.

(2) *Operations strategy.* Here, decisions are made regarding the medium- to long-term operational aspects of providing certain products and services.

(3) *Operations management.* Deals with the tactical processes necessary to implement both of the above strategies and provide products and services.

(4) *Information system (IS) and information technology (IT) architecture.* Defines the supporting information and technology necessary in an e-business setting (often there might also be distinct IT and IS strategies).

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The role of the operations strategy and operations management (levels 2 and 3) is to execute or implement the general business strategy and effectively use the tools and information flows involved in level 4. In addition, an e-business must seek to understand how to take advantage of new operational and IS/IT capabilities to migrate to more effective business models. The challenge for an operations strategy for e-business is to translate these business models into activity. This involves a continual, and in some cases ever-decreasing, business cycle.

An operations strategy is concerned with both the internal and external decisions necessary to translate the business vision. The subsequent business model will be a fluid collection of business activities – each node or business activity will focus on a limited number of competencies to create value.

Operations strategy – e-business opportunities

An e-business will have a number of revenue enhancing opportunities for any organisation that will need to be facilitated and included in any operations strategy:

- *Direct sales to customers.* Allows more members of the supply network an opportunity to have direct contact with the customer in channels not previously open or controlled by intermediaries (a retailer or wholesaler for example).
- *Twenty-four hour access from any location.* Accessibility, in theory, 24 hours a day and seven days a week for the placement of orders. However, unlike a retailer the goods are not always provided straight away. Similarly, geographic location is no barrier to accessing e-services, but e-fulfilment may not always be feasible.
- *Aggregating information.* Sales can be increased by offering information regarding a large selection of products and services that do not have to be held in inventory (a corresponding variety offered by a retailer would entail having a large stock-holding).
- *Personalisation and customisation.* The Internet offers the potential to use customer's personal information to intelligently guide each buying experience and increase sales. At a B2B level it is possible to establish customer-specific sites to personalise the buying experience.
- *Speeding-up time to market.* Increased revenues are available by introducing new products much faster than using physical channels. A new product can be made available as soon as the first unit is produced.
- *Flexible pricing.* An e-business can alter prices by changing one entry in a database. Prices can be adjusted rapidly to reflect inventory and demand preferences.
- *Price and service discrimination.* Prices can also be altered to reflect the buying power of individuals. Prices can be adjusted for each micro-segment and even by individual customer – rather than having a single price for all.
- *Efficient funds transfer.* The payment collection cycle can be much shorter for an e-business – this can substantially increase revenues.
- *Shipping time and e-fulfilment.* Still a potential revenue disadvantage for an e-business. For example, physically buying a pair of jeans allows the customer to touch and try-on the goods. After payment the customer leaves with her purchase. For an e-business, shipment takes time (unless we are dealing with services and goods that can be downloaded from a PC). Shipping costs are also a common cause of concern with many consumers abandoning their online "shopping cart" when they add the cost of shipping.
- *Centralised inventory.* The ability to stock goods in one location rather than spread over numerous scattered locations allows the firm to keep substantially lower amounts by avoiding duplication.
- *Reduced facilities cost.* Avoiding the need for stores and other outlets in expensive prime locations.
- *Self-sourcing.* Consumers often can do some of the work of the business. For example, delivery services encourage the customer to track their own deliveries, on-line purchasing of tickets, paying bills and setting-up banking facilities on-line. These advantages may be the single most important feature of the Internet.
- *Job specialisation and scheduling.* Allows companies to centralise operations giving rise to opportunities of greater task specialisation. For service firms especially, this is a valuable benefit as it allows a high degree of customisation to

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be retained in the front-end of the service, but this is supported behind the scenes by standardised tasks and processes that can utilise economies of scale through high volume transactions. The Internet alleviates the fundamental trade-off between customisation and efficiency, especially when applying technology to 24-hour, seven-day a week services.

- *Other positive cost impacts.* Cost reduction opportunities include: reduced product handling and shorter supply networks; postponement of product differentiation until the order is placed; decreasing delivery cost and time (downloaded goods); reduced physical processing costs; reduced inventory costs; and improved supply chain co-ordination arising from better information flows.

Operations strategy – e-business challenges

Just as certain opportunities will exist for an e-operations strategy, there will also be limitations involved in any e-business, the impacts of which the e-operations strategy must seek to reduce or negate.

- *Technology.* An e-business and its operations strategy will live or die by its technological choice. The flexibility brought by information technology will also have a price in terms of the necessary development and maintenance. Often, firms will not possess the expertise necessary in these areas and will either have to out-source or hire the human resources necessary. This can result in higher costs and loss of control. In addition, according to Moore's law, computing power doubles every 18 to 24 months. To keep pace, investment in new technology is both necessary and substantial.
- *Increased shipping.* Rather than delivering one shipment to a store for customers to purchase, e-operations must ensure that each individual purchase is delivered. For tangible goods, this has high cost implications that cannot be avoided – especially if they are fragile or large.
- *Accountability/legality.* Accountability for the sale of controlled items is always a problem with the anonymity of the Internet. It is difficult to ensure that items such as liquor or prescription drugs do not fall into the wrong hands. Similar problems arise regarding copyright of music and other intellectual property.
- *Communication barriers.* Despite the customised Web-pages of Amazon and Dell for example, there is still a barrier to communication without two-way or face-to-face interaction.
- *Other negative cost impacts.* Higher costs are likely in the following: inbound and outbound transportation costs are likely to be higher as the e-business will tend to aggregate inventory at a central location rather than at a number of geographic points; increased handling costs if customer participation is reduced (groceries for example, where some tasks are performed by the customer); and large initial investment in information infrastructure.

An operations strategy for e-business development

We can now examine in more detail the building blocks of an operations strategy for e-business using an expanded framework. It was noted earlier that an operations strategy would be composed of certain generic elements; these can now be further developed and applied to an e-business operation using an empirical case study.

As we suggested, the building blocks of the operations strategy for e-business can be considered as:

- *Core competencies, capabilities and processes.* These are: process-based (derived from transformation activities); system or co-ordination-based (across the entire operation system); organisation-based (across the entire organisation); and network-based (covering the whole supply network).
- *Resources.* These depend upon the industry and the firm, but can be thought of at two levels: individual resources of the firm (capital equipment, skills, brands and so on); and the way they work together to create competitive advantage. Given the individuality of a resource-based strategy, for our purposes we will have to think of resources as being: tangible (physical, technologies and financial, etc.); intangible (communication and information systems, reputation, culture, brands, and

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so on); and human (specialised skills and knowledge, communication and interaction, motivation and so on).

- *Technologies*. In addition to being a resource used in the general sense (equipment etc.), technology will have an increasingly important role to play as it also includes core technological know-how in product and process innovation across the whole organisation and its supply network.
- *Tactical activities*. Key activities that are vital in order to support a particular strategy or positioning. The continuation of certain core tactical activities will be vital to sustain a particular operations strategy or business positioning.

If an organisation views particular core competencies and processes; resources; technologies; and key tactical activities as being of strategic importance, then it will adopt an operations strategy reflecting this view. More likely, it will adopt an operations strategy that reflects the particular "blend" of all these components – one that is closely aligned to the organisation's strategic priorities and the commercial environment. Each of the elements in the strategy will have a particular emphasis depending upon the firm and industry.

The operations strategy will evolve over time through dealings with suppliers and customers – indeed many of the strategic components may in fact be introduced at their behest. Further, the model is fluid and dynamic – changing constantly as new building blocks are introduced. However, this inherent complexity provides its strength. The cohesion between the various elements (those having both a strong and weak emphasis) will determine the difference between "world-class" operations, those that are merely efficient, and those sub-optimal or dysfunctional.

Thus as with the various "clusters of value", organisations will have not one, but many operations strategies. Each may have common components, but each has a unique and individual emphasis that is dictated by a number of factors such as trading partners, supply system configuration and demand behaviours. In addition, these findings would seem to further expand and develop Fisher's (1997) conceptualisation of supply chains. He argues that there may be a difference between "physically efficient" and "market responsive" supply chains that are based upon their purpose in supplying functional or innovative products and their requisite demand patterns. Although Fisher confines his dichotomy to supply chains rather than the full range of operations strategies, he accepts the notion that different supply chains satisfy different demand types. We suggest that in using a number of building blocks that are "blended" into a strategic architecture, organisations match the exigencies of the competitive environment. Second, we can also postulate that an operations strategy with distinct building blocks will provide necessary and unique emphases to each situation.

We can conclude the analysis of e-operations strategy by reviewing a small case study to see how the strategy can be developed using the building blocks described.

Pentwyn splicers: an operations strategy for e-business

> Just a year ago, the small engineering firm Pentwyn Splicers was on the edge of bankruptcy. Now it is turning itself around thanks to innovation and e-commerce. Hard work, new product ranges and the development of an acclaimed Internet site have lifted export sales by more than a fifth since its black days. Turnover, helped by fresh markets in Thailand, Korea, Poland and Indonesia, has reached £350,000 at the company, which makes devices known as splicers for the textiles industry. And last year the Website won the Welsh final of the ISI/InterForum E-Commerce award (Johnson, 1999).

The pneumatic splicers, made by the Pontypool, South Wales company, allows weavers to join two separate lengths of yarn without tying knots which introduce ugly lumps into the fabric and potentially, jam up looms. These simple yet innovative products have given Pentwyn, an SME employing 12 staff, a way of surviving the huge slump in the British textiles industry. However, the firm also had to develop new markets and e-commerce proved the solution.

Pentwyn wanted to improve its customers' experience by providing better quality and faster information on its products. It wanted to reach new markets in a cost effective manner. The company also needed to cut costs; particularly the cost of travelling to

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service customers and the costs of developing new products.

The firm incurred minimal cost in hardware and software, but the investment time and resources in setting-up a Web site was considerable. The company introduced e-mail to aid communication with agents and customers and established a Web site to market its products to new customers. Having Internet access also allowed it to source its business needs on-line.

Pentwyn increased export turnover by 20 percent in its first year of introducing these new technologies into the business. Its Web presence has enabled it to sell to new customers and markets it could never previously reach (Poland and Thailand for example). It has improved the speed of communications with customers and is now able to send high-resolution video stills of products and full-technical manuals by e-mail, at much reduced cost.

Using the Internet as a market communications device, prospective customers can seek information and send an e-mail to which the company responds by attaching product photographs to the messages. For example, a firm in Estonia recently sent samples of their yarn and the company responded immediately by e-mail, attaching photos of splicers joining the ends together. The company also delivers manuals and product updates electronically to clients: "It saves printing costs", according to Graham Waters, managing director.

As British textile firms diversify into more specialist areas, Pentwyn have developed machines that can join carbon fibre, glass and Kevlar-based materials. They are also developing a cheap version of the splicing machine for the US market.

More than 25 percent of Pentwyn's new business can be tracked directly to the introduction of the Internet. It has also made a 10 percent saving in cycle-time necessary for product development by sourcing materials from new suppliers discovered via the Internet. On-line searches have also cut the cost of foreign travel.

In the future, the company plans to set-up a password-protected extranet for agents and existing customers to improve the level of service that can be offered. It also plans to translate its on-line manuals and price lists into French, German, Spanish and Italian. According to Water's:

"We have a simple vision of the future. We want our Web presence to be like a bookshop. We want visitors to stay for ten minutes and browse, not pressurised and not threatened by hard sell. The real revelation to us is the progress achieved through e-mail communication and Website development. The quality of our responses, and their speed, has transformed relationships with customers and our agents. E-commerce offers opportunities to all small manufacturing companies to transform their approach to business, and the quality of their service. We have found it an ideal medium to equip us to expand in a global market. But, firms cannot just rely on the technology alone. Their operational systems, and as we have now learned, operations strategies, have to also be developed to support e-commerce."

It is now possible to analyse the operations strategy for e-business applied by the firm using the building blocks introduced earlier. It should be noted that we can only provide a brief summary of the work conducted with the firm's owner.

Core competencies, capabilities and processes

Process-based (derived from transformation activities)

For Pentwyn, the main transformations involved in their e-business systems concern information. The core competence developed involved producing information regarding products and services that are accessible on an international basis, seeking information from potential customers and suppliers globally, and then matching the two streams by providing business opportunities.

System or co-ordination-based (across the entire operation system)

The information transformation described above had to be co-ordinated across their current operations in order to manufacture for new customers or source from new suppliers. Here, their managing director, whose task was aided by the fact that the firm was small, provided the capability.

Organisation-based (across the entire organisation)

For an e-business operation, organisational structures and processes will need to radically change. First, competencies and processes will have to reflect the new speed of immediate operation. With a faster, more

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flexible, "real time" response, Pentwyn had to develop the ability to process information and react to demand across the whole organisation. In addition, their domain of operation became global and much larger. This involved developing new capabilities to deal with a much more outward facing firm.

Network-based (covering the whole supply network)
As indicated above, the ability to manage a wider network of operations (both suppliers and customers) quickly became a core necessity for Pentwyn, as did the integration tasks involved in developing a supply network.

Resources (individual resources and their unique combination)
Tangible
Clearly the technologies used by Pentwyn in the operations strategy for e-business proved vital. ISDN lines, CAD software and sufficiently powerful stand-alone PCs, Internet access, e-mail, video-conferencing facilities, and membership of an electronic trading system (BT Sextant).

Intangible
The various communication and information systems developed for co-ordination have become an important contributor to Pentwyn's success. They had to develop completely new business systems for a new method of trading. Thus, the skills in developing new management structures became vital.

Human
Specialised skills had to be quickly developed to take advantage of the e-business opportunities. Knowledge, motivation and training all played an important part in providing a unique resource combination capable of utilising the e-business environment.

Technologies
Over and above resource technologies used, as with any e-business, future technological development and application will be vital. The innovation and know-how to apply technological advances to new products and processes becomes more important than the technology itself.

The key tactical activities
These are the necessary tactical activities that were vital to Pentwyn in supporting their business strategy and strategic positioning. Although, not strategic in themselves, e-operations decisions had to be made regarding the future of these aspects. For example, fast and effective sourcing, higher quality levels despite speed of response, information system integration, close communication and working partnerships with suppliers and customers and supply system integration.

As we have mentioned, the various building blocks will need to be fused into a particular strategic architecture that reflects the importance placed upon some elements *vis-à-vis* others. In so doing, unique operations strategies are developed with a unique emphasis that reflects the commercial situation.

Conclusions

This work provides a long-overdue synthesis that we hope will mark an advance in the e-business debate. We have defined e-business, discussed its impact, and mentioned the dangers of much of its rhetoric. The role of operations management in providing and supporting "best practice" has also been outlined together with the changing nature of the e-business operational domain. It was suggested that e-operations may become an important concept for many firms; its potential and a definition were also provided. Finally, perhaps contentiously, we described an operations strategy and its application in an e-business domain. The research then formulated a model by which to analyse an operations strategy for e-business. It was noted that these strategies did in fact possess generic building blocks that could be blended providing a unique emphasis for each particular situation. Finally, the paper concluded by describing the context of an e-business operations strategy, aided by the use of a small research study. Here, we demonstrated how one SME, in what many might consider a "sunset" industry, has revitalised its fortunes through the use of e-business. The firm managed to reach new markets and customers with fast, cost effective, information rich communications that increased quality levels, reduced cycle times and improved its flexibility and responsiveness. However, we also demonstrated the importance of operational

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systems and operations strategies in supporting this form of commerce.

This paper will be thought provoking, even contentious. But, it marks the need for further research. We hope the findings will signify the first step in a move towards a greater understanding of a young and unfolding discipline – based upon creative thought and empirical scientific study, rather than mere evangelical description. Both authors would of course welcome constructive criticism and suggestions for future directions.

Notes

1 Supply and demand networks or systems are our preferred terminology to describe what is often known as the "supply chain". We feel that the terms "system" or "network" demonstrate a complex flow of information and products, both up and down stream, whereas a "chain" only really represents a linear sequence of activities.

2 The authors are grateful to Ian Brodie at UEA for his contribution to this definition.

3 We acknowledge the role of strategic management may not always be rational and planned. Some strategies will be logical and of a breakthrough nature, others will be adaptive, emergent and incremental.

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